

Transforming Project Management with AI: Opportunities and Challenges

Rahul Yadav

Project Management Office, QSTC Space, Montreal, Canada

Email: ray@qstc.space

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Abstract

The project management field is common in several industries, and it is not an exception to the innovations powered by artificial intelligence. Nonetheless, the application of artificial intelligence in project management is a little extensive. The objective of this study is to acknowledge the prospects and challenges of Artificial Intelligence in the domain of project management. This study presents a systematic literature review examining the opportunities and challenges of implementing AI-based techniques in project management. The paper aims to provide key insights into how AI is transforming project management. The study utilized SLR methodology, and a total of 21 articles were reviewed. The findings and analysis show that there is greater interest among stakeholders in this field, although some areas are yet to be explored.

Keywords

Project Management, PM Process Groups, Machine Learning, Data-Analytics Tools, Artificial Intelligence

1. Introduction

Businesses are often shaped by technological innovations, which result in high productivity in an organization (Müller et al., 2021). The conventional working and operating methods can be changed because of unceasing technological advancements. Regardless of the field, a revolution can be an agent of change by introducing new technologies (Martínez-Caro et al., 2020).

Artificial Intelligence (AI) has become a disruptive force in the world of technology, reshaping businesses and thereby redefining contemporary business processes on a global scale (Dwivedi et al., 2021). AI has significantly transformed various domains, and one of many domains that have been profoundly revolutionized is Project Management (PM). The combination of AI and project

management offers immense prospects for overcoming challenges, optimizing project realization, and uplifting organizational success (Niederman, 2021; Wamba-Taguimdje et al., 2020).

While traditional project management approaches are effective, they often have inherent limitations that may hinder effectiveness and efficiency. Moreover, manual procedures, human biases, and information silos can bring bursts of delays, increase costs and suboptimal usage of resources (Lalmi et al., 2021).

Recently, efforts have been made to reduce difficulties associated with project management by using advanced analytical approaches. Among them is AI, which has considerably improved the quality of project management. From the start till the end of a project, a substantial amount of data is gathered and analysed. Data is required for different processes and is shared among project teams (Guo and Zhang, 2022). Project managers can use AI technologies to train the data. For instance, AI can reduce uncertainties in project management by utilizing probability calculations and logical reasoning.

In addition, AI has become more and more relevant. Users and businesses have been adapting to what seems like an inevitable change. Nevertheless, in most businesses, there is still reluctance when it comes to its full exploration. Literature has pointed out the uncertainty of the path (Madaio et al., 2022). However, it is imperative to mention that there are clear signs that AI has huge prospects, which cannot be ignored, and many businesses have rightly predicted that AI can assist humans in the future. Literature indicates that AI offers more innovation and better performance, offering organizational growth (Da Costa et al., 2022; Wamba-Taguimdje et al., 2020). For instance, innovation can boost the performance of organizations, and in this digital era, AI can grow significantly.

This paper aims to conduct a systematic literature review (SLR) to explore the challenges observed during the implementation of AI in project management, especially the role of AI in the process groups defined in PMBOK. Moreover, the paper aims to analyze how AI may assist project managers' efficiency in the field of project management. The main research question, therefore, is: How can AI effectively transform project management? The core objective of this research work is to view AI as an ally that can potentially lead to the transformation of project management as a function and can make both project managers and organizations reach higher positions, reaping maximum benefits from the function as it is.

2. Research Method

The study conducted a Systematic Literature Review (SLR). The goal is to gather, select and analyze the most recent and relevant materials on the given topic. To achieve the objectives, we established the terms to be researched and specified the criteria to be met. Moreover, the study complied, analyzed and elevated relevant articles to correlate them with our objectives.

A systematic literature review was conducted using the preferred reporting

items for systematic reviews and meta-analyses (PRISMA) approach. The PRISMA approach was chosen because of its ability to provide better results and because it offers a structured procedure that involves a thorough systematic review. In addition, this approach employs a set of steps to achieve its objectives (Shaffril et al., 2020; Peters et al., 2015).

Data collection is an integral step in any systematic literature review as it serves as a major source of data from which results are mainly based (Shaffril et al., 2020). Moreover, search conditions were also considered carefully.

For the collection of data, the study defined search conditions, such as “AI”, “Artificial Intelligence”, “project management”, “transformations in PM” and “machine learning algorithms”. Google Scholar, Science Direct, and Web of Science were utilized as databases to select desired materials. The web search led us to materials with the exact wording. Moreover, in the search engines, the defined search keywords were checked in all the titles, abstracts, and keywords. The study avoided other databases to avoid duplicates. It is imperative to mention that the search data was from 1st March 2023, so data further from this date was deliberately avoided.

The study identified 405 relevant articles with the search keyword. After that, a screening procedure was adopted based on selection and exclusion criteria. The selection criteria were the articles with the keyword’s artificial intelligence and project management, materials written in English and articles published between 2017 and 2023. The distribution of articles on yearly basis is shown in **Figure 1**. The elimination standards were articles in other languages, anecdotes, duplicated publications, short papers, viewpoints, book chapters, letters, newspaper articles, posters, and duplicated publications. To enhance the data selection process, the web search results were compiled in an Excel spreadsheet.

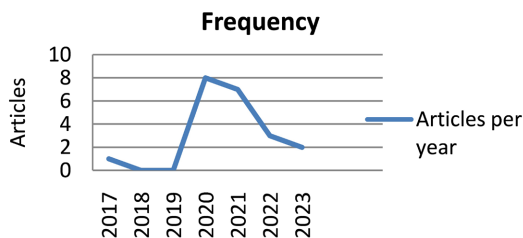


Figure 1. Articles per year.

Due to the use of selection/elimination criteria, selection bias may occur in a systematic review. To mitigate this challenge, the author reviewed the abstract and conclusion of each article and selected studies for full-text review. After carefully reviewing the selection/elimination process, the PRISMA method led to a total of 21 representative articles for the research, shown on **Figure 2**.

3. Results and Analysis

In this systematic literature review using the PRISMA approach, our focus was

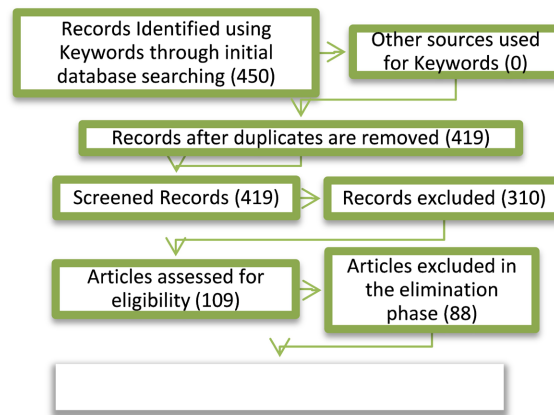


Figure 2. Data selection process using PRISMA approach.

examining the role of AI in transforming project management. The literature search was designed to select relevant peer-reviewed articles that explore both the opportunities and the challenges with the implementation of AI in the project management domain.

The database search phase provided several relevant articles. By using the inclusion/exclusion criteria, we filtered the initial pool of material to ensure relevancy and research quality. For a detailed examination of the research topic, the study selected 21 peer-reviewed articles.

The literature under review has categorized project management into 5 process groups, 10 knowledge areas and 49 processes. The 5 process groups are initiating, planning, executing, monitoring, controlling, and closing a project (Gondia et al., 2020; Rose, 2013; Rahimian et al., 2019; Yaseen et al., 2020). Moreover, these project management process groups are logically grouped to accomplish objectives, which are demonstrated in Figure 3. On the other hand, project management knowledge areas are identified areas in terms of knowledge requirements.

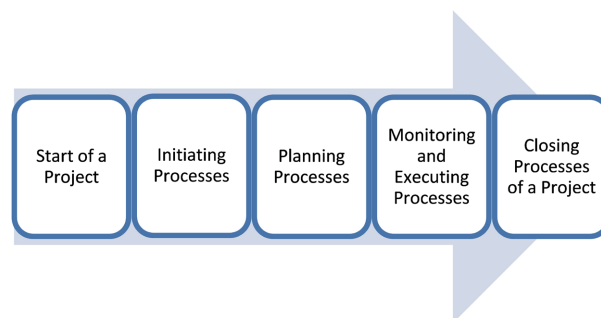


Figure 3. Project management process groups.

Out of 21 articles, 9 discussed that AI-powered smart systems have made their way into real-world applications and continue to do so at a rampant pace. Recently, these smart systems have become more sophisticated and have reinvented every job swiftly, thus creating an augmented workforce. These recent developments

are responsible for major changes in work and, consequently, in demands that are taking place from the future workforce. [Da Costa et al. \(2022\)](#) pointed out that businesses are reanalysing how to design jobs, organize work, and plan for future growth. For a detailed examination of the research topic, the study selected 21 peer-reviewed articles, which are shown in [Table 1](#).

Table 1. Summary of the reviewed articles.

Articles	
Title	Author
Machine learning algorithms for construction projects delay risk prediction	Gondia et al. (2020)
A Guide to the Project Management Body of Knowledge: PMBOK Guide. In Project Management Institute	Rose (2013)
On-demand monitoring of construction projects through a game-like hybrid application of BIM and machine learning	Rahimian et al. (2019)
Prediction of risk delay in construction projects using a hybrid artificial intelligence model	Yaseen et al. (2020)
A risk prediction model for software project management based on similarity analysis of context histories	Filippetto et al. (2020)
The effectiveness of project management construction with data mining and blockchain consensus	Li et al. (2021)
Robustness of LSTM neural networks for multi-step forecasting of chaotic time series	Sangiorgio and Dercole (2020)
Characterizing machine learning processes: A maturity framework	Akkiraju et al. (2020)
Data-driven project buffer sizing in critical chains	Li et al. (2022)
Data mining in the construction industry: Present status, opportunities, and future trends	Yan et al. (2020)
Appropriate budget contingency determination for construction projects: State-of-the-art	Ammar et al. (2023)
A machine learning study to improve the reliability of project cost estimates	Narbaev et al. (2023)
Ensemble Model of Machine Learning for Integrating Risk in Software Effort Estimation	Natarajan and Balachandran (2022)
Cost estimation and prediction in construction projects: A systematic review on machine learning techniques	Hashemi et al. (2020)
Explainable machine learning in credit risk management	Bussmann et al. (2020)
From artificial intelligence to explainable artificial intelligence in industry 4.0: a survey on what, how, and where	Ahmed et al. (2022)

Continued

Deep learning in the construction industry: A review of present status and future innovations	Akinosho et al. (2020)
Machine learning algorithm model for improving business decisions making in upstream oil & gas	Rahman et al. (2021)
Software project management using machine learning technique	Mahdi et al. (2021)

Almost all organizations follow project-based structures, and for that reason, efficient project management has a major role in the growth of an economy (Pan and Zhang, 2021). Even though projects have prolonged importance, project management methods are not at advanced levels, and these methodologies are delimited due to bureaucratic and procedural constraints (Kaymakci et al., 2021; Füller et al., 2022). For these reasons, researchers have tried to utilize advanced AI tools in project management. It is imperative to mention that the introduction of these tools has not been a great success yet. However, recent developments have created prospects to enhance the efficiency of project management methodologies.

AI is defined as the ability of a machine to mimic real patterns and provide artificial output that represents human behaviour. By doing so, AI uses human-inspired algorithms to approximate defiant issues (Lishner and Shtub, 2022). Literature has categorized AI into sub-fields, such as machine learning (ML) and pattern recognition (PR). PR mainly focuses on recognizing patterns and classifying data. Moreover, ML is defined as a method that trains algorithms using the unique traits of training data to make accurate predictions. According to the reviewed articles, AI tools in project management include IoT, ARIMAX model, moving averages, time series models, statistical methods, ML algorithms (Generative Adversarial Networks, SMOTH, ADASYN approach), optical character recognition models, feature selection approach, deep generative techniques, artificial neural networks, Bayesian techniques, cost-based factors, support vector machines (SVMs), and random forest techniques (Alshaikhi and Khayyat, 2021; Da Costa et al., 2022; Dwivedi et al., 2021; Füller et al., 2022; Kaymakci et al., 2021; Lishner and Shtub, 2022; Pan and Zhang, 2021; Saltz et al., 2017). **Table 2** presents the opportunities and challenges of implementing each AI technique in project management.

Table 2. Challenges and opportunities of implementing AI in project management.

AI Techniques	AI in project management	
	Opportunities	Challenges
Bayesian Networks	Bayesian networks predict project failures, detect project drifts, and advise corrective measures to project managers.	Incorporating Bayesian networks with project management formalizes expert knowledge.

Continued

Data mining techniques, IoT, time series analysis models, process mining	AI based techniques allow bottleneck predictions, workload forecasts, practical decision making for better efficiency.	Real-time complexity management and data mapping in large projects.
Artificial Neural Networks	These neural networks are highly accurate to forecast project durations. They also improve decision making in project management.	Adaptability to diverse organizations, and validation.
Deep learning models	These models can enhance building management accuracy, energy conservation, and communication.	Limited applicability due to their early stage.
Data mining methods	AI-based methods can accurately predict project duration, provide timely actions and enhance project planning.	Challenges of implementing these methods include data quality, and problems in extracting minute datasets.
AI-based data analytic tools	AI-based analytics tools improve automation; emphasize on risk management and stakeholder relations.	Adaptation of these software features.
Machine learning algorithms	These techniques enhance decision making and are valuable in constructions.	Limited evaluation, at early stages to fully implement in project management.

Almost 5 articles pointed out that, these AI techniques can mimic human cognitive functions, which include problem-solving and decision-making. These techniques have advanced abilities in project management, which can bring innovation in risk assessments, decision-making, monitoring and evaluation of projects, data analysis, and project optimization. Moreover, these advanced methods optimize AI, ML, and statistical approaches to enhance project resource allocation, risk alleviation, project planning, and overall outcomes of a project. Additionally, these techniques improve project management processes by bringing accuracy, efficiency, and key insights, thus leading to high success rates and project delivery (Alshaikhi and Khayyat, 2021; Da Costa et al., 2022; Dwivedi et al., 2021; Füller et al., 2022; Kaymakci et al., 2021; Lishner and Shtub, 2022).

The thorough examination of chosen research articles provides a detailed overview of AI's capabilities in redefining project management. For instance, Dwivedi et al. (2021) highlighted that the ability of AI systems to process and analyze

diverse datasets enables project managers to make informed decisions. AI-based decision-making is advanced and different from the conventional process of decision-making. Conventional decision-making processes are normally based on heuristic analysis, thus making them more prone to biases and mistakes. The literature highlights the fact that AI-based analytic tools are not only automating ordinary tasks but also providing predictions that were previously out of reach (Alshaikhi and Khayyat, 2021).

Moreover, project managers can use advanced predictive models, such as supervised ML techniques, to determine previously unknown risks in advance so that they can implement proactive rather than reactive project planning and execution Taboada et al. (2023).

Moreover, another significant prospect of adopting AI is the access to real-time data analytics in project management. Accessing various data streams empowers a flexible adaptation of a project in line with fresh insights and chronological occurrences. As a result, a more flexible and malleable model would be created, which would bring new developments into operations and increase the chance of project success. Articles in this review recurrently highlighted case studies where the integration of real-time analytics into project management systems brought about significant cost savings, time efficiency, and the improvement of stakeholder satisfaction.

Moreover, the literature has emphasized machine learning algorithms, which are key tools for tracking patterns and forecasting project phases. In addition, natural language processing (NLP) tools are used to summarize and interpret information from the project documents, as well as the AI-driven dashboards that can suggestively present complex project data. Not only do these tools aid the technical project management capabilities, but they also insist on a culture change in which projects are created, monitored, and delivered effectively (Dwivedi et al., 2021; Füller et al., 2022; Kaymakci et al., 2021; Lishner and Shtub, 2022; Pan and Zhang, 2021; Saltz et al., 2017).

According to Liu and Hao (2021), transparency and accountability challenges may arise from the implementation of AI systems within project management. The study emphasized the trust issues among stakeholders due to the unclear nature of AI systems, which can lead to complex decision-making processes. There is a need to develop AI systems that are explainable and interpretable by design. Moreover, to mitigate these challenges, the establishment of robust approaches is required, which can make sure that AI systems are designed with a level of transparency that allows for meaningful transparency and accountability.

In addition, out of 21 articles, 10 discussed the challenges of AI systems creating new forms of biases, which could lead to unfair treatment of certain groups within project teams. The study Ntoutsis et al. (2020) calls for the ethical designing of AI systems, emphasizing the concept of fairness to decrease the biases in AI systems. The researchers highlight the importance of diverse training data and ongoing supervision of AI systems for biases as necessary steps. Moreover, researchers highlight the role of diversified training datasets and monitoring mechanisms for

AI systems for biases as a crucial measure.

A study by [Acemoglu and Restrepo \(2019\)](#) presents a detailed analysis of the prospects of AI to automate tasks usually performed by humans, indicating a shift of employment in project management. While attributing to the prospects of AI systems, the study emphasized the importance of a balanced approach that uses AI to guide human skills rather than take their place. Additionally, there is a need for up-skilling initiatives to prepare project teams for a future where humans and AI collaborate closely.

The integration of AI with project management practices has sparked great debate among practitioners and researchers. An in-depth analysis discloses a variety of concerns, primarily around accountability, equity of AI systems, transparency, and its impact on human expertise and job markets.

4. Conclusion

The findings of this study highlight AI's integration into project management. The study emphasizes the importance of leveraging AI tools and techniques in transforming project management process groups. Moreover, the study highlights the significance of addressing specific challenges for successful AI integration. The findings of this systematic literature review (SLR) show the effectiveness of AI tools and analytical methods in handling challenges related to risk assessment, cost prediction and decision-making. Moreover, the literature shows that integration of AI-based data analytics tools in the planning phase of projects enhances enhanced risk assessment, project selection, cost estimation, resource allocation and decision making.

Moreover, the reviewed literature indicates that the execution of projects saw improvements in productivity, resource utilization, cost savings and better decision-making with the use of tools and techniques. By aligning challenges with prospects, this study provides insight to help organizations effectively navigate AI implementation. By gaining insights into the prospects and challenges linked to every phase of a project, businesses can transform project management using AI tools effectively.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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