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Review Paper

The Future of AI-Integrated Project Management: A Structured Literature Review Based Risk Identification

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Abstract. The evolution of artificial intelligence (AI) is changing the landscape of project management. Despite the various advantages that have been associated with the application of AI in project management, there are still weaknesses and challenges that need to be addressed. The rapid advancements in technology have changed the dynamics of the field which have created ambiguities on its existing state. Therefore, the roadmap for further development perspective in the field is also in focus. Furthermore, the inability to define the risks associated with the implementation of AI in project management and the ways to mitigate them is a main reason that could lead to organizational reluctance. The gap between theory and practical application of these concepts presents the necessity of further research in this direction. The study aims to come up with an in-depth conceptual understanding that identifies risks associated with the adoption of AI in project management and to offer structured guidance to industry and academia for future advancements. The study methodology comprises a structured literature review following PRISMA guidelines, to assess the effects of AI on the most significant facets of project management, implementation challenges and potential benefits. The results outline the opportunities and threats that could be harnessed or mitigated in order to make the adoption of AI in the project management more effective. Thus, offers a foundation for the formulation of risk mitigation strategies and standard frameworks to adopt AI. The study findings are a significant contribution to the field that will assist academic researchers and industrial practitioners in designing AI implementation plans.

Keywords: Artificial Intelligence (AI), Benefits, Challenges, Decision-Making, Efficiency, Project Management, Risk Identification.

Introduction

The success of any organization relies on its ability to execute its projects effectively. In broad terms, project management is a structured and methodological approach to manage projects [1]. However, Project Management Institute (PMI), a globally recognized association, further describes it as the application of certain knowledge, skills, techniques and tools to deliver projects successfully [2]. Project management is also categorized into methodologies as approaches to initiate, plan, execute, monitor and control, and close projects [3]. The waterfall, agile and hybrid approaches are the most commonly used in project management. But this raises a critical question that what is a project? And how can we define its success?

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According to [4], a project is a temporary effort, with a specified deadline, plan, and scope of work. The author in [4] further elaborates on it to produce a unique output and has constraints. It is not only about economics; as Thomas Sowell, an economist, once said, there is never enough of anything to satisfy all those who want. Projects also operate under constraints which we refer to as the Project Management Triangle (PMT). These constraints include scope, time and cost, and the project must be managed while balancing them [5]. Project success, defined in [6], is the effective planning, monitoring, and management of every aspect of a project to meet its objective within defined time and performance.

However, traditional project management approaches are facing limitations as projects become more complex and dynamic. In which they are confronted with large sets of data and unidentified risks that sometimes result in exceeding the project's cost and time constraints [7]. It often results in project failure. The digital advancements and the dynamic nature of projects are changing the project management's landscape. The traditional processes, including planning, executing and monitoring, are now often substituted by AI-based technologies [8]. Therefore, the progress of AI is uplifting the project management field by improving the decision-making process and project efficiency.

The project management field is significantly impacted by the incorporation of AI. Planning, execution and tracking are the core three areas that are primarily impacted by AI [9]. Based on AI-integrated systems, the decision-making process and efficiency in project management are improved [8]. They can assist in analyzing real and historical datasets and direct project managers on the future course of action [10]. Machine learning (ML), predictive analytics, and natural language processing (NLP) are three crucial components of AI that have widely influenced project management's core facets [11]. Predictive analytics have substantially enhanced accuracy of cost and schedule predictions, playing a key role in improving the resource allocation and enhanced scheduling [12]. Furthermore, real-time monitoring and proactive risk identification are also among in its valued features [13].

One of the most important components of AI is Machine learning (ML) which imitates human intelligence [14]. In ML, the algorithms are trained on data that enables systems to analyze both real-time and historical data, based on which resources and timelines are predicted accurately [15]. With the integration of predictive analytics, it enhances the decision-making process and enables intelligent task automation [16]. NLP, a branch of AI, is revolutionizing the field of project management. It has enabled computers to communicate humans in natural language [17], and can even extract actionable information from unstructured data [18], [19]. Additionally, it facilitates automated responses and enables continuous communication between the team members of a project [20]. The machine learning models in Generative AI (Gen AI) can even integrate unsupervised learning to generate original content, optimize workflows and suggest new solutions [21], [22]. It is an intelligent tool that can take inputs and as a result generate codes, multimodal content and solutions [23]. Even though it has a significant potential to automate repetitive tasks, the distinctive nature of different projects makes its usage challenging [24], [25], [26], [27].

Fig. 1 illustrates the integration of AI's three main components with project management. Even though the integration of AI with project management has shown encouraging results, the field is still in its infancy to show wider applicability and establish its effectiveness. While adoption of AI in project management has reported numerous benefits, it still faces notable challenges and weaknesses. The benefits include enhancement of resource allocation, optimization of scheduling and early risk

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identification. On the other hand, the challenges include a lack of transparency, unavailability of high-quality data and higher implementation costs. These diverse aspects, integrated with the technological advancements, are changing the landscape of the field.

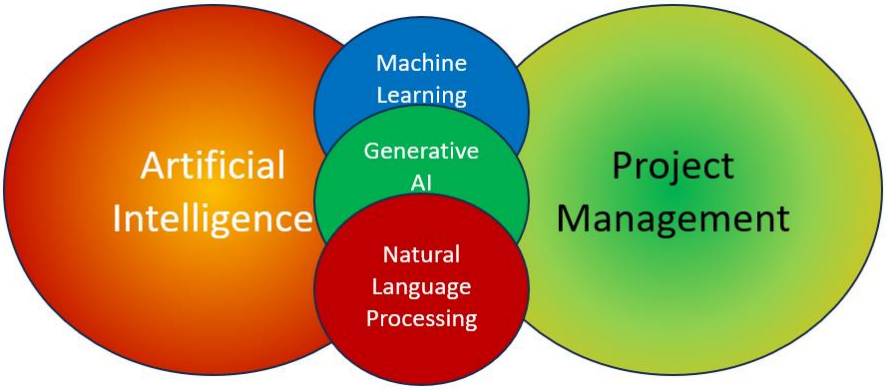

Figure 1. Integration of AI models and Project Management

Although Ahmed et al. [28] acknowledge AI's benefits in project management, it strongly recommends careful considerations in AI systems' integrations. It highlights the need to identify the risks associated with AI integration in project management, which can facilitate organizations in its effective adoption. A recent study by Abyaneh et al. [29] emphasizes the need for research to bridge the gap between theory and practical implementation to address challenges in the adoption of AI in project management practices. Another recent research proposes that a well-developed framework is necessary for organizations willing to adopt AI in their project management practices [30]. Hence, an in-depth study that unveils the opportunities and threats related to the implementation of AI in project management is an important step in the development of such frameworks.

Hence, the present state of the field and its risks associated remains unclear, and a roadmap for AI adoption in project management also remains undefined [31]. This highlights the need to bridge the gap by developing an in-depth and updated conceptual understanding of the current state of the field and identify its associated potential risks. This will provide guidance to the developers and researchers in planning strategies for the adoption of AI in project management. Therefore, this study aims to present a structured and thorough literature review, and then evaluate and synthesize the data to conduct a comprehensive analysis.

The project management community is showing massive interest in this AI evolution. However, the transition from conventional project management to AI-based project management encounters challenges. Recent studies suggest that a major challenge in the adoption of AI is the lack of quality data which may lead to incorrect project outcomes [22], [32]. Another challenge to its adoption is project managers' lack of trust in the AI models' outcomes due to their lack of interpretability and transparency [33]. Furthermore, small and medium-sized organizations face financial challenges due to high implementation costs on the acquisition of expensive computing systems and trainings in the process of adoption [11], [34]. Though AI adoption has different challenges and benefits in project management, this field is still at the exploratory stage. Hence, a thorough investigation of the present state, with identification of its associated risks is important for developers and researchers to pursue future advancements in the field.

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The study formulates research questions to guide a comprehensive structured literature review that will lead us to identify the risks associated with AI adoption in project management.

1. What are the key facets of project management that are widely impacted by the application of Artificial Intelligence*?*
2. What are the commonly reported benefits of integrating artificial intelligence technologies into project management?
3. What are the technical and organizational challenges in the adoption of artificial intelligence (AI) technologies in project management?

Question No. 1 aims to identify the aspects of project management most influenced by artificial intelligence (AI). It will also examine the impact of AI on each of these aspects and how it improves overall project outcomes. Question No. 2 encourages an examination of the significant benefits of integrating AI into project management and its impact on project outcomes. It will also explore how this integration transforms various aspects of project management processes. Question No. 3 addresses the reported technical and organizational challenges that hinder its adoption.

This research paper assesses the impact of artificial intelligence (AI) on project management by addressing the research questions outlined above. A systematic literature review is conducted, adhering to the PRISMA protocol for screening and selection. The reviewed literature is categorized and thematically analyzed to provide a comprehensive understanding of each theme. The results are then analyzed to discuss the practical and theoretical implications. The synthesized findings provide a basis to identify positive and negative risks (opportunities and threats) that can be leveraged or mitigated to ensure the effective adoption of AI in project management. Finally, the study identifies future research directions in this field.

1. Research Method

The methodological approach used in this study is adapted from the work of Bachari et al. [35], with modifications to align with contextual requirements and practical constraints. The PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) framework is used in this structured literature review to ensure that the review procedure is methodological and transparent. The PRISMA 2020 statement provides the updated reporting guidelines for reviews and methods for identifying, selecting, evaluating, and synthesizing literature [36]. The methodology adopted in this research is illustrated in Fig. 2. The first three steps of the research methodology are discussed in this section, whereas the last two are presented in separate two sections.

Figure 2. Research methodology for literature review: Future of AI-Integrated Project Management

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1.1. Identification of Research Articles

Identification of the literature was conducted using the Google Scholar database, by defining specific keywords. The Google Scholar database was searched to retrieve relevant literature published since 2018. A Combination of keywords was applied to identify the related literature, for example, "Project Management AND Artificial Intelligence", "Project Management AND Generative Artificial Intelligence", "Project Management AND Artificial Intelligence AND Risk Management", "Project Management AND Artificial Intelligence and Challenges".

As the field is evolving, the selection criteria were intentionally inclusive by considering a wide range of publications. Additional screening was conducted by analyzing abstracts and keywords of the retrieved literature to ensure the study remained aligned with the scope of this research.

1.2. Filtering Research Articles

To meet the research aim, clearly defined inclusion and the exclusion criteria were established for selection of the literature relevant to the scope, which are presented in Table 1. By providing widespread access to literature and guaranteeing a diverse pool of scholarly sources, Google Scholar greatly aided the research selection process. Since the field is emerging, it is made sure that any research published before 2018 will not be included.

Criteria	Inclusion	Exclusion
Database	Google Scholar	
Publication Year	Since 2018	Literature published prior 2018
Language	English	Non-English
Research Interest	AI in Project Management	Unrelated literature
Type of Publication	Empirical research, theoretical research, literature reviews, case studies, methodological paper, journal article, conference paper, research thesis, reports	Books, editorials, magazine articles, blogs

Table 1. Inclusion and Exclusion Criteria

The criteria were deliberately kept broad to ensure the inclusion of a range of research works and perspectives on the impact of artificial intelligence (AI) on project management. The database inquiry took place from 15 February 2025 to 15 July 2025. Google Scholar served as the resource for the literature search yielding an initial total of 110 records. Following the elimination of records and a screening procedure, 40 studies were identified as relevant and included in the final review; criterion is shown in Table 2.

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S. No.	Keywords	Selected Literature
1.	"Project Management" and "Artificial Intelligence"	11
2.	"Project Management" and "Generative Artificial Intelligence"	06
3.	"Project Management" and "Predictive Analytics"	03
4.	"Project Management" and "Conversational Artificial Intelligence"	02
5.	"Project Management" and "Artificial Intelligence" and "Impact" and "Key Facets"	05
6.	"Project Management" and "Artificial Intelligence" and "Resource Allocation"	07
7.	"Project Management" and "Artificial Intelligence" and "Scheduling"	07
8.	"Project Management" and "Artificial Intelligence" and "Cost Estimation"	02
9.	"Project Management" and "Artificial Intelligence" and "Risk Management"	05
10.	"Project Management" and "Artificial Intelligence" and "Communication"	06
11.	"Project Management" and "Artificial Intelligence" and "Benefits"	05
12.	"Project Management" and "Artificial Intelligence" and "Advantages"	04
13.	"Project Management" and "Artificial Intelligence" and "Challenges"	04
14.	Additional Relevant Literature	05
	Total Selected	72
	Duplicate Records Removed	32
	Total Included in Review	**40**

Table 2. Database Search Result

1.3. Data Extraction and Synthesis

The data extraction process in this study followed the PRISMA framework as shown in Figure 3. The systematic search identified the potential references from the database, resulting in 110 entries. Following the removal of 32 duplicate entries, there were 78 unique entries left for the first screening. Out of them, 9 were eliminated on the basis of their titles or preliminary relevance assessment. Then, 69 documents were chosen to review their complete text. Nonetheless, 12 of them were inaccessible. Eligibility review of the remaining 57 studies was done. A review of the abstract identified 17 studies that did not address the research questions and were thus excluded. Finally, the review included 40 studies, thus ensuring a comprehensive analysis of the application of artificial intelligence in project management.

The included studies for the review are thematically categorized into the impact of AI application on key facets of project management, its benefits and challenges. The literature was analyzed and synthesized to develop a comprehensive understanding of the extent of impact of AI on key facets of project management. Finally, based on a comprehensive structured literature review, this paper discusses its implications and identifies the risks associated with AI adoption in project management.

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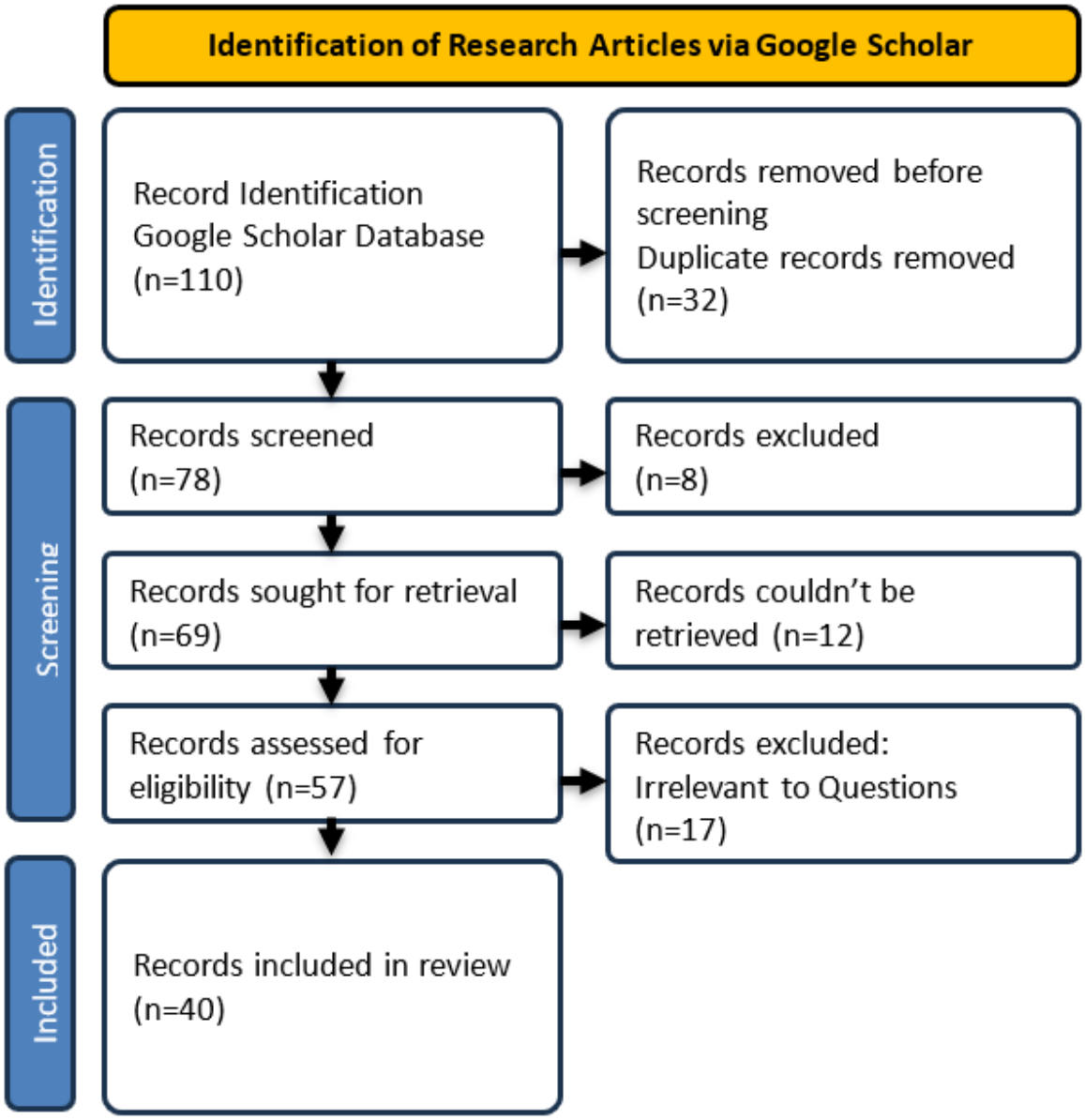

Figure 3. PRISMA framework for Identification and Selection of Literature

2. Results

In this research, the responses of the three research questions are analyzed through the extensive literature review. Hence three sub-sections provide the responses of each research question.

2.1. Facets of Project Management impacted by the AI

The study critically reviewed the literature to assess the impact of AI in project management for the response of the first research question. The number of studies on the impact of AI varies across different facets of project management. Fig. 4 shows the frequency of research articles showing the core project management facet impacted by the AI.

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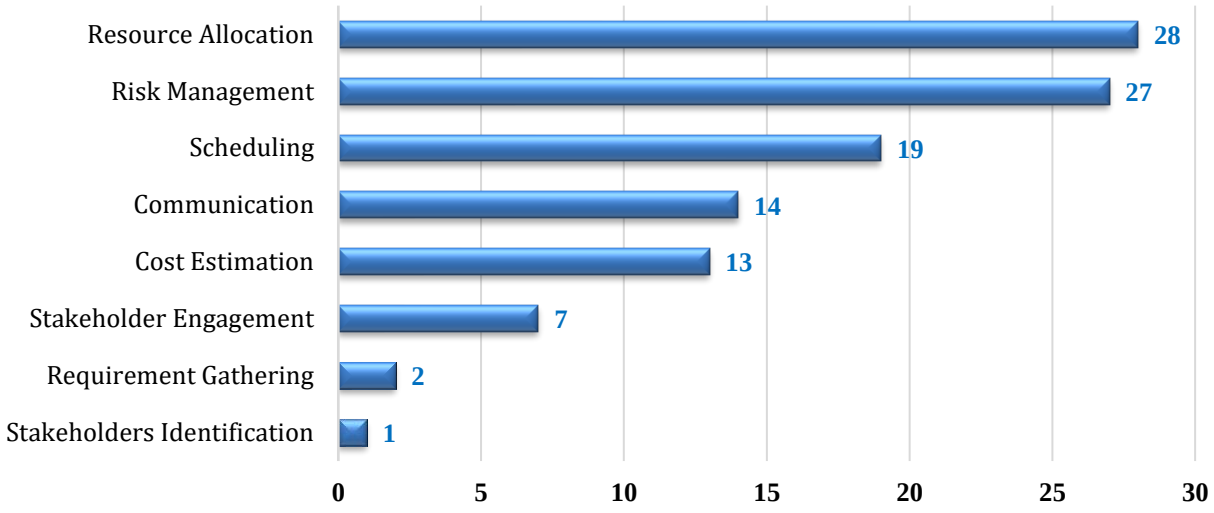

Figure 4. Frequency of literature reporting Project Management Face impacted by the AI

Fig. 4 illustrates that resource allocation is one of the most frequently discussed facets of project management in the reviewed literature, appearing in 28 studies, followed by risk management and scheduling, with 27 and 19, respectively. The role of AI on communication is addressed in 14 reviewed studies, with one more than those focusing on cost estimation. Other facets of project management, such as stakeholder engagement, stakeholder identification, and requirement gathering are also discussed in the studies, but with much less frequency. Therefore, the subsequent analysis of AI's impact will focus on five most frequently addressed facets of project management. Table 3 summarizes the impact of AI applications on key facets of project management and overall project outcomes.

Key Facet	Description	Impact	References
Resource Allocation	AI tools analyze large datasets, project requirements and resource availability to optimize resource distribution and workload balancing.	• Efficient resource allocation, • Improve resource optimization, • Predict future resource requirements, • Preempt potential bottlenecks, • Enhance project efficiency, • Reduce project cost.	[3], [7], [11], [15], [17], [21], [26], [32], [33], [34], [37], [38], [39], [40], [41], [42], [43], [44], [45], [46], [47], [48], [49], [50], [51], [52], [53], [54]
Scheduling	AI tools optimize project schedules by balancing constraints, analyzing resource availability and task dependencies.	• Efficient scheduling, • Efficient sequencing of tasks, reduce timelines, • Avoid cost overruns, • Improve productivity, • Improve project efficiency, • Optimize project cost.	[7], [10], [15], [17], [21], [26], [32], [38], [39], [40], [42], [43], [45], [49], [52], [53], [55], [56], [57]
Cost Estimation	AI tools analyze data to identify cost factors and patterns, thereby forecasting the estimated cost.	• Accurate budget forecasting, • Precise cost prediction, • Improve budget control, • Reduce financial risk, • Enhance decision-making, • Improve project planning, • Smooth project execution.	[7], [17], [21], [26], [32], [34], [40], [45], [49], [52], [53], [56], [57]

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Risk Management	AI algorithms identify potential risk factors and assess their impacts by analyzing project data and external variables.	• Early identification of risks, • Real-time risk assessment, • Proactive risk mitigation, • Ensure project stability, • Enhance project success rate, • Avoid cost overruns.	[7], [10], [11], [15], [17], [21], [26], [32], [33], [34], [38], [39], [40], [42], [43], [44], [45], [47], [48], [49], [50], [51], [52], [53], [54], [56], [57]
Communication	AI tools handle routine communication to enhance stakeholders' communication and collaboration.	• Improve project communication, • Enhance collaboration, • Effective coordination, • Promote team workflow, • Enhance team productivity, • Effective stakeholder engagement.	[7], [11], [15], [17], [21], [26], [37], [41], [42], [44], [45], [50], [52], [58]

Table 3. Impact of AI on Key Facets of Project Management and Project Outcomes

The literature review highlighted resource allocation as one of the key project management facets that is mostly influenced by AI. It is discussed in 70% of the selected studies. AI-enabled systems possess an enormous capacity to analyze large datasets, to predict and allocate resources, and to avoid their conflicts [33]. This optimized resource allocation is widely influencing efficiency in modern-day projects. This development reduces the risk of resource conflicts and decreases latency by allowing efficient workload distribution [32]. AI tools improve performance by eliminating resource bottlenecks and preventing duplication [11], [34].

Scheduling is one of the most challenging areas for project managers. Nevertheless, AI can play a major role in addressing this challenge [40]. Through the analysis of the available resources and their interrelations, AI-driven systems can produce optimal schedules to meet project deadlines [32]. These schedules might need some changes after consultation with stakeholders, yet in most situations, these schedules are used as the starting point [49]. In addition, projects cannot be considered static and thus have to be adjusted during their execution. Predictive analytics uses historical data and the existing performance trends to adjust the project schedule in the execution phase [52]. Project managers can use automated scheduling through AI systems to keep projects on track that often encounter unforeseen challenges [15], [45].

The historical averages are used in traditional cost estimations, which lowers precision and hence, more chances of projects going beyond budgets [26]. Cost overruns have led to the failure of several large-scale projects. AI-based data analysis techniques can assist project managers in the evaluation of the cost drivers and patterns to provide more precise predictions of the budget [24]. This enhanced forecast minimizes the financial risk associated with a lack of control over the project. Constraints, involving cost, are also managed in project management. AI-based systems will assist companies in operating within the budget in the project implementation process [34].

Risk management is a challenge for project managers, particularly due to its financial implications. Machine learning (ML) models are evolving risk management with better risk factor identification and accurate risk assessment [27], [59]. This enables projects to have a better stability and consequently high chances of project success. Moreover, AI technology is capable of anticipating risks throughout the project lifecycle, which project managers can utilize to formulate and apply risk mitigation strategies [26], [32]. Such mitigation measures prevent risks from escalating into costly issues and result in project

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inefficiencies [15]. Moreover, AI automation makes it possible for systems to generate real-time risk notifications [34].

AI plays a crucial supporting role in project teams [41]. AI technologies are able to generate actionable insights from data, and hence, can enhance stakeholders' collaboration [18]. On the same note, daily project management activities, including updating project stakeholders on the progress, are other notable gains of AI systems [27]. This transparent and smooth communication supports the performance of the project [60]. Moreover, the communication process in project teams can be streamlined with the assistance of AI chatbots when combined with project management systems [7], [50]. A study [26] finds that AI chatbots are narrowing communication gaps, enhancing stakeholders' engagement and increaing project efficiency.

2.2. Benefits of Integrating AI and Project Management

The response of second research questions is also analyzed through literature. In this study, the benefits of AI and project management integration are highlighted. Fig. 5 summarizes the number of studies in the literature review that discuss the various benefits of AI integration in project management.

The benefit of improved project efficiency was discussed in 12 studies in the reviewed literature, followed by the advantages of accurate forecasting and real-time monitoring which are reported in 11 and 10 studies, respectively. However, the number of studies emphasizing enhanced decision-making through the application of AI is the highest, with 25 studies, while 19 studies discussed the benefit of task automation. There are other primary and secondary gains of adopting AI in project management; however, the aforementioned widely reported benefits will be the focus of this paper. Table 4 provides a summary of the benefits of AI integration in project management and their potential impact throughout the project lifecycle.

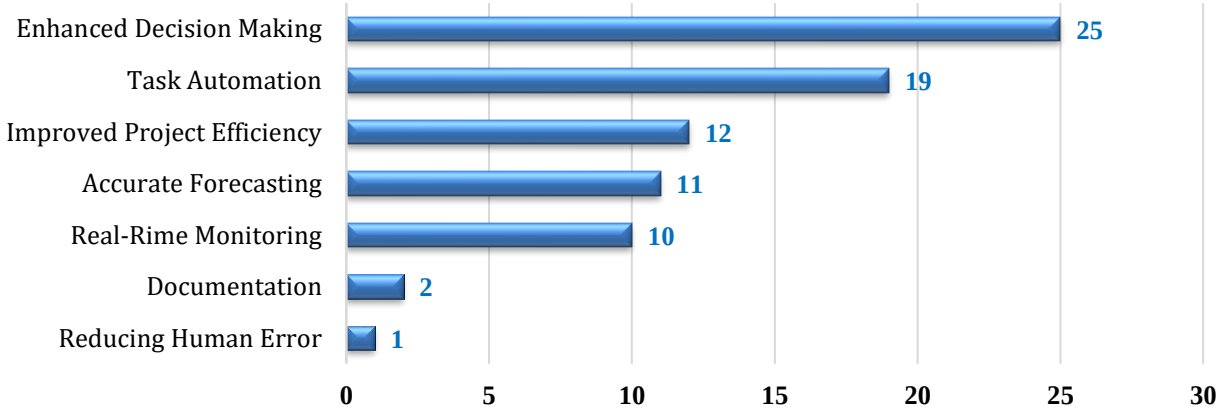

Figure 5. Frequency of literature reporting the benefits of Integrating Project Management & AI

AI-enabled predictive analytics can analyze large volumes of historical data and patterns to provide reliable project outcomes. These predictive models employ various statistical techniques to ensure accurate forecasting [33]. This capability for accurate forecasting is a core of any AI-driven system to produce an optimized schedule while avoiding resource conflicts [12]. Such AI-driven project planning helps prevent schedule overruns and meet critical deadlines [32], [53]. By utilizing AI-enabled systems, project managers can better manage their budgets and control costs [26].

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A survey reported in [54] showed that 84 % of respondents were of the opinion that enhanced decision-making is the most beneficial aspect of AI-integrated project management. Predictive analytics and machine learning (ML) enable project managers to analyze a large volume of data and patterns hence, allow project managers to make informed decisions [11]. The real-time analysis with the help of AI systems allows project managers to make data-driven decisions throughout the project life cycle [53], [59]. Real-time analysis has the potential of enhancing the effectiveness of project control as the project managers are able to respond swiftly to any deviation in performance [18], [48]. This data-centric decision-making eliminates biases and minimize human errors from decision-making.

Key Benefit	Description	Impact	References
Accurate Forecasting	AI-integrated project management enables accurate forecasting of project timelines, resource requirements, and potential risks.	• Informed decision-making, • Enhance planning accuracy, • Improve project outcomes, • High project success rate, • Financial control, • Proactive risk mitigation.	[10], [26], [32], [33], [34], [40], [45], [47], [48], [51], [53]
Enhanced Decision-Making	AI technologies enable project managers to evaluate complex datasets to make data-driven decisions.	• Swift and accurate decisions, • Reduce human error, • Eliminate bias decision-making, • Optimize project plans, • Increase project efficiency, • Improve project performance.	[11], [15], [17], [26], [32], [33], [37], [38], [39], [40], [41], [42], [43], [45], [47], [48], [51], [52], [53], [54], [57], [58], [61], [62], [63]
Improved Project Efficiency	AI-driven tools facilitate predictive analytics, automate repetitive tasks and streamline workflows to enhance project efficiency.	• Timesaving, • Cost saving, • Minimize waste, • Increase productivity, • Improve project outcomes.	[10], [11], [17], [26], [37], [39], [40], [43], [44], [47], [53], [61]
Real-time Monitoring	AI-enhanced systems offer real-time monitoring of project metrics and keep projects on track.	• Identify deviation from project plan, • Real-time resource adjustment, • Early risk detection, • Reduce likelihood of project failures.	[10], [11], [26], [33], [34], [38], [45], [48], [49], [52]
Task Automation	AI systems facilitate automation of routine tasks and performance reporting.	• Streamline workflows, • Timesaving, • Fast project execution, • Decrease human error, • Reduce administrative burden, • Improve efficiency.	[11], [18], [26], [33], [37], [39], [40], [42], [43], [45], [47], [48], [49], [51], [52], [53], [54], [58], [64]

Table 4. Benefits of AI Applications in Project Management

A major determinant in successful project management is project efficiency. AI-based systems with predictive analytics and real-time analysis capacities will enhance the efficiency of projects in the future [16], [37]. Automation and optimization of workflows through the integration of AI systems are also

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significant factors in enhancing productivity [47]. The other significant advantage of AI-based algorithms used to improve workflows is enhanced scheduling [26]. This reduces timelines and increases cost effectiveness, thereby adhering to typical time and cost constraints for successful project delivery [17], [58].

AI-based systems provide better insights into real-time performance data and hence, a holistic view of project progress [34]. These tools can be used to monitor complex projects, allowing managers to respond to deviations early with their risk mitigation plans [33]. This capability allows AI-based systems to improve project control and prevent their failures [48], [65]. Another way to track progress is through key performance indicators (KPIs). AI-based dashboards enable project managers to visualize them in real-time data to assess any variance [10].

AI's ability to automate processes is becoming increasingly appealing to project leaders. This feature is reported to be used by 65% of the project managers in a survey [43]. Automation of repetitive processes saves human efforts and minimizes the chances of human mistakes [11]. Besides, automation has the ability to process tedious tasks such as progress tracking and reporting, thereby lessens the administrative load [53]. Moreover, another benefit of automation is that it saves time on the routine tasks, which gives a project team an opportunity to concentrate more on humane decision-making [58].

2.3. Challenges of Integrating AI and Project Management

This paper also discussed the response of research question number 3, which is facing multiple technical and organizational challenges for the adoption of AI in project management. The challenges discussed in various studies reviewed and summarized in Fig. 6.

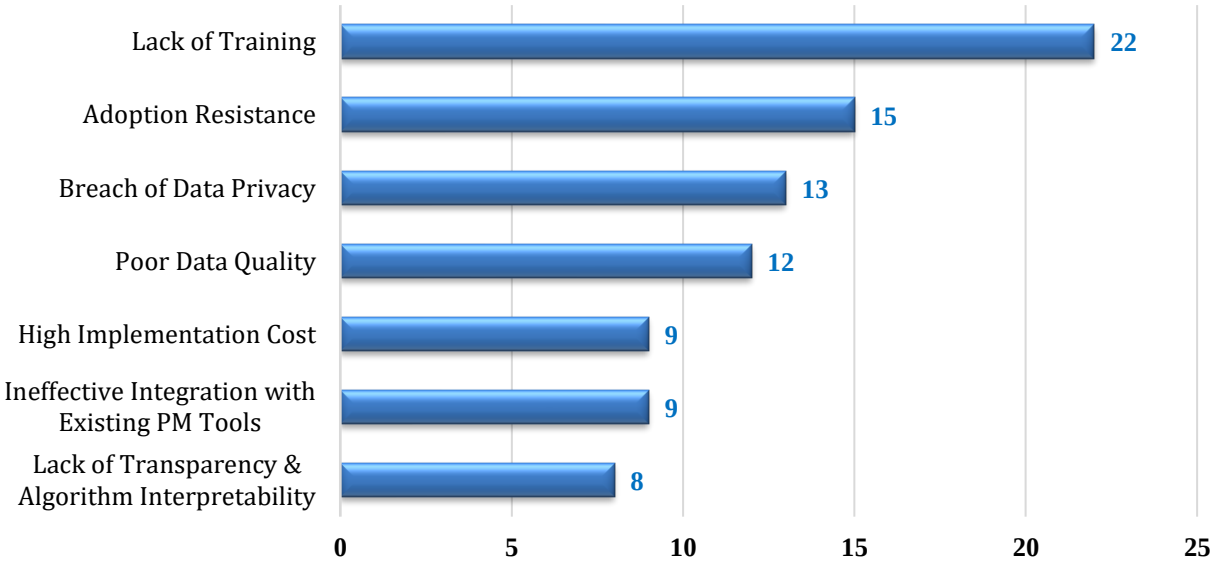

Figure 6. Frequency of literature reporting the challenges in Integrating Project Management & AI

Lack of training and the resistance to adoption of AI in project management are the most frequently mentioned challenges, cited in 22 and 15 studies, respectively. The results of AI models are inconsistent and unreliable without the availability of quality data, and 12 studies have discussed this challenge. The protection of sensitive data is another challenge, as mentioned in 13 studies. The transparency and

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interpretability of AI algorithms, integration of AI into legacy project management tools and high implementation costs are other challenges addressed in studies. Table 5 summarizes the barriers to implementing AI in project management and their effect on its adoption.

Challenge	Description	Impact	References
Poor Data Quality	AI-driven project management relies on the quality of data to train AI models for forecasting and decision-making. Its availability is a challenge.	• Unreliable forecasting, • Inconsistent decision-making, • Suboptimal resource allocation and scheduling.	[7], [17], [22], [26], [32], [33], [39], [47], [48], [52], [53], [64]
Breach of Data Privacy	AI systems access a large volume of data, raising concerns about data privacy and the protection of sensitive data.	• Organizational hesitancy on adoption of AI, • Non-compliance with data protection regulations, • Commercial and legal implications.	[10], [15], [17], [22], [33], [37], [42], [43], [50], [51], [53], [54], [58]
Lack of Transparency & Algorithm Interpretability	The concept of "black box" AI models results in a lack of transparency and algorithm interpretability.	• Impedes validation of AI models results, • Reduces confidence, • Lack of transparency and accountability.	[7], [10], [17], [26], [32], [33], [47], [52]
Adoption Resistance	AI adoption is facing resistance due various factors like high implementation cost, lack of technical skills and fear of job displacement.	• Slowdown AI adoption, • Implementation delays, • Negative impact on digital transformations of project management practices.	[10], [17], [22], [32], [33], [42], [43], [43], [45], [47], [48], [49], [52], [54], [58], [64]
Lack of Training	Successful AI adoption is possible with comprehensive training and skilled workforce capable of supporting AI integration.	• Limited adoption of AI, • Inefficient usage of AI tools, • Failure to realize its full potential, • Reluctance to embrace emerging technology.	[10], [11], [15], [17], [22], [32], [33], [37], [38], [39], [42], [43], [47], [48], [49], [51], [53], [54], [58], [61], [63], [64]
Ineffective Integration with Existing Project Management Tools	Integrating AI technologies with existing project management systems and legacy tools presents a challenge.	• High-implementation cost, • Implementation delays, • Disruption in project workflows.	[11], [15], [33], [39], [42], [47], [51], [52], [64]
High Implementation Cost	High investment in training and acquiring advanced systems for AI implementation poses a financial challenge.	• Extended ROI timeline, • Organizational reluctance in AI adoption, • Limits scalability.	[7], [10], [11], [26], [34], [37], [42], [48], [64]

Table 5. Challenges of Adopting Artificial Intelligence in Project Management

The accuracy of AI models depends on the quality of data. The project managers, however, have a challenge with their availability [47]. This absence of quality data may result in poor training of AI models that will lead to erroneous results [33]. Even more, data determines the quality of the analysis.

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The inability to provide high-quality data may result in poor scheduling and inefficient allocation of resources [32]. Statistical analyses with such shortcomings can reduce the confidence of organizations in adopting AI in project management [22], [52].

The concern of data breaches is what makes many companies hesitant to implement AI in project management [33]. One of the biggest challenges that companies are facing is the protection of project data and intellectual property [66]. Furthermore, not only a matter of commercial interests, but legal actions can also be initiated for non-compliance with data protection regulations [51]. A survey [43] showed that 61% of the project managers considered it a significant concern. The successful integration of artificial intelligence in project management is impossible without companies adopting multi-layered data protection systems to manage cases of data breach [15], [58].

The "black box" type AI models force project managers to accept the results without understanding the algorithms and decision-making process [32]. The limited interpretability of AI models reduces stakeholders' confidence in AI-based solutions [33], as their results cannot be validated [7]. The adoption of AI requires a certain level of trust, which is only possible when AI models are more interpretable [47]. Resistance to change is a challenge faced by all modern organizations. On one hand, economic factors are holding back organizations from proceeding with full-scale integration of AI into project management [49], while the complexity of AI tools and uncertainty of meeting objectives are technical barriers [32]. One of the underlying factors that is slowing down this transition to AI-integrated project management is the fear among employees of losing their jobs [48], [67].

A lack of skilled workforce is another obstacle to optimal implementation of AI [17]. The implementation of AI in project management could only be successful when project managers are well-trained to overcome their reluctance to embrace this new technology [33], [53]. Organizations should conduct specific training programs to make project managers aware of its potential benefits in project management [63]. The upskilling of team members to achieve a certain level of expertise in AI tools for project management is essential for its successful adoption [10], [32].

Most organizations have already deployed several standard commercial project management tools. The incompatibility of AI tools with existing project management software is also causing an organizational reluctance to their adoption [15]. To overcome the compatibility issue, companies should invest in new platforms and interfaces; however, on the flip side, this will increase its implementation costs [33]. Likely disruptions to existing operations during the implementation of AI tools are also causing hindrance in AI adoption in institutions [11]. A substantial budget is required to conduct training programs and acquire advanced computing systems for implementing AI in project management [37]. For many SMEs, limited financial resources remain one of the biggest hurdles to implementation [68]. In most cases, the high implementation cost is limiting its widespread adoption [11], [34].

3. Discussion

The purpose of the study to develop a well-grounded conceptual understanding of AI-integrated project management by analyzing its impact on various facets of project management, its significant benefits and its practical challenges. The literature was filtered and screened, using the PRISMA protocol, and then categorized thematically for analysis. Finally, 40 articles were included in the review, which

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provides a comprehensive analysis of AI adoption in project management. This discussion highlights both practical and managerial implications of AI in project management, as well as the theoretical contribution of this study.

3.1. Practical Implications of AI-Integrated Project Management

A review of the literature shows that the integration and adoption of AI in project management offers the following practical implications. A study conducted by Bachari et al. [35] found that AI-driven systems are inherently more suited to quantitative aspects of project management. This observation is supported by the results presented in this section, since they prove that AI has a potent influence on such spheres of management like scheduling, risk management, and cost control, while human-centric aspects of management remain less supported by AI.

- **Resource Optimization**

AI offers a massive transformational opportunity for resource optimization, which can greatly enhance the efficiency of projects. The fact that it can analyze large volumes of data makes it able to provide accurate predictions, thereby providing a possibility of optimized resource allocation [32], [33]. Such optimization eliminates bottlenecks which is a major issue encountered by project managers when executing projects.

- **Efficient Scheduling**

Project management involves scheduling as an essential component, and when it is done well, it will contribute to the project success. Predictive analytics will improve the capacity to forecast resource requirements, which is a key element in an efficient schedule [12]. This capability of the AI-based project management enables managers to optimize schedules with available resources and interdependencies between tasks.

- **Dynamic Planning**

The possibility of real-time information gathering is also a benefit of powerful AI tools in comparison to the classical project management software. Dynamic planning may be implemented with the aid of AI integration and this is a valuable attribute to achieve the project objectives [59].

- **Early Risk Identification**

The other important aspect of project planning is risk identification, which involves developing a risk register. Nonetheless, project risks are not static, but they also arise during execution. Through the real-time monitoring abilities of AI-powered systems, project managers can detect risks early [18] and accordingly, formulate strategies to mitigate them and avoid financial consequences [11], [15].

- **Time Saving**

Project managers are increasingly adopting automation in project management practices. Systems driven by AI assist in automating project management processes such as scheduling and monitoring progress [53]. This saves time on repetitive tasks and allows decisions in shorter time [35].

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- **Cost Effectiveness**

AI-integrated project management has also improved project scheduling, which lowers the total project duration and cost [11], [53]. In addition, AI applications enable project managers to identify the cost drivers to forecast the budget more accurately than conventional methods of cost estimation [24], [68].

- **Stakeholders' Trust Deficiency**

One of the foremost technical barriers to the adoption of AI in project management is the "black box" type AI models, which lack transparency and reduce interpretability. This lack of transparency in AI models erodes trust in the decision-making process and its subsequent results [7], [32]. Another hindrance to the acceptance of AI models is the absence of explainability in their output. Therefore, human oversight is essential to ensure trust in AI-integrated project management outcomes.

- **Unskilled Workforce**

The absence of AI literacy, particularly in the context of project management, will lead to poor project performance and resistance to its adoption. Therefore, organizations should conduct training programs to upskill team members and make project managers aware of the potential benefits of AI adoption [63], [10], [32].

- **Emotionless Project Leadership**

In the real world, team leadership requires specific soft skills and emotional considerations that are beyond the capacity of data-driven AI systems [45]. Moreover, AI lacks the capacity to replace human-centric aspects of project management, such as empathy and negotiations, and therefore fails to achieve stakeholder satisfaction [17], [21], [44]. Project leaders should complement AI-driven decision-making with human leadership strength.

3.2. Managerial Implications

Based on the research findings, enhanced decision-making and efficiency are key managerial implications for organizations adopting AI in project management. AI applications assist project managers in optimizing resource allocation, improving scheduling, managing risks, producing accurate cost estimates, and enhancing stakeholders' engagement and communication.

With the integration of artificial intelligence (AI) into the project management process, managers are able to anticipate the future needs of the resources and the possible bottlenecks. Besides, efficient scheduling is another advantage of AI to the project managers. Real-time monitoring is one of the main advantages as it enables managers to monitor progress and determine project deviation. This is useful in mitigating risks as they arise. Repetitive jobs can be automated, which minimizes human interferences and workload, freeing managers from repetitive tasks, and allow them to concentrate on better decision-making.

3.3. Theoretical Implications

This study offers theoretical implications that would inform future research. It contributes to existing frameworks, including Technology-Organization-Environment (TOE), when it comes to evaluate AI

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adoption in project management. The TOE framework examines the influence of different factors on the technology acceptance [69]. These are technological prowess, organizational preparedness, and external environmental considerations that impact the adoption decisions. An overview of the TOE framework is shown in Fig. 7.

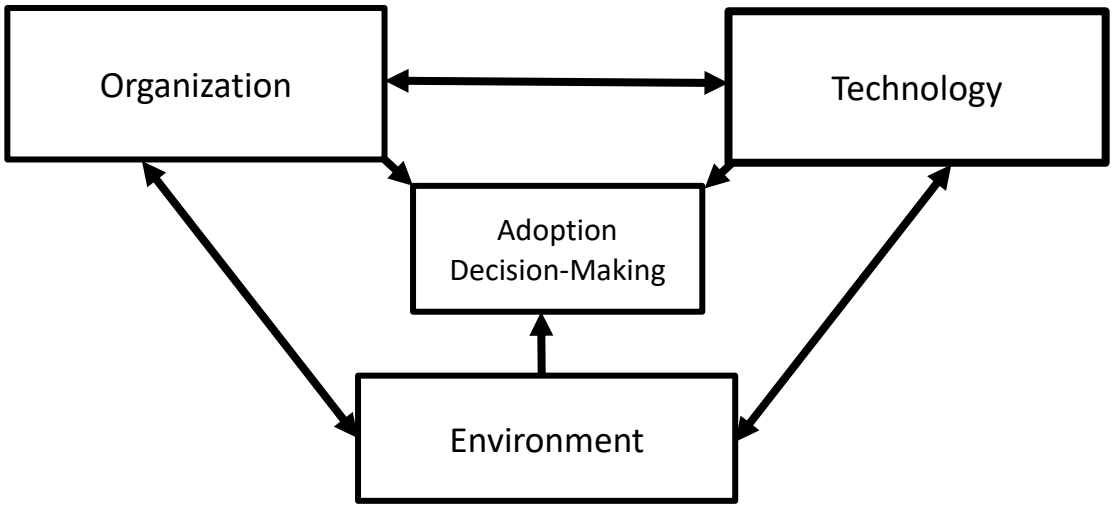

Figure 7. An Overview of TOE Framework

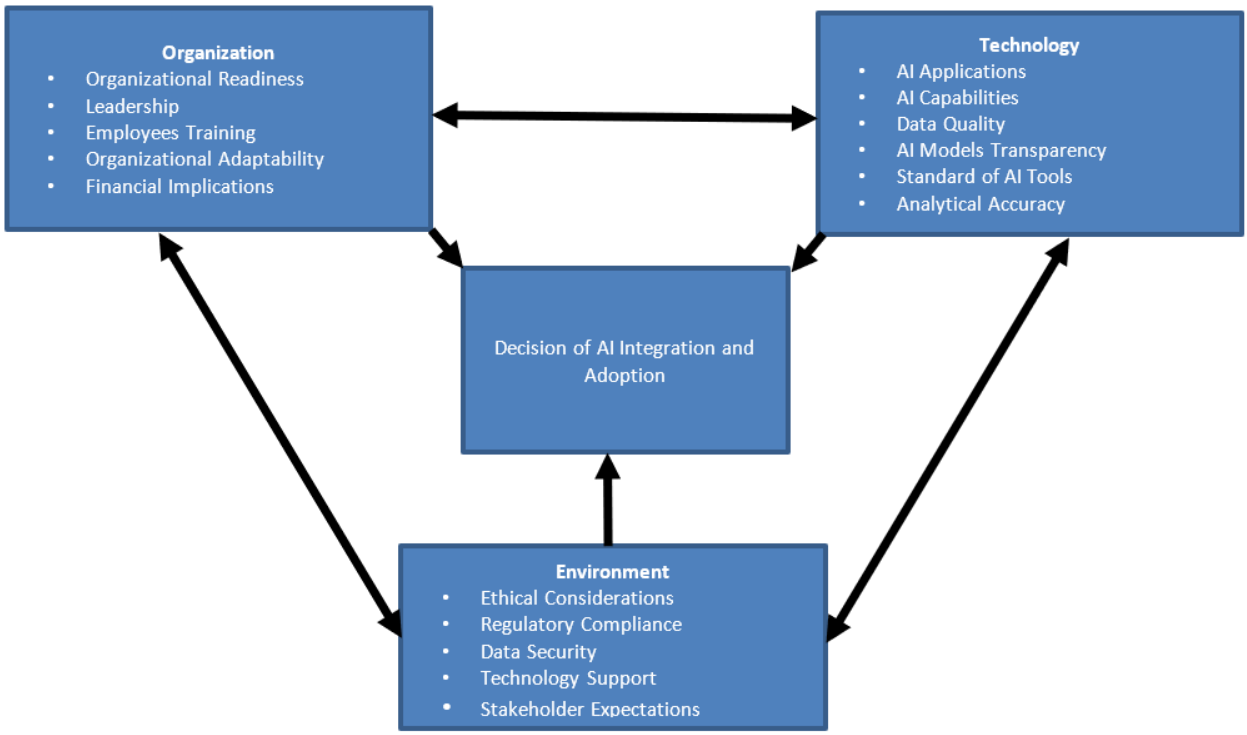

Figure 8. An Extended TOE Framework for AI Integration and Adoption

Nevertheless, the conventional TOE model lacks the sub-factors that can be used to analyze AI adoption in project management. This research study contributes to this framework through the introduction of pertinent sub-factors in order to allow future research to assess these interrelated factors that affect the

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adoption of AI in project management. The extended TOE framework with interrelated sub-factors for AI adoption is shown in Fig. 8.

4. Risk Identification Analysis

This paper evaluated existing knowledge and carried out a structured literature review, which involved the identification of studies, the systematic selection of literature, the extraction and synthesis of information. The findings were interpreted to come up with a holistic view of how artificial intelligence (AI) can affect key facets of project management. Its possible advantages and challenges were also considered in the study. The main opportunities and threats, associated with the adoption of AI in project management, identified through the structured literature review and subsequent data synthesis are illustrated in Figure 9. This section presents an in-depth analysis aimed at addressing the ultimate objective of assessing the risks associated with the implementation of AI in project management.

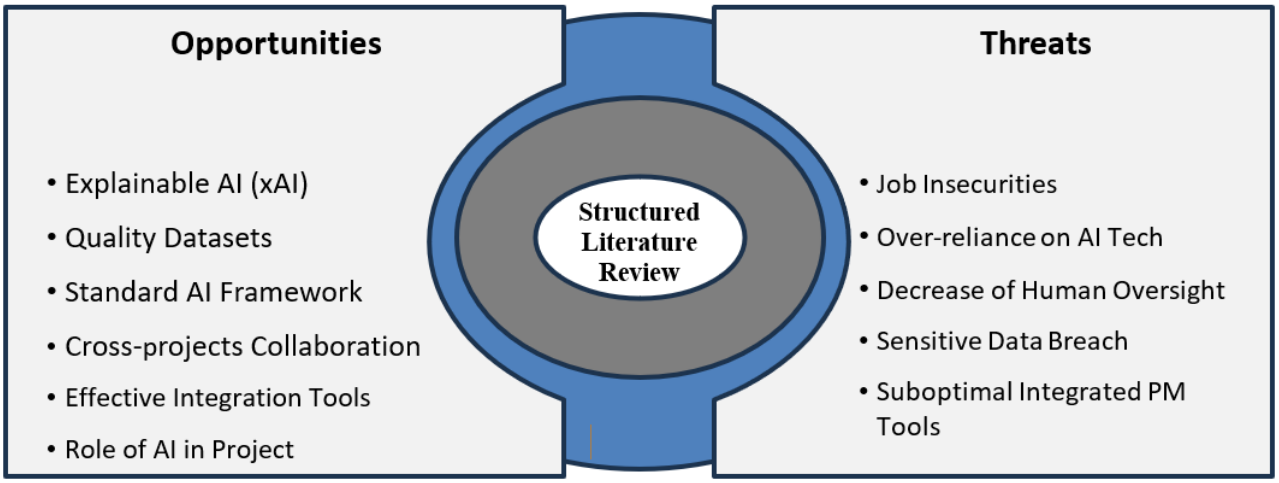

Figure 9. Identified Risks Based on Literature Review and Systematic Analysis

4.1. Opportunities

The inability of "black-box" AI models to provide transparency and interpretability in their processing has already been discussed in this article. It leads to a decrease in stakeholders' trust in the results proposed by these models. Thus, investment in R&D for explainable AI (xAI) will enable project managers to comprehend their results and increase trust in the decision-making process [32]. The development of xAI will enhance the interpretability of AI models and make stakeholders more confident in their results [33]. Moreover, these advances in technology will encourage the adoption of AI in project management. AI tools are based on data-driven decision-making; hence, it is necessary to enhance data quality to get reliable outcomes. It is also essential to take into account industry-specifics and contextual factors in datasets to enhance the project results [21]. Another avenue is exploring cross-project collaboration to achieve more productive results in AI-integrated project management. Organizations manage several projects, and hence, by incorporating AI in their interconnected projects, they can integrate decisions to optimize resource utilization [33]. It is also important that project management professionals in industry and academia should address the absence of standard frameworks for adopting AI in project management. The absence of standard frameworks can be

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regarded as one of the key impediments to the implementation of AI, as it provides organizations with no systematic method on how to incorporate AI into existing workflows [11], [37]. The development of a standard framework would ensure the smooth adoption of AI in project management by allowing organizations to obtain credible project results [17], [18]. As stated above, AI tools are data-driven and sometimes lack contextual knowledge and industry peculiarities [21], [33]. Thus, it is essential to develop a model of human-AI collaboration that incorporates human supervision to esnure effective decisions. There are many challenges associated with effectively integrating AI tools with existing and legacy project management software. This incompatibility between AI tools and legacy systems is causing resistance to adoption and hindering a complete implementation [15], [47]. Thus, the industries will have to make both technical and financial investments to guarantee the provision of efficient AI-based project management software.

Procurement is an essential component of project management, and inefficient procurement can increase the risk of project failure. Researchers emphasize the need for further research into AI-integrated procurement management [35]. This presents another opportunity to explore the integration of AI into the procurement process to facilitate its widespread adoption.

4.2. Threats

Although excitement about the evolution of AI technologies and their possible advantages is rising, the concern of job reductions is on the rise as well [38]. According to [43], 37% of the surveyed project managers expressed apprehension about the likelihood of job losses due to the growing relevance of AI in project management. The risk of job losses is not restricted to project managers. Automated routine tasks could be endangering the jobs of many professionals working on projects, exacerbating socioeconomic inequalities [21], [50]. Proximate deadlines and the urgent nature of tasks are inherent to projects. Thus, the tendency of humans to laziness and complacency will most probably result in over-dependence of project partners on AI tools and reduced human oversight [70]. As discussed above, a lack of transparency and interpretability, along with the unavailability of high-quality data can lead to unreliable project results. Thus, AI technology should be used alongside human supervision to ensure the proper balance and provide the appropriate outcomes of the project [53].

The issue of data privacy is critical to organizations, and its violation might compromise the trust of stakeholders, competitive edge, and cause financial and legal repercussions. AI-based project management systems are based on enormous data volumes; thus, unauthorized data access and the loss of sensitive data pose significant threats to companies [43], [66]. The fact that the existing AI-enabled project management tools are not trusted by project managers underscores the need to devise a standard validating process for these tools. The implementation of suboptimal AI tools is bound to lead to poor results and undermine the chances of widespread adoption of AI-based project management applications.

Conclusion

This research aimed to conduct an in-depth examination to determine the risks associated with the implementation of AI in project management. A structured literature review, using the PRISMA protocol,

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was performed to study the existing body of knowledge and determine the risks associated with the adoption of AI in project management. This study can help researchers and developers to design a more sophisticated plan for applying AI to project management. The study was developed on the basis of a comprehensive understanding of the impact of AI on key aspects of project management, its potential benefits, and practical challenges. The emergence of AI impacts the underlying core functions of project management, including resource allocation, scheduling, budgeting, and risk management. Although AI is employed to achieve accurate forecasting, improve decision-making, enhance project performance, and automation of tasks, it is also experiencing a lot of challenges, such as data breaches, non-transparency and uninterpretable AI models. Other challenges include high implementation costs and the absence of efficient AI-integrated project management tools.

Analysis and synthesis of the results provided an evaluation of positive and negative risks, i.e. opportunities and threats. The development of explainable artificial intelligence (xAI) and the availability of high-quality datasets will make people much more confident in adopting AI to support decision-making in project management. Moreover, organizations need robust frameworks to assist in the successful adoption of AI in project management. However, although unemployment and increased socioeconomic inequality are the main concerns expressed by employees regarding the adoption of AI, excessive reliance on suboptimal AI tools and ineffective human oversight may also result in project outcomes.

This paper offers a holistic conceptual insight into the practical and managerial implications of AI integration in project management, including real-time monitoring, dynamic planning, and early risk identification. Moreover, this study contributes to future research by providing key factors for assessing the integration and adoption of AI in project management using theoretical frameworks, such as the TOE model. This also helps both academia and industry develop more effective strategies for implementing AI in project management, thereby improving project productivity across sectors, including infrastructure development, software and information technology development, and healthcare. For example, in healthcare projects, AI-based predictive analytics can accurately predict patient-to-staff ratios, enabling improved facility planning and resource allocation [30].

Limitations and Future Research

Despite the detailed analysis provided in this paper, it is important to note that there are a number of limitations. To start with, this research is based on secondary data; thus, the inclusion of empirical data in future research can further improve the validity of the findings. Second, the research is not focused on a specific industry, which can lead to a decrease in the generalizability of the findings to particular sectors. In addition, the research is restricted to publications in English language, which may have left out other valuable publications in other languages that could provide findings in a regional context. Lastly, the field is evolving very fast and the findings can become obsolete over time. That is why it is necessary to regularly update a literature review.

Future studies should examine how contextual information can be incorporated into the datasets and industry-specifics details, as the project environment of different industries differs. In addition, the lack of standard frameworks for AI implementation in project management is one of the key factors that have

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led to the unwillingness of organizations to adopt AI. Therefore, it is an important area suggested for future research. Our analysis demonstrates that AI systems cannot be trusted without human oversight. Thus, one should develop a holistic human-AI collaboration model to facilitate integrated AI-based project management to enable trustworthy results. Furthermore, a literature review indicates the need for more empirical studies in this field to better address the challenges of implementing AI in project management.

Authors' Contributions

Both authors contributed equally to the conceptualization and research design. Muhammad Adnan Siddiqui conducted a comprehensive literature review, applied the methodology, analyzed of the results, synthesized the findings and prepared the original draft. Whereas Dr. Muhammad Wasif, as the supervisor of the project, validated the findings, contributed the discussion, and reviewed and edited the draft of the paper. All authors have read and approved the final version of the manuscript.

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Conflicts of Interest

The authors declare no conflicts of interest.

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