01-016 – The impact of artificial intelligence on Project Management: a state of the art review – El impacto de la inteligencia artificial en la Dirección de Proyectos: una revisión del estado del arte

Bernal Alcázar, María[1]; *Aragonés-Beltrán, Pablo*[1]; *Fuentes Bargues, José Luis*[1]
(1) Project Management, Innovation and Sustainability Research Center (PRINS). Universitat Politècnica de València

English Spanish

Artificial Intelligence (AI) is transforming the way we approach many tasks and revolutionizing all areas in recent years. The integration of AI in Project Management is presented as a strategic tool with significant benefits that directly impact the improvement of efficiency, risk management, decision making, resource allocation and communication with project stakeholders. The objective of this study is to conduct an analysis of the current status and impact of AI implantation in Project Management and to identify the areas of use of AI, its level of implementation, ethical considerations and other relevant aspects cited in the literature. AI continues to evolve, its role can be critical in the future of Project Management if managers and researchers take advantage of its potential to achieve successful results, promoting an innovative attitude and encouraging continuous adaptation to new opportunities and needs.

Keywords: *Artificial intelligence; Project management; Impact; Integration; Potential; Challenges*

La inteligencia Artificial (IA) está transformando la forma de enfrentarnos a muchas tareas y revolucionando todos los ámbitos en los últimos años. La integración de la IA en la Dirección de Proyectos se presenta como una herramienta estratégica con beneficios significativos que impactan directamente en la mejora de la eficiencia, gestión de riesgos, toma de decisiones, asignación de recursos y comunicación con los interesados de los proyectos. El objetivo de este estudio es realizar un análisis sobre el estado actual y el impacto de la implantación de la IA en la Dirección de Proyectos e identificar los ámbitos de utilización de la IA, su nivel de implantación, consideraciones éticas y otros aspectos relevantes citados en la literatura. La IA sigue evolucionando, su papel puede ser fundamental en el futuro de la Dirección de Proyectos si los directores e investigadores aprovechan su potencial para conseguir el éxito de los resultados, promoviendo una actitud innovadora y fomentando la adaptación continua a nuevas oportunidades y necesidades.

Palabras claves: *Inteligencia artificial; Dirección de proyectos; Impacto; Integración; Potencial; Retos*

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1. Introduction

Artificial Intelligence (AI) is here to transform and empower businesses around the world and across all industries, including project management (Svetlana et al., 2022),(Dam et al., 2019). The success of a project "is measured by product and project quality, timelines, budget, customer satisfaction, and achievement of intended outcomes" (Project Management Institute, 2021). On the other hand, ISO 21502 states that determining the success of a project includes meeting objectives, achieving benefits, driving organizational or societal changes, such as operational performance, and achieving sustainable change, including ongoing fulfillment of the business case expectations. In this regard, project management plays a critical role in the successful delivery of projects across all industries by ensuring that requirements are met and effectively managing their scope, quality, time, and cost (Zia et al., 2024), considering both customer and stakeholder satisfaction. The greater the scale and complexity of the project, the more necessary it is to use tools and methodologies that help make decision-making and resource-allocation tasks more efficient (Mahfuzul & Shamim, 2024),(Khatib et al., 2021).

The democratization of AI began in the early 2000s with advances in statistical and machine learning techniques, enabling applications such as image recognition and natural language processing. By the mid-2010s, deep learning enabled major advances in computer vision and natural language, bringing platforms like Siri into everyday life. Today, Generative AI (GenAI) is leading the revolution by creatively creating content based on massive training data, understanding context and complex language patterns (Deshpande, 2023).

How does the advent of AI impact project management? By automating repetitive and low-cognitive tasks, it is easier to improve existing knowledge and acquire new skills. Project managers who incorporate AI into their roles and take advantage of its capabilities will improve their efficiency, effectiveness, creativity, and strategic decision-making, and will be better positioned to stand out in this changing and evolving environment (Deshpande, 2023) (Fridgeirsson et al., 2021).

PMBOK 7 introduces a new approach that focuses on project development and value creation. In this context, project managers are guided by twelve principles that are integrated with eight fundamental performance domains: Stakeholder Performance, Team Performance, Development Approach and Life Cycle Performance, Planning Performance, Project Work Performance, Delivery Performance, Measurement Performance, and Uncertainty Performance.

This research aims to conduct a systematic literature review (SLR) to investigate the impact of artificial intelligence tools on project management, specifically mapping them to the performance domains defined in the seventh edition of the Project Management Institute PMBOK. By conducting a comprehensive review of the existing literature, the findings provide insights into the concrete impact that AI can have on the performance of stakeholders, teams, development approach and lifecycle, planning, project work, delivery, measurement, and uncertainty to help organizations in their challenge to get the most out of AI and achieve the maximum possible benefits in its integration into project management.

Given the accelerated pace at which AI is advancing, it is considered essential to review the current state of its application in Project Management based on the most recent research, which justifies the emphasis on the literature of recent years. This analysis allows not only to identify concrete advances, but also to make visible the existing gaps in knowledge, opening clear lines for future research.

The communication approach is structured around the performance domains of the PMBOK 7 with the objective of providing a comprehensive analysis aligned with the current PMI model practices on the impact of AI on Project Management. Future developments will analyze the

impact of AI on other Project Management models. This organizational structure allows us to examine how AI influences each key performance domain, facilitating the identification of opportunities, risks, and transformations in project planning, execution, and control. Furthermore, this approach aligns with the evolution of the PMI standard. In its seventh edition, the PMI standard adopts a principles-based framework instead of a process-based one. This promotes a more agile, adaptive, and value-delivery-focused management approach. In this context, domain analysis can demonstrate how to effectively integrate AI to reinforce these principles and improve performance in complex and changing environments.

2. Methodology

A systematic review of the literature was conducted to determine the state of the art in the use of artificial intelligence in project management. Figure 1 shows the steps which are described below.

1. Research question definition.

   In this case, the main question on which the research was focused was "How has Artificial Intelligence affected project management in recent years? From this, other sub-objectives were identified to determine how areas such as stakeholder or team management or planning, among others, have been affected, but also the challenges and difficulties that project managers have encountered in applying AI in their daily work.

2. Protocol review with exhaustive search.

   The next step was to define the search to be performed.

   a. Aims and objectives: First, the objective was defined according to the question posed, which is to examine the impact of AI on project management and the tasks of project managers. The keywords for the literature search, therefore, are Artificial Intelligence or AI, and project management.

   b. Information sources: The literature search was conducted in recognized academic databases such as Scopus, Web of Science and Google Scholar. The search was carried out with the combination of the above-mentioned keywords, and in SCOPUS 335,493 results were obtained using the search (Artificial Intelligence OR AI) AND (Project Management OR PM); in Web of Science the search (ALL= (artificial intelligence)) AND ALL= (project management)) was applied, and 16,098 results were obtained; finally, in Google Scholar 6,050,000 results were obtained using the search "AI in Project Management" and 4,890,000 results were obtained using the search "Artificial Intelligence in Project Management".

   c. Inclusion and exclusion criteria: To refine the search, inclusion criteria were used to consider only studies published in the last five years, starting with 2019. Document type was also included as a criterion, filtering by articles, conference papers, books, and book chapters, and always in English. Furthermore, SCOPUS also included the inclusion of "artificial intelligence" and "project management" as keywords.

3. Study selection process.

   The initial searches returned tens of thousands of results in all cases, with 23,329 in SCOPUS specifically, 15,916 in Web of Science, and 28,400 in Google Scholar. Following this search, duplicate results were first discarded, and then the titles and abstracts of the most interesting were reviewed, eliminating those whose content was inconsistent with the research question. Also included are results that did not come up in the detailed search above but were cited in articles of interest.

4. Data extraction.

   To facilitate data extraction and collection, two forms were created: one to manage the content of interest after reviewing the articles (Content Extraction Form) and another to list all relevant literature (Literature Review Form), which was entered into Mendeley. Each time an article was found to be of interest due to its content, it was saved in both forms, compiling the relevant information, which is listed below:

   a. Content extraction form: (1) Current application of AI in Project Management, (2) Challenges and difficulties, and (3) Opportunities and open fronts

   b. Literature review form: (1) Title and link, (2) Date, (3) Authors, (4) Relevant content information (e.g. notes on the fields of application of AI, challenges, opportunities), (5) Keywords

5. Quality assessment.

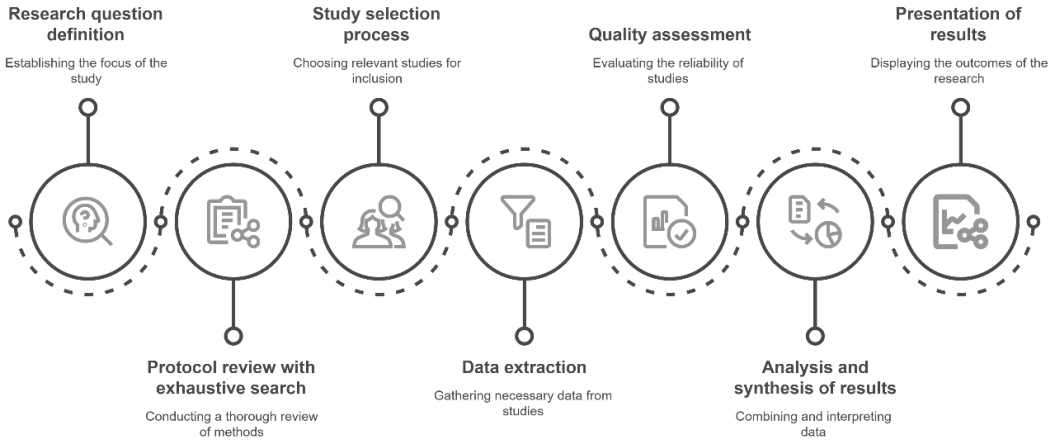
   The selected studies were assessed for quality, ensuring that the sources, results, and conclusions were relevant to the question posed and the objective of this paper.

6. Analysis and synthesis of results.

   After reviewing the studies and obtaining relevant information, an analysis was conducted to identify trends and patterns that recurred in the application of AI to project management. These findings were then grouped by the areas affected by AI within project management (stakeholders, teams, measurement, uncertainty, among others), and the difficulties, challenges, and opportunities for future research were identified.

7. Presentation results.

Figure 1: Methodology.



3. Results

This section is divided into three subsections. First, it presents current contributions of AI to project management, organized by specific areas that have seen significant impact. The second section discusses the main difficulties and challenges encountered so far in integrating AI into project management. Finally, a section suggests various opportunities and potential lines of future research in applying AI to project management.

3.1 Current Contributions of AI in Project Management

1. Stakeholders performance

   A very important part of project management is working with stakeholders from the outset to ensure alignment and successful relationships are maintained throughout the project. This domain involves working with stakeholders, who may change over the course of the project and whose interests and power may also change, to gather requirements, manage expectations, negotiate, prioritize, make decisions, and resolve problems (Project Management Institute, 2021).

   AI has transformed project communication through Natural Language Processing (NLP) tools like chatbots and virtual assistants (Felicetti et al., 2024), (Nagarhalli et al., 2022), and RPA for automating routine tasks, enhancing stakeholder engagement. By automating the process of summarizing meeting notes, extracting next actions lists, and generating and distributing the status updates and tailored reports, these tools can streamline communication between project stakeholders (Muthusubramanian et al., 2024), (Nitin Rajadhyaksha & Saini, 2022), (Shoushtari et al., 2024). This facilitates more efficient interactions, saves time and ensures that everyone is aware of and aligned on their responsibilities. Moreover, RPA can track changes in project documentation and notify the appropriate stakeholders of updates, so everyone is aware of the most recent news (Muthusubramanian et al., 2024). AI could also improve communication about risks among stakeholders by helping to summarize risks and their potential impact (Erfani, 2023), as well as about project performance by automating the generation of assessment reports, including key metrics, achievements, budget adherence, cost forecast, and variance analysis. Project managers can then engage stakeholders in discussions, foster a collaborative approach, and ensure that all relevant parties are involved in addressing potential threats (Dhliwayo & Dhliwayo, 2024).

   AI tools enhance communication and collaboration among project stakeholders by providing virtual assistants and a shared space for data analysis and decision-making. This collaborative and AI-powered tool encourages contributions from team members and stakeholders since they allow to interact in natural language, providing access to relevant project information and helping with data retrieval, resulting in more in-depth and well-informed decisions (Muthusubramanian et al., 2024), (Dhliwayo & Dhliwayo, 2024).

   In addition, AI can mine stakeholder engagement data to measure the success of communication and collaboration efforts throughout the project (Mahfuzul & Shamim, 2024). By reviewing feedback and participation rates, NLP can extract insights from open-ended responses and AI can highlight stakeholder satisfaction and pinpoint areas that need attention (Auth et al., 2021), (Mariani & Mancini, 2023), (Nagarhalli et al., 2022).

Table 1: AI on stakeholders performance

Applications of AI	Results
Summarize meeting notes Extract next action list Generate tailored reports Distribute reports and status updates	Streamline communication between stakeholders
Shared space with virtual assistants for members to contribute and interact in natural language to access relevant information about project	Enhance collaboration
Measure the success of communication and collaboration Review feedback and extract insights	Highlight satisfaction and pinpoint areas of attention

2. Team performance

In terms of team performance, project management combines management activities such as planning, coordinating, and monitoring with leadership activities that focus on motivating, influencing, and supporting the team. The project manager's role in team performance includes removing obstacles, providing guidance, and facilitating development opportunities (Project Management Institute, 2021).

One of the ways to make the team's work more efficient is to use RPA to automate administrative tasks, allowing the project manager and the team to focus and spend more time on more strategic (Fridgeirsson et al., 2021), higher-value tasks that require human intervention for creativity and critical thinking (Nitin Rajadhyaksha & Saini, 2022). In addition, the use of RPA facilitates task scheduling by automatically assigning tasks based on pre-defined criteria such as availability, expertise and specialty, or team member workload (Auth et al., 2021). Using AI to match people's skills with the right tasks not only improves efficiency (Ruiz et al., 2021), but also boosts team morale, as team members feel more satisfied when they are assigned tasks that play to their strengths. Another functionality that RPA enables is the sending of reminders through notifications to the team to encourage proactive communication to warn of changes, upcoming deadlines, and more (Muthusubramanian et al., 2024).

Table 2: AI on team performance.

Applications of AI	Results
Automation of administrative tasks	Focus of strategic tasks
Assign tasks to team members based on predefined criteria, such as areas of interest or expertise	Improve team satisfaction
Send reminders	Foster communication

3. Development approach and life cycle performance

This domain focuses on the activities and functions that define the project's development approach, cadence and life cycle phases. Successful execution of this domain leads to development approaches that aligned with project deliverables, a project life cycle that includes phases that support the continuous delivery of value to stakeholders throughout the project, and phases that provide the necessary cadence and approach to achieve the intended project outcomes (Project Management Institute, 2021). As mentioned above, one of the benefits of AI, and RPA in particular, is the automatic generation of reports without the need for human intervention (Muthusubramanian et al., 2024). This tool allows information to be extracted from various systems, such as spreadsheets, databases, and different software (Nitin Rajadhyaksha & Saini, 2022), and dumped into predefined templates and other management software, saving time in the production of deliverables, autonomously updating data in the systems involved, reducing the likelihood of human error, and ensuring access to real-time project insights (Deshpande, 2023).

RPA increases standardization across project processes by automating repetitive tasks (Dr. Deepali Godse et al., 2024). This uniformity minimizes variability and increases the reliability of project outcomes. Additionally, standardized processes help identify inefficiencies and areas for improvement because the same steps are followed consistently. Moreover, RPA-driven standardization can improve compliance with regulatory requirements and organizational policies, as automated processes are less likely to deviate from manual processes (Muthusubramanian et al., 2024).

Table 3: AI on development approach and life cycle performance.

Applications of AI	Results
Extract information from multiple systems or applications Dump data into templates and management software Generation of deliverables with real-time project insights	Access updated information in real time
Automation of repetitive tasks Identification of areas for improvement	Standardization, improve reliability and compliance

4. Planning performance

The planning performance domain includes the activities and functions related to the organization and coordination required to provide project results and deliverables and to ensure project progress in a coordinated and organized manner. This requires the estimation of effort, duration, cost, and human and physical resources. Planning must be detailed, yet adaptable to new needs as they arise (Project Management Institute, 2021).

The use of AI in project planning is very useful because it allows the simulation of long-term plans. These tools analyze large amounts of data on project history, outcomes, impacts, and implications, helping to generate forecasts for future initiatives (Auth et al., 2021).

As projects progress, conditions can change rapidly, requiring adaptation. With AI, resource allocation can be automatically adjusted based on new information and unforeseen events (Mariani & Mancini, 2023), (Fridgeirsson et al., 2021). It also enables analysis of workload, resource utilization, and performance metrics – such as cost or schedule - throughout the project lifecycle, identifying trends and patterns and suggesting task redistribution or staffing based on workload balance (Muthusubramanian et al., 2024). This allows managers to proactively respond to changes, optimize resource utilization in real-time, reduce the risk of cost overruns, and ensure that the project stays on track (Hashfi & Raharjo, 2023).

One of the advantages of GenAI is that it allows you to enhance planning by analyzing large amounts of data that were previously very difficult to manage and obtain (Deshpande, 2023). AI can assess the costs associated with different resources and suggest alternatives that reduce costs without compromising project quality or schedule (Auth et al., 2021). This includes identifying lower-cost resources or rescheduling tasks to take advantage of the availability of lower-cost resources at different times and optimize their allocation.

In addition to the benefits of using AI in resource management, AI can use historical data from other projects and machine learning algorithms to accurately predict project deadlines (Savadatti et al., 2022). Through this analysis, AI can predict the duration of similar tasks or phases in future projects and identify when specific project milestones will be achieved and cost trends, making it easier for managers to realistically set deadlines, identify bottlenecks, and adjusting schedules based on informed estimates and providing more reliable budget forecasts (Fridgeirsson et al., 2021), (Muthusubramanian et al., 2024). These innovative tools enable the evaluation of potential costs against expected benefits to suggest specific actions and better alternatives that provide the highest potential return on investment (Ruiz et al., 2021).

The use of AI also helps identify critical paths in scheduling, as it can identify which tasks are critical to project completion and help prioritize efforts and resources. This can alert managers to plan ahead for the acquisition or allocation (Ruiz et al., 2021), (Mariani & Mancini, 2023) and makes it easier to avoid delays, ensuring that the project continues as planned (Muthusubramanian et al., 2024).

Another useful application of AI is to improve task sequencing. AI analyzes hypothetical scenarios and allows project managers to explore the potential impact of various decisions before implementing them. By simulating these different scenarios, potential outcomes and associated risks can be assessed, allowing for more informed and strategic decision-making (Ruiz et al., 2021). For example, by changing resource allocation or schedule or adjusting budget constraints, different scenarios are generated to predict how these changes may affect the project and weigh the pros and cons of each option.

Table 4: AI on planning performance.

Applications of AI	Results
Analysis of large amount of data on project history	Simulation of long-term plans
Adjust resource allocation automatically Analysis of workload, resource utilization, and performance metrics to identify trends and patterns Suggest task redistribution or staffing	Adaption to change
Assess costs associated with different resources Suggest alternatives without compromising quality and schedule Identification of lower-cost resources and rescheduling tasks to take advantage of the availability of lower-cost resources	Cost reduction
Analysis of historical data to predict the duration of tasks and budgets Identify bottlenecks and cost trends Evaluation of potential costs against expected benefits to suggest actions and alternatives Identification of critical paths to prioritize efforts and resources	Estimate time and cost
Analysis of hypothetical scenarios Explore potential impact of various decisions Simulate different scenarios	Strategic decision-making

5. Project work performance

One of the results of the effective implementation of this domain is the improvement of the capabilities of the team, both by providing them with the appropriate continuous learning and by streamlining the processes in which they are involved (Project Management Institute, 2021).

RPA can be easily and non-invasively integrated with the various software used in project management to automatically synchronize data across tools (Nitin Rajadhyaksha & Saini, 2022). By reducing manual intervention, the potential for errors that can occur when using multiple systems is minimized. It ensures that all tools are up to date and reduces the time spent on these mechanical tasks, allowing the team to focus on other, higher value tasks. Furthermore, AI can improve innovation by enhancing the agility and responsiveness of project workflows (Hashfi & Raharjo, 2023). For example, in software projects, for instance, AI can assist in code generation, bug identification and suggest solutions, accelerating delivery times and helping the team deliver results.

Lessons learned enhance project management effectiveness and foster a culture of continuous improvement through knowledge sharing. AI can review lessons learned from other similar projects, identify common challenges, and synthesize feedback from the team members and stakeholders for the project team to learn from such situations to avoid repeating mistakes on similar projects and identify what they can do better (Ruiz et al., 2021), (Shoushtari et al., 2024).

Table 5: AI on project work performance.

Applications of AI	Results
Synchronization of data across tools	Updated tools
Reduction of manual intervention Enhance agility and responsiveness of project workflows	Innovation
Review lessons learned Identification of common challenges Feedback synthesis	Continuous improvement

6. Delivery performance

Expected results in the area of delivery performance include producing deliverables and outcomes within the time frame established (Project Management Institute, 2021).

To achieve this, and as mentioned above, tools like RPA can help retrieve data from various management systems, emails, and other sources to generate reports according to established formats, saving time and reducing the possibility of human error by eliminating manual intervention (Nitin Rajadhyaksha & Saini, 2022). In terms of on-time delivery, AI analyses and tracks critical project metrics, such as schedule and cost, in real time to identify deviations. Project managers can then take corrective action based on AI-recommended suggestions (Auth et al., 2021), generated by the predictions of machine learning models that analyze large amounts of data (Fridgeirsson et al., 2021). There is also the potential to use AI-powered tools for automatic schedule adjustments, reallocating tasks or resources based on changing circumstances to ensure the project continues on track (Mariani & Mancini, 2023), (Fridgeirsson et al., 2021).

Table 6: AI on delivery performance.

Applications of AI	Results
Data recovery Generate reports	Reduce time and potential human error
Identification of deviations Corrective actions suggestions Automatic adjustments in tasks and resources	Ensure on-time delivery

7. Measurement performance

The activities associated with this domain are those that evaluate project performance to take appropriate actions to maintain expected performance, that is, to ensure that the level of work done in the Delivery Performance Domain matches what is expected and reflected in the Planning Performance Domain (Project Management Institute, 2021). Measures are used to track and evaluate resource usage, budget spend, and work performed against plans. They indicate whether the project is progressing as expected and provide actionable information to support decision-making (Project Management Institute, 2021).

AI tools can continuously assess and monitor project performance in real-time throughout the project lifecycle. They can integrate with various management systems and track key performance indicators (KPIs) to identify deviations and provide managers with the necessary data to facilitate decision-making, reducing the likelihood of potential negative impacts on project outcomes (Hashfi & Raharjo, 2023).

Table 7: AI on measurement performance.

Applications of AI	Results
Monitor project performance in real time Track KPIs to identify deviations	Support decision making

8. Uncertainty performance

The scope of this domain is the assessment and management of activities associated with uncertainty and risk. This requires knowledge of the broad environment in which the project is being developed, all its implications (technical, political, market, economic), the ability to anticipate and handle risks and identify and leverage opportunities (Project Management Institute, 2021).

AI is becoming an essential tool for improving risk management in projects, enabling managers to predict risks, identify opportunities, and proactively adjust schedules. By analyzing historical data and using machine learning algorithms, AI can predict the likelihood and impact of risks before they occur, simulate different risk scenarios (Savadatti et al., 2022), identify potential bottlenecks, and suggest mitigation strategies, allowing project managers to evaluate different response strategies and proactively determine and develop the most effective one (Auth et al., 2021). It can also perform root cause analysis of past failures, identify contributing factors, and facilitate scenario planning and strategies to evaluate responses to potential risks.

AI also helps automate risk identification through document analysis and stakeholder feedback using tools such as natural language processing (NLP). By providing real-time updates and adapting to new data, it improves decision-making and resource allocation, avoids potential schedule impacts, and ensures continuous improvement and adaptation in a changing environment (Ruiz et al., 2021).

In addition to risk prediction, AI enables the analysis of market trends, project data and feedback to highlight areas for improvement and help identify opportunities for innovation and improvement (Abayomi Odejide et al., 2024). Finally, AI contributes to ethical risk management by analyzing social factors and aligning risk management strategies with ethical considerations, thereby enhancing sustainability and stakeholder confidence in the project (Abayomi Odejide et al., 2024).

Table 8: AI on uncertainty performance.

Applications of AI	Results
Prediction of likehood and impact of risks before they occur Simulation of different risks scenarios Suggestion of mitigation strategies	Evaluate and determine the most effective strategy
Automation of document analysis and stakeholders feedback for risk identification Provide real-time updates Adaptation to new data	Improve risk prediction and decision making
Analysis of market trends, project data and feedback	Opportunities for innovation and improvement
Analysis of social factors Alignment of risk mitigation strategies with ethical considerations	Ethical risk management, sustainability and stakeholders confidence

3.2 Challenges of implementing AI in Project Management

As well as the significant benefits of AI, there are also several challenges for organizations in terms of the effective integration of these tools into their project management processes. Below are some of the key challenges to adopting AI in project management.

1. Data quality

   AI tools work with vast amounts of information, and the effectiveness of these systems depends heavily on the quality of the data they use. Organizations face this challenge because their data quality is often poor, incomplete or inconsistent, leading to inaccurate predictions and reduced decision-making power (Mariani & Mancini, 2023). Furthermore, in many cases, data is not integrated; rather, it is distributed or fragmented across different systems or departments, making it difficult to access and analyze (Auth et al., 2021).

2. Technical complexity

   One of the barriers organizations face is the technical complexity of integrating AI tools into their systems, as it requires a deep understanding of software development. This requires hiring skilled personnel, as in many cases they lack resources with skills and experience in AI, such as machine learning or RPA, to develop and maintain these tools (Muthusubramanian et al., 2024). It is also complicated by the need to customize AI solutions to the organization's specific project management needs, which is time-consuming and requires collaboration between project teams and technical experts for development and integration (Fridgeirsson et al., 2021).

3. Integration with existing systems

   Many organizations continue to work with legacy systems that may not be compatible with the most advanced AI solutions. This would require a significant investment of time and money to migrate to more modern systems (Muthusubramanian et al., 2024), (Shoushtari et al., 2024).

4. Resistance to change

   Change management is a critical aspect of AI implementation, as both project teams and stakeholders are often reluctant to adopt new technologies and the change of role that the project manager can experience (Mahfuzul & Shamim, 2024). With the advent of AI, the “human project manager” will play a key role in decision-making and in using their creative and emotional skills (Auth et al., 2021).

   On the one hand, there is a cultural resistance that makes people reluctant to change because they believe that workers might be displaced by the arrival of a new technology, or because they fear an increase in their workload (Shoushtari et al., 2024). It is therefore necessary to foster a culture of innovation that supports change (Felicetti et al., 2024). On the other hand, there is also some resistance from employees because adapting to new technologies and new ways of working requires extensive training programs, which can involve a significant investment of time and resources (Auth et al., 2021).

5. Lack of skills

   Related to the need for training mentioned above, project team members need to be trained to ensure the successful implementation of AI (Shang et al., 2023). That is, they must have the necessary skills to understand AI and the technical skills required to use these tools (Auth et al., 2021), (Mariani & Mancini, 2023), (Shang et al., 2023), (Fridgeirsson et al., 2021). It is therefore necessary for organizations to implement training programs (Muthusubramanian et al., 2024), not only to foster a culture of change as mentioned above, but also to equip teams with the skills and competencies required to implement and integrate AI tools into their daily project management practices.

6. Need for human supervision

   AI tools have great potential and powerful capabilities, but human intervention and intelligence are still required (Deshpande, 2023). AI cannot currently replace human creativity, critical thinking and intuition (Auth et al., 2021), (Fridgeirsson et al., 2021), so project managers need to oversee and provide context in decision-making processes.

7. Cost considerations

   Organizations face a challenge in implementing AI due to the significant initial investment and subsequent maintenance costs (Shang et al., 2023), (Fridgeirsson et al., 2021). First, the costs associated with the initial acquisition and implementation investment can be very high and a significant inconvenience, especially for startups or small and medium-sized businesses (Shoushtari et al., 2024). Second, there will be ongoing maintenance costs for AI systems for updates and support, which can negatively impact project budgets.

8. Time consumption

   AI can also pose a challenge in terms of the time required to integrate it into workflows due to the potentially steep learning curve for resources, as project team members may face long adaptation times, impacting project efficiency during this transition period. It can also lead to delays in project timelines due to the time and resources required to integrate these technologies (Fridgeirsson et al., 2021), (Reddy Nagireddy, 2023).

9. Ethical and social considerations

   One of the biggest concerns for organizations is the ethical and social issues they need to address when integrating AI tools. AI processes large amounts of data, raising concerns and questions about data privacy and compliance with regulations and laws (Shang et al., 2023). In addition, AI algorithms can be unintentionally biased (Muthusubramanian et al., 2024), potentially leading to unfair results and negatively impacting the recommendations provided to project teams for decision-making (Mahfuzul & Shamim, 2024), (Shoushtari et al., 2024), (Zia et al., 2024).

3.3 Opportunities for further research and future trends

As organizations move forward in implementing AI tools for project management, new opportunities and trends for future research are emerging. This research will help identify where project management practices can be improved and areas for innovation. Some future research directions for applying AI to project management include but are not limited to the following:

1. Integration with emerging technologies

   One potential line of research could be the integration of AI with emerging technologies such as the Internet of Things (IoT), blockchain, and augmented reality, and their impact on project management practices. Specifically, this could explore how AI can improve management processes by analyzing real-time data from IoT devices; the potential of augmented reality tools integrated with AI to improve communication within project teams and with stakeholders; or how AI combined with blockchain technology can improve security and transparency in project management solutions and practices (Muthusubramanian et al., 2024).

2. Ethical approaches to AI adoption

   It is essential to address ethical considerations in the use of AI tools in project management, to create ethical guidelines and frameworks for their responsible use, and to develop methods and strategies to identify and mitigate bias in AI algorithms (Muthusubramanian et al., 2024).

3. Industry-specific applications

   Another line of future research could be to focus on conducting studies to assess the effectiveness of AI implementation in project management in different industries, such as IT, healthcare or construction, and analyze the specific needs and challenges.

4. Implications of AI adoption in the long term

   This line of research would be to determine the long-term impact of AI adoption by developing metrics to evaluate how AI affects project performance and management (risks, costs, resources, stakeholders) and how it affects the reorganization of businesses (changes in their processes, in their employees) that adopt it for project management (Reddy Nagireddy, 2023).

5. Tackling global challenges

   More research is needed to evaluate how AI can be a part of a more sustainable project management practice.

6. Knowledge sharing and peer-led initiatives

   This line of research focuses on fostering collaboration among project managers by developing knowledge-sharing platforms for them to share the best practices and experiences related to the application and use of AI in their projects. It could also consider investigating the impact of peer-led initiatives to foster innovation and creativity in the application of AI tools in project management (Felicetti et al., 2024).

4. Conclusions

This paper examines the impact of integrating Artificial Intelligence (AI) into project management and how it is changing traditional practices to improve efficiency, aid decision-making, and facilitate risk, resources, and cost management. Through a comprehensive literature review, the role of advanced AI capabilities in each of the eight domains described in the Project Management Institute's (PMI) PMBOK Version 7 to ensure successful project and outcome delivery was examined.

However, it also identified challenges and difficulties in integrating AI in this area, including data quality, the technical complexity involved and the need to develop new skills, as well as the cost and time investment, especially in the early stages of implementation, without overlooking ethical and social considerations, among others.

In addition, this paper presents some potential future lines of research to further explore the integration of AI in project management. These lines suggest evaluating the integration of AI with new emerging technologies to further improve project management practices. It is also important to consider exploring approaches that identify and mitigate biases to make AI recommendations fairer. Other potential opportunities could include applying AI to a specific sector to identify opportunities and challenges for AI in project management in sectors such as healthcare or IT; or the long-term impact of this integration and how to measure and monitor it, as well as how to foster a culture that encourages knowledge sharing among project managers regarding the use of AI in their projects.

In summary, the use of AI by project managers in their practices offers significant opportunities to improve management and outcome production, decision-making, and efficiency. There is still room for improvement, and organizations can be more successful in project management by advancing the integration of AI and innovation if they address challenges related to data quality, security, and ethical considerations, as well as foster a culture of innovation that encourages the development of technical skills that facilitate the integration of these technologies.

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Use of Generative Artificial Intelligence

No generative artificial intelligence was used in preparing this communication, except for the generation of Figure 1 with the Napkin tool.

Communication aligned with the Sustainable Development Goals