Investigating the Industry Perceptions and Use of AI Tools in Project Management: Implications for Educating Future Engineers

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Abstract

Background: The rapid evolution of Artificial Intelligence (AI) has opened up numerous avenues for automating various tasks in diverse industries. Project management, a crucial element in engineering education, can greatly benefit from AI tools, such as chatbots and virtual assistants. ChatGPT, a variant of the GPT series known for its conversational capabilities, exemplifies the growing prominence of AI in everyday applications, becoming almost synonymous with accessible AI. As the boundaries of what AI can achieve are continually pushed, engineering education must also evolve alongside these advancements. Through this research, we aim to align the current industry usage of AI in project management with academic approaches.

Purpose: The purpose of this study is to understand the current usage and perceptions of industry professionals about AI tools in project management tasks. The specific research questions are: (1) What factors influence the usage of AI tools in project management practices? (2) How are project managers currently using AI tools? (3) What are their perceptions of these tools?

Methods: A survey was designed to gauge industry professionals' usage and perceptions regarding AI's tools in project management tasks and included questions to gather demographic data. This survey was shared across multiple project management groups on LinkedIn over a three-month duration, attracting 113 responses. A cleaning process was implemented to remove any invalid responses. A correlational analysis was performed on the quantitative data. Concurrently, qualitative data was thematically analyzed to gain insights into usage and perceptions surrounding AI.

Results: The study revealed a growing trend among project management professionals in leveraging AI tools for a variety of tasks, including project planning, task assignment, tracking, and crafting emails, reports, and presentations. A strong correlation was observed between familiarity with ChatGPT and its likely usage in project management tasks. While some participants found AI tools convenient and efficient, they were frustrated with potential inaccuracies and the need for specific input prompts. Overall, industry professionals demonstrated the usage of AI in project management, with a notable emphasis on task automation and aid in data-driven decision-making.

Implications: The study findings depict the current usage of AI tools in project management and suggest opportunities to update project management curricula to include AI-focused content, practical applications, and ethical considerations of AI. Educators are recommended to provide hands-on experiences with AI tools, aligning academic teachings with current industry practices. This alignment is essential for preparing engineering graduates to meet the demands of a workplace increasingly reliant on AI.

Keywords: Artificial Intelligence, AI, ChatGPT, Project Management, Engineering Education, STEM Education, Chatbots, Industry Trends, Curriculum Development, AI Integration

1. Introduction

1.1 Evolution of Artificial Intelligence (AI)

The advent and evolution of Artificial Intelligence (AI) has revolutionized multiple industries, altering how tasks are executed and managed [1]. AI, characterized by its ability to simulate human intelligence processes, has seen significant advancements over the past few decades particularly with the development of Large Language Models (LLMs) like the GPT (Generative Pre-trained Transformer) series [2]. The emergence of ChatGPT, a variant of the GPT series known for its conversational capabilities, exemplifies the growing prominence of AI in everyday applications, becoming almost synonymous with accessible AI [3]. From basic machine learning algorithms to more complex neural networks, AI's capabilities have expanded due to its ability to learn from data and improve over time, offering solutions that were once thought to be within the sole domain of human intellect [4]. This has led to breakthroughs in natural language processing, image recognition, and predictive analytics, among others [5]. The concept of prompt engineering, which involves crafting inputs to elicit desired responses from AI models, has become crucial in maximizing the efficiency and applicability of these technologies [6]. The AI evolution has particularly impacted data analysis, automation of routine tasks, and decision-making processes, paving the way for its integration into project management.

While AI has brought about numerous advancements and opportunities, it is essential to acknowledge the risks associated with its use [7], [8]. One significant concern is the potential for AI to perpetuate biases present in the data it is trained on, leading to discriminatory outcomes [9]. Additionally, the lack of transparency in some AI decision-making processes, often referred to as the "black box" problem, can make it difficult to identify and rectify errors or biases [10]. The use of AI also raises privacy concerns, as it often involves the collection and analysis of vast amounts of personal data [11]. Moreover, the increasing reliance on AI systems can lead to job displacement and the need for workforce reskilling [12]. From an ethical perspective, there are concerns about the development of AI systems that align with human values and the potential for misuse or unintended consequences [13]. Addressing these risks requires ongoing research, governance frameworks, and collaborative efforts between researchers, policymakers, and industry stakeholders to ensure the responsible development and deployment of AI technologies [14].

1.2 Project Management in Industry

Project management has existed since the times of ancient Egyptians, however, it was never systematically defined or practiced using standardized tools or techniques until the 1950s [15], [16]. Project management is vital in industry, serving as the backbone for delivering projects efficiently and effectively. It involves planning, executing, and supervising projects to achieve specific goals within set constraints [17]. Effective project management ensures that projects meet their objectives, stay within budget, and are completed on time, contributing to the overall success of organizations [18].

Traditionally, project management has relied on methodologies like Waterfall and Agile, and tools such as Gantt charts and risk matrices. These tools have been effective in managing tasks, resources, and timelines but often require extensive human intervention and are limited in their ability to handle complex, data-driven decision-making scenarios [19]. Integrating AI into project management has the potential to revolutionize how projects are planned, executed, and monitored [20]. AI tools, such as predictive analytics, can anticipate project risks and suggest mitigation strategies, while AI-driven chatbots and virtual assistants can streamline communication and administrative tasks [21]. This integration could automate routine tasks as well as lead to more efficient resource management, real-time decision-making, and enhanced project outcomes. [22]

1.3 Project Management Curriculum

Teaching project management in engineering higher education is crucial for preparing students for real-world challenges [23]. It equips future professionals with the necessary skills and knowledge to effectively lead projects, fostering critical thinking, problem-solving, and leadership abilities [24].

The current project management curriculum in many educational institutions often focuses on traditional methodologies, with limited exposure to the latest technological advancements like AI [25]. While foundational knowledge in these areas is essential, there is a growing need to incorporate contemporary tools and techniques to stay relevant in the evolving industry landscape [26]. To develop work-ready engineers, it is important to align the project management curriculum with industry advancements [27]. Integrating AI-related topics and practical AI tools into the curriculum can ensure that graduates are well-equipped with relevant, up-to-date skills [28].

This study seeks to understand the current usage of AI tools in project management and align academic approaches with evolving industry practices. By understanding industry usage and perceptions regarding AI, educators can tailor the curriculum to better prepare students for the realities of the modern workplace.

2. Research Questions

The purpose of this study is to understand the current usage and perceptions of industry professionals about AI tools in project management tasks. The specific research questions are:

RQ1: *What factors influence the usage of AI tools in project management practices?*
RQ2: *How are project managers currently using AI tools?*
RQ3: *What are their perceptions of these tools?*

3. Methods

The research adopts a mixed-methods approach, combining quantitative and qualitative research methods. This approach allows for a comprehensive understanding of the subject matter,

capitalizing on the strengths of both methodologies.

3.1 Data Collection and Cleaning

A survey instrument was used to gather data on participant demographics, AI tools usage, and perceptions. It included both closed and open-ended questions, enabling the collection of specific data while also allowing respondents to provide more detailed responses. Key questions covered areas such as the respondent's role, industry, company size, and their experience and opinions regarding AI usage in project management. The survey also included questions specific to eligibility criteria outlined by IRB (IRB Number: IRB-2023-690), for example – consent to participate, at least 18 years of age at the time of the survey, and current residence in the United States. The complete list of questions is provided in Table 1.

For the purposes of this study, AI tools were defined as any software or system that utilizes artificial intelligence techniques to assist with or automate project management tasks. This includes but is not limited to machine learning algorithms, natural language processing, predictive analytics, chatbots, and virtual assistants. Chatbots specifically refer to AI-powered conversational agents that interact with users via text-based interfaces, while virtual assistants incorporate both text and voice-based interaction. These definitions were provided to participants in Survey Preamble.

Table 1. Survey Data Collection Instrument

Q#	Question	Options/Response Type
Eligibility		
Q1	Do you agree to participate in the study?	Yes | No
Q2	Are you 18 years of age or older?	Yes | No
Q3	Are you a US resident?	Yes | No
Demographics		
Q4	What is your gender?	Male | Female | Non-binary | Prefer not to say
Q5	What is your current role/title?	Free-Text Response
Q6	How long have you been working in your current role?	Free-Text Response
Q7	Which industry do you work in?	Healthcare | Finance | Technology | Retail | Education | Manufacturing | Other (please specify)
Q8	How big is your company?	Small (less than 100 employees) | Medium (100 to 1499 employees) | Large (1500 or more employees)
Q9	What is the highest degree you have achieved?	High school diploma | Associate's degree | Bachelor's degree | Master's degree | Doctorate | Other (please specify)
Q10	Please list any certifications you have related to your industry or job.	Free-Text Response
AI Usage & Perceptions		
Q11	Do you currently use any AI tools for project	Yes | No

	management?	
	a. [If yes] Which AI tools do you use?	Free-Text Response
	b. [If yes] For which tasks do you use AI tools?	Free-Text Response
	c. [If no] What tasks do you think current AI can automate or assist with?	Free-Text Response
Q12	Have you ever used a chatbot or virtual assistant for project management tasks?	Yes | No
	a. [If yes] Please describe your experience using a chatbot or virtual assistant for project management tasks.	Free-Text Response
Q13	Based on your experience as a project manager, what are some project management tasks that you think could be automated or assisted by chatbots or virtual assistants?	Free-Text Response
Q14	How familiar are you with ChatGPT technology?	Not familiar at all | Slightly familiar | Moderately familiar | Very familiar | Extremely familiar
Q15	How likely are you to use ChatGPT for project management tasks in the future?	Extremely unlikely | Somewhat unlikely | Neither likely not unlikely | Somewhat likely | Extremely likely

The survey was shared across professional networks and forums, particularly LinkedIn groups related to project management for three months (May 2023-July 2023), attracting 113 responses. This process ensured a purposive sampling method, targeting professionals in project management roles across various industries. Responses were cleaned to remove any incomplete or inconsistent data. Of the 113 total responses, 42 were removed due to ineligibility (non-US residency), and 17 were excluded for not answering any of the AI-related questions (Q11-15).

The study was limited to US residents to control potential regional variations in AI tool adoption and perception as well as abide by IRB recommendations (as mentioned in Data Collection section). While this provides a focused perspective, it does limit the generalizability of the findings to the global project management community.

3.2 Participants

From the remaining 52 valid responses, 22 participants identified as female, 21 as male, 5 as non-binary while 4 chose to not disclose. The participant backgrounds spanned several disciplines, with a notable concentration in Technology as evident in Figure 1. Similarly, the spread in Figure 2 indicates the diversity in the work experience of the study participants where the experience ranged from 1 to 14 years, with more participants in their early to mid-career. The company size distribution is relatively balanced, with Figure 3 showing a significant presence in all three categories: small, medium, and large size companies. Most of the participants had at least a bachelor's or master's degree as seen in Figure 4. This distribution aligns with the typical qualification requirements of project management roles.

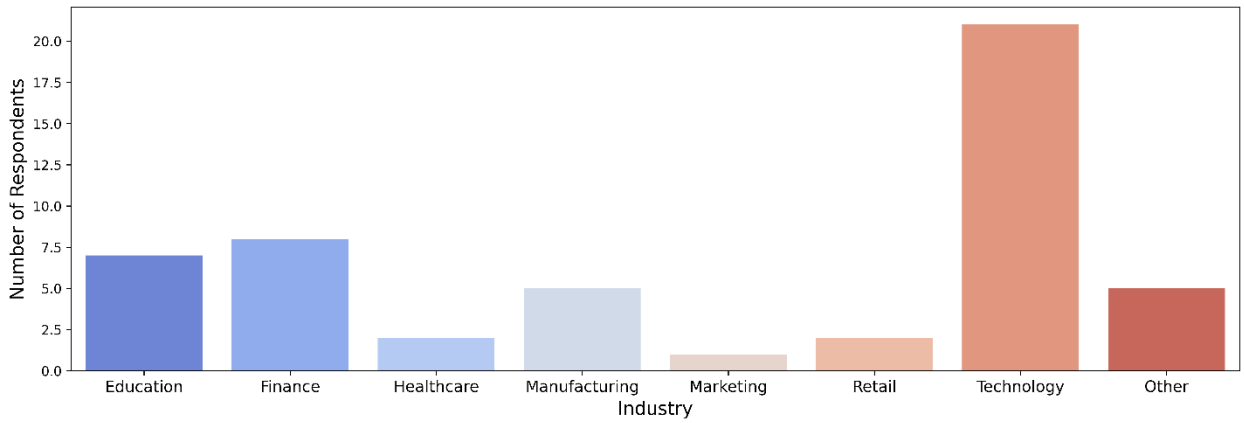

Fig 1. Distribution of Participants' Work Industry

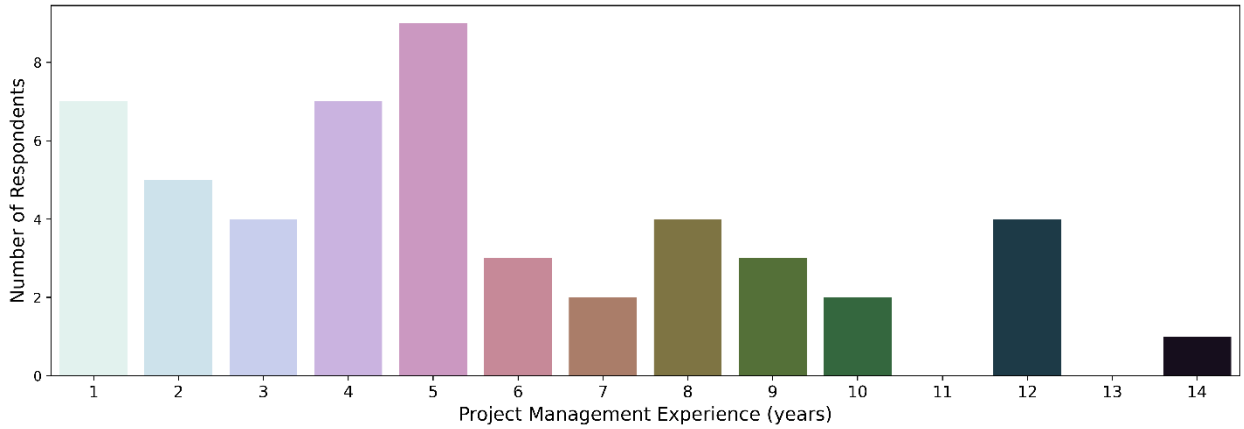

Fig 2. Distribution of Participants' Work Experience

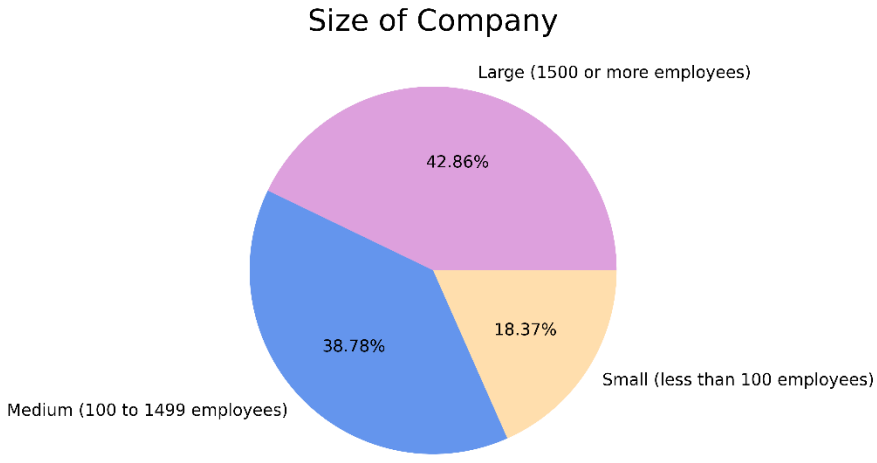

Fig 3. Distribution of Participants' Company Size

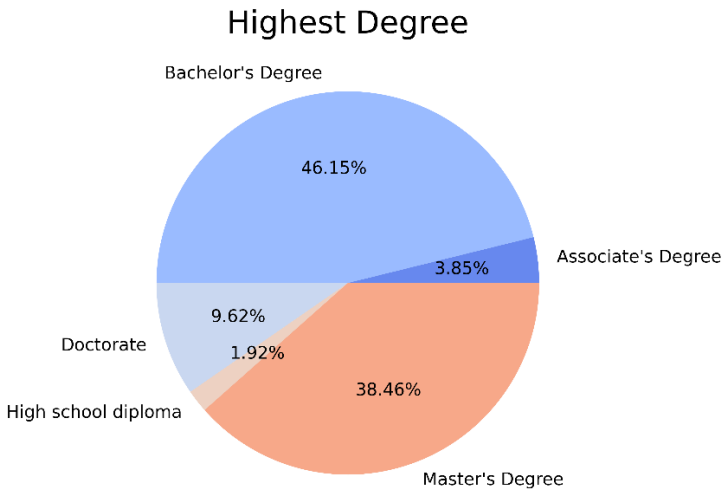

Fig 4. Distribution of Participants' Highest Degree

3.3 Data Preparation

The final set of 52 valid responses underwent several processing steps to ensure consistency and analysis readiness. For example -

- The survey format was flattened to eliminate nested questions, simplifying the analysis structure.
- All spellings of 'chatgpt' were standardized to 'ChatGPT' for uniformity.
- Project management experience responses (Q6), originally in varied formats, were converted uniformly to years as well as numeric format to facilitate quantitative analysis.
- Responses to Likert-scale type questions (Q8, Q9, Q14, Q15) were transformed into a numeric scale (1-5). This conversion was crucial for the subsequent creation of a correlation matrix.

3.4 Data Analysis

The analysis of the cleaned and processed data was divided into three phases. The first phase utilized quantitative analysis to answer RQ1: What factors influence the usage of AI tools in project management practices? Specifically, a correlation analysis was conducted for select questions (Q6, Q8, Q9, Q11, Q12, Q14, and Q15) to identify patterns and relationships. The statistical significance of these correlations was also assessed.

The second phase was a qualitative analysis phase where thematic analysis was conducted on Q11b and Q11c to extract recurring themes and insights related to RQ2: How are project managers currently using AI tools? The coding process involved open coding and axial coding stages. The open coding stage resulted in the following codes: 'templates for document', 'reports', 'work breakdown structures', 'excel sheet formulas', 'timelines', 'project plans', and 'emails'. (Refer to Table 2 for complete list). During the axial coding stage, these codes were organized into three main themes: 'Task Planning and Assignment', 'Communication and

Reporting', and 'Data Analysis and Prediction'. These themes formed the basis of the results section.

The third phase employed content analysis to address RQ3: What are their perceptions of these tools? The qualitative data from Q12b were systematically categorized into two predefined categories: 'Negative Perceptions' and 'Positive Perceptions'. This categorization allowed for a structured understanding of the current perceptions of AI tools in project management practice. Representative quotes were selected to highlight specific themes.

3.5 Methodological Considerations

Ethical considerations were addressed by obtaining informed consent from the participants and ensuring that they were aware of the purpose of the study, their rights as participants, and the potential risks and benefits involved. Confidentiality and anonymity were maintained by not collecting any PII (personally identifiable information) from the participants and storing their data securely on Box.

Trustworthiness considerations were addressed by conducting an interrater reliability test. To enhance the dependability and consistency of the analysis, the researcher enlisted a second coder to code a portion of the data independently. The interrater reliability score of 87% was obtained to ensure consistency in the coding process. To mitigate sampling bias, the study employed a purposive sampling strategy, targeting a diverse range of professionals to ensure a representative sample. However, the focus on US residents and LinkedIn users may still limit the generalizability of the findings.

4. Results and Discussion

4.1 Factors Influencing AI Tool Usage

This section corresponds to RQ1: What factors influence the usage of AI tools in project management practices? To answer this question, a correlation matrix was constructed as shown in Figure 5, to understand the key variables affecting *Likely Usage* of ChatGPT for project management tasks.

The years of *PM Experience* was weakly correlated with *Likely Usage* suggesting that the usage of AI tools in project management is relatively independent of how long managers have been in the field. Similarly, the *Size of Company* did not significantly correlate with *Likely Usage*, indicating that organizational scale does not necessarily influence AI tool usage in project management tasks. The *Highest Degree* of participants was weakly correlated with the usage of AI tools in project management.

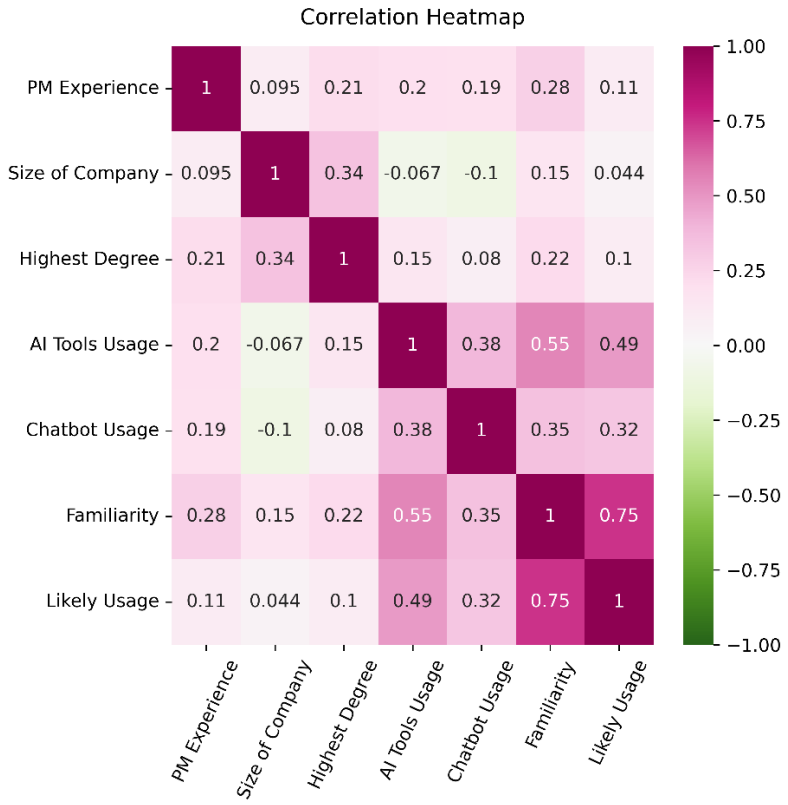

Fig 5. Correlation Matrix

A statistically significant (P value < 0.01) correlation of *Likely Usage* was observed with *AI Tools Usage* and *Chatbot Usage.* This indicates that project managers who are already using some form of AI for project management are more likely to consider the use of advanced AI tools like ChatGPT for their tasks. Finally, a statistically significant (P value < 0.001) positive correlation was found between *Familiarity* and *Likely Usage*. This indicates that awareness and understanding of specific AI tools are key factors linked to their adoption. This supports the premise that education and training in AI project management tools should be integral components of curriculum development for students aspiring to enter the project management field. Equipping students with knowledge and hands-on experience in these AI technologies may not only enhance their readiness for the industry but also potentially accelerate the integration of AI into project management practices across various sectors.

4.2 AI Tools Usage

This section relates to RQ2: How are project managers currently using AI tools and what are their perceptions of these tools? To this end, we collected data from a diverse group of project managers to shed light on current practices, perceived potentials, and experiences with AI tools in project management.

28 out of 52 (~54%) project managers reported using AI tools, particularly for content creation, data manipulation, research, and operational tasks. These tools are employed in generating product requirements, project plans, schedules, timelines, and Gantt charts, among

others. For those not currently using AI tools, there was an expressed belief that AI could automate or assist with tasks such as trend analysis, sentiment analysis, proofreading, grammar checks, and various organizational tasks.

When discussing the potential of chatbots and virtual assistants in project management, project managers highlighted several areas such as task planning and assignment, communication and reporting, and data analysis and prediction. Specific tasks mentioned were the creation of project plan documents, work breakdown structures, task assignments, and automated dashboards. There was also an emphasis on the potential for AI to streamline communication, track project status, and provide reminders for upcoming deadlines. Table 2 summarizes the project management tasks that are currently or potentially can be completely automated or at least assisted in by AI tools.

Table 2: Project Management Tasks Assisted by AI

Category	Specific Tasks
Task Planning and Assignment	Project plan documents, Work breakdown structures, Task assignments, Templates for documents, Excel sheet formulas, Timelines, Work-back plan creation, Sprint planning, Event planning, Client presentations, Resource allocation optimization, Task prioritization, Revise documents
Communication and Reporting	Emails, Project tracking, Coordination with employees, Schedule meetings, Take meeting notes, Routine reports/emails, Updates based on progress, Creation of tickets, Project status tracking, Upcoming deadline reminders, Streamlining communication, Performance reports, Automated Dashboards, Project status reports, Flagging delays
Data Analysis and Prediction	Data analysis, Predicting potential project delays, Reports and annotations

4.3 AI Tools Perceptions

This section corresponds to RQ3: What are their (project managers) perceptions of these (AI) tools? Overall, perceptions of AI tools were mixed among the respondents. On the positive side, many found them convenient, efficient, and a valuable starting point for tasks. They were credited with accelerating the working process and providing quick responses to queries. However, there were also negative experiences, including the need for refining prompts repeatedly, receiving incorrect answers, and the frustration of forming precise inputs. Figure 6 summarizes the participant experiences as a word cloud.

Fig 6. Experience with using AI Chatbots

Some representative quotes from the participants include:

- *"ChatGPT is a great tool for brainstorming ideas and getting a starting point for various tasks. It saved me a lot of time in drafting project plans and status reports. Very convenient!"* (Participant 23, Technology Industry)
- *"While the chatbot was quick to respond, I often had to rephrase my questions multiple times to get a relevant answer. It was a bit frustrating at times."* (Participant 11, Healthcare Industry)
- *"I found the AI tool super useful for data analysis and generating insights. But it often gives incorrect answers, so I always verify the results manually. It's an efficient assistant but can't fully replace human judgment in complex projects."* (Participant 37, Finance Industry)

While the current study did not directly investigate the ethical implications of AI usage in project management, the reported experiences of participants regarding inaccurate responses from AI tools raise important ethical considerations. Inaccurate or misleading information provided by AI tools can lead to flawed decision-making, miscommunication, and potential project failures [29]. This issue is particularly concerning in the context of project management, where decisions often have significant financial, strategic, and human consequences [30], [31]. This emphasizes the need for responsible AI development and deployment practices, as well as the importance of human oversight and judgment in interpreting and acting upon AI-generated information.

From an educational perspective, addressing the ethical implications of inaccurate AI responses is crucial in preparing future project management professionals [8], [32]. By incorporating discussions on the limitations and potential risks of AI tools, as well as strategies for mitigating these risks, educators can foster a more responsible and ethically conscious approach to AI usage in project management [33].

5. Recommendations for Educators

Considering the current usage and perceptions of AI tools in project management as revealed by this study, we propose the following recommendations for educators in engineering and project management programs to best prepare graduates for industry needs:

Update Curriculum with AI Focus: Integrate AI-focused modules and case studies into the project management curriculum. This includes teaching the basics of AI, its applications in project management and limitations and potential risks of AI tools. The study findings highlight the growing use of AI tools in various aspects of project management (Table 2) and potential risks from incorrect responses (Figure 6). Moreover, the strong correlation between familiarity with AI tools and their likely usage (Figure 5) emphasizes the importance of equipping students with the necessary knowledge and skills to effectively leverage these technologies in their future roles. By incorporating AI-focused content into the curriculum, educators can better prepare students to navigate the evolving landscape of project management in the era of AI.

Hands-On AI Experience: Facilitate hands-on experience with AI tools, such as chatbots and virtual assistants, in classroom settings enabling students to apply AI and prompt engineering skills. The activities could involve practical exercises, projects, and simulations that use AI to solve real-world project management challenges. This approach will help develop proficiency in effectively communicating with AI tools, a skill gap identified in this study. As seen in Figure 6 and the participant quotes, project managers reported both positive and negative experiences with AI tools, highlighting the need for students to gain practical experience in navigating the challenges and leveraging the benefits of these tools.

Collaboration with Industry: Establish partnerships with industry professionals and companies to provide students with exposure to current AI applications in project management. Guest lectures, internships, and collaborative projects can provide valuable insights into practical AI usage and foster knowledge exchange between academia and industry. While the study did not directly capture data on the lack of training or preparation for using AI tools, the varying levels of familiarity with AI technology among participants (as seen in the correlation analysis) and the reported challenges in using these tools effectively suggest that there is room for improvement in AI education and training. Industry partnerships can help bridge this gap by providing students with real-world perspectives and opportunities to learn from experienced professionals.

6. Conclusion, Limitations, and Future Work

6.1 Limitations

This study primarily gathers data from industry professionals in the United States, utilizing the LinkedIn platform for data collection. Such an approach, while effective in reaching a specific professional demographic, may not capture the full spectrum of experiences and perspectives in project management, as it excludes those who are either not present on LinkedIn or reside in other geographical regions.

Moreover, the sample size, though adequate for initial insights, may not be expansive enough to allow for broad generalizations of the findings. In survey and interview-based research, there's always the potential for response bias. Participants may provide socially desirable answers or may not fully disclose their reservations about AI in project management, potentially skewing the results. To mitigate potential response bias, particularly in terms of participants providing socially desirable answers, several steps were taken. First, the survey was designed to be anonymous, and participants were assured of the confidentiality of their responses. This approach aimed to encourage honest and candid feedback. Second, the survey questions were framed in a neutral manner, avoiding leading or suggestive language that could influence participants' responses. Third, the study included a mix of closed-ended and open-ended questions, allowing participants to express their thoughts and experiences in their own words. However, despite these efforts, the possibility of response bias cannot be entirely eliminated, and the results should be interpreted with this limitation in mind.

Finally, the rapidly evolving nature of AI technology presents another challenge. The study's findings are reflective of the current state of AI and may not remain relevant as new advancements and shifts in the industry emerge.

6.2 Future Work

To build upon the findings of this study and address its limitations, future research could expand the scope to include a more diverse range of participants from various industries and geographic regions. This would enhance the generalizability of the findings. Implementing experimental or quasi-experimental designs could help in establishing causal relationships between AI usage and various outcomes in project management. Experimental designs involve the random assignment of participants to different treatment groups (e.g., using AI tools vs. not using AI tools) and the manipulation of independent variables (e.g., type of AI tool used) to establish causal relationships between variables. Quasi-experimental designs, on the other hand, lack random assignment but still aim to establish causal relationships by comparing naturally occurring groups (e.g., project managers who have received AI training vs. those who have not) or by measuring variables before and after an intervention (e.g., assessing project outcomes before and after the implementation of AI tools). These designs can help provide stronger evidence for the impact of AI usage on project management outcomes, beyond the correlational findings of the current study. Additionally, conducting longitudinal studies could provide insights into how the usage of AI in project management evolves over time, offering a dynamic perspective on the adoption and impact of AI technologies. Future inquiry could also dive deeper into specific AI applications in project management, such as machine learning for risk assessment or natural language processing for team communication, providing a more granular understanding of their benefits and challenges.

6.3 Conclusion

This study sheds light on the current usage of AI tools in project management and its implications for engineering education. Our findings demonstrate that industry professionals are leveraging AI for various aspects of project management, including task automation, data

analysis, and communication. The high correlation between familiarity with ChatGPT technology and likely usage reinforces the importance of integrating AI-focused education into project management curricula. By equipping future professionals with the necessary knowledge and practical skills in AI, educators can ensure that graduates are not only well-prepared for the evolving demands of the industry but also capable of driving further innovations in project management practices. Aligning academic approaches with industry usage is crucial for bridging the gap and fostering a workforce ready to harness the potential of AI in project management.

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