Artificial Intelligence in Project Management: Insights from Croatia

Borna Vegar*, Tea Mijač**
* INNOVATIO PROFICIT Ltd., Split, Croatia
** Faculty of Economics, Business and Tourism, University of Split, Split, Croatia
tea.mijac@efst.hr

***Abstract* — Artificial intelligence (AI) technology has become integral to everyday life, extending its influence into various business aspects. The concept of AI in Project Management (PM) has been discussed since the 1980s, portraying AI as a tool with the potential to expedite, optimize, and enhance project management, aiding decision-making processes. Project management is a pivotal process in nearly every organization, and integrating AI into this process can offer numerous advantages, such as heightened efficiency, precision, speed in decision-making, and improved risk assessment. Data from Eurostat in 2020 indicates that only 6% of businesses in Croatia used some form of AI in their operations, reflecting the limited adoption of this technology in the business sector. This paper explores the current state of AI application in project management in Croatia, exploring both perceived benefits and barriers. A survey conducted in Croatia with 115 respondents revealed that currently, only 29.1% of correspondents utilize some form of AI in project management. Unsurprisingly, AI is predominantly used in the IT industry (52%), followed by the educational sector (28%) and the healthcare sector (4%).**

Keywords – Project Management; Artificial Intelligence; Croatia; Adoption

I. INTRODUCTION

Artificial Intelligence (AI) has become an inevitable concept in everyday life. Unquestionably, it has fundamentally changed all our daily and business activities. The integration of AI into various facets of business has become ubiquitous, shaping how organizations operate daily [1]. Project management (PM) holds a pivotal role in the functionality of nearly every organization, and the infusion of AI can bring forth many benefits. The incorporation of AI in project management, a concept that has been under discussion since the 1980s, envisions AI as a powerful tool capable of expediting, optimizing, and enhancing project-related processes while aiding in decision-making. Taking into consideration the evolution of AI technology and despite the evident potential, the adoption of AI in business operations still remains relatively low. According to Eurostat data, in 2020, only 6% of all companies in Croatia used some form of AI in their operations [2]. In 2021, that number was 9%, and it can be concluded that companies in Croatia are becoming more aware of this technology that can be applied in their company as well [3].

Literature on AI often highlights both the benefits and challenges of implementing such tools. However, to successfully apply AI in project management, it is essential to consider existing examples in organizations and investigate how they perceive challenges, how they successfully applied the technology, and what benefits they had from it [4]. It is also important to consider how the application of AI can be adapted to the specific needs and requirements of the organization and how it can be integrated into existing processes and systems [5]. This paper tackles the project management discipline, which has been implemented across all industries, and presents a large body of research. A recent literature review highlights the *lack of proof of AI adoption within the context of project management.* While the prospect of AI-assisted project management appears promising, its development, establishment of standards, and execution in project-oriented businesses remain challenging [6]. Thus, AI adoption in PM is yet to be noted [6]. Furthermore, recent discoveries emphasize that a substantial number of organizations and professionals is lacking maturity and expertise in AI [7].

As organizations strive to leverage the advantages and benefits offered by AI in project management, overcoming barriers to adoption and fostering a greater understanding of its applications will be essential for unlocking the full potential of AI in optimizing project outcomes. Based on the identified research gaps, the main goal of our paper is to investigate the current state of adoption of AI in PM as well as related benefits and challenges in Croatia. Four research questions were posed: *What is the level of AI use in PM in Croatia?* (RQ1); *Does artificial intelligence provide benefits in all project activities?* (RQ2); *What are the main benefits and barriers that employees perceive related to AI in PM in Croatia?* (RQ3), and *How do employees perceive the introduction of artificial intelligence into their business environment, and are they afraid of it?* (RQ4).

II. LITERATURE REVIEW

A. Artificial Intelligence in Project Management

Project management is a discipline that deals with the planning, execution, and completion of a project from its inception to completion. The focus is meeting project objectives within defined constraints such as time, cost, and resources. The concept of PM has been evolving for decades, and many methodologies, tools, and approaches are designed to assist project managers in their work [8].

AI has recently become a predominant concept across all industries and has been affecting our everyday activities and all work-related ones. In the context of PM, the concept of AI was introduced far back in the 1980s [9]. The initial contributions of Alan Turing, who posed the query, "*Can machines think?"* [10], are regarded as the starting

point in the evolution of the contemporary concept of AI. This concept foresees intelligent machines capable of matching the cognitive processes employed by humans, wherein they leverage accessible information to address challenges and reach decisions. The beginning of AI systems can be traced back to the 1980s when Expert systems emerged as the pioneering technology initially designed to aid decision-making processes [11]. Since then, AI technology has rapidly been emerging, and today, we find ourselves witnessing in the widespread integration of generative AI, exemplified by the ubiquitous use of technologies like ChatGPT in our daily activities [12] and well as business-related activities across all industries [1].

PM is one of the critical processes in almost every organization and industry, and the application of AI in this process can bring numerous benefits**,** such as *increased efficiency, precision and speed of decision-making, and better risk assessment* [13]. Project management includes distinct phases, such as planning, monitoring, execution, and closing of the project, and it is crucial that the application of AI is integrated into all these phases [14]. In addition, the literature indicates that the vast potential of AI is remarkably reflected in planning and measurement, where a substantial amount of work has been dedicated to AI-enabled project time forecasting and software effort prediction [6].

A prerequisite for successfully implementing AI in PM is a robust foundation comprising suitable infrastructure, tools, and comprehensive training for those who will use the technology to maximize its effect [15] [16]. Applying AI to PM requires knowledge and skills to use new tools and technologies [17]. Despite the potential benefits, it is essential to address emerging ethical and security challenges accompanying the widespread adoption of AI [18]. The PM would benefit from integrating the various AI technologies to achieve project goals by improving project performance and achieving higher sustainable success [6].

However, one of the main challenges when applying AI in PM is efficient integrity and alignment with existing processes and information systems [19]. Another challenge is ensuring people's awareness of AI tools that can help them perform various activities within PM, such as automated resource allocation, automated documentation filling, risk assessment, etc. [20]. In addition, training people to use the tools and technology also represents a significant challenge.

To conclude, for a successful implementation of AI in PM, it is crucial to explore the perceived benefits and barriers to tailor the implementation process for maximum efficacy. From an empirical standpoint, it can be asserted that the incorporation of AI into PM *represents a transformative trend, reshaping the dynamics of the industry* [7]. The recent literature review confirmed that there had been an increased number of high-impact publications related to the AI–PM topic during the last decade [6], even though it is still in the nascent phase [7].

B. Benefits and Barriers of AI in Project Management

As aforementioned, implementing AI in project management presents a myriad of benefits and barriers that organizations must navigate to harness the full potential of this technology. Several significant benefits have been identified based on the literature review, and each has been listed and briefly introduced in the continuation.

- **Decision-making support.** Given the complexity of most projects, decision-making can often be challenging. The AI can analyze available data and suggest the best options based on historical data, current trends, and simulations of future scenarios [21].
- **Problem forecasting.** This can also be considered as a benefit related to decision-making support. AI algorithms can analyze these historical data sets faster and better, leading project managers to predict delays, cost overruns, or other problems to prevent unnecessary delays in the timely execution of the project [23]. These algorithms significantly contribute to planning and recognizing potential obstacles and delays and help the project manager react to them on time [23].
- **Real-time tracking.** AI algorithms can autonomously and continuously monitor the progress of the project, update plans and deadlines if necessary, and perform other automated tasks to monitor the project. Also, they can warn the project manager about possible obstacles or deviations from the planned state so that the necessary corrective actions can be taken [24]. One such example is the use of drones that independently record the situation on construction projects where the construction site is scanned using cameras and sensors. Then, AI algorithms check this data, and the project's current state is compared in real-time with what was planned [24].
- **Resource optimization.** Algorithms for the distribution of resources can ensure the correct and maximally used division of resources (human resources, costs, equipment, materials, etc.). These AI algorithms can predict time frames for specific tasks and the proper distribution of resources to make the project as efficient and economical as possible [25]. AI can provide customized solutions for each project, recognizing specific needs, challenges, and team dynamics and proposing the most appropriate strategies for each situation [26].
- **Process automatization**. There are many repetitive tasks in PM, including updating project status, tracking work hours, sending notifications, etc. AI algorithms can automatically perform these tasks instead of a human. That same human can then be repurposed to some other phase of the project, which will ultimately make the project more efficient [27].
- **Enhanced communication.** This form of AI is most used in customer support, where various companies use Chabots to answer frequently asked questions instead of a person. This algorithm can recognize and meaningfully answer questions that the client may have to improve the flow of communication between the user and the client [28].

- **Human resources upskilling.** AI can also be used to recommend additional training for employees. By analyzing historical data, AI can identify areas where employees may need additional training or education to handle a given task or situation [26] successfully. In the example, Zhang explained that AI assisted the people involved in the project by providing them real-time advice or recommendations. Also, this algorithm analyzes each team member's actions in this project, and by analyzing the overall project, it can provide feedback and guidance on optimizing the set tasks even better [29].
- **Integration with existing technologies**. AI algorithms can be easily integrated with other technological solutions, such as the cloud, Internet of Things devices, or blockchain, providing a holistic approach to project management [30]. In the example described by Pan and Zhang, such an AI algorithm was integrated with Building Information Modeling (BIM). This integration enabled an AI algorithm to analyze BIM data and automatically generate tasks or notifications within the PM system. For example, if the BIM model indicates a potential conflict between two design elements, an algorithm can automatically create a task within the PM system to resolve the conflict [30].

While AI brings many benefits to PM, it also faces numerous challenges and barriers that limit its full potential. In the following, potential obstacles that can appear in projects will be considered, as well as what project managers can expect from their employees during their management. Based on the literature review, barriers are listed and briefly explained.

- **Resistance to change**. It is human nature to resist changes since people are creatures of habit, as the famous psychologist Kubler-Ross described [31]. Recent research underscores employees' concerns about introducing AI, particularly concerning losing jobs and privacy issues [32], invoking fear as a frequently associated emotional response [33].
- **Lack of relevant skills**. Companies face the challenges of successfully finding and training people to use AI tools [34]. This lack of knowledge in the company resulted in low accuracy and poor model performance, thus adversely affecting the project as a whole [34]. Recent survey results indicate that project managers are interested in learning more about AI and recognize its significant impact on their future roles. However, survey results also showed that 65% of participants possess no or only a basic level of AI knowledge and experience [7].
- **Security and privacy issues**. Companies use very sensitive data in their projects, and its leakage can result in catastrophic consequences for that company. For these reasons, there is a fear of misuse or information leakage when using such advanced AI algorithms [35].
- **Implementation cost.** Implementing new technologies can be extremely expensive, and although they can bring savings in the long run, initial investments can be high, which can be a big obstacle for small and medium-sized companies in implementing these tools [36].
- **Lack of standardization.** Integrating AI tools with existing enterprise systems can sometimes run into various problems, such as compatibility issues, additional costs, and extended implementation times [37].
- **Lack of transparency**. Many AI models, especially those based on deep learning, are often *black boxes*, meaning their decision-making processes are unclear to users. This further leads to mistrust of the results [38].
- **Ethical dilemmas.** The application of AI in PM can lead to ethical dilemmas, especially when automation leads to job cuts or when artificial intelligence is used to make decisions that involve deep human deliberation [39].
- **Rapid technology evolution**. AI technology is developing increasingly daily, and these sudden changes can result in cardinal changes quickly. One such example was described by Knight (2017) where a software company, during the development of the project, which lasted two years, technology and algorithms in the field of AI advanced rapidly, and by the time their product was ready for launch, there were already new, more advanced solutions on the market that offered better performance and additional functionalities [40].

III. METHODOLOGY

In order to address the main research aim and posed research questions, we applied a quantitative research method in the form of an online survey. Participants were employees who worked in positions relevant to PM across different industries in Croatia. We applied the snowball sampling approach, as it involves identifying initial participants who meet the criteria for the study and then asking them to refer other potential participants. The survey lasted from July to September 2023.

The survey was conducted online using a Google Forms research tool. The visualization was made using the Tableau tool and Excel, and we used SPSS software to analyse the received data statistically. The survey consisted of 11 questions, which took approximately two to five minutes to complete.

Besides six demographic questions, the survey included questions related to the industry, education level, work position, role in PM, and current level of AI use. In addition, 31 statements were prepared, and participants graded them using a Likert scale from 1 (strongly disagree) to 5 (strongly agree).

Based on the literature review [5], [41], [42], items regarding benefits per project activities, perceived benefits in general, perceived barriers, and fear were prepared.

IV. RESULTS

Out of 115 questionnaires received, five responses were excluded from further analysis. This exclusion was based on the absence of relevant work experience in project management, ensuring that the remaining dataset accurately reflects participants with applicable expertise in the field.

Regarding the educational level, 16% possess postgraduate degrees 61% hold master's degree, and 20% have completed undergraduate study. Only 3% indicated having a high school education level.

Of all respondents, 57.3 % were female, and 42.7% were male. As for the age results, most respondents are between 46 and 55 years old (n=32; 30%). More details are provided in the Figure. 1 in continuation.

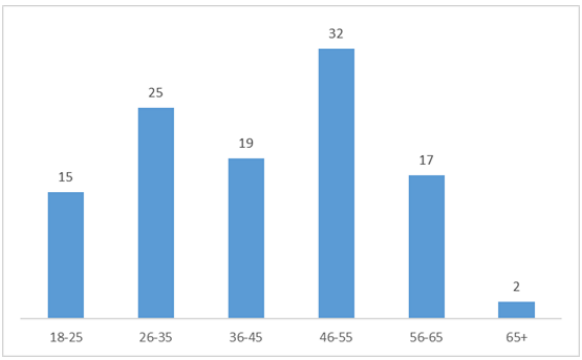

Figure 1. Age of respondents

While participants in this study represent a diverse range of 20 different industries, most are affiliated with the IT industry (33, 30%). Following closely are individuals from the healthcare and medicine, constituting (26, 23%), and the education sector, comprising (18, 16%). The share of participants originating from other listed industries does not surpass 2% individually.

To address our first research question, we analysed the inquiry into the utilization of AI tools in PM. The results revealed a notable trend of limited adoption, with 56.5% of respondents indicating no use of AI. In contrast, a modest 29.1% affirmed the affirmative use of AI in their project management practices. Additionally, 14.5% expressed uncertainty regarding incorporating AI tools in their PM processes. A detailed examination of the usage level of AI in PM was conducted, focusing on the top three industries. The findings underscored that a majority of respondents from the IT sector, accounting for more than half, incorporate AI in their PM practices. In the education industry, usage stood at 28%. Conversely, the lowest adoption rate among these top three industries was observed in medicine, where a mere 4% of respondents affirmed using AI in PM.

These results are illustrated in Figure 2 in continuation.

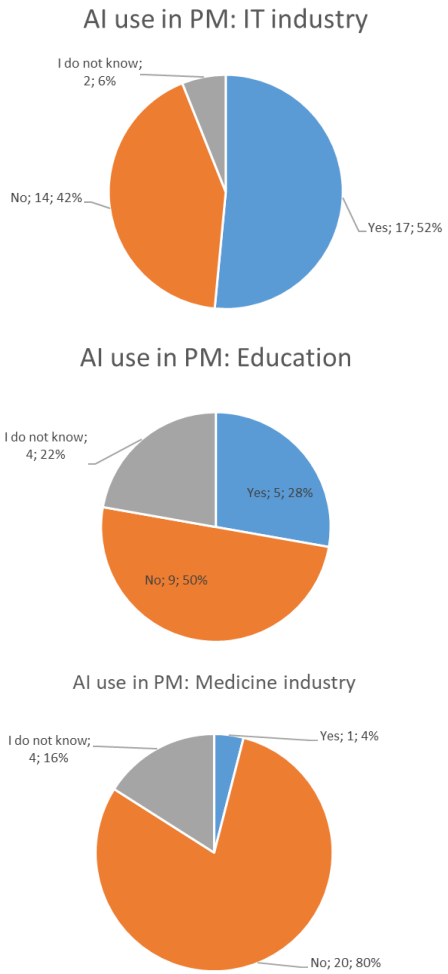

Figure 2. AI use in IT, medicine and education

An in-depth exploration of PM activities suitable for AI implementation (a1-a10), the benefits derived from AI (b1-b11), barriers (c1-c6), as well as fear associated with AI (f1-f5), was performed through descriptive analysis, and the results of which are elucidated in Table 1. Notably, all variables show a normal distribution, as evidenced by Skewness and Kurtosis values falling within the recommended range.

TABLE I. DESCRIPTIVE STATISTICS

Variables	Items	Mean
PM activities	Case study development (a1)	3.1909
	Cost and resources estimation (a2)	3.4727
	Setting tasks, deadlines and costs (a3)	3.2273
	Project plan development (a4)	3.2636
	Activity implementation (a5)	2.9818
	Communication within the project (a6)	*2.2000*
	Comparing as-is and to-be (a7)	3.1909
	Taking corrective actions (a8)	3.0455
	Achievement analysis (a9)	**3.5455**
	Documentation and project evaluation (a10)	3.3273
Perceived benefits	Cost savings (b1)	3.4182
	Increasing the employees' efficiency (b2)	*3.0545*
	Increasing the accuracy, relevancy and information presentation (b3)	3.2636
	Increases the accuracy of the use of regulations (b4)	3.3818
	Competitive advantage (b5)	3.2909
	Better strategic position (b6)	3.1909
	Increased revenues (b7)	3.2091

Variables	Items	Mean
	Enhancement of user support (b8)	3.3000
	Enables faster IT implementation in the future (b9)	**3.6455**
	Information dissemination (b10)	3.6182
	Risk reduction (b11)	3.0364
Perceived barriers	The cost of implementing an AI system in a company (c1)	3.3182
	Security risk (c2)	3.5182
	Companies are not aware of the existence of AI tools (c3)	**3.6091**
	Employees refuse to use AI tools (c4)	3.3727
	The cost of investing in employee knowledge to use AI tools (c5)	*3.2818*
	Lack of skills for using AI tools (c6)	3.4636
Perceived fear	The introduction of AI in PM will result in a reduced demand for human staff (f1)	3.3000
	AI can replace part of my work tasks (f2)	3.2636
	AI can replace most of my work tasks (f3)	2.4273
	I have doubts that AI will replace some of my work tasks (f4)	2.8727
	I have my doubts that AI will completely replace my workplace (f5)	2.3364

In regard to our second research question, results show that the activity in which **AI has been graded as the most contributing** is the one regarding *achievement analysis* (a9). The opposite, an activity where there is the **least possible benefit of AI**, is the one related to *communication within the project* (a6).

The answer to our RQ3 (*What are the main benefits and barriers that employees perceive related to AI in PM in Croatia)?* is presented in the continuation. The most perceived benefit is the *faster IT implementation in the future* (b9), while the benefit perceived as the least relevant was *increasing employees' efficiency* (b2). In addition, *not being aware of AI tools is considered the biggest barrier* (c3), while the *cost of investing in employee knowledge to use AI tools* (c5) is considered the lowest barrier. To examine if there is a difference between the perceived relevancy of benefits and barriers, average values for perceived benefits and barriers have been calculated, and the results indicated *no significant differences between these two observed variables*.

To provide the answer to our RQ4, we analysed the results of the fear variable (Figure 3). The *decrease in demand for human resources* (f1) garnered the highest rating, underscoring the apprehensions within the surveyed group. Conversely, the statement that *AI could entirely replace the jobs carried out by respondents* (f5) received the lowest rating, suggesting a degree of scepticism or resistance towards complete automation of their roles.

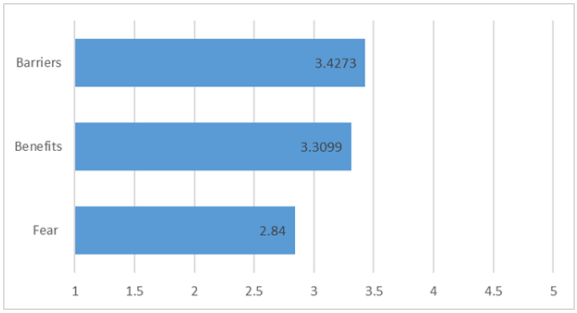

Figure 3. Average values for barriers, benefits and fear

To conclude, the fear construct has the lowest average grade (2.84), followed by perceived benefits (3.309) and barriers (3.427), which are illustrated in Figure 3.

V. Discussion and Conclusion

The conducted quantitative survey spanning over 20 industries in Croatia aimed to address the primary research goal of assessing the current state of AI usage in PM. The obtained results reveal that the utilization of AI in PM remains remarkably low (56.5% of respondents indicating no use of AI), aligning with prior research indicating that AI in PM is still in its early stages [7] [6]. Nevertheless, a noteworthy increase has been observed when comparing our findings with Eurostat data.

Our study uncovered no significant disparity in how employees perceive the benefits and barriers associated with AI implementation. This suggests a high level of employee awareness regarding both the advantages and challenges posed by AI in the workplace. The examination of the construct of fear yielded unexpected results, with employees expressing a relatively low level of apprehension (average score of 2.84 out of 5). This could be attributed to the fact that a significant majority (77%) possess a high level of education (master's or PhD), implying that their knowledge and skills may mitigate concerns related to job security or other associated issues.

In future research, it is imperative to address several limitations. The first limitation is the relatively limited sample size, which should be expanded and supplemented with qualitative interviews to get deeper insights into AI adoption within project management. In addition, expanding the scope to include cross-cultural comparisons could enhance the relevance to a global audience.

Even though previous literature confirmed a substantial increase in influential publications on AI-enabled project management over the past decade, additional research gaps have been identified that warrant further exploration. This study provides an insightful overview of the current status of AI in PM in Croatia and serves as a foundational starting point for future research endeavours. Given the potential for more in-depth investigations, one promising direction could involve conducting research with specific AI tools (14.5% of respondents did not know if they use AI tools), addressing the identified research gaps, and further advancing the understanding and integration of AI in the field of PM.

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