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AI For Effective Project Resources Management

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ABSTRACT

This research endeavours to delve into the potential of Artificial Intelligence (AI) in bolstering Project Resource Management (PRM), discerning the principal challenges inherent in project resource planning, acquisition, and human as well as physical resource management, while also appraising the utilization of AI tools by project team members (PTM) and their efficacy in daily tasks. This research contributes a theoretical basis for what lies ahead studies in PM and unveils the benefits of AI in task monitoring, scheduling, team assignment, cost estimation, and the monitoring of physical project resource availability. This study employs a mixed-method approach, commencing with an initial literature review to identify project challenges. Data collection is facilitated through the administration of questionnaire surveys and interviews with project managers, encompassing both closed-ended and semi-structured questions. The research reveals that PTM readily embraces the utilization of AI for daily tasks and Project Resource Management can be enhanced through AI.

Keywords: *Artificial Intelligence, Project Management, Project Resource Management, Project Managers*

INTRODUCTION

In tandem with the rapidly advancing technology landscape, various innovations have emerged to simplify and enhance tasks that were traditionally performed by humans, often replaced by automated machines and digital technology. One of the highly influential and versatile technologies in various domains today is Artificial Intelligence (AI). Apart from its manifold benefits, AI can save time, allowing for the efficient completion of various tasks. Additionally, AI conserves economic resources and has significant social impacts. In the industrial sector, the trend of AI is continuously evolving, as evidenced by various autonomous machines and digital technologies that were once operated by humans but now

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function independently. Examples include smart cashiers, autonomous vehicles, and voice recognition technology, among others. Furthermore, in the realm of project management (PM), AI plays an increasingly prominent role, both in professional and academic environments. AI brings forth software-based solutions that streamline activities that used to be laborious and expensive, making them highly efficient and cost-effective. This is particularly evident in communication, monitoring processes, data collection, data analysis, and various other variables.

However, in the realm of crucial decision-making within a project, Project Managers continue to depend on the affirmation of expertise and gut feelings across all facets of knowledge within the field of PM. This paradigm may soon transform with further advancements in AI, which can provide rapid responses and make decisions drawing from a flawless equilibrium of all factors and variables influencing project evolution (Gil et al., 2021). When observing the application of AI adopted in PM, it becomes apparent that there are gaps in this area of research. Machines will assess the project's current status regarding time, expense, and quality and autonomously make decisions regarding planning resources, estimating, assigning, maintaining, scheduling, task prioritization, development, and team management to optimize project development efficiency. Although AI will not replace the role of PM in its current stage of development, AI will maintain its substantial involvement in managing human and physical resources (PR) in a project. In this research, insights into how AI can be used as a supportive resource with the potential to enhance PM as a versatile software tool will be explored. Various existing tools will also be evaluated to find the right way to integrate various tools to enhance the user experience and discover various impacts on project development in the next study. The main objective of this research is to investigate AI's function in Project Resource Management (PRM) and its contribution to improving the capabilities of users in performing their tasks.

LITERATURE REVIEW

Project Management (PM)

Within the management domain, PM, one of the core subfields, is defined as the extensive application of a variety of methods, expertise, capabilities, and instruments to effectively advance the successful progress of an ongoing project, to achieve predefined objectives (PMI, 2021). Understanding a project is of paramount importance, whether in the short term, medium term, or long term. This is because every project possesses unique driving factors, meaning that a project lacks routine elements that would make it a repetitive

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application of skills, resources, knowledge, or funding. Instead, it seeks outcomes that have a long-term impact, benefiting the company or client in the short, medium, and long term. Similar to other fields, the field of PM offers various methodologies to determine the right and effective ways to develop the ongoing project. Jovanovic & and Beric (2018) analysed existing PM methodologies to understand how to choose the best methodology applicable to each project. Their findings indicated that traditional classics are better suited for projects that are enduring and intricate in nature whereas agile methodologies are better suited for smaller and less complex projects (e.g., IT projects). They also stressed the significance of choosing and employing the correct methodology for the relevant project to ensure effectiveness and achieve optimal project development results.

In managing project resources, effective resource management is crucial for a successful process. This covers a wide range of assets, encompassing both human and tangible resources, such as expertise, information, machinery, raw materials, inventory, and more. In the management of human resources (HR), a Project Manager's role involves guaranteeing that all team members fulfil the prerequisites essential for project progress, all while assuming the roles of both a leader and a manager. This implies that the Project Manager needs to secure the team's access to necessary training and development chances, availability of materials and equipment, effective communication among stakeholders, technical and psychological support, appropriate task allocation, and reward systems that encourage team development and performance achievements. In the Project Planning phase, it falls upon the project manager to create the desired description of the project team (PT), and identify and define The essential positions for team members, encompassing their levels of authority, responsibilities, and required skills. Additionally, it's essential to estimate the volume of effort required to fulfil all the project's necessary tasks. In this context, the Project Manager requires various tools and techniques to facilitate accurate decision-making. The dedication invested in strategizing the various stages comprising the project has a significant impact on its success and efficiency, enhancing both aspects (Dvir, 2005).

Once the necessary resources have been identified, the task of the Project Manager during the Execution phase is to assemble a professional team with specific considerations tailored to the project's needs. However, it's crucial to acknowledge that the Project Manager might not possess complete autonomy or direct influence over the hiring of personnel due to various factors for hiring employees. To select team members, the Project Manager needs to make decisions by applying a multi-criteria analysis method. This includes factors such as cost, capability, experience, knowledge, expertise, and attitude, as well as international

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factors like geographical location, time zone, and communication abilities. Furthermore, the Project Manager also needs to consider interpersonal skills and team capabilities because they may need to engage in discussions for particular requirements, obtain resources or machinery, or impact choices of external parties that can impact the project.

After the team is formed, The Project Manager's responsibility involves guaranteeing that the team experiences suitable growth, encompassing the enhancement of team member skills, improvements in the team's working environment, and the facilitation of effective collaboration among team members. Employing the right leadership approach for overseeing HR emerges as a vital factor in leading and developing this newly formed team. According to Northouse (2016), Leadership is defined as a procedure where one person guides a group of individuals toward shared objectives, ultimately motivating them to be more involved and committed to their duties. According to Ceri-Booms et al. (2017), behaviours closely linked to the tasks at hand are believed to positively influence team performance by focusing on individuals and tasks, while also recognizing the importance of task allocation and coordination in effective teamwork. Dabirian et al. (2019) contend that overseeing the distribution of HR is a pivotal aspect of the human resource management (HRM) process. They propose that proper and well-scheduled HR allocation can wield substantial influence on project results, especially concerning expenses and time, while also providing opportunities for workers to enhance their skills during project execution.

To achieve peak productivity and the best possible results from the team, the Project Manager must make certain that the PT receives adequate training and competence enhancement. According to PMI (2021), this can be accomplished by offering online courses, training sessions, mentorship, or even in-person training. These approaches additionally enhance the capabilities of team members, allowing them to gain fresh skills that can be applied and prove advantageous in future projects. Another vital aspect to incorporate in team leadership is effective communication. This enables the Project Manager to monitor the team's advancement, offer prompt and crucial input, and guarantee that team members receive both emotional and technical assistance, thereby nurturing their commitment to the project. Zulch (2016) found that effective communication skills can drive the implementation of better leadership approaches and lead to enhanced project performance, along with an increased success rate. Improving the work environment to ensure employee contentment and productivity while executing essential adjustments within the team is also a vital aspect of a successful PM.

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Siddiqui et al. (2022) have demonstrated that assigning demanding tasks that align with professional growth and providing suitable support to the PT can boost dedication, lessen communication hurdles, and diminish the likelihood of conflicts, ultimately enhancing the overall performance of the PT. This aligns with Bjorvatn & and Wald (2018), who examined the connection between Project-focused HRM practices and project performance. They found that behaviours centred on employee training, engagement, and acknowledgment play a pivotal role in improving project effectiveness. As the Project Manager oversees the team, it's essential to evaluate both the advancement and the calibre of the work being done. This evaluation yields valuable information about the team's strengths and weaknesses, as well as those of individual team members. Additionally, it aids in comprehending their ambitions and their approaches to organizing tasks, decision-making, and team interaction (PMI, 2021). This evaluation requires the Project Manager to actively partake in monitoring and control measures to prevent delays, swiftly adapt to project alterations, execute essential modifications and measures, and uphold planned activities or minimize the consequences of any delays (Aljamee et al. 2020). Providing rewards to the Project Team and its members is also essential for boosting their involvement in the project. Identifying and rewarding constructive behaviours provides additional motivation as team members feel appreciated and acknowledged by the organization. These rewards can take the type of monetary remuneration, fresh prospects for professional development, or additional responsibilities to make them feel more involved.

Physical Resource Management (PRM)

In the realm of PRM, certain specifications must be met to facilitate Project development. Project Managers should identify essential project resources and equipment for each task, decide on the methods and timing of their procurement, manage these materials, and track their utilization over time. First and foremost, Project Managers need to plan the procurement and management of PR accurately, utilizing project charters and project documents that encompass schedules and requirements. Furthermore, project managers can also employ various resource estimation methods, such as activity-based estimation, analogous estimation, and data analysis, aided by data representations and expert meetings (PMI, 2021).

Secondly, the allocation stage of PR involves the selection, assignment, and procurement of resources, whether internal or external. Resource selection is carried out through multi-criteria analysis based on availability, cost, location, and timing. Procurement involves agreements between buyers and sellers, with varying levels of complexity.

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International businesses also need to pay attention to cultural and legal aspects (Project Management Institute, 2021). According to Mota et al. (2017), decision-making in selecting the party to carry out a task and assessing their work during the contract's duration is a crucial aspect to ensure satisfactory outcomes. This involves two main stages in the procurement process: provider selection and provider performance evaluation. Setting criteria for selection and evaluation is a matter that can influence the overall process and should align with client requirements because Projects generally strive for excellence in terms of cost, quality, and timeliness. Negotiations are usually required when procuring resources, whether due to cost implications, availability, and needs.

Thirdly, there is the aspect of PRM, a process typically carried out throughout the Project's lifecycle, much like resource procurement. During this stage, it falls to the Project Manager to assign and allocate the appropriate PR to adhere to the outlined in the Project while preparing a plan and to implement corrective measures if any problems surface. This ensures that users receive PR in a timely and well-located manner, avoiding delays and ensuring better performance (PMI, 2021). Some of the primary methods employed in PR management encompass alternative assessment, cost-effectiveness evaluation, performance appraisals, and trend monitoring. According to Lu et al. (2018), various logistics approaches can be employed to address material resource allocation issues, for instance, deciding the volume of inventory project managers need to keep and the allocation of accessible materials to guarantee that processes adhere to the scheduled plan. In this regard, a variety of tools are needed to assist Project Managers in achieving their objectives, and current trends are rooted in AI-based solutions.

Artificial Intelligence (AI)

AI is achieved through the interpretation of inputs and data, analysis of historical outcomes, and even learning the proper methods to address any situation based on experience. It takes the form of a series of instructions created by humans to facilitate tasks and solve problems, possessing the capability to process vast amounts of data rapidly. This technology is renowned for mimicking human intelligence and demonstrating exceptional abilities in problem-solving, intricate strategizing, logical thinking, negotiation, decision-making, forecasting, adapting to novel settings, comprehending multiple languages, debating, and visual/audio identification. With AI's problem-solving capabilities, the range of functions performed by AI for humans is continually expanding, and organization is shifting their focus to this technology, assuming that its long-term performance is superior and more cost-

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effective. “AI has a wide range of applications in the modern world and is present in most aspects of daily life” (Kubo, 2021).

AI is used for time series analysis to predict crude oil prices (Wang et al., 201). Therefore, it can be understood that AI applications are extensive and only limited by the current state of technology. The advancement of AI elicits mixed feelings of enthusiasm and uncertainty. This is because AI is capable of learning like humans, with an increasing level of proficiency. It can mimic and improve itself, as well as access the entirety of information on the Internet. This might eventually lead to AI becoming smarter than humans and, one day, possibly surpassing human capabilities (Steels & De Mantaras, 2018). In various fields that embrace AI-based functionalities, management is also implementing this technology in everyday activities, and PM is one of the fields currently striving to automate the functions required for the development of each project.

The integration of AI within PM

The integration of AI into PM is increasingly becoming more frequent, with the development of new tools for various applications year after year. These tools manifest as a variety of algorithms and machine learning applications, empowering users to anticipate project scope, budget, and outcomes while setting up initial schedules and resource allocations, as well as identifying control, and monitoring with higher accuracy. Martínez et al. (2015) identified key tools for project control and monitoring in PM. They emphasized the vital role of implementing AI in achieving higher project success rates. Their research primarily centred on predictive project success using AI technologies like Neural Networks, Genetic Algorithms, and Bayesian Models. Currently, many Project Managers continue to depend on subjective expert judgment and parametric tools to progress in their projects. Nevertheless, due to the growing complexity of projects undertaken by companies, maintaining accuracy and predicting project success has become progressively challenging. Gil et al. (2021) identified and found that AI-based tools are far more accurate than traditional tools, although they are currently used primarily for monitoring and control purposes. They acknowledge that the integration of existing foundational tools is an emerging trend to address weaknesses in these models and enhance their capabilities. This indicates that the coordination process among various tools for PM is still incomplete. To further support this statement, Huang & and Liang (2022) have developed a report that highlights the latest characterization of software and machine learning technologies available for PM. They explain that the key issues affecting PM are related to schedules and timelines, which are

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typically presented by most companies to managers to complete projects, Coupled with ineffective monitoring and control procedures.

AI Tools in PRM

In the specialized field of PRM, solutions are already available to aid Project Managers in improving their effectiveness in resource planning, procurement, and management. Several tools have been developed to aid Project Managers in resource-related decision-making. Aziz et al. (2014) proposed software "SCPMS" which is based on features used in the CPM and multi-objective GA. Its objectives include improving resource efficiency, reducing construction time, lowering total construction costs, and enhancing the quality of mega construction projects in the future. In its application, this technology is in charge of taking into account all pertinent factors affecting the decision-making process and can affect the time, cost, and quality of a project. These variables include input related to construction materials, crew size, crew overtime policies, machine efficiency, and more. By running inputs through various solution sets, this program provides users with the optimal balance between time, cost, and quality measures, typically regarded as a suitable trade-off model for projects. To further explore the implementation of AI in PRM, the available technology must be thoroughly understood to oversee all facets of resources and their efficiency in PM. HR and PR have different ways of being managed and different applications during project development.

Integration of AI Tools in HRM within Projects

Managing HR in PM is not an easy task. Project Managers need to plan, estimate, and recruit team members with various considerations, incorporating factors like accessibility, expenses, capabilities, experience, knowledge, skills, and attitudes factors. These stages are crucial in project planning and execution. Understanding how to recruit and retain the best talent to gain significant strategic advantages is essential because it provides a competitive edge to the company. The implementation of AI in e-recruitment is becoming increasingly important and common, streamlining the recruitment process for any role in modern companies (Black et al., 2019). ML algorithms are gaining increased usage because they can process candidate data according to criteria and preferred qualifications more efficiently than a human recruiter (Tambe et al., 2019). Creating timetables for team members is another complex duty that Project Managers must manage. Scheduling should be formulated to determine the resources necessary for a particular project, and often, rescheduling is necessary due to issues with the performance of specific tasks, a lack of capacity to complete tasks according to the established schedule, or the inability to perform certain tasks because

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they have dependencies that must be completed before other tasks can commence (Myszkowski et al., 2018).

AI scheduling is increasingly being utilized, supported by various studies that indicate a growing trend in adopting this technology in projects. Ge & Xu (2016) Utilize a software-based project scheduling system that facilitates the flexible inclusion of staff members and the adjustment of schedules as needed. Users provide detailed input regarding tasks and employees, predict task durations through simulation, and encompass management goals and control measures. By providing this information, the optimal project schedule is efficiently generated in digital agent format, assigning tasks and employees to meet specific objectives or using prior task relationships as guidelines for scheduling all activities effectively. This aligns with Myszkowski et al. (2018), who present AI Hybrid Ant Colony Optimization (HAntCO) to allocate task assignments to resources so that schedules can be executed in the shortest possible time.

During project development, Project Managers must build and manage their teams by Improving their expertise and capabilities, fostering a conducive work atmosphere, employing leadership skills and emotional intelligence to inspire employees, ensuring efficient communication, and facilitating collaboration for progress, while also offering suitable compensation for their contributions. Various forms of e-learning technology have been present in companies for a considerable amount of time and are considered time-saving methods that provide online education systems with a significant degree of efficiency and the capability to discern the optimal approach for instructing individuals, including recognizing learners' emotional cues (Megahed et al. 2020). There are some doubts about e-learning systems, as this technology can make trainees feel isolated as they do not interact directly with instructors (Choudhury et al. 2020), although this technology demonstrates significant employee development and provides robust learning opportunities. Johnson et al. (2008) suggest that the presence of an instructor is a pivotal factor in the success of e-learning and propose that this digital approach should prioritize creating mechanisms that promote the establishment of a collaborative social learning environment to augment the effectiveness of e-learning.

As team members enhance their expertise, they gain increased familiarity with their roles and responsibilities, and AI agents can assign and reallocate tasks based on their skills to promote project format optimization. Myszkowski et al. (2018) state that “resource R can perform task T only if R possesses the required skills for T at the same or higher level”. The AI system, HAntCO, created in their study, factors in cost by considering an hourly wage that

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may vary based on the relevant skills. Consequently, proficient individuals or teams can accomplish tasks more swiftly if appropriately assigned, leading to reduced project costs. Additionally, AI aids users in communication by employing natural language processing, enabling direct interaction with AI for feedback on tasks and resource utilization. Moreover, it facilitates communication among team members through a range of programs and applications. Butow & and Hoque (2020) found that healthcare management systems focus on employing communication systems to grant trainees the capability to directly communicate with e-learning systems, bypassing the need to consult their supervisors, thus saving time. These systems can also analyse patient speech to comprehend their requirements and process extensive volumes of audio data to acquire a deeper understanding of how patients are receiving care. When it comes to rewarding team members for their contributions to a project, there are similar e-compensation programs that can be used. Systems like Oracle PeopleSoft eCompensation Manager Desktop (Oracle.com, 2019) provide easy-to-use online access for managers to access Comprehensive employee compensation details, enabling automation of payroll choices, supervision of salary amounts, and oversight of the compensation cycle.

From this literature, it can be understood that effectively handling and retaining talent while assigning various team members to more suitable tasks is a key element in having the right HR allocation system and reducing both cost and project activity completion time. Leveraging suitable systems to track each parameter recommended by PMI-HRM can indeed lead to project cost savings improved time management, and improvements in all parameters' quality. However, these systems can also impact the emotional well-being of Project Managers and team members (PM-TM), team development opportunities, create communication and feedback issues, and pose a burden on PMI advanced and proficiently deployed AI systems, when not executed by skilled digital science experts, can pose an obstacle. Additionally, the absence of the necessary expertise to support and advance these systems in Portugal can hinder their complete integration. Proper PR management is essential for successful project planning. Estimation and planning help Project Managers identify PR requirements, including cost, attributes, schedule, properties, and location, for efficient resource utilization. Li et al. (2018) developed digital agents addressing construction project scheduling and PR allocation. They introduced the MOPSO-IPM AI tool to optimize scheduling and resource allocation, reducing costs and project execution time, despite some limitations due to external factors.

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The integration of AI in PRM within Projects

Some software applications can make decisions when choosing PR by considering factors like price changes, activity expenses, material availability, and geographical location. Furthermore, due to the dynamic environment faced by most projects, the demand for PR is non-stationary, meaning that the demand for various types of materials is constantly changing over time. Given the non-stationary nature of the material requirements mentioned, uncertainty in inventory levels is always present. Hence, managers need to determine the appropriate inventory levels to uphold and how to distribute the existing materials among ongoing tasks in case of shortages. According to Lu et al. (2018), This has the potential to influence project scheduling and cost efficiency, underscoring the importance of optimizing the allocation of materials through on-site and off-site supply logistics. Lu et al. (2018) conducted research focused on the effective allocation of limited materials among activities to minimize project duration and enhance cost efficiency, GASM is employed to tackle an integrated inventory model. It aims to identify the optimal inventory level based on a particular allocation policy. They found that an efficient centralized material management system greatly enhances the outcome of large-scale projects, such as the construction project studied in this context, while simultaneously lowering project expenses and timeframes. It is also crucial to allocate the appropriate PR to the right tasks at the right time and place. Blokdyk (2019) presents software tools known as STRM and Allocation used to manage PR in almost real-time by scheduling tasks that use a limited number of PR among them. This is done while considering resources with various capacities and skill levels, different priority rules, and various calendars. The simulations conducted by this tool provide users involving various optimal solutions and how they influence costs and schedules, contingent on expert decision-making for full operation.

When further investigating the study of allocating available PR, another issue that often arises in most projects is the cost of rehandling material management associated with PR when not distributed correctly during project development. Li et al. (2019) proposed a technique to facilitate the entry of material components into constrained construction areas, mitigating the expenses associated with inventory rehandling and enhancing overall project efficiency. They utilized the CCSAP, which verifies real-time component supplies, identifies AoI in actual data on-site, and optimizes using a flexible GA configuration Enabling materials to be deposited into adaptable storage spaces that adjust in real-time as construction locations evolve. This entails utilizing imaging technology to monitor storage zones within construction sites with constantly shifting layouts and ever-changing schedules that impact

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workflow. Li et al. (2019), the application of this model led to a twenty-one point nine percent reduction in inventory rehandling costs and a nineteen point four percent enhancement in construction efficiency when compared to conventional approaches.

Managing PR during a project requires ongoing corrective actions, including reallocating specific resources, rescheduling their availability and locations in line with monitoring the project's progress and activity requirements, and reclaiming particular resources when activities demand it, as the procurement or acquisition of physical resources is an ongoing process throughout the project's timeline. The tools reviewed enable PM-TM to oversee and implement PR management, but the use of this technology also carries additional consequences. With rapid advancements, AI systems are becoming increasingly popular and will become part of everyday life in various aspects, ranging from professional AI tools to AI assistants in various household functions. In PM, there is already a range of AI-powered solutions that address various project challenges and provide assistance to PTs without fully replacing their roles. Through this literature review, various AI machine learning models have been found to have been applied in the field of PM, but most of them are tailored to specific types of projects and have limited functionalities. Additionally, most are used to support decision-making, with the majority being supportive in nature, as described by Gil et al. (2021) and Bughin et al. (2019).

As mentioned by Huang & and Liang (2022), many existing machine learning-based PM solutions focus on one or several PM elements, yet a comprehensive solution remains absent within the procedure. In other words, Numerous AI and machine learning models have found application in the field of PM, yet there is a notable absence of synergy among these models in harnessing this technology. This lack of cohesion poses a barrier regarding the incorporation of AI by both businesses and individuals. There is currently a lack of a managerial framework that guides users in comprehending the appropriate circumstances and methods for applying AI in the project workflow. The consequences of complete technology integration in PRM remain incompletely grasped, and there appears to be a research void in comprehending its potential impact on PM-TM. This includes exploring their readiness and willingness to adopt this technology, even when proven benefits such as enhanced revenue, cost reduction, time savings in projects, and overall project quality improvement are evident. There exists a lack of comprehension regarding how this technology can impact Team Members and Project Managers in a corporate setting, preventing a comprehensive understanding of its effects on overall business operations. Similarly, decreased oversight from a Project Manager as a result of the incorporation of autonomous systems can influence

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the way leadership is exercised in managing PTs, conducting team-building exercises, providing emotional intelligence to ensure team mental well-being, and creating a conducive workplace environment can have an impact on overall productivity. The presence of AI capable of negotiating and negotiating prices for PR can avoid interactions The necessity for Project Managers or Team Members to engage in communication with external or internal parties, whether they are within or outside the organization, has not been studied in terms of its impact on corporate relationships between the company, suppliers, or customers.

RESEARCH METHOD

In this research, a mixed-methods approach is utilized, combining both qualitative and quantitative research techniques. The quantitative aspect, consisting of a survey, is employed to obtain primary data necessary for addressing Sub-Questions 1 and 2. The survey aims to collect numerical descriptive data from a representative sample of the population, shedding light on behavioural patterns and opinions (Huyler & McGill, 2019). The research employs a questionnaire format designed using Google Forms and is disseminated online through various platforms. The research population of interest comprises individuals with project-related experience. Stratification is based on whether these individuals possess project experience or not (Huyler & McGill, 2019).

Data Analysis

Sample Error

The sample comprises 127 acceptable answers with a 95% level of certainty. The anticipated margin of error in this research is around 8.7%, signifying the sample size is expected to deviate from accurately reflecting the anticipated outcomes of the entire population.

Sample Characterization

The survey sample was targeted at professionals who had prior experience with projects, without restrictions based on their organization type, sector, organization size, or project job function, creating a diverse pool of potential candidates. Among the 142 respondents, 3 had no prior project experience, 11 lacked experience in HR and/or PR management, and 1 had no experience in either field. Consequently, the analysed sample consists of 127 respondents who possess experience in PM HR, and/or PR. Regarding age, 37.0% fell into the 35-44 years age bracket, 26.8% were in the 25-34 years age group, 22.0% belonged to the 45-54 years age category, while the 18-24 years age group accounted for 8.7%, and those aged 55 years or older represented 5.5% of the respondents. Consequently,

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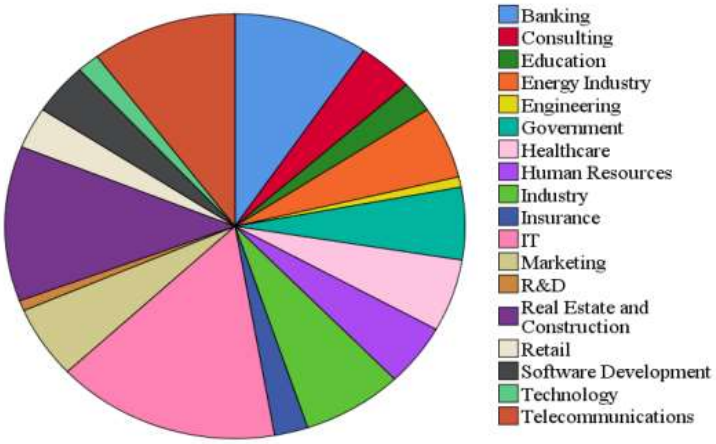
the majority of the sample fell within the 25 to 44 years' age range. Regarding the positions held by the respondents in projects, the statistics show that 72.4% were Project Managers, 11.8% held roles as Directors, 9.4% were Program Managers, 2.4% served as Junior Project Managers, 2.4% were in PTM roles, and there was one respondent each in the positions of Product Manager (0.8%) and Project Officer (0.8%). With the majority of respondents holding roles related to PM, with nearly three-quarters of the sample being Project Managers, it can be assumed that this sample possesses the necessary understanding to provide valuable and significant insights for this study. Furthermore, there are a total of 18 different sector categories, with the majority of the sample working in the IT sector (15.7%), Real Estate and Construction (11.8%), and Telecommunications (10.2%). The presence of a large number of diverse sector categories indicates projects are not confined to particular sectors; instead, they exhibit diversity across various field endeavors involving various professions.

Table 1. *Sector Results (Source: Author's elaboration, 2022)*

Sector

	Frequency	Percent
Banking	12	9,4
Consulting	5	3,9
Education	3	2,4
Energy Industry	7	5,5
Engineering	1	,8
Government	7	5,5
Healthcare	7	5,5
Human Resources	6	4,7
Industry	9	7,1
Insurance	3	2,4
IT	20	15,7
Marketing	7	5,5
R&D	1	,8
Real Estate and Construction	15	11,8
Retail	4	3,1
Software Development	5	3,9
Technology	2	1,6
Telecommunications	13	10,2
Total	127	100,0



Consequently, the collected sample includes respondents with a substantial level of experience, as only 24.4% possess five years of experience or less. The survey also gathered data on the Company Size where the respondents are employed, revealing that 55.1% work in large companies, 18.1% are in medium-sized companies, 13.4% work in small companies, and 13.4% are employed by micro-companies. Thus, more than half of the sample is employed in large companies with over 250 employees.

Descriptive Analysis

Ranking of HR and PR Processes

In the realm of HR, the most demanding process overall was HRM, having the lowest mean rank (Mean Rank = 1.82), followed by HR Acquisition (Mean Rank = 1.83), while HR

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Planning was considered the least challenging, with a mean rank of 2.35. Importantly, it's worth noting that HR Acquisition and HRM exhibited similar Mean Rank values, indicating that respondents perceived these two processes to be of comparable difficulty. Therefore, HR Acquisition and HRM have the same level of difficulty for PTs when implementing a Project.

Table 2. *Ranking of HR Processes (Source: Author's elaboration, 2022)*

Descriptive Statistics					Friedman Test Ranks	
	Mean	Std. Deviation	Minimum	Maximum		Mean Rank
Human Resource Planning	2,35	,801	1	3	Human Resource Planning	2,35
Human Resource Acquisition	1,83	,721	1	3	Human Resource Acquisition	1,83
Human Resource Management	1,82	,821	1	3	Human Resource Management	1,82

For the PRM Process, the lowest ranking is held by PR Acquisition having a Mean Rank of 1.76, PMR was rated as the most challenging, followed by PRM with a Mean Rank of 2.06, and the least demanding was PR Planning, with a Mean Rank of 2.17. These results provide a clearer distinction regarding which process is the most challenging among the three processes. However, PR Planning and PRM are perceived as having a similar level of difficulty by the respondents, as the Mean Rank only differs by 0.11 points.

Table 3. *Rankings of PR Processes (Source: Author's elaboration, 2022)*

Descriptive Statistics					Friedman Test Rank	
	Mean	Std. Deviation	Minimum	Maximum		Mean Rank
Physical Resource Planning	2,17	,846	1	3	Physical Resource Planning	2,17
Physical Resource Acquisition	1,76	,718	1	3	Physical Resource Acquisition	1,76
Physical Resource Management	2,06	,833	1	3	Physical Resource Management	2,06

Rankings of AI Tools

The identical approach was utilized for AI tools employed to aid PRM, in discerning which tools offer more substantial support for distinct tasks within each process. Each process comprises a sequence of tasks, and throughout the literature review, various AI technologies associated with these tasks were identified.

Table 4. *Tasks of the HR Process (Source: Author's elaboration, 2022)*

Human Resource Processes	AI Human Resource Tool
Human Resource Planning	*Scheduling Project Tasks*
Human Resource Acquisition	*e-Recruitment and Candidate Selection*
Human Resource Management	*Scheduling Project Tasks*
	Allocation for Project Tasks
	Project Task Monitorization
	e-Learning
	Communication
	Rewarding Team Members

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AI-HR tools were assessed and ranked on a scale from one to seven, with the tool receiving the lowest Mean Rank being regarded as the most valuable according to the respondents. Conversely, the tool with the highest Mean Rank was considered the least beneficial. Notably, the Project Task Monitoring tool had the lowest Mean Rank (Mean Rank = 2.87), indicating that it was perceived as the most useful among the tools, the second-ranking tool is Project Task Scheduling (Mean Rank = 2.94), The tool that secured the third position is the Assignment for Project Tasks, with a Mean Rank of 3.48, aligning with the tasks in the HRM Process.

Table 5. *Ranking of AI-HR Tools*

Descriptive Statistics			Friedman Test Rank	
	Mean	Std. Deviation		Mean Rank
e-Recruitment and Candidate Selection	4,16	1,986	e-Recruitment and Candidate Selection	4,16
Scheduling Project Tasks	2,94	1,692	Scheduling Project Tasks	2,94
Allocation to Project Tasks	3,48	1,685	Allocation to Project Tasks	3,48
Project Task Monitorization	2,87	1,743	Project Task Monitorization	2,87
e-Learning	4,42	1,801	e-Learning	4,42
Communication	4,80	1,873	Communication	4,80
Rewarding Team Members	5,33	1,860	Rewarding Team Members	5,33

Table 6. *Tasks of the PR Process*

Physical Resource Processes	AI Human Resource Tool
Physical Resource Planning	*Cost Estimation for Resources*
	Scheduling Resources for Project Tasks
Physical Resource Acquisition	*Monitoring Resource Availability*
	Inventory Management
	Cost Estimation for Resources
Physical Resource Management	*Resource Placement*
	Allocating Resources to Project Tasks
	Inventory Management
	Monitoring Resource Availability

The AI tools supporting PR tasks were ranked by respondents from one to six. It's worth noting that the AI tool with the lowest Mean Rank, Cost Estimation for Resources, is a component of the PR Acquisition Process, which is considered the least challenging process in PR management. This may appear somewhat contradictory, given that this process is considered the least difficult. Looking at Table 5, It can be noted that the Mean Ranks do not show significant differences among them, suggesting that these tools are perceived to offer a similar degree of utility.

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Table 7. *Tasks of AI Tools for PR (Source: Author's elaboration, 2022)*

Descriptive Statistics			Friedman Test Rank	
	Mean	Std. Deviation		Mean Rank
Cost Estimation for Resources	3,02	1,813	Cost Estimation for Resources	3,02
Scheduling Resources for Project Tasks	3,36	1,636	Scheduling Resources for Project Tasks	3,36
Allocating Resources to Project Tasks	3,82	1,524	Allocating Resources to Project Tasks	3,82
Resource Placement	4,03	1,431	Resource Placement	4,03
Inventory Management	3,46	1,934	Inventory Management	3,46
Monitoring Resource Availability	3,31	1,698	Monitoring Resource Availability	3,31

AI utilization

The findings reveal that 63% (n=80) of the sample have previous experience with AI, 29.9% have never encountered AI in past situations, and 7.1% are uncertain about their previous AI exposure. Unsurprisingly, most respondents have interacted with AI before, given its widespread integration into various aspects of daily life. When identifying individuals who have employed AI in PM, the results indicate that only 8.7% have used AI in PM, while 87.4% have not employed AI in this context, and 3.9% are unsure if they have ever utilized AI agents in PM. It's not surprising that most respondents have never used AI in PM, as many companies have not implemented this technology in their infrastructure, either due to a lack of funds, The reasons for not using AI tools can vary, such as having an insufficient workforce to operate or maintain the technology, or because certain functions do not necessitate the use of such advanced tools. In the context of PRM tasks, 7.9% have employed AI to assist in these tasks, 88.2% have never utilized AI for these tasks, and 3.9% are unsure if they have employed AI agents to support their tasks. It was anticipated that fewer respondents would affirm using AI agents in PRM, and interestingly, only one respondent who used AI in PM did not use AI tools in PRM. It's noteworthy that 7.9% of respondents have employed these agents when managing HR or PR in Projects, indicating that some companies have already integrated AI into their operations.

Pearson's r Correlation Analysis

We conducted a correlation analysis involving the sample variables, process ranking variables, and AI technology ranking variables. This analysis aims to comprehend the connections among these various factors, and we used Pearson's r Correlation Coefficient for this purpose. Pearson's r is a parametric correlation analysis that produces values ranging from +1 to -1. In this scale, +1 indicates a strong positive correlation between variables, -1 suggests a strong negative correlation, and 0 implies no discernible relationship between variables (Atoum, 2019). The magnitude of the relationship between two variables is

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indicated by the absolute value of the correlation coefficient, which ranges from 0 to 1 (Musa et al., 2018). In this scenario, SPSS automatically identifies statistically significant correlations based on the sample size and the provided confidence interval, typically set at 95%. The correlations will be established between the Independent Sample Variables, including "Age," "Role in the Project," "Years of Experience in Projects," and "Company Size," with three distinct sets of Dependent Variables, specifically HR, PR, and AI. Since the sample data responses are categorical, they need to be transformed into sets of ordinal variables to facilitate the interpretation of correlations in SPSS.

Table 8. *Survey Sample Variable Values (Source: Author's Elaboration, 2022)*

Age	Role in Projects	Years of Experience	Size of the Company
18 to 24 = 0	Junior Project Manager = 0	< 2 = 0	Less than 10 = 0
25 to 34 = 1	Project Team Member = 1	2 - 5 = 1	10 to 49 = 1
35 to 44 = 2	Program Manager = 2	5 - 10 = 2	50 to 249 = 2
45 to 54 = 3	Project Officer = 2	10 to 15 = 3	More than 250= 3
More than 55 = 4	Product Manager = 2	15 to 20 = 4	
	Project Manager = 2	More than 20 = 5	
	PMO Director/Manager = 3		

Regarding the correlation (r) analysis for Sample Variables, the results identify a slight positive correlation between Age and Role in the Project (r = 0.361) and a substantial positive correlation between Age and Years of Experience in the Project (r = 0.803), as indicated in Table 9. These findings align with expectations, as career progression typically involves accumulating years of experience, which is naturally linked to the respondents' age. In the analysis of HR correlations, both Process Rankings and AI Technology Rankings for HR are considered. First, as we explore the connection between Sample Variables and Process Variables, SPSS reveals several noteworthy correlations among them. Specifically, when examining Age and Years of Experience, we observe modest positive values about HR Planning (r = 0.260 and r = 0.204, respectively). These findings suggest that individuals with greater Age and more Years of Experience tend to perceive HR Planning as the least challenging process within HR. Another relationship identified is between Age/Years of Experience and HRM, there's a mild negative correlation (r = -0.250 and r = -0.258, respectively) between the variables, which suggests that as Project

Managers advance in their roles, they come to realize that Managing HR is a complex process. Notably, this process was identified as the most challenging in the survey. The connections among the Processes exhibit a moderate negative correlation, as depicted in Table 9. This outcome aligns with expectations, as when one Process receives a higher ranking, the others tend to receive lower rankings, and vice versa.

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Connecting Sample Variables with AI Technology Variables for HR, only correlations between Company Size and AI Task Assignment to Project Tasks were detected, revealing a mild negative correlation (r = -0.206), we observe a connection between Company Size and Task Allocation, and a weak positive correlation (r = 0.224) between Company Size and Rewarding Team Members. These associations may suggest that as companies expand, they seek technology solutions that can efficiently distribute personnel to tasks to minimize costs and task duration, while they perceive less need for technology related to rewarding team members. Across most technologies, correlations are generally rated as weak to moderately negative, which is in line with expectations for a ranking-based study. However, some technologies show positive correlations, such as between Project Task Scheduling and Task Assignment to Project Tasks (r = 0.458, Moderate), as well as between Task Assignment to Project Tasks and Project Task Monitoring (r = 0.227, Weak), which can be interpreted in two ways. Respondents who deemed Project Task Scheduling highly valuable may hold the view that Task Assignment to Project Tasks is also crucial, or they may rate both technologies as less beneficial compared to others. Finally, the relationship between HR Processes and HR AI technology that corresponds was observed. For HR Planning, two correlations were identified, a weak negative correlation with Project Task Monitoring (r = -0.217) and A modestly positive correlation of 0.210 exists with Rewarding Team Members. This suggests that individuals who find HR Planning to be a challenging process may not derive as much benefit from Project Task Monitoring. Conversely, those who perceive HR Planning as uncomplicated may see Project Task Monitoring as a valuable resource. Additionally, respondents who find HR Planning a challenging process may find technology that rewards team members useful or vice versa.

Table 9. *HR Correlation Results (Source: Author's elaboration, 2022)*

Correlation Matrix for Human Resources

	Age	Role in Projects	Years of Experience in Projects	Size of the Company	Human Resource Planning	Human Resource Acquisition	Human Resource Management	e-Recruitment and Candidate Selection	Scheduling Project Tasks	Allocation to Project Tasks	Project Task Monitoring	e-Learning	Communication	Rewarding Team Members
Age	1	.361**	.883**	.156	.288**	.083	-.258**	.046	.058	.041	.032	-.001	-.031	.173
Role in Projects	.361**	1	.340**	-.132	.068	.080	-.118	-.041	.051	.059	-.021	-.050	.031	.062
Years of Experience in Projects	.883**	.340**	1	.140	.204*	.067	-.255**	-.129	.006	.003	.003	-.040	-.003	.105
Size of the Company	.156	-.132	.140	1	.100	-.039	-.178	.090	-.178	-.206*	.077	-.014	.041	.224*
Human Resource Planning	.288**	.060	.204*	.166	1	-.422**	-.604**	.148	-.138	.066	-.217*	-.020	.062	.210*
Human Resource Acquisition	.083	.080	.067	-.039	-.422**	1	-.447**	.087	.051	.064	.032	.011	-.045	.032
Human Resource Management	-.258**	-.118	-.255**	-.178	-.604**	-.447**	1	-.143	.050	.023	.066	.025	.003	-.215*
e-Recruitment and Candidate Selection	.046	-.041	-.129	.090	.148	.087	-.143	1	-.258**	-.246**	-.372**	-.138	-.106*	.058
Scheduling Project Tasks	.058	.051	.006	-.178	-.138	.051	.050	-.258**	1	.458**	.181*	-.400**	-.417**	-.415**
Allocation to Project Tasks	.041	.059	.003	-.206*	.066	.064	.023	-.246**	.458**	1	.227*	-.407**	-.337**	-.401**
Project Task Monitoring	.032	-.021	.003	.077	-.217*	.032	.066	-.372**	.181*	.227*	1	-.253**	-.297**	-.266**
e-Learning	-.001	-.050	-.040	-.014	-.020	.011	.025	-.138	-.400**	-.407**	-.253**	1	.138	.075
Communication	-.031	-.031	-.003	.041	.062	-.045	.003	-.106*	-.417**	-.337**	-.297**	.138	1	.028
Rewarding Team Members	.173	.062	.105	.224*	.210*	.032	-.215*	.058	-.415**	-.401**	-.266**	.075	.028	1

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

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When examining the relationship between Sample Variables and Process Variables, we discovered a notably feeble negative correlation, specifically between PRM and Years of Project Experience (r = -0.193). This indicates that the connection is quite weak and suggests that individuals with greater years of project experience perceive managing PR as a challenging task, or vice versa. As for the correlation between Sample Variables and AI Technology for PR, no correlation was identified, this implies that these variables do not possess statistical significance. The correlation between Process and AI Technology for PR also seems to be absent, as SPSS did not identify any correlations, and the highest relationship between variables is only r = 0.147. As observed in the correlation between HR Processes rankings, all correlations among different PR Processes are moderate and negative, suggesting that they exhibit an inverse linear relationship. Lastly, when examining the correlations among different AI Technologies used for PR tasks, we observe a notable number of correlations, the majority of which are negative due to the survey's ranking scale. Nevertheless, once more, there exist some weak positive relationships between these variables. Specifically, we note positive correlations between Estimation of Resource Costs and Resource Scheduling for Project Tasks (r = 0.217), Resource Scheduling for Project Tasks and Assignment of Resources to Project Tasks (r = 0.208), as well as Inventory Management and Resource Availability Monitoring (r = 0.236). This suggests that respondents may perceive these pairs of technologies as beneficial, or conversely, they might not see them as useful.

Table 10. *Results of PR Correlations (Source: Author's elaboration, 2022*

Correlation Matrix for Physical Resources

	Age	Role in Projects	Years of Experience in Projects	Size of the Company	Physical Resource Planning	Physical Resource Acquisition	Physical Resource Management	Cost Estimation for Resources	Scheduling Resources for Project Tasks	Allocating Resources to Project Tasks	Resource Placement	Inventory Management	Monitoring Resource Availability
Age	1	,381**	,803**	,156	,114	,029	-,140	,077	-,142	-,168	,067	,130	,047
Role in Projects	,381**	1	,348**	-,132	-,001	-,059	,051	,017	,038	-,074	,169	-,013	-,105
Years of Experience in Projects	,803**	,348**	1	,168	,008	,121	-,193*	-,021	,094	-,028	,005	,055	,084
Size of the Company	,156	-,132	,168	1	,003	-,015	-,071	-,069	,091	,002	,108	,016	-,038
Physical Resource Planning	,114	-,001	,008	,003	1	-,442**	-,035**	-,043	,063	,008	-,050	-,039	,007
Physical Resource Acquisition	,029	-,059	,121	-,015	-,442**	1	-,413**	,078	,040	-,068	-,029	,095	-,147
Physical Resource Management	-,140	,051	-,193*	-,071	-,035**	-,413**	1	-,022	,090	,053	,072	-,043	,059
Cost Estimation for Resources	,077	,017	-,021	-,069	-,043	,078	-,022	1	,217*	-,103*	-,404**	-,208**	-,453**
Scheduling Resources for Project Tasks	-,142	,038	-,094	,091	,063	,040	-,090	,217*	1	,208*	-,334**	-,529**	-,488**
Allocating Resources to Project Tasks	-,168	-,074	-,028	,002	,008	-,068	,053	-,103*	,208*	1	,043	-,208**	-,189**
Resource Placement	,067	,169	,005	,108	-,050	-,029	,072	-,404**	-,334**	,043	1	-,043	,078
Inventory Management	,130	-,013	,055	,016	-,039	,095	-,043	-,208**	-,529**	-,208**	-,043	1	,236**
Monitoring Resource Availability	,047	-,105	,084	-,038	,007	-,147	,059	-,453**	-,488**	-,189**	,078	,236**	1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

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Lastly, the correlation analysis between Sample Variables and the AI-related responses from the participants reveals a modest negative correlation between Company Size and Users Who Have Prior Experience with AI (r = -0.196). This implies that individuals in larger companies are more inclined to utilize AI in their everyday activities. There is a very weak positive correlation between "Role in the Project" vs. "Users Who Would Find It Beneficial If an AI Agent Was Supporting PRM Tasks" (r = 0.177), which may indicate a greater desire to use AI among users with "lower" roles in the Project, such as Junior Project Managers. Regarding the connections observed among responses concerning the utility of AI, several relationships emerged. A slight positive correlation of 0.210 was found between "Individuals Utilizing AI" and "Individuals with Prior AI Experience in Project Management," suggesting that those who use AI are more inclined to utilize it in project management. The correlation between "AI Users" and "Individuals with Previous AI Experience in Project Resource Management" is positive but very weak at 0.197, implying that respondents with prior AI experience may also consider AI for resource management. Lastly, there exists a moderate positive correlation of 0.569 between "Individuals with Previous AI Experience in Project Management" and "Individuals with Previous AI Experience in Project Resource Management," indicating that those who have used AI in project management are more likely to have used it in project resource management as well.

Table 11. *AI Correlation Results (Source: Author's elaboration, 2022)*

Correlation Matrix for Artificial Intelligence

	Age	Role in Projects	Years of Experience in Projects	Size of the Company	Users that have used AI	Users that have used AI in PM	Users that have used AI in PRM	Users that would find useful having AI agents supporting PRM Tasks
Age	1	,361**	,803**	,156	-,065	,066	,003	-,035
Role in Projects	,361**	1	,348**	-,132	-,054	-,048	,034	,177*
Years of Experience on Projects	,803**	,348**	1	,160	-,110	,043	,031	,050
Size of the Company	,156	-,132	,160	1	-,196*	-,098	,061	,000
Users that have used AI	-,065	-,054	-,110	-,196*	1	,210*	,197*	-,006
Users that have used AI in PM	,066	-,048	,043	-,098	,210*	1	,569**	-,022
Users that have used AI in PRM	,003	,034	,031	,061	,197*	,569**	1	,051
Users that would find useful having AI agents supporting PRM Tasks	-,035	,177*	,050	,000	-,006	-,022	,051	1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

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RESULT AND DISCUSSION

Q1: The main difficulties experienced by PTM during PRM

The results indicate that HRM (Mean Rank = 1.82) and HR Acquisition (Mean Rank = 1.83) are closely tied in scores, suggesting similar difficulties in performing these tasks, while HR Planning (Mean Rank = 2.35) appears to be an easier task for PTM. The correlation coefficients reveal a modest negative correlation between Age and HRM (r = -0.250) as well as Experience Years and HRM (r = -0.258). This suggests that as PTM individuals grow older and accumulate more experience, they tend to perceive these tasks as becoming more intricate, which in turn, makes them more inclined to seek support in handling the tasks associated with this Process. Another factor contributing to this observation could be the rising complexity of projects as their careers advance. For PRM, the results show clear difficulties in performing Resource Acquisition tasks (Mean Rank = 1.76), while PRM (Mean Rank = 2.06) and PR Planning (Mean Rank = 2.17) seem to be less challenging for PTM. In the case of these variables, the correlation analysis reveals a connection only between "Experience Years" and "PRM" (r = -0.193). This relationship is quite feeble and implies that as PTM individuals accumulate more experience and engage in more demanding projects, they may become more conscious of the increased complexity within the components of Resource Management. However, it's important to note that this correlation value doesn't provide sufficient evidence to draw definitive conclusions. Therefore, the most challenging Process in PRM is HRM and Resource Acquisition.

Q2: PTM uses AI tools for PRM

Based on the survey data, it's noteworthy that a significant majority of respondents, specifically 87.4%, do not utilize AI in PM, and 88.2% do not employ AI in Resource Management, even though 63% of them have experienced AI in other aspects of their lives. Nevertheless, there is a minority, 8.7% in the case of PM and 7.9% in Resource Management, who have integrated AI into their professional workflows. This indicates that certain professionals or companies have already embraced this technology in their operations. In the correlation analysis, we identified a very weak negative correlation between "Company Size" and "Users Who Have Utilized AI" (r = -0.196), signifying that larger companies are more inclined to have individuals who have previously engaged with and employed AI, even if it is unrelated to PM. Three other correlations that were detected are between "Users Who Have Used AI" and "Users Who Have Used AI in PM " (r = 0.210), "Users Who Have Used AI" and "Users Who Have Used AI in Resource Management" (r = 0.197), and "Users Who Have Used AI in PM " and "Users Who Have Used AI in Resource Management" (r = 0.569). The

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first expectation is logical because if respondents have experience using AI in PM or Resource Management, it's reasonable to assume they would acknowledge having prior AI experience. However, the moderate positive correlation suggests that a significant portion of users who have employed AI in PM also apply it to manage HR and/or Resource Management in their projects. Just as the AI tools examined in the Literature Review have demonstrated the capability to handle diverse tasks like Resource Management (as shown by Lu et al., 2018) or PTM recruitment (as discussed by van Esch & Black, 2019), these available technologies are gradually being integrated into PM practices. With concerted efforts from companies and governments, as indicated by Steels & De Mantaras (2018), the widespread progress in AI could empower Project Managers to enhance their efficiency and undertake more tasks or projects. To sum up, these technologies are still emerging and have only just begun to find their way into PM practices.

Q3: PTM feels that AI can provide support in performing various tasks

The results indicate that the top 3 ranked technologies (Project Task Monitoring (Mean Rank = 2.87), Project Task Scheduling (Mean Rank = 2.94), and Project Task Assignment (Mean Rank = 3.48)) align with the tasks of the HRM process, which is considered the most challenging process in the HRM process rankings. There is a positive correlation between these technologies (Project Task Monitoring with Project Task Assignment, r = 0.277, and Project Task Assignment with Project Task Scheduling, r = 0.458), indicating that these technologies complement each other. These are PRM responsibilities that demand increased assistance from AI agents, and they are linked to HRM responsibilities, signifying that the Project Manager community needs support in this domain. In SPSS, we have marked the correlation between these technologies and the Sample Variables. Specifically, there exists a correlation between Company Size and Project Task Assignment (r = -0.206), suggesting that as companies expand their workforce, they may require technology capable of more efficiently distributing their employees across projects. Additionally, there is a correlation between Company Size and Team Member Recognition (r = 0.224), which may imply that as companies increase their staff size, there's a greater emphasis on recognizing team members' contributions, they will need fewer tools to recognize their employees, although it is difficult to hypothesize any specific correlation for this.

In the case of PR, the arrangement of existing AI technologies for aiding responsibilities linked to resource handling shows that the AI cost estimation agent (Mean Rank = 3.02) was chosen as the most beneficial technology to integrate into PRM for

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Projects, After AI Resource Availability Monitoring (with a mean rank of 3.31), which is part of the PR Acquisition Process, AI Project Scheduling (with a mean rank of 3.15), also within the same PR Process category, emerged as the most demanding aspect. This highlights a significant requirement for the integration of these technologies into the project development process. The remaining tasks were ranked without any discernible correlation established between the specific processes and AI PR technologies. Therefore, the rankings of these technologies are primarily based on respondents' perceptions of the level of difficulty in particular tasks and are not associated with various tasks within the same process. Once again, some weak positive relationships between variables related to technology rankings were observed. For instance, there were correlations of 0.217 between Cost Estimation for Resources and Project Task Scheduling, 0.208 between Project Task Scheduling and Assigning Resources to Project Tasks, and 0.236 between Inventory Management and Resource Availability Monitoring. These correlations correspond to technologies performing functions within the same process, suggesting that if respondents find a particular process complex, they tend to rate the technologies within that process accordingly, they may assess these technologies similarly, either more favourably or unfavourably, but in tandem with each other.

CONCLUSION AND RECOMMENDATIONS

Conclusion

This study aims to pinpoint the primary difficulties encountered in projects when it comes to the planning, procurement, and administration of HR and PR. The outcomes suggest that the majority of Project Managers encounter more significant challenges in handling HR and acquiring PR. Additionally, the research results indicate that the age and experience levels of project professionals influence their perception of the challenges in PM. These findings underscore the demand for AI systems capable of performing tasks like Project Task Monitoring, Project Task Scheduling, and Resource Allocation for HR, as well as Cost Estimation for Resources and Resource Availability Monitoring for PR. This indicates a real need for AI technology to be integrated into PM. Furthermore, regarding the understanding of AI usage in projects by Project Managers, the findings show that it has not yet become a common practice for most professionals. However, some individuals have used AI for PM and PRM, indicating that these AI agents are beginning to become part of the job structure in projects. Finally, in terms of the usefulness of AI technology for daily tasks, the results indicate that most individuals feel that AI would indeed be useful for their professions.

Generalizing these results to the population of Project Managers this technology can offer substantial assistance within the PMKA, given the existence of AI solutions designed to aid in these precise tasks. Moreover, the extensive embrace of this technology among the majority of industry professionals suggests minimal resistance to AI adoption, with users demonstrating readiness to acquire the necessary skills and harness their full potential.

Future Research Recommendations

As anticipated, addressing the implications of a study on systems capable of autonomous learning necessitates more than a single research endeavour. Firstly, the study should be conducted to investigate how users' experiences with AI tools impact their willingness to embrace this technology and how their perception of AI's utility influences their adoption. This is particularly significant given that 29.9% of respondents have never used AI, 87.4% have no prior experience with AI in PM, and 88.2% have not used AI in PRM. However, there remains a substantial 70.9% of respondents who express a desire for this technology to support their daily tasks in PRM, suggesting that some users may have no prior AI exposure or are unsure if they have, yet still exhibit a willingness to utilize these agents. An investigation into the social implications of incorporating AI agents into projects is also essential to comprehend how PTM will respond to technology directing them in fulfilling project requirements and to gauge its impact on their performance, commitment, and psychological well-being.

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