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PROGRAM

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Universidade do Minho
Escola de Engenharia
Departamento de Produção e Sistemas

CENTROALGORITMI

10h45-11h15	**COFFEE BREAK**	
11h15-11h45	**WELCOME SESSION** Room: Noble auditorium	**Drª Adelina Pinto -** Vice President Guimarães City Council **Prof Raul Fangueiro - Vice President** Presidency of Engineering School **Prof Paula Fernandes -** Director ALGORITMI Research Centre **Prof Nelson Costa -** Deputy Director of the Production and Systems Department **Prof Madalena Araújo -** ICOPEV 2024 Chair
11h50-12h30	**KEYNOTE SPEAKER** Room: Noble auditorium	**Benny Tjahjono -** Coventry University, UK
12h30-14h00	**LUNCH BREAK**	
14h00-14h40	**WORKSHOP** Room: Noble auditorium	**Adriana Leiras -** Pontifical Catholic University of Rio de Janeiro, Brazil
	Session D **Project & Risk Management** **Building 2, Noble auditorium** **Chair: Wellington Alves**	**Session E** **Strategic Management & Business Modelling** **Building 2, Room 0.33** **Chair: Ana Cristina Ferreira**
14h45-16h00	**71 – A MACHINE LEARNING FOUR-LAYERED APPROACH TO PROJECT RISK PREDICTION.** Pedro Ferreira, Wellington Alves **117 – ASSESSMENT OF SMALL DEVELOPMENT PROJECTS: AN INNOVATIVE APPROACH FOR EVALUATING AND STRUCTURING SMALL-SCALE PROJECTS IN VITICULTURE.** Thomaz Fagá, Jorge Cunha **140 – ENHANCING PROJECT PORTFOLIO SELECTION BY CONSIDERING ROBUSTNESS MEASURES: A LITERATURE REVIEW.** Camilo Gómez, Juan Holguín, Camilo Micán **208 – FACTORS INFLUENCING EFFECTIVE MANAGEMENT OF STAKEHOLDERS IN IT 4IR PROJECTS IN SOUTH AFRICA.** Stanley Fore, Irshaad Desai **218 – ADDRESSING THE CHALLENGES OF INTEGRATING ARTIFICIAL INTELLIGENCE IN PROJECT MANAGEMENT.** Pedro Almeida, Filipa Freitas, Gabriela Fernandes, José M. R. C. A. Santos, Samuel Moniz	**87 – THE CONCEPT OF STRATEGY: A BIRD'S-EYE VIEW.** Fernando Barbosa, Fernando Romero **216 – IMPLEMENTATION OF AGILE PROJECT MANAGEMENT APPROACHES IN THE REGIONAL INDUSTRY OF VALE DO AVE: EXPLORING PRACTICES, CHALLENGES AND BENEFITS.** Vitor Granjo, Bruna Ramos, Nelson Rodrigues, Ana Cristina Ferreira **273 – PROCUREMENT MANAGEMENT: HOW PORTUGUESE SMES HANDLE THE RELATIONSHIP WITH THEIR SUPPLIERS.** Ana Cristina Ferreira, Senhorinha Teixeira, Ângela Silva **280 – AN OVERVIEW OF THE CRITICAL SUCCESS FACTORS IN THE SHIPBUILDING SECTOR.** Josério da Silva, Jorge Cunha, Paula Ferreira **138 – ANALYSING THE IMPACT OF HOTEL INVESTMENTS ON CUSTOMER SATISFACTION.** Nuno Moutinho, Elaine Scalabrini

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Addressing the Challenges of Integrating Artificial Intelligence in Project Management

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KEYWORDS

Project Management, Artificial Intelligence, Digital Competencies

ABSTRACT

In recent years, Artificial Intelligence (AI) has been transforming various fields, including Project Management (PM). While AI offers significant benefits to PM, its implementation also presents several challenges. This paper explores some of the main barriers faced by organizations when integrating AI into PM practice.
Through a review of current literature, this study identifies major challenges, such as the creation of unemployment, the need for upskilled project managers, erosion capabilities of project managers, ethical issues, high initial investment, security and data privacy concerns, and data availability. By analyzing these challenges, this paper provides insights into strategic approaches for overcoming them, emphasizing the importance of change management strategies, investment in training, development of clear ethical regulations, and the highlighting the need for project managers to develop a versatile skills set that balances technical proficiency with human-centric skills like empathy, adaptability, collaborative mindset, and emotional intelligence. These findings help to equip PM professionals with the necessary knowledge to navigate through the complexities of AI implementation effectively, while also guides scholars for future research on this emergent field.

INTRODUCTION

The Digital World (DW) can be defined as a comprehensive environment where digital technologies such as Artificial Intelligence (AI), Internet of Things (IoT), and Big Data play a critical role. The DW marks a shift from traditional industrial infrastructures to networks that seamlessly combine digital and physical resources (Ratten, 2024). It is characterized by enhanced connectivity that exceeds geographical and cultural barriers, enabling global real-time communication. This connectivity is facilitated by digital platforms that integrate various technologies, making interactions faster and more efficient (Mithas et al., 2022). Balancing the new technological advancements with human-centered practices is crucial for project managers to transition from automation-focused Industry 4.0 to the more sustainable, human-centered Industry 5.0 (Knap-Stefaniuk, 2023; Leon, 2023). AI technologies are essential to tackle complex challenges across various domains with increasing autonomy and efficiency (Maphosa and Maphosa, 2022). AI is experiencing rapid growth, and it is being used across several industries (Ong and Uddin, 2020), transforming the way tasks are executed, and problems are solved (Miller, 2022; Nagireddy, 2023). Tasks considered too complex are now handled with more simplicity and efficiency, thanks to the ongoing progress in technology (Gomes and Bento, 2022). These developments compel organizations to continuously adapt and explore the potential of available new tools and approaches (Sarafanov et al., 2024). However, alongside the benefits, such as enhanced

communication, improved decision making, and better resource allocation, come challenges emerge in implementing these new tools and approaches (Hassani and El Bouzekri El Idrissi, 2019; Taboada et al., 2023; Wachnik, 2022).

In the new DW, rapid technological evolution has been redefining the Project Management (PM) field, with AI being the paradigm shift of this new era. PM plays a crucial role in achieving organizational objectives in a competitive business environment which is always shifting (Fernandes et al., 2019). Despite the importance of PM, some organizations still rely on outdated tools and methodologies that struggle to keep pace with the complexity and dynamism of the new DW. This underscores the need for innovative and technologically advanced approaches in managing projects, to adapt and evolve from traditional PM (Hassani and El Bouzekri El Idrissi, 2019; Nenni et al., 2024). Despite the potential of AI, the integration of AI in PM is still limited. There is some reluctance among project managers to adopt AI in PM due to the uncertainty about its integration into existing processes and its effective benefits (Choquehuanca-Sánchez et al., 2024). Additionally, the need for upskilling in digital competencies remains a barrier to expanding its adoption (Knap-Stefaniuk, 2023; Poláková et al., 2023).

This paper aims to answer two main research questions: What are the main challenges of integrating AI tools in PM? And what strategies should organizations and project managers implement to address these challenges? By reviewing the existing literature, the study seeks to enlighten practitioners and scholars about the main challenges of the integration of AI in PM and how to overcome them.

METHOD

The methodology applied for the selection of scientific articles involved a broad approach to identify relevant contributions within the field of PM in the new DW. The research was conducted with studies from the Scopus and Web of Science databases, using specific search terms such as “project management” AND “digital world” OR "artificial intelligence" AND "project management" and from other sources by snowballing. Following the retrieval of results, an initial eligibility check was carried out, reviewing the article titles and abstracts and applying inclusion criteria based on relevance to the study’s research questions. Next, the selected articles were analysed using content analysis to answer the two research questions (Fletcher, 2017). This selection and review process ensured that the study was grounded in pertinent and current research (Ankrah and Al-Tabbaa, 2015), providing a robust basis for exploring the integration of AI in PM.

RESULTS

Although the large advancements of AI in PM several challenges persist (Savio and Ali, 2023; Uchihira et al., 2020). This demands project managers to address various challenges while leveraging the numerous benefits of this integration. Challenges are expected to emerge at different stages of the project when integrating AI into PM (Alshaikhi and Khayyat, 2021; Sarafanov et al., 2024), and can potentially include unemployment and ethical issues, like bias and discrimination, high initial investments, security and data privacy concerns, data availability, and the need for upskill project managers to prevent the erosion of their capabilities (Brandas et al., 2023; Kolade and Owoseni, 2022; Sarafanov et al., 2024).

As AI becomes increasingly capable of performing repetitive tasks, jobs that depend on manual labor or basic cognitive competencies face a growing risk of automation or replacement by AI-enabled technologies (Jauhar et al., 2023; Kolade and Owoseni, 2022; Uchihira et al., 2020). This may lead to diminishing opportunities for low-skilled workers, potentially leading to higher unemployment rates among those with limited education or training (Kolade and Owoseni, 2022; Vărzaru, 2022). This shift may not be due to AI directly replacing human workers, but rather because workers who can utilize AI tools, such as those skilled in "prompt engineering", may become more valuable (Barcaui and Monat, 2023; Fridgeirsson et al., 2021; Müller et al., 2024). AI (utilized at a large scale) being a relatively new and urgent topic means there is a shortage of specialized expertise, and intense competition among organizations quickly hires available AI specialists, exacerbating the specialists’ shortage (Sarafanov et al., 2024). This could increase socioeconomic disparities and worsen existing inequalities (Kolade and Owoseni, 2022; Ong and Uddin, 2020).

AI may also free up time, allowing employees to focus on more complex and successful project outcomes (Dacre and Kockum, 2022; Taboada et al., 2023).This displacement of low-skilled workers by AI underscores the urgent need for

retraining and upskilling initiatives (Choquehuanca-Sánchez et al., 2024). As traditional job roles evolve, acquiring new competencies relevant to the digital economy becomes increasingly essential (Ong and Uddin, 2020; Taboada et al., 2023). Without proper training, understanding how AI technologies can benefit organizations may be challenging (Fridgeirsson et al., 2021). Clique ou toque aqui para introduzir texto.Clearly defining AI's problem-solving capabilities and managing data effectively are also crucial (Nagireddy, 2023). By creating an inclusive learning environment, it is possible to help alleviate fears and uncertainties about AI (Dacre and Kockum, 2022).

As AI becomes more integrated into PM, there is a risk that dependency on AI could diminish project managers' critical thinking and analytical competencies, impacting their ability to perform tasks independently (Bushuyev et al., 2024; Geraldi et al., 2024).

From an ethical point of view, it is crucial for organizations to ensure AI systems do not perpetuate biases or discriminatory practices that could lead to unfair decision-making (Miller, 2022). AI can introduce biases such as strategic distortion, political or power bias, and optimism bias, leading to unrealistic expectations and underestimated risks (Alevizos et al., 2023; Sarafanov et al., 2024).

The high costs associated with implementing AI in PM, including the initial investment and training, may be a barrier for many organizations (Brandas et al., 2023; Hashfi and Raharjo, 2023; Todorović, 2022; Wachnik, 2022). Evaluating the return on investment and long-term cost efficiencies of AI solutions is necessary (Alshaikhi and Khayyat, 2021; Wachnik, 2022). Despite these costs, AI has already delivered significant savings for organizations and investors (Hashfi and Raharjo, 2023; Todorović, 2022).

AI also faces challenges in security and data privacy, such as distinguishing between public and restricted data, which could lead to privacy violations and legal issues (Auth et al., 2021; Brandas et al., 2023; Merhi and Harfouche, 2023; Taboada et al., 2023). Ensuring robust safeguards and ethical guidelines in AI development is essential to address these concerns (Bahi et al., 2024; Miller, 2022).

AI works best in structured environments, but PM often involves unstructured or unavailable data, which can hinder AI's effectiveness (Auth et al., 2021). Ensuring high-quality, diverse data is crucial for AI's success, but challenges such as data inconsistency and unavailability are common (Alshaikhi and Khayyat, 2021; Brandas et al., 2023; Hashfi and Raharjo, 2023).Table 1 summarizes the identified key challenges of integrating AI into PM.

Table 1: Challenges of Integrating AI into PM.

Challenges	References
Creation of unemployment	Fridgeirsson et al. (2021); Jauhar et al. (2023); Ong and Uddin (2020); Uchihira et al. (2020); Vărzaru (2022)
Need for higher-skilled project managers	(Alshaikhi and Khayyat, 2021; Brandas et al., 2023; Choquehuanca-Sánchez et al., 2024; Fridgeirsson et al., 2021; Kolade and Owoseni, 2022; Müller et al., 2024; Ong and Uddin, 2020; Sarafanov et al., 2024; Taboada et al., 2023)
Erosion capabilities of project managers	(Bushuyev et al., 2024; Geraldi et al., 2024)
Ethical issues – Bias and discrimination	(Alevizos et al., 2023; Miller, 2022; Sarafanov et al., 2024)
High initial investment	(Brandas et al., 2023; Hashfi and Raharjo, 2023; Todorović, 2022; Wachnik, 2022)
Security and data privacy	(Brandas et al., 2023; Taboada et al., 2023; Todorović, 2022)
Data availability	(Alshaikhi and Khayyat, 2021; Brandas et al., 2023; Taboada et al., 2023; Todorović, 2022)

Answering the second research question, to deal with these challenges, project managers must possess a versatile skill set, including technical proficiency, and the capacity to navigate digital advancements (Alvarenga et al., 2020; Taboada et al., 2023). Adaptability, continuous learning, and a proactive approach to leveraging digital technologies are essential for project managers to excel in this new dynamic environment (Jena and Satpathy, 2017). In the DW, project managers must respond rapidly and effectively to unforeseen challenges.

Industry 5.0 emphasizes human-centric approaches, blending advanced technologies with human creativity and intuition, making empathy, adaptability, collaborative mindset, and emotional intelligence as crucial as technical competencies (Afzal et al., 2018; Soto et al., 2021). In this context, project managers are tasked with not only managing projects but also leading and inspiring teams, fostering innovation, and maintaining continuous learning and

adaptability. Effective communication is essential for success, facilitating clear interactions among diverse teams and enhancing coordination (Colbert et al., 2016; Đajić et al., 2024). Adaptability, innovation, emotional intelligence, and resilience are vital competencies for managing the complexities of digital projects and ensuring alignment with evolving objectives of organizations (Afzal et al., 2018; Knap-Stefaniuk, 2023; Sousa and Rocha, 2019). These competencies provide a competitive advantage, enhance team dynamics, and improve project outcomes in an environment of technological disruption and constant change (Alvarenga et al., 2020).

DISCUSSION

As organizations are more aware of the benefits of AI in the PM field, they have been implementing those technologies in their management processes (Müller et al., 2024). Due to this integration, they encounter numerous challenges that require a balanced approach to take advantage of AI's benefits while mitigating its challenges.

As mentioned, one significant challenge is the possible displacement of low-skilled workers due to AI's capacity to automate routine tasks, potentially causing unemployment and social disparities (Fridgeirsson et al., 2021; Jauhar et al., 2023; Uchihira et al., 2020). This issue emphasizes the need for upskilling and retraining of the employees (Choquehuanca-Sánchez et al., 2024; Kolade and Owoseni, 2022). By investing in training programs, organizations can transition these employees to roles that require more advanced cognitive skills, maintaining employment levels and enhancing overall productivity (Ong and Uddin, 2020; Taboada et al., 2023). Collaborations with educational institutions can also aid in filling the competencies gap, ensuring that organizations are well-equipped to navigate the new DW (Fridgeirsson et al., 2021; Kolade and Owoseni, 2022).

However, integrating AI into PM is not just about enhancing technical competence, it also demands a shift in project managers' behavioural competencies (Afzal et al., 2018). Project managers must cultivate adaptability, enabling their employees to respond effectively to the rapid changes in PM. This adaptability may be crucial not only for handling technical changes but also for navigating the ethical complexities that AI introduces (Soto et al., 2021). AI systems can involuntarily perpetuate biases by relying in past biased data, leading to unfair or poor decision-making (Alevizos et al., 2023). To tackle this challenge, project managers should supervise every decision-making process and establish clear ethical guidelines for AI use, ensuring that the used technologies are developed and utilized responsibly (Miller, 2022).

As AI technologies take over routine tasks, there is a risk that project managers reduce their critical thinking and analytical capabilities could erode (Bushuyev et al., 2024; Geraldi et al., 2024). To address this, organizations should implement a balanced approach to automation, where AI complements decision-making rather than replacing the human input, even because AI cannot replace human intuition and empathy (Colbert et al., 2016; Kolade and Owoseni, 2022). This balance allows project managers to focus on strategic planning and creative problem-solving, preserving their core competencies (Savio and Ali, 2023).

The financial investments of AI integration cannot be ignored, being a significant barrier for many organizations, due to high initial investments and the training expenses (Todorović, 2022). A phased implementation strategy can help organizations to manage these investments by starting with small-scale projects that demonstrate AI's value and implementing one tool at a time (Alshaikhi and Khayyat, 2021). Detailed cost-benefit analyses would aid organizations to make informed decisions about these investments, ensuring a positive return on investment over time (Wachnik, 2022).

Data security and privacy are additional concerns in the integration of AI into PM. With the increasing reliance on AI, sensitive information can be exposed. Organizations must utilize technologies which incorporate encryption and access controls to protect data from disclosure (Auth et al., 2021). Transparency in data handling with data protection regulations build stakeholder trust and mitigate privacy concerns (Kolade and Owoseni, 2022; Merhi and Harfouche, 2023).

To tackle some of these challenges in this new complex landscape, project managers are expected to develop new behavioural competencies that complement their technical expertise. Emotional intelligence is becoming increasingly vital as project managers lead diverse teams among diverse locations and manage stakeholder relationships (Afzal et al., 2018). Effective communication skills ensure that all the stakeholders remain aligned and engaged, while resilience enables project managers to navigate the challenges of a rapid evolving DW (Sousa and Rocha, 2019).

Furthermore, the shift from traditional PM to PM practice with AI integration, highlights the importance of integrating human-centric approaches among the new technological advancements (Knap-Stefaniuk, 2023). So, in this context,

empathy and a collaborative mindset may be as crucial as technical skills, allowing project managers to thrive innovation and foster a culture of continuous learning on their organizations (Leon, 2023).

CONCLUSIONS

The integration of AI into PM presents great benefits but also major challenges, necessitating a nuanced approach that balances technological advancements with human-centered practices (Kolade and Owoseni, 2022). This study highlights the importance of addressing these challenges such as unemployment risks, ethical concerns, and the potential erosion of project managers' capabilities, while emphasizing the need for new behavioral competencies in project managers to navigate the new DW effectively. Organizations must invest in training to ensure that their employees are well equipped to leverage AI effectively (Choquehuanca-Sánchez et al., 2024). This involves developing not only technical skills but also cognitive and emotional competencies (Knap-Stefaniuk, 2023).

Besides the valuable insights on the challenges of the integration of AI in PM and how to overcome them, this study presents some limitations. The rapidly evolving nature of AI causes that some findings may become outdated as new developments occur. Also, the study is limited to existent literature, and further empirical research is needed to explore and validate these findings, namely across different organizational contexts. Future research should focus on several areas to improve the understanding of AI integration in PM. This includes conducting empirical studies across practitioners to validate theoretical findings and examine the long-term impacts of AI in PM practice. For example, the impact on employment, which represents one of the main concerns of the employees when integrating AI into their organizations (Kolade and Owoseni, 2022). Finally, investigating the design of AI technologies to enhance decision-making support systems, while ensuring optimal collaboration between AI and human project managers, is crucial (Hashfi and Raharjo, 2023; Savio and Ali, 2023).

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