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The role of artificial intelligence in project management: a supply chain perspective

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ABSTRACT

Artificial intelligence continuously overtakes an increased number of functions within numerous business fields. Consistently, its appliance in supply chain-related project management is also constantly rising. The purpose of this paper is to explore the role of artificial intelligent (AI) technologies in project management (PM) undertaken in supply chain (SC) contexts. Moreover, a focus is set on explaining the relationship between supply chain project management and AI, with emphasis on the appliance of AI in PM and the level of activities and operations that could be performed by the algorithms, AI-related integration challenges and risks and future anticipation of AI.

KEYWORDS

Artificial intelligence; cognitive technology; supply chain management; project management

Introduction and problem definition

Advancements in computer science and computational power have allowed for the application of artificial intelligence (AI) algorithms in various business sectors and complex scenarios across projects and pertinent supply chains. Apart from the regular process automation or data analysis tasks, artificial systems have started to globally undertake other more complex activities and operations. One area where the impact of artificial intelligence has received limited interest is in supply chain project management contexts, where different business and management processes need to be properly planned, monitored and executed in complex scenarios while delivering multifaceted objectives and outcomes (Nilsson and Santos 2022; Stein et al. 2024). The enduring relationship between Supply Chain Management and Project Management is well established in practice and in theory over numerous studies and white papers (Gaudenzi and Christopher 2016; Hartel 2019; Wei, Prybutok and Sauser 2021). All projects have suppliers and supply chains to consider, while most changes and improvements initiated within supply chains are implemented by utilising formal project management methodologies (Polychronakis 2007; Salmiah et al. 2020). Ultimately, all projects possess or are influenced by supply chain dynamics, characteristics and constraints and, therefore, prone to generating complex systems and subsystems that managers need to operate within (Helo and Hao 2022). Because of that for years, organisations are facing difficulties in completing projects on time, at cost, or on schedule while delivering added value to stakeholders and broader society (Stein and Polychronakis 2023). The focus of this paper is on the application of AI in project management within global supply chain contexts.

The role of the project management is continuously increasing, where, by 2027, it is expected that the cost contribution of the project-oriented economy would reach the US 20.2 trillion USD, and employers would need about 87,7 million people worldwide working in project-oriented roles (PMI 2017). Research has revealed that about a decade ago, the average project cost overrun has been about 27%, and almost every sixth project has been a black swan, with a cost overrun of about 200% on average and a schedule overrun of almost 70% (Flyvbjerg and Budzier 2011). In recent times, the success trend has not significantly improved. Worldwide about 35% of the projects have failed or lost their budget, 34% have experienced scope creep, and about 12% have been deemed a failure (PMI 2021b, Figure 1).

The monetary losses due to poor project management practices are estimated to reach about 10% of the companies' investment (PMI 2018). Moreover, depending on the project size, scope and timeline, delays or failures could be not only related to the loss of a huge amount of money but also could harm customer satisfaction, miss business opportunities or even influence the business's existence.

In this context, it is essential to investigate in detail the reasons for the failures and approach them proactively. Steward (2021) has summarised multiple reasons that could lead to a project failure, like supply chain-related constraints and complexities such

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as resource availability, team communication, stakeholders' engagement, unreliable estimates, low project risk management, insufficient monitoring and control and organisation culture. More fundamentally, Lauesen (2020) has identified about 37 different causes for project failures and 22 potential cures for avoiding project disasters, where each project suffers from around 15 of the causes. Furthermore, Wei, Prybutok and Sauser (2021) have emphasised the benefit of recognising the impact of supply chain management (SCM) integration within project management and the need for increasing the emphasis on SCM among project teams (also in Polychronakis and Syntetos 2007). In this direction, as an outcome, it could be concluded that due to the great number of pitfalls, it is almost impossible to consider every single reason for failure.

In this regard, special attention must also be given to the technologies, which could support and increase the number of successful projects. One of the major technologies that has intricately impacting science and industry for decades and continuously evolved as autonomous systems with knowledgeable decision capability, is AI (Heimans and Timms 2024). Organisations have begun to apply AI to project management and supply chains, where it is expected that by 2030, the sectors will experience significant transformations (Nieto-Rodriguez and Vargas 2023). Therefore, the primary purpose of this paper is to evaluate and explore AI's impact on projects currently and in the future. In more detail, this research stipulates the following questions: What is the level of practical AI adoption by project managers in different industries? What are the AI systems' limitations and risks? What are the main AI-related integration challenges and concerns? What would be the potential developments of AI in project management environments of the future?

Literature review

Artificial intelligence

The term artificial intelligence was first introduced in 1955 and was referring to the science of making intelligent machines (McCarthy et al. 1955). Boucher (2020) has extended the definition and has outlined that 'AI refers to systems that display intelligent behaviour by analysing their environment and taking action – with some degree of autonomy – to achieve a specific goal'. Moreover, van Duin and Bakhshi (2017) have summarised that the concept of intelligence refers to an ability to plan, reason, learn, sense and build a perception of knowledge. Generally, artificial intelligence could refer to both computers' or machines' human intelligence and the modelling of massive amounts of data (Etzioni 2022).

Over the years, AI deployment was going through different stages, highly depending on the development focus and new technologies applied and that timing. With further technological expansion and an increase in computation power, an AI revival was observed since the early 1990s. In this context, the various AI technologies on the market are following a common conceptual framework, where dedicated data is gathered and processed, and an action is performed, (Gerbert et al. 2017, Figure 2).

One of the major requirements and a vital precondition for the successful integration of AI technology is the availability of reliable data (Loten 2019). Considering the continuous increase in data volume produced in the world, where from 33 zettabytes (1

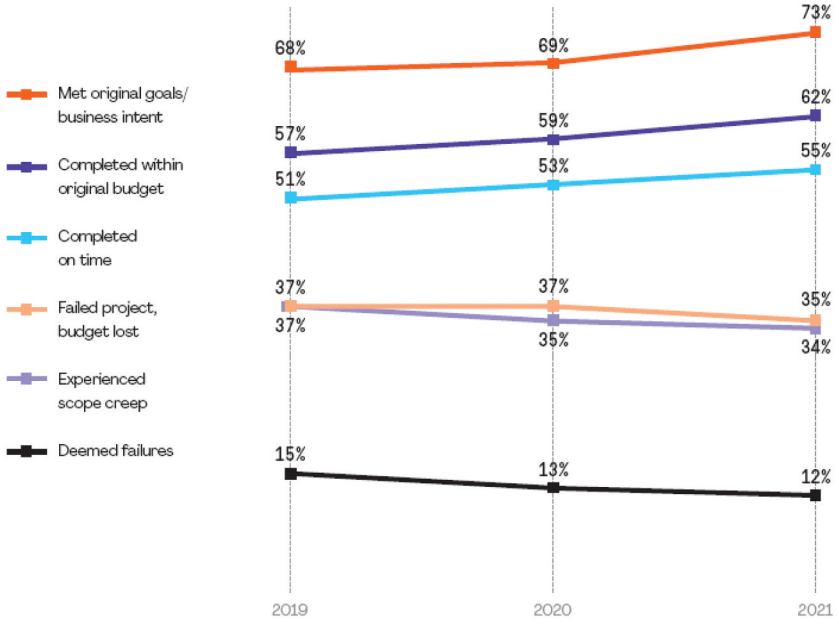

Figure 1. Project outcomes (PMI 2021b).

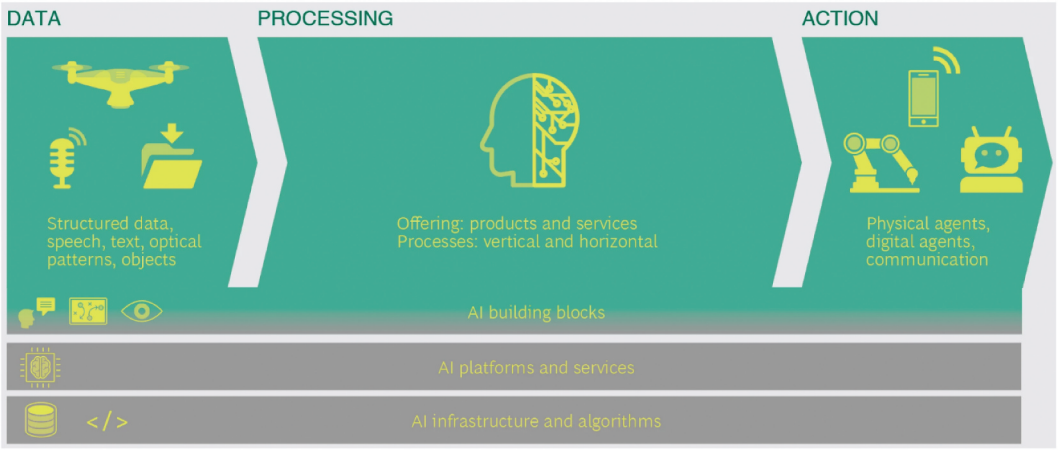

Figure 2. A practitioner's framework for AI (Gerbert et al. 2017).

zettabyte = 10^{12} gigabytes) data in 2018 it is expected to reach 175 zettabytes in 2025 (European Parliament 2022), it is vital to emphasise the importance of proper data gathering, data analysis and pre-processing.

To advance from the data content, it is essential to consider the data lifecycle and steadily work to address and optimise the four major pillars of successful data management (Joyce et al. 2020). Data governance aims to establish and define the methods, responsibilities, standardisation processes, collection, integration, protection, archiving and data storage (Olavsrud 2021). As a follow-up step, it is required to focus on the data discovery process, where data preparation, visual analysis, guided advanced analytics to discover patterns, clusters, trends and outliers are performed (Baier et al. 2021). Consequently, data protection will cover privacy protection and awareness, data security, data credibility, authenticity and reliability (Zhang 2018). At the latest stage of the data lifecycle, it should be emphasised on data minimisation, where 'Personal data shall be: [. . .] adequate, relevant and limited to what is necessary in relation to the purposes for which they are processed (data minimisation)' (GDPR Regulation 2016).

Once the data content is mature enough to be used, it is fundamental to apply appropriate cognitive technology for data processing. In this regard, some of the major AI technologies are Machine learning, Deep learning, Natural language processing, Biometrics, Computer vision and Robotics process automation. Please also see Table 1 for full details regarding that.

As an output of the data processing, it is expected to obtain a reasonable action, context-driven analysis, predictive suggestion or a solution to a company-customised project management issue, problem or task. In this way, AI technologies could play a vital role in improving project management performance while considering supply chain-related complexities.

Taking into consideration the existing AI technologies and different management processes, knowledge areas and methodologies, it is essential to investigate the level of AI adoption in the PM area, as technologies have advanced to a level of functionality that provides new business opportunities with considerable potential for value creation (Fuhrman and Mooney 2021; Nozari, Szmelter-Jarosz and Ghahremani-Nahr 2022). Moreover, a focus would be set on the evaluation of the current AI functionalities and technologies that are applied in the PM domain.

Level of AI adoption in projects

Bearing in mind project management, AI technologies are not seen as an intuitive solution for improvement, mainly because quite often the required input data is scattered across the supply chain and so not in a structured form as in some other domains (Hofmann et al. 2020). Moreover, Nieto-Rodriguez and Vargas (2023) have concluded that one of the reasons why the project success rates are so poor is because of the low degree of maturity of technologies used for managing them. This situation is changing, and AI algorithms have already started to find their rudimentary place in supply chains and project management, and their adoption is increasing (Prifti 2022).

Among the most significant advantages of using AI in project management is the high accuracy of data management, which could lead to improved speed and effectiveness of decision-making (El Khatib and Al Falasi 2021). In this direction, Davenport and Ronanki (2018) have outlined that the two most common applications of AI are in the tasks process automation and cognitive insights, where about 38% of the projects have used machine learning intelligent algorithms to detect patterns, analyse data, provide data modelling and even to predict behaviour. The valuable results could be used for improving the project status, as lessons learned for future projects, or project risk analysis. In fact, AI has found a brought usage in the area of supply chain-related risk management and risk

Table 1. Brief description of AI technologies.

AI technologies	Description
Machine learnings	- Process of mastering computers to learn from experience and transform it into expertise or knowledge Shalev-Shwartz and Ben-David (2014) - "Addresses the question of how to build computers that improve automatically through experience" Jordan and Mitchell (2015)
Deep learning	"Subset of machine learning, where artificial neural networks, algorithms inspired by the human brain, learn from large amounts of data" Marr (2018)
Natural language processing	Machines learn to understand natural languages as spoken and written by humans, which allow them to recognize, understand, translate and respond to different languages S. Brown (2021)
Biometrics	Identification of individuals based on biological characteristics or behaviours, like fingerprints, faces, hand veins, irises or voices Berghoff, Neu and von Twickel (2021)
Computer vision	Automatic visual understanding and representation of Information from digital images, video sequences, views from multiple cameras or multidimensional data Borji (2018)
Robotic Process Automation	"Software robots automate processes originally performed by human work" Hofmann, Samp, and Urbach (2020)
Generative AI	- "The term generative AI refers to computational techniques that are capable of generating seemingly new, meaningful content such as text, images, or audio from training data". Feuerriegel et al. (2024) - "Types of machine learning models that are used to create novel data samples that are similar to examples it was trained on". Ali et al. (2024)

avoidance. AI is considered as a 'game changer for risk management', where with the proactive usage of cognitive technologies, companies would manage to detect more complex imitations and so gain competitive advantage and increased performance (Hans 2016). Moreover, there are use cases of AI appliances in threats analysis, real-time prediction models, risk reduction, data classification, facilitation of decision-making processes and risk assessment (USAII 2022).

Special attention must also be given to the appliance of AI as an action-supportive tool and assistant, where among the major roles of AI in project management are to provide assistance and advice, improve decision-making and better performance and reporting across supply chain partners (Bodea et al. 2020). Consistently, Preindl, Nikolopoulos and Litsiou (2020) have highlighted the increased amount of automated simple data-driven decisions, which together with the new opportunities in terms of forecasting have the potential for improved efficiency and productivity in supply chains and projects (also in Anderson and Polychronakis 2023; Babai, Boylan, and Rostami-Tabar 2022; Israilides, Polychronakis and Kelly 2023). In this direction, Lahmann (2018) has outlined several use cases of application of AI in the area of integration, automation, chat robot assistant and even machine learning-based project management, like for example schedule adjustment and planning, analytics and prediction tools.

A significant focus must also be set on the role of AI in the process automation, optimisation, and enhancement of business operations, where AI is examined as a powerful solution for the betterment of work processes and contribution to project success (Holzmann and Lechiara 2022). The leading organisations have already deployed machine-learning-based tools to automate decision processes to improve supply chain engagement, increase employee and customer satisfaction, automate finance, measure brand exposure, detect fraud, predict maintenance and improve supply chain processes (Wellers, Elliott and Noga 2017). Moreover, despite the conclusion that AI and particularly the newly developed generative models, specifically the GPT-4, have enormous potential to augment project planning, the human factors remain undisputable (Barcaui and Monat 2023).

In conclusion, Gil, Martinez Torres and González-Crespo (2021) have outlined that AI technologies and tools are more accurate than traditional tools; however, despite the fact that they have some weaknesses and limitations, they still remain complementary to the traditional approaches. In this context, the focus of the following section is set on the evaluation of AI system limitations and risks.

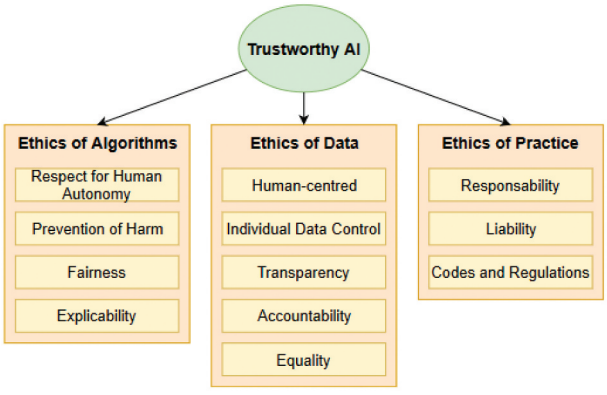

Figure 3. The three main components of a trustworthy AI (Kumar et al. 2020).

Examine AI systems' limitations and risks

To be able to acquire a broader understanding of AI technologies' impact on business, it is essential to assess in detail the overall system challenges and concerns. Among the significant limitations and major AI risks that need to be addressed from the very beginning is related to cybersecurity across organisations and supply chains, as every system is considered to eventually fail from a security perspective (Yampolskiy and Spellchecker 2016). Although some notable changes are observed across regions and there is an overall

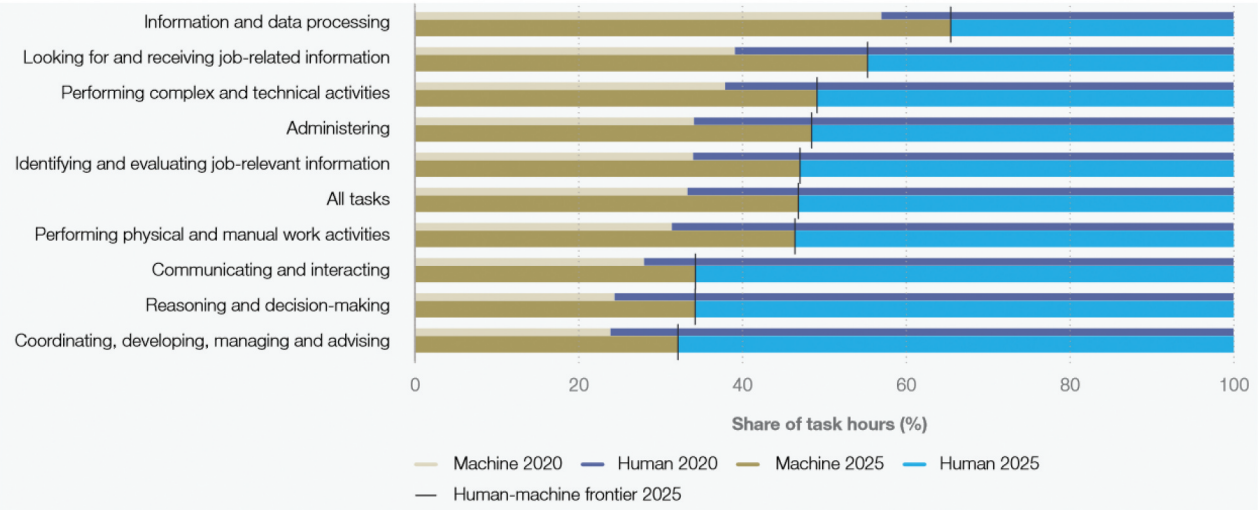

Figure 4. Expected share of tasks performed by human-machine, 2020 vs. 2025 (Weforum 2020).

decline compared to 2020, cybersecurity remains the top AI risk for the developed countries in 2021 with about 57% and for emerging economies in 2021 with approximately 47% (Chui et al. 2021).

Another major challenge is related to AI ethics and trustworthiness across supply chains. These challenges could be represented by three major axes – the ethics of data, the ethics of algorithms and the ethics of practices (Floridi and Taddeo 2016). Figure 3 captures this in more detail.

Regarding the ethics of algorithms, society must persistently insist that decisions taken by cognitive technologies are fair and transparent and respect people's privacy and autonomy (Keams and Roth 2020). Besides the higher focus on personal respect, prevention of harm and fairness, major attention must also be set on algorithm bias. In this context, as the algorithms are developed by humans, they could reflect their biases or prejudices, conscious or unaware, which accordingly could lead to machine learning mistakes or mal-operations (Mann and O'Neil 2016). There is no universal data management guidance that could be applied to every single data content and therefore ethical practices must be accordingly adapted, depending on the context (Vallor 2018). In this regard, Young, Smith and Zheng (2020) have extended Mason's Information Ethics Framework, comprised of Privacy, Accuracy, Property and Accessibility (PAPA) (Mason 1986), and have added three new ethical issues related to big data – Behavioural surveillance, Interpretation and Governance (BIG). Moreover, the U.S.A. federal government has defined a Data Ethics Framework to guide the ethical acquisition, management and use of data, where the main focus is set on upholding professional practices and ethical standards, respecting privacy and confidentiality, supporting honesty and integrity, holding accountability and promoting transparency (FDS 2020).

Another major AI ethical perspective that must be evaluated is the ethical usage in practice and people's daily life. Hagendorff (2022) has concluded that AI ethics sometimes fail to address the technical complexity of AI and are often too abstract to be put into practice. Consistently, Munn (2022) has argued that AI ethical principles are useless and meaningless, failing to mitigate major topics, like racial, social and environmental harm of AI technologies in any meaningful sense, as they are isolated principles situated in a system in which ignores ethics to a great extent.

Furthermore, it is essential to asses AI's possible negative effect on employment, where research has revealed that about 37% of employees are concerned about automation putting jobs at risk and that generally the adaptive continuous intelligent systems will take over decision-making and the future of humans at work is questioned (J. Brown et al. 2017). In this context, there is already a relocation of tasks between humans and machines, where the algorithms will be mostly focused on information and data processing, administrative tasks or performance of technical activities (Weforum 2020, Figure 4).

It is important to highlight that only a minority of the companies acknowledge most AI risks and the potential threats, and even fewer mitigate them (Cam, Chui and Hall 2019). In this context, it is vital that in addition to a risk and mitigation management plan the organisations also assess the AI integration challenges and concerns related to the deployment of AI solutions (Nozari, Szmelter-Jarosz and Ghahremani-Nahr 2022). This is further discussed in the next section of the paper.

Assess AI integration challenges and concerns

Notwithstanding the great popularity and increased trust in cognitive technologies, AI is still viewed as one of the most impactful disruptive technologies, despite the change of the negative consideration

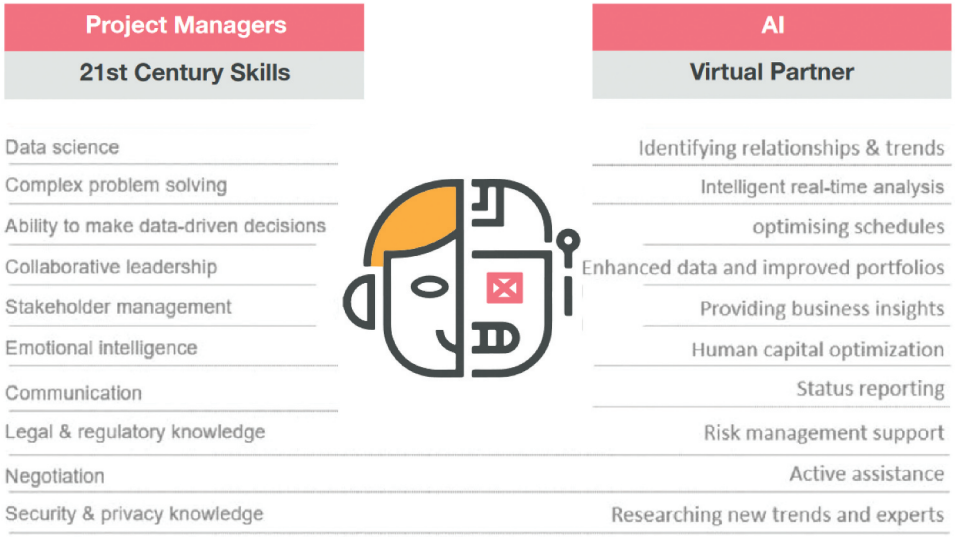

Figure 5. The Project manager's skill set compared with AI (Al-Sarraj and Al Najjar 2018).

from 80% in 2019 to 47,5% in 2021 (Newvantage 2022). In this direction, there are numerous major challenges and possible barriers that need to be evaluated in detail and proactively approached, to increase the probability of successful AI integration.

Continuously increasing deployment of AI algorithms has led to an increase in people, organisations and governments' concerns regarding AI reliability, decision-making capabilities and trustfulness. Moreover, the regulations could be viewed from a micro-perspective regarding algorithms and their functionality, training, testing, warranty or morals and from a meso-perspective concerning employment and people's daily business (Haenlein and Kaplan 2019).

Among the major AI challenges that supply chains and organisations are facing is understanding of algorithm's complexity. Consistently, Davenport, Loucks, and Schatsky (2017) have concluded that managers do not understand cognitive technologies and how they work. Often, the major stakeholders scattered across supply chains are not fully aware of AI capabilities or think too big regarding AI appliances and functionality, which could lead to project failure due to limited AI adoption or overpromising and impossibility to deliver (Westenberger, Schuler and Schlegel 2022). To overcome this situation, the executives need to consider AI technologies as a living entity, not inanimate technology, and should develop appropriate processes and principles that address business risks, increasing the awareness of management and the board, asking the right questions, adopting the correct mental frame, think like a regulator and certify and monitor continuously (Babic et al. 2021).

It is worth highlighting the importance of having a defined strategy for the integration and implementation of AI within the organisation to successfully approach the existing challenges. Even though in many cases the strategy would result in a sequence of pilots, proof of concepts or deployment of tools, it is important to address the technology strategy from content, technology components, people, change management and ambition perspective (Davenport and Mahidhar 2018). Moreover, Kiron and Schrage (2019) have outlined that it is not simply sufficient to create a strategy for AI, but it should also be created with AI. In this context, it is vital to assess the impact of AI technologies on future complex project management environments.

Impact of AI development on future project management

With the continuous advancement of technologies, AI's role would further increase, and intelligent algorithms will continue to spread everywhere (Rainie and Anderson 2017). Branscombe (2018) has outlined that the level of AI applications would continue to grow and would cover new areas, such as overall project predictions and experiments regarding performance and improvements across supply chains. It is also expected that by 2030, about 80% of today's project management activities would be eliminated by AI, overtaking to a great extent the traditional PMs functions such as supplier selection and evaluation (and as an extension certain procurement functions), data collection, tracking, reporting and more (Costello 2019; Liravi and Polychronakis 2015). This is captured in more detail in Figure 5.

Despite the undisputed benefits that AI could bring to PM, these technologies still should be considered as supporting tools, which could not easily overtake or replace a certain set of project managers' skills (Nouman 2019). In this context, Agrawal, Gans and Goldfarb (2017) have conclude that the focus should

be set on shifting from prediction-related skills to judgement skills and building an effective organisation of judgement-capable people and prediction-focused AI technologies.

Within the next years, it is foreseen that AI, PM and SCM will undergo major shifts and these technological opportunities would majorly affect the areas of projects selection and prioritisation; support for the project management office; improvement of project definition, planning and reporting; virtual project assistants; advanced testing systems and software and a new role for the project manager (Nieto-Rodriguez and Vargas 2023). Moreover, it is assumed that AI will overtake more responsibilities in oversized complex engineering projects, which are characterised by their uniqueness, long lifetime, social impact, large number of stakeholders involved and high level of uncertainty (Litsiou et al. 2019). It is further expected that AI will continue to provide valuable business insights, detect patterns, support supply chain-related business decisions and manage output processes (Javaid et al. 2022). Going even further in the future, about 25 years from now, it is likely that AI will be capable of managing the entire supply chain and projects while fully controlling the project environment, including complete stakeholders' management and analysis, albeit with some human supervision (Gil, Martinez Torres and González-Crespo 2021). Nonetheless, the future and AI are here, and so managers should learn to live with and make the best of it.

Methodology

Taking into account the major topics covered in the literature review and the research objectives and aims, the quantitative questionnaire survey concept has been defined. More fundamentally, the primary perceptions and views have been epitomised in a comprehensive format and used for the generation of survey questions. Due to the limited availability of studies in the area and the existence of research questions in the study, the research team decided against hypothesis development and testing. Instead, a survey questionnaire has been developed from the literature review sources examined. The purpose of this research is to identify the main challenges that practitioners in industries are facing in adopting and accepting AI in PM environments while considering pertinent SCM issues. This approach is well deliberated in numerous methodology-related books and expert forums (Oppenheim 1992; Sekaran and Bougie 2010)

The total number of participants is 103 people. Participants have been contacted via professional social networks and project management forums and groups, where the objective was to cover a wide range of professionals from different industries to avoid a common source bias (Jakobsen and Jensen 2015). In order to automate the data gathering and increase the number of reached people, a cloud-based data management tool has been used. Due to the limited number of respondents, no generalisation statements are made in this research, and so the ensuing results and discussion chapter are strictly articulated based on the sample responses. All pertinent analysis is also grounded on the same premises albeit participants based on numerous industrial settings (Hussey and Hussey 1997).

Within the survey participants, approximately 55% of the professionals have occupied project/supply chain-related positions, including but not limited to project managers, supply chain managers, programme and product managers, product owners, scrum masters and project management officers. The remaining number of participants was either managers/leaders at different leadership levels (40%) or not holding any management responsibilities (5%).

Ethics

In order to undertake the fieldwork of this research, a questionnaire was developed based on the literature review. Ethical approval was sought and consequently obtained by The University of Sheffield ethical approval panel. All anonymised participants have provided an informed consent to take part in this research.

Results

This section of the paper presents the empirical results obtained and analysed from the 103 manager participants. As previously stipulated, the questionnaire addresses research questions and has been developed via the literature review. Figures 6–12 below capture and summarise the key components of that interaction. These are further discussed in the ensuing sections.

From a business perspective, the three major reasons for adopting AI in PM are business insights and data analysis (63%), productivity increase (62%) and performance improvement (54%).

As AI integration could have a possible negative impact on the organisation, it is vital to assess the related limitations and risks. In this context, 62% of the survey participants consider cybersecurity as a major risk, 52% are concerned about the regulatory compliance of AI algorithms and about 46% are thoughtful about AI ethics and trustfulness. Moreover, it is noticeable that about 4% could not conclude about the possible AI risks, and approximately 17% are worried about workforce displacement.

According to survey results, 39% consider that a realistic timescale to implement AI in the PM would be between 3 and 6 years. About 35% have indicated

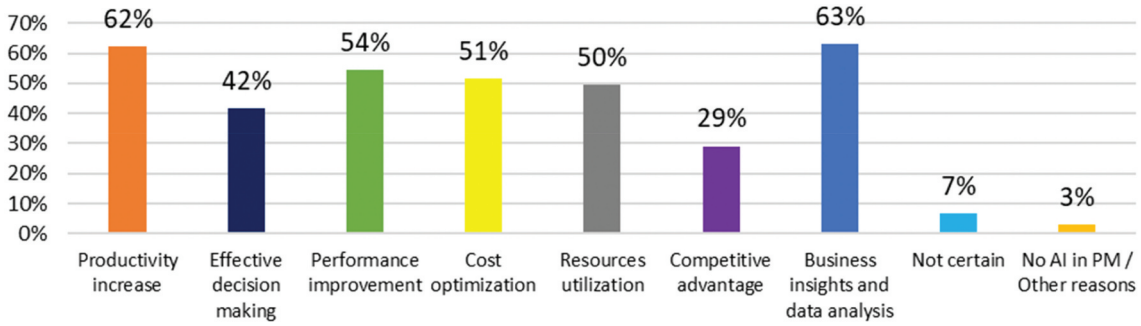

Figure 6. Major reasons for adopting AI in PM.

that in the next 3 years, the implementation would take place, while about 12% expect to take between 7 and 15 years. The major PM process groups where AI would be most valuable are Monitoring and Controlling (81%), Planning (70%), Executing (42%), Project Initialisation (14%) or Closing (13%).

Taking into consideration the PM knowledge areas, about 73% foresee the most AI value to be in the time management area, whereas about 70% expect a positive impact in the cost management area. The least influence is assumed in stakeholder (12%), communication (16%), Human Resources (18%) or integration (22%) management.

Taking into account the areas where AI would support PM the most, 72% presume that the main support would be in data collection or reporting, while 67% presuppose that it would be in the area of performance monitoring. Moreover, 48% expect that the main AI role in the PM area in the next 5 years would be PM assistant, while 43% assume it would be PM adviser.

Discussion

Evidence of the analysis presented in section 4 of this paper designates several empirical results and alternative avenues of enquiry. These are discussed in the light of the pertinent academic literature in the subsequent paragraphs.

Among the major reasons for adopting AI in PM (Figure 6) are placed business insights and data analysis (63%), productivity increase (62%), performance improvement (54%) and cost optimisations (51%). Al-Sarraj and Al Najjar (2018) have outlined that organisations could benefit from AI integration at reduced cost with improved efficiency and greater insights for enhanced decision-making. PMI (2021a) has consistently summarised the advantages of AI data analysis and guidance to successfully steer projects and concluded that AI systems could keep projects on budget and schedule. This is because AI can bring PM and SCM closer by offering better visibility, agility and control optimisation. Concerning the productivity increase, Kpmg (2019) has presented that companies investing in AI report on average about 15% productivity improvement.

Taking into account the PM process groups defined by PMBOK (2013), 81% of the survey participants believe that the adoption of AI will be most valuable for monitoring and controlling, followed by planning at 70% (Figure 9). Consistently, Dacre and Kockum (2022) have outlined that about 65% of the project professionals would most likely use AI to monitor and control activities during the deployment and execution phase (65%), while about 17% would be used in the definition and planning phase.

Regarding the PM knowledge areas, according to the survey participant, AI adoption will be most valuable for time management (73%), cost management (70%), quality management (55%) and risk management (51%) (Figure 10). From a time and schedule perspective, AI could monitor and recognise if there

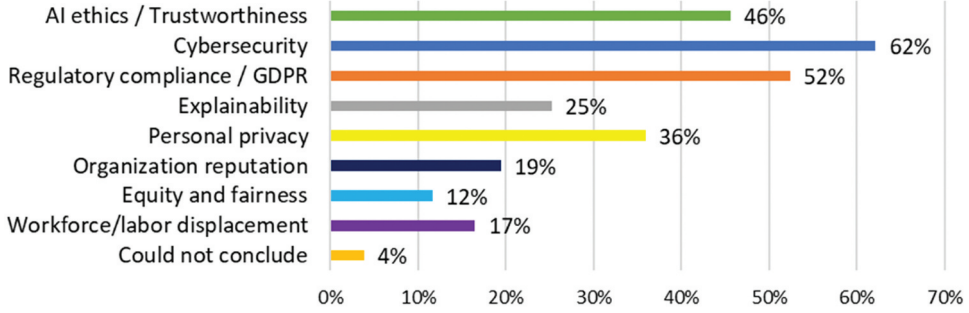

Figure 7. Organization's AI-relevant risks.

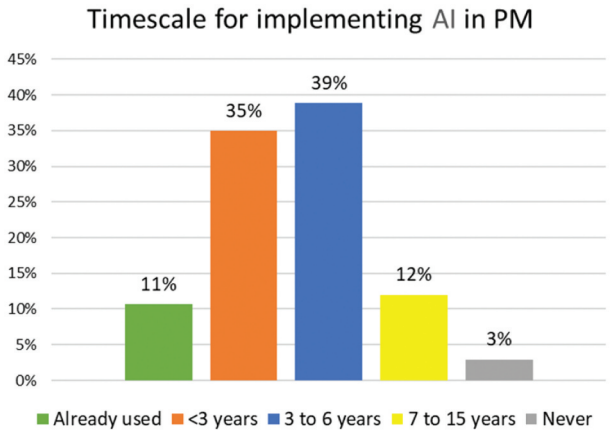

Figure 8. AI implementation timescale.

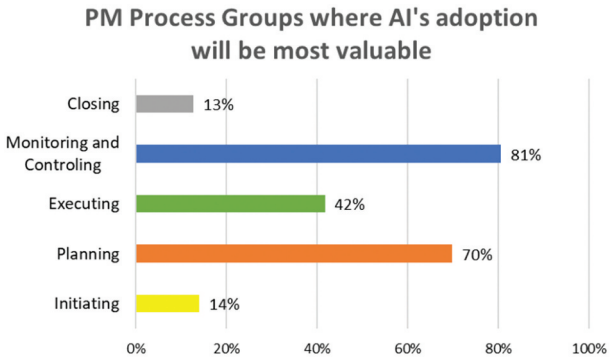

Figure 9. AI and PM process groups.

is a potential conflict and could make a suggestion or offer a personalised alternative on how to overcome these potential constraints (Schmelzer 2019). Considering the AI adoption influence on the cost management area, there is a global expense decrease observed, where more than 78% of the organisations have reported a reduction of minimum 10% of costs, mainly in the area of service operations, manufacturing, HR, marketing and sales, risk and supply chain management sectors (Thormundsson 2022). Holmström and Carroll (2024) have also addressed this and highlighted the positive cost impact of generative AI integration, by increasing efficiency while enabling better resource management.

It should also be highlighted that the knowledge areas where the least value of AI adoption is recognised are stakeholders (12%) and communication (16%) management. Regarding communication management, these low results are not consistent with Ransbotham et al. (2022) who has outlined that AI would improve communication and collaboration with the team members (56%), managers (47%) or others in the department (52%). Concerning supply chain and general stakeholder management, Fridgeirsson et al. (2021) have highlighted that AI will most likely have a very low or low effect on identifying stakeholders, planning and managing overall stakeholders' engagement.

Moreover, the analysis of the results demonstrates that data collection and reporting (72%), performance monitoring (67%) and planning and action prediction (54%) are among the areas where AI will support PM the most (Figure 11). Nilsson and Santos (2022) have revealed a similar ordering of the important areas of AI applications, where about 89% have placed data collection/reporting in the first place, followed by performance monitoring at 72%. By the same token, Malone, Rus and Laubacher (2020) have outlined that the directions in which AI is expected to support the most are the areas where AI is recently better at what people do – routine data processing and predictable work. In addition, applications in the area of advanced risk prediction and predictive project management will make AI a powerful partner (Odejide and Edunjobi 2024).

AI adoption is related to various risks and challenges that need to be assessed and proactively approached and managed as they could have a possible negative effect on the organisation. In this context, prior research has revealed that about 72% of respondents see cognitive technologies as a disruptive force that most likely will negatively influence their companies over the next decade (Davenport and Mahidhar 2018). In this regard, the survey results demonstrate that among the biggest organisation's AI risks (Figure 7) are cybersecurity

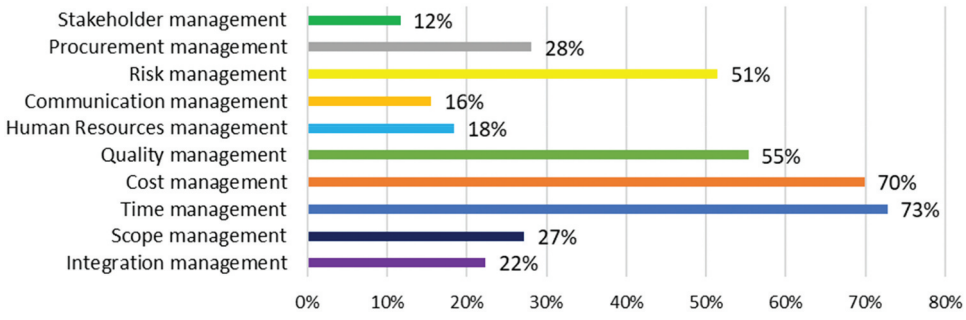

Figure 10. PM knowledge area AI adoption will be most valuable.

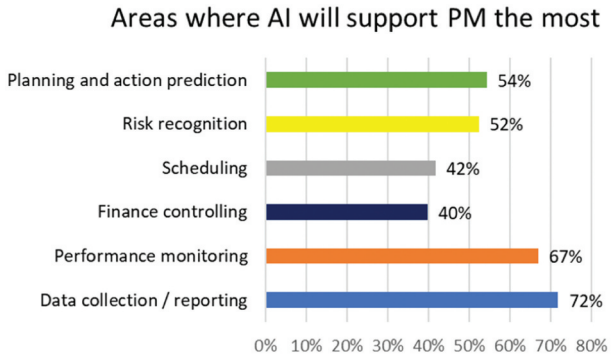

Figure 11. AI and PM support.

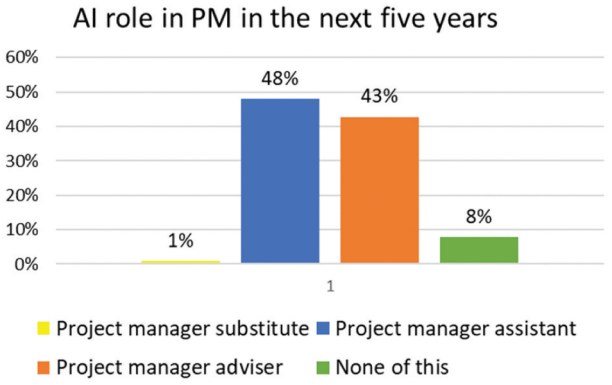

Figure 12. AI & PM in the next 5 years.

(62%), regulatory compliance (52%), AI ethics & trustfulness (46%) and personal privacy (36%). Consistent findings have been reported about emerging economies by Chui et al. (2021), where cybersecurity (47%), personal privacy (45%), regulatory compliance (40%) and AI explainability (34%) are among the major AI risks. It is worth highlighting that in smart projects and supply chain projects one of the most important challenges is the lack of proper infrastructure (technological or internal company restrains), where as a result, numerous companies delay the AI integration (Nozari, Szmelter-Jarosz and Ghahremani-Nahr 2022).

To complete the analysis of AI's role in project management, it is vital to assess the possible AI future implications over the project management area. Considering the next 5 years, about 48% of the survey participants assume that AI would be majorly used as a project assistant, 43% suggest that AI will be a PM adviser, 1% consider that AI could be a PM substitute and about 8% do not think that AI will play any of the proposed roles (Figure 12). Consistently, previous research by Bodea et al. (2020) has revealed similar results, where 52% consider that AI will be a project manager assistant within the next 5 years and 44% expect it to be a project manager adviser. Similarly, Lahmann (2018) believes that AI will assist, not replace, project managers and that AI creates the possibility of automated processes and intelligent tools that will reduce manual work, such as managing supplier contracts or some procurement functions.

From an AI implementation timescale perspective, the results revealed that the next few years will be crucial for AI integration in PM (Figure 8). While considering the supply chain perspective, there are some concerns mainly related to data availability, information sharing among partners, missing communication interface standards and company readiness (Preindl, Nikolopoulos and Litsiou 2020), which could further delay the integration. In conclusion, it is undisputed that AI is steadily expanding within project management and will become an undividable part of the personal and professional lives of leaders and managers.

Future recommendations

Without a doubt, AI will systemically continue expanding and will take over more and more standardised and complex functions and processes in all industries and businesses. This rapid growth is related to an enormous increase in computational power and the usage of advanced algorithms, which would suggest the potential usage of distributed and decentralised systems such as blockchains. In this context, it is important for academics to undertake further research and dedicated analysis on the application of AI in projects undertaken within supply chains in specific industrial (the empirical aspect of our research addresses numerous industries) and national contexts in both profit and non-for-profit sectors. Blockchain technologies, for example, can offer numerous advantages: trust among partners, improved security, enhanced information management and sharing, reduced systemic complexity, increased reliability and more (Verbeek and Lundqvist 2021).

For practitioners, our research outlined key AI areas and priorities within projects for consideration: data analysis and productivity gains, monitoring and controlling opportunities, time and cost management opportunities, algorithmic options, but also cybersecurity and GDPR concerns and slow implementation times, among others. The somewhat slow progress of AI in PM is largely attributed to organisations' limited investment and supply chain management-related complications (Gil, Martinez Torres and González-Crespo 2021). There is a need to train and develop business leaders on AI practises and options to remove fear and showcase opportunities (Barcaui and Monat 2023). Managing a portfolio of practices, implementing at least some of the identified solutions and focusing on change, should take priority over cost-cutting and the mentality of quick gains (Davenport, Loucks and Schatsky 2017).

Conclusions

In this research, the role of artificial intelligence in project management within supply chains has been empirically evaluated in various industrial settings. Initially, the level of AI adoption in the project management area has been assessed, where it could be concluded that AI has already found a broad appliance in the PM sector as well as in the pertinent supply chains. This is especially true in the area of data analytics, business insight, process automation, real-time and risk prediction, project assistance, supply chain related decision-making processes and overall status monitoring and controlling. Moreover, these AI functionalities have intensely correlated to a various number of supply chain system limitations and risks, mainly related to cybersecurity, regulatory compliance, AI trustworthiness, ethics or personal acceptance.

AI implementation in project management practice is expected to improve the performance of managers and functions and increase the number of successfully finished projects while reducing the associated inherent risk complexity. However, professionals need to understand the importance of AI and its future role in business contexts. They should ascertain, adopt, adapt, accept or risk falling behind (Taylor 2021). Exploring the role of AI in project management while considering the pertinent supply chain implications and influences and sharing the results within the project management community would increase the awareness of AI advantages and challenges and should accelerate the strategic planning for integration and control.

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