AI-Driven Knowledge Management in Megaprojects: The Leadership Factor

Quba Ahmed, Muhammad Saleem Sumbal and Carman Lee
Department of Industrial and Systems Engineering, The Hong Kong Polytechnic University, Hong Kong, China

qubaa.ahmed@connect.polyu.hk
saleemkhan.sumbal@polyu.edu.hk
ckm.lee@polyu.edu.hk

Abstract: With the increasing complexities and uncertainties, the integration of artificial intelligence has become paramount as the utilization of digital technologies has transformed the management practices across industries, especially in the domain of megaprojects. The paper analyzes the influence of integrating artificial intelligence (AI)- based knowledge management initiatives on the decision-making process of leadership in large-scale initiatives. As the supply chains of large-scale initiatives face complex challenges, leveraging artificial intelligence-based knowledge management initiatives has become essential to enhance resilience and operational efficiency. The qualitative data analysis has shown how AI-driven tools can significantly improve the data analysis in real time, ultimately facilitating knowledge management and enhancing the predictive insights shaping and devising strategic decisions. The AI adoption helps in fostering collaboration through knowledge sharing among the stakeholders, facilitating and promoting innovation and sustainability throughout the lifecycle of the project. Moreover, the AI utilization can deal with the upcoming challenges and uncertainties, helping in informed choices that align with the strategic objectives. The paper discusses the challenges in adopting the AI-based knowledge management initiatives. Leadership support can be marked vital as a clear support with visionary guidance is necessary to gain traction. The study investigates the role of leadership support in the AI-based KM initiatives for the success of the project. Leadership support plays an important role in the implementation of AI by creating a culture of knowledge sharing and embracing innovation and change. Furthermore, strong leadership assists in utilizing the resources, sustainably, and allocates them in the training and development of the human resource to equip them with the necessary knowledge with the help of AI. The qualitative interviews from the industry professionals reflected the positive influence of this step, as it not only empowered the employees but also mitigated the resistance to change. In summary, the paper reflects preliminary findings from an ongoing study that there is a need for leadership support to implement AI-based KM initiatives in megaprojects by articulating a clear vision, securing resources, addressing challenges, and maintaining and sustaining competitive advantage in megaprojects. This supportive framework ultimately enhances the likelihood of achieving project success and driving sustainable growth.

Keywords: AI, Knowledge management, Megaprojects, Leadership, Decision-making, Sustainability, Collaboration

1. Introduction

Megaprojects, large-scale, ambitious ventures involving staggering investments, diverse stakeholders, extended durations, and uncertainties, are crucial for economic development (Li et al., 2024). Megaprojects create new jobs, address social needs, and enhance the infrastructure. They also encounter complex challenges, including cost overruns, delays, governance issues, and other social and economic hurdles (Damayanti et al., 2018). Mainly, the changing market trends, environmental uncertainties, and political factors influence the effective operations of the megaprojects. China-Pakistan Economic Corridor (CPEC) is one of the megaprojects launched in 2015 under the Belt and Road Initiative, which aims to enhance connectivity between China and Pakistan. CPEC is spread over 3000 km, including infrastructure projects like highways, railways, and energy facilities. The primary goal of this megaproject is to stimulate economic growth, attract foreign direct investment, and create job opportunities, particularly in developing and underdeveloped areas of Pakistan. CPEC is aimed at improving trade routes and access to services, benefiting around 220 million people with an investment exceeding $62 billion. Energy security is also one of the focuses of the megaproject through power generation, fulfilling Pakistan's energy crisis. With the help of this bilateral cooperation, Pakistan and China can shape their economic future and strengthen the ties, ultimately promoting sustainable growth and regional integration (Awan et al., 2022).

Due to the expansive spread of the megaproject, complexities are inherent, which necessitates advanced strategies to manage risks and ensure resilience, calling for the integration of artificial intelligence (AI) in knowledge management (KM). AI can play a vital role in enhancing decision-making processes by doing real-time data analysis and predictive insights, which are critical for navigating the disruptions associated with megaprojects. AI tools can be leveraged to enhance collaboration among the stakeholders, ultimately promoting innovation throughout the lifecycle of the project (Ghobakhloo et al., 2025).

Leadership support is necessary for the implementation of AI based knowledge management initiatives in the organization by encouraging knowledge sharing and innovation to deal with the challenges due to the scale and complexity of the megaprojects (Wang et al., 2020). Strong leadership not only empowers employees but also mitigates resistance to change and facilitates the implementation of AI technologies through resource allocation (Ahmed et al., 2025). Although AI has significant potential in enhancing resilience but many organizations still lack the infrastructure and support for its integration in the decision-making process. Leadership support is required to fill this gap and ensure the implementation of AI-based KM initiatives to articulate a clear vision to allocate resources effectively (Li et al., 2025).

Previous research regarding megaprojects indicates a need for in-depth exploration of AI-based KM initiatives focusing on the economic impacts and the project's overall success (Cui, n.d). This study aims to fill the existing gap by exploring how AI-driven KM initiatives can enhance resilience amid a dynamic environment, including geopolitical instability and logistical complexities. The ongoing disruptions, previously exacerbated by COVID-19 and other geopolitical tensions, highlight the need for robust crisis management strategies by focusing on preparedness and adaptive resilient strategies ensuring business continuity (Yu et al., 2018).

The study investigates the critical role of AI-based knowledge management initiatives in enhancing the project's resilience and success. The role of leadership in the phenomenon is also explored by investigating the stakeholders' experiences. The research aims to provide valuable insights that can assist in the effective planning and implementation strategies for the success of megaprojects. The findings will be useful for policymakers and practitioners in the navigation of the complexities arising in the management of megaprojects, ultimately contributing to sustainable growth and project success in the long term.

2. Literature Review

Artificial intelligence is the capability of a machine to imitate human behaviour, assisting in real-time data analysis and decision-making. Moreover, effective knowledge sharing is also critical for sustaining resilience, enabling the stakeholders to address the potential risks proactively. AI-based knowledge management initiatives are mainly the integration of artificial intelligence technologies with the knowledge management practices to enhance knowledge creation, sharing, application, utilization, and transfer within the organization (Majumder, 2022). These initiatives are utilized to enhance the decision-making process and inculcate proactive risk management strategies by fostering collaboration among the stakeholders (Pomaza-Ponomarenko et al., 2023).

Implementing AI-driven KM initiatives mainly depends on the role of leadership in the megaprojects. Strong leadership fosters knowledge sharing and innovation, ultimately supporting the integration of AI (McDermott et al., 2024). Moreover, this support also empowers the employees resulting in the facilitation of the change management process and optimum resource utilization amid the ongoing complexities in the megaprojects (Wang et al., 2020). Effective leadership also supports stakeholder engagement and promotes teamwork within megaprojects (Safari et al., 2024). AI has been empirically tested to enhance resilience by enhancing the visibility, managing risks, and facilitating decision making (Riad et al., 2024; Attah et al., 2024). Project success demands the achievement of the objectives within the defined scope, time, and budget, ultimately ensuring the stakeholders' satisfaction. Through AI utilization for real-time data analysis, organizations swiftly anticipate and respond to disruptions. With the assistance of AI tools, knowledge sharing can be automated, ultimately enhancing organizational agility (Yang, 2024). The interplay of leadership, AI, and knowledge management practices can assist in the development of resilience in organizations. Resilience is the ability of the organization to be proactive and reactive in an uncertain environment. The organization can anticipate, respond to, and recover from unexpected disruptions (Wang et al., 2023). In the domain of CPEC, there are several disruptions ranging from environmental risks, political risks, to social disruptions (Awan et al., 2022). This integration not only helps the organization to adapt to a dynamic environment proactively but also helps deal with the disruptions, maintaining and sustaining the competitive advantage in the long term (Sullivan & Wamba, 2022; Božić, 2023).

3. Methodology

The research study utilizes a qualitative research design to explore the role of leadership support on the implementation of AI-based KM initiatives in megaprojects, specifically CPEC. Data is being collected through conducting semi-structured interviews from the "elite workers", influencing the decision making; i.e., project managers and industry experts, to gather insight regarding the research topic (Sumbal et al. 2017). The conference paper highlights the preliminary findings of the pilot study from the six participants from various projects under CPEC (Table showing the participants' details). This preliminary research aimed to refine the

interview guide and to gain insights for the final research design. The research analysis follows the technique of Charmaz's constructivist grounded theory and ATLAS.ti as software for organizing data, coding, and identification of research themes. Charmaz's theory has been utilized to explore the subjective experiences of the stakeholders. As the methodology allows for a nuanced understanding of how individuals interpret their experience, along with the challenges within this complex environment. Grounded theory is a step-by-step process where researchers revisit and refine their ideas back and forth to think critically and make analytical connections at any point (Gupta, 2024; Charmaz, 2006). The research study emphasized the critical role of leadership support for fostering knowledge sharing and innovation through the collaboration of AI. The research findings aim to enhance the resilience and operational efficiency in megaprojects, specifically (CPEC, ultimately contributing to the success of the project by sustaining its growth in the long term.

Table 1: List of the Participants in the Pilot Study

Company	*Designation*	*Domain*
A	Project Manager	Energy (CPEC)
B	Project In-charge	Energy (CPEC)
C	Research Analyst	Belt & Road Initiative Research Institute
D	Supply Chain Manager	Energy (CPEC)
E	Project Manager	Energy (CPEC)
F	General Manager	Energy (CPEC)

4. Results and Discussion

The integration of AI in the knowledge management initiatives offers crucial opportunities to enhance the success and the resilience of the mega project, i.e., CPEC. The interviews reveal that although the technology-driven knowledge management initiatives contribute to problem solving and overall project management, leadership support plays a critical role. The results back the AI's ability to analyze vast datasets, which resultantly enables organizations to identify potential risks before they escalate and creation of new relevant knowledge, as a participant told,

> *"AI can change how we run supply chains... With predictive analytics, we can make backup plans ahead of time."*

By this, the organization can maintain continuity in operations and mitigate disruptions with the participative leadership style within its projects. Moreover, the results highlighted that the leadership of their project utilizes AI's potential in real-time monitoring, and then knowledge is shared as this immediate intervention can prevent minor issues from developing into significant disruptions, enhancing the overall project's resilience.

The findings also state that AI facilitates the knowledge transfer among the stakeholders through collaborative platforms, which not only streamlines the data recording but also enables organizations to draw lessons from past practices. The knowledge-sharing collaborative platforms enabled by AI foster better communication among all stakeholders involved in megaprojects. As said by a participant,

> *"The use of collaborative platforms also fosters better communication... ensuring that everyone is aligned and informed."*

This alignment is critical in large-scale projects, as such a setup results in coordinated responses to challenges and ensures that all parties are working towards common goals. The results indicate that participative leaders play a crucial role in aligning the stakeholders and ensuring the effective usage of communication channels to address the challenges. This strategy maintains the operational focus amid this complex venture.

The results proved that AI-driven tools can enhance decision-making by providing insights derived from comprehensive data analysis. A participant mentioned,

> *"AI-driven tools can improve decision-making by analyzing vast amounts of data to predict trends and outcomes."*

This aspect not only allows the organization to respond quickly to disruptions such as regulatory changes. Some projects face delays and shutdowns as those projects lack the adaptive capability, stated by a participant, *" we*

are not asked for any opinion, we are told to perform any task, that's why there are a lot of issues". Moreover, in such projects, the utilization of AI to support knowledge management initiatives is also lacking, which can be regarded as one of the reasons for failure. The results suggest that leadership support has a direct influence on the implementation AI AI-based KM initiatives. More specifically, the authoritarian and abusive leadership style hinders its adoption, whereas participative leadership inculcates a supportive environment, to attain successful implementation and tangible outcomes, which demands reforms for the leadership in the projects where the implementation of AI-based KM initiatives is low.

4.1 AI Tools and Environmental Monitoring

The integration of AI-driven tools into decision-making is crucial as the interviews reveal how these technologies enhance knowledge sharing and collaboration among stakeholders, thereby improving the overall project's resilience. The findings described the utilization of AI tools for environmental monitoring. As per the results, the carbon footprints and emissions can be tracked through these tools, enabling real-time monitoring (Huang & Mao, 2024). The research found that the developing countries lack the leadership support to utilize AI for social coordination. As per the interviews, some of the projects have a portal where all the news is shared, hence the knowledge sharing is better. This indicates ongoing efforts to utilize technology for managing stakeholder communication (Iaia et al., 2023).

4.2 Leadership's Role in AI-Based Knowledge Management

Effective leadership is required to ensure operational continuity with the implementation of AI-based KM initiatives. Participative leadership facilitates the resolution of minor disruptions through sharing knowledge when and where required, proactively, ultimately enhancing the resilience of megaprojects.

4.3 Training and Generative AI Tools

According to the results, regular training sessions and workshops supported by the leadership keep everyone in the loop on best practices and new rules. These initiatives ensure that all team members are knowledgeable, fostering a culture of collaboration (Khare et al., 2025). The use of generative AI tools, such as the "net zero cloud," was noted to be used by some projects under CPEC, showing significant advancement. The AI tool reads the data and generates the reports, which need more focus and are non-compliant with the requirements. Such capabilities streamline knowledge management and facilitate proactive decision-making (Leoni et al., 2024). Despite the positive aspects of AI integration, challenges remain, particularly in developing countries. The results show a gap in the utilization of technology and transfer of knowledge, which can be filled with the help of leadership support. This study helps to distinguish itself from present literature by highlighting the practical applications of AI in uplifting knowledge sharing, specifically within developing countries where such technologies are used or underutilized. This research provides actionable insights for practitioners aiming to strengthen resilience in complex megaprojects through the utilization of AI-based KM initiatives.

4.4 Bridging the Gap: Leadership Support

A critical hurdle identified in the results is the lack of leadership support for utilizing AI-driven KM initiatives. Lack of top management support disturbs the allocation of required resources in decision-making processes. This finding highlights the importance of engaging top management (leadership) in promoting the utilization of AI tools to attain real-time data and analytics to enhance the knowledge base. The preliminary results highlight the fundamental role of leadership in the implementation of AI-based KM initiatives. In developing countries, the participative leadership style not only enhances collaboration but also ensures proactive planning to deal with disruptions and enhance resilience. So leadership support can be regarded as the missing link in the success of AI-driven KM initiatives. The following table summarizes the leadership styles and their influence on the AI-based KM initiatives and outcomes.

Table 2: Leadership styles and their influence

LEADERSHIP STYLE	KEY CHARACTERISTICS	IMPACT ON AI-BASED KNOWLEDGE MANAGEMENT INITIATIVES	OUTCOME
AUTHORITARIAN LEADERSHIP	- Centralized decision-making - Minimal stakeholder involvement	- Suppresses innovation - Reduces knowledge sharing - Hinders AI utilization	- Delays and disruptions - Ineffective implementation - Low project resilience

LEADERSHIP STYLE	KEY CHARACTERISTICS	IMPACT ON AI-BASED KNOWLEDGE MANAGEMENT INITIATIVES	OUTCOME
	- Rigid and hierarchical control		
ABUSIVE LEADERSHIP	- Hostile work environment - Lack of trust and collaboration - Disregard for stakeholder input	- Negligible or zero adoption - Lack of knowledge sharing - Resistance to change	- Complete failure of KM initiatives - Disengaged teams - Operational inefficiencies
PARTICIPATIVE LEADERSHIP	- Inclusive and collaborative decision -making - Encourages stakeholder participation - Proactive and supportive	- Facilitates AI utilization - Enhances knowledge sharing - Promotes proactive planning	- Improved operational resilience - Successful implementation- Timely responses to disruptions
LACK OF LEADERSHIP SUPPORT	- Limited resource allocation - Absence of strategic vision - Lack of training and engagement	- Underutilization of AI tools - Inadequate knowledge transfer - Poor collaboration	- Reduced project outcomes - Low adaptability to challenges - Missed opportunities for innovation

5. Conclusion and Future Work

The ongoing PhD research study highlights the interplay of AI-driven tools integrated in knowledge management and leadership support, significantly influencing the project's resilience and collaboration initiatives, specifically in megaprojects like CPEC. The preliminary results state the critical role of leadership support in AI-based KM initiatives, enabling real-time monitoring, predictive analytics, and effective knowledge sharing among stakeholders. However, there is a gap in the support from leadership and technological adoption, especially in developing countries. The ongoing research study can provide insights regarding other factors hindering the integration of AI in KM to enhance resilience and sustainability. Moreover, the future work can quantitatively analyse the different leadership styles and their influence on AI-based KM initiatives through mediating and moderating effects of different factors.

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