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A REVIEW OF THE CURRENT STATE OF ARTIFICIAL INTELLIGENCE ADOPTION IN SOUTH AFRICAN CONSTRUCTION PROJECT MANAGEMENT

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Abstract

Artificial Intelligence (AI) is increasingly transforming the global construction industry through enhanced automation, predictive analytics, and data-driven decision-making. In construction project management, AI technologies such as machine learning, computer vision, and Building Information Modelling (BIM) integration are improving project planning, cost estimation, safety management, and resource optimization. This paper reviews the current state of AI adoption in construction project management practices in South Africa. The study examines existing literature on global AI developments and evaluates how these technologies are being integrated within the South African construction sector. The review reveals that AI adoption in South Africa remains at an emerging stage, with implementation largely concentrated among large construction firms, multinational companies, and infrastructure megaprojects. Current applications include predictive analytics for cost and risk management, AI-enabled scheduling systems, BIM-integrated machine learning tools, and drone-based site monitoring technologies. Despite growing awareness of AI's potential benefits, several barriers continue to hinder widespread adoption. These include high implementation costs, inadequate digital infrastructure, shortage of skilled professionals, fragmented project data, resistance to organizational change, and limited regulatory support. Furthermore, small and medium-sized enterprises (SMEs), which constitute a large portion of the South African construction industry, often lack the financial and technological capacity to adopt AI systems effectively. The study concludes that although AI adoption is still limited, the increasing advancement of digital technologies, growing industry awareness, and ongoing development of supportive innovation frameworks present significant opportunities for future AI integration in South African construction project management practices.

Keywords: Artificial Intelligence, Building Information Modelling (BIM), Construction Project Management, Digital Transformation.

1. INTRODUCTION

The construction industry plays a significant role in economic growth, infrastructure development, and employment creation globally. However, the industry continues to face persistent challenges related to cost overruns, project delays, low productivity, poor communication, and safety incidents (Oesterreich & Teuteberg, 2016). In response to these challenges, the integration of digital technologies associated with the Fourth Industrial Revolution (4IR) has become increasingly important in improving construction project delivery and operational efficiency. Among these technologies, Artificial Intelligence (AI) has emerged as one of the most transformative innovations influencing modern construction project management practices.

AI refers to computer systems capable of performing tasks that normally require human intelligence, including learning, reasoning, problem-solving, prediction, and decision-making

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(Russell & Norvig, 2021). In the construction sector, AI technologies such as machine learning, computer vision, robotics, natural language processing, and predictive analytics are increasingly being integrated into project management processes to improve decision-making, automate repetitive tasks, and enhance project performance (Zhang & El-Gohary, 2021). Globally, countries such as the United States, China, and the United Kingdom have accelerated the adoption of AI-driven systems in areas including cost estimation, safety monitoring, risk analysis, scheduling optimization, and quality control (Elhegazy et al., 2022).

The integration of AI with Building Information Modelling (BIM) and Internet of Things (IoT) technologies has further transformed construction management practices by enabling real-time data collection, predictive maintenance, and intelligent project planning (Du et al., 2021). According to Li et al. (2023), AI-supported systems improve construction productivity by reducing human error, optimizing resource allocation, and enhancing communication among project stakeholders. Furthermore, AI technologies are increasingly being used to support construction health and safety management through automated hazard detection, site surveillance, and predictive accident prevention models (Aghimien et al., 2022).

Despite these global advancements, the adoption of AI within the South African construction industry remains relatively slow and fragmented. The South African construction sector is characterized by labour-intensive practices, limited digital infrastructure, and varying levels of technological readiness among firms (CIDB, 2022). While some large contractors and multinational construction companies have begun implementing AI-enabled tools for project scheduling, cost forecasting, and safety monitoring, many small and medium-sized enterprises (SMEs) continue to face barriers related to financial limitations, inadequate technical expertise, and resistance to organizational change (Tjebane et al., 2022).

In recent years, there has been growing interest in digital transformation initiatives within the South African built environment sector. The adoption of BIM, cloud computing, and data analytics platforms has gradually created opportunities for AI integration in construction project management (Moyo et al., 2023). Additionally, national initiatives aimed at promoting innovation and digital technologies, including the establishment of the South African National Artificial Intelligence Institute (SANAI), indicate increasing recognition of AI's potential contribution to economic and industrial development (DTIC, 2023). However, literature suggests that the practical implementation of AI in South African construction remains at an emerging stage, with limited empirical studies examining the extent of adoption, readiness, and associated challenges within the industry.

This paper therefore reviews the current state of AI adoption in construction project management practices in South Africa. The study explores global developments in AI application within construction, examines the level of AI integration in the South African context, identifies current areas of application, and discusses the organisational, technological, and institutional barriers affecting adoption. The review further highlights opportunities for advancing AI-driven construction project management practices to improve productivity, safety, sustainability, and overall project performance within the South African construction industry.

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2. LITERATURE REVIEW

2.2.1 Global Context of AI in Construction

In the rapidly evolving global construction industry driven by digital technology, artificial intelligence (AI) is becoming a major driver of innovation and productivity (Li et al., 2023). AI technologies such as machine learning, computer vision, and natural language processing are increasingly integrated into project management tasks to improve productivity, safety, and decision-making (Zhang & El-Gohary, 2021). Industrialized countries such as China, the US, and the UK are quickly adopting AI-based decision-support systems to automate tasks like design validation, cost estimation, and quality assurance (Elhegazy et al., 2022). These developments show that AI acts as both a technological and managerial enabler, promoting data-driven decision-making throughout all project phases.

2.2.2 The South African Construction Context

The document shows that AI adoption in construction worldwide and in developing economies is in its early stages but is growing steadily. Construction firms are increasingly combining AI with cloud computing, IoT, and digital collaboration platforms to boost productivity and operational efficiency. The growth of cloud computing, big data analytics, and Building Information Modelling (BIM) has accelerated the use of AI in construction globally. According to research, dynamic cost, time, and performance simulation is made possible by combining AI algorithms with BIM environments (Du, 2021). Using predictive modelling, this integration helps managers forecast hazards, optimize resources, and reduce cost overruns. These tools have revolutionized productivity management, risk assessment, and project planning in South Africa. Their adoption in building projects is gradually rising, especially in smart city initiatives and major infrastructure developments (Elhegazy et al., 2022). Additionally, AI's potential in areas such as supply chain management, project scheduling, and safety monitoring is gaining wider recognition. Early adopters leading large projects and urban centres are pioneering AI-driven solutions, suggesting a promising future for broader AI use in South African construction project management (Mgolombane, 2023).

In South Africa, the adoption of AI in Construction Project Management has been slow and inconsistent across different sub-sectors. While larger contractors and multinational companies have started exploring AI-powered solutions, especially in cost estimation, scheduling optimization, and safety management, small to medium-sized enterprises (SMEs) often lack the financial and technical resources to implement AI systems effectively (Ayorinde et al., 2025). Nevertheless, there is growing awareness of AI’s potential in areas like project scheduling, supply chain management, and safety monitoring (Oke and Aghimien, 2018).

2.2.3 Current Areas of AI Application in South Africa

In South Africa, the construction industry is beginning to adopt these technologies to address longstanding problems such as low productivity, safety issues, and project delays. Early adopters in major urban centres and large projects are leading the way in AI-enabled solutions, signalling a positive trend for broader AI adoption in South African construction project

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management (Moyo et al., 2023). AI applications are mainly pilot projects focused on high-value ventures in South Africa's construction industry. Common uses include:

- Machine learning algorithms integrated with BIM, which support better design coordination;
- Predictive analytics for cost and risk management, which is mainly utilized in large-scale infrastructure projects (Moyo et al., 2023); AI-based cost simulation models greatly increase price accuracy and decrease estimating time when paired with BIM. Du (2021). This strategy is being investigated more and more in South African consultancies and institutions.
- AI-enabled project planning tools, which provide real-time schedule changes and resource allocation; and
- Computer vision and drone-based monitoring, which improve safety inspections and site progress tracking (Ayorinde et al., 2025)

Despite these new uses, AI is still underutilized by global standards. The primary adopters of digital transformation are large international contractors and consulting firms that have the financial and technological means to do so. (CIDB, 2022).

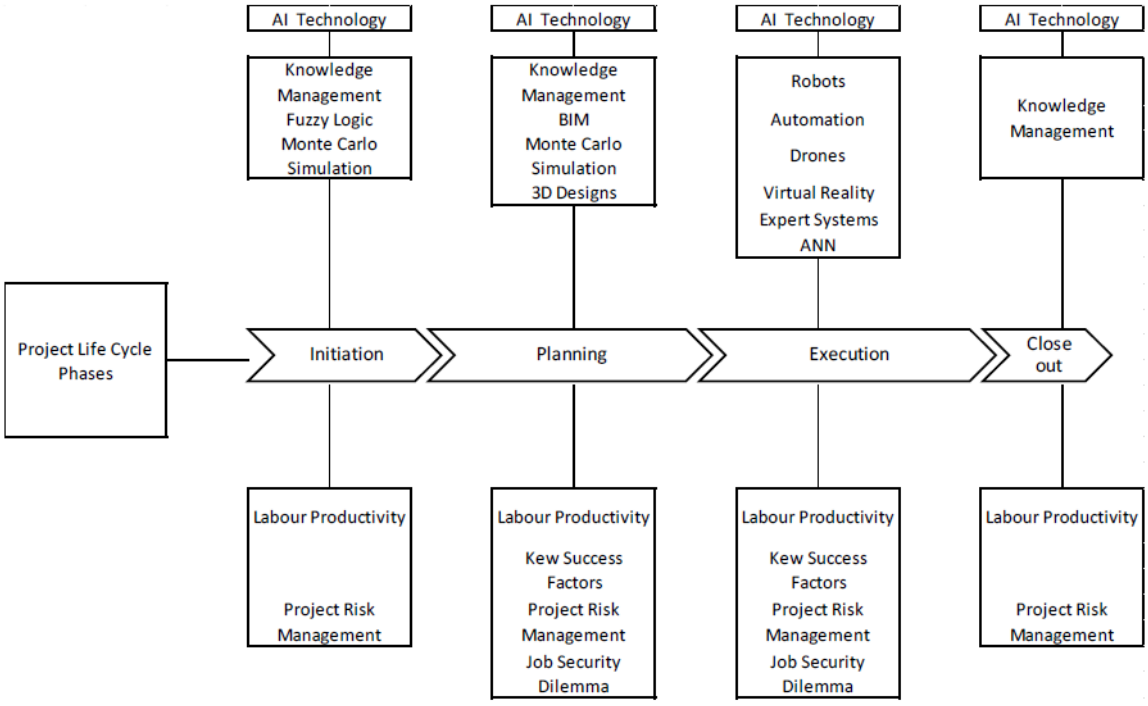

Figure 2: Conceptual Framework of the Current Areas of AI Application in South Africa

Source: Researchers Own

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2.2.4 Organisational Drivers and Readiness

According to empirical data, organizational and competitive pressures rather than legal requirements are the primary drivers of AI adoption in South Africa's construction industry. Tjebane et al. (2022) identify three significant organisational predictors of AI adoption in construction:

1) dedication of the leadership and strategic vision,
2) The availability of knowledgeable staff, and
3) AI tools are thought to have a relative advantage over conventional project management systems.

Due to exposure to worldwide norms and expectations from international partners, large, globally connected firms, particularly those involved in mining, energy, and infrastructure mega projects, tend to adopt AI tools earlier. Small and medium businesses (SMEs), on the other hand, exhibit low levels of digital maturity and frequently lack data platforms that can integrate AI (CIDB, 2021).

(Osunsanmi et al., 2020) emphasise that AI integration in South African housing and infrastructure projects has the potential to enhance sustainability and quality control. However, smaller firms often lack the financial and human resources to implement such advanced technologies. The emphasis on traditional labour-intensive methods continues to slow digital transformation.

Furthermore, the degree of BIM deployment and AI readiness is clearly correlated, which asserts that combining AI and BIM enhances data interoperability and predictive cost modelling. These benefits, however, rely on comprehensive digital models and well-structured project data, both of which are still in their infancy in South Africa. (Du 2021)

Generally, the use of AI in South African construction project management is still in its early stages. There are more awareness and selective use than systematic integration. The literature repeatedly demonstrates that institutional, technological, and cultural hurdles are the main reasons why AI's transformational promise has not yet been completely realized however, there is increasing hope that AI will gradually become a commonplace part of South Africa's building project management ecosystem as professional training grows and digital infrastructure advances. (Aghimien et al., 2022).

3. RESEARCH METHODOLOGY

This study adopted a qualitative desktop review methodology to examine the current state of Artificial Intelligence adoption in construction project management practices in South Africa. A systematic literature review approach was employed to collect and analyse secondary data from peer-reviewed journal articles, conference papers, industry reports, and policy documents related to AI applications in the construction industry. According to Snyder (2019), a systematic literature review enables researchers to critically analyse and synthesize existing knowledge within a specific field while ensuring methodological transparency and reliability. Relevant

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literature published between 2018 and 2025 was sourced from reputable academic databases such as Google Scholar, ScienceDirect, Scopus, and Semantic Scholar.

Keywords including "Artificial Intelligence in construction," "AI adoption in construction project management," "Building Information Modelling," and "digital transformation in construction" were used during the search process to identify relevant studies (Zhang & El-Gohary, 2021).

The collected literature was analysed using thematic content analysis to identify key patterns, trends, and themes relating to AI adoption within construction project management. Thematic analysis is widely used in qualitative research to interpret recurring concepts and relationships within literature and textual data (Braun & Clarke, 2019). The analysis focused on current areas of AI application, organisational readiness, barriers to adoption, and opportunities for future implementation in the South African construction sector (Aghimien et al., 2022). The use of peer-reviewed scholarly sources ensured the reliability and credibility of the findings, while the systematic review process minimized selection bias and enhanced the consistency of the study (Snyder, 2019). Since the research relied entirely on publicly available secondary data, no ethical clearance was required; however, all sources were properly acknowledged through academic referencing and citation practices.

4. FINDINGS AND DISCUSSION

The findings of this review indicate that the adoption of Artificial Intelligence within construction project management practices in South Africa is steadily emerging, although the level of implementation remains relatively low compared to developed countries. Existing literature shows that AI technologies are mainly adopted by large construction firms, multinational organizations, and infrastructure-driven projects that have the financial and technical capacity to support digital transformation (Aghimien et al., 2022). Current AI applications in the South African construction sector include predictive analytics for cost estimation and risk management, machine learning integrated with Building Information Modelling (BIM) for improved coordination, AI-enabled scheduling systems, and computer vision technologies for safety monitoring and site inspection (Ayorinde et al., 2025). These applications demonstrate the potential of AI to improve project efficiency, reduce delays, enhance resource allocation, and strengthen construction safety management practices.

The findings further reveal that organizational readiness plays a critical role in the successful adoption of AI in construction project management. Firms with strong leadership commitment, digital infrastructure, and skilled personnel are more likely to implement AI technologies effectively (Moyo et al., 2023). However, several barriers continue to limit widespread adoption across the industry. These include high implementation costs, inadequate digital infrastructure, fragmented project data, shortage of technical expertise, resistance to organizational change, and limited regulatory support (Daniel et al., 2024). Small and medium-sized enterprises are particularly affected due to financial constraints and low digital maturity levels (CIDB, 2022). Although awareness of AI benefits is increasing within the South African construction industry, the sector still relies heavily on traditional labour-intensive methods and

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conventional project management approaches. Nevertheless, the gradual growth of digital technologies, increased investment in innovation, and expansion of smart construction initiatives suggest a positive trajectory for future AI integration in construction project management practices in South Africa (Mgolombane, 2023).

5. CONCLUSION AND FURTHER RESEARCH

The review indicates that the adoption of Artificial Intelligence in construction project management practices within South Africa is gradually increasing, although implementation remains at an early stage compared to developed countries. The findings reveal that AI technologies such as machine learning, predictive analytics, computer vision, and Building Information Modelling (BIM) integration have significant potential to improve project planning, cost estimation, safety management, resource optimization, and decision-making processes in the construction industry. However, AI adoption is currently concentrated among large construction firms and multinational companies, while small and medium-sized enterprises continue to face challenges related to limited financial resources, inadequate digital infrastructure, shortage of skilled personnel, and resistance to technological change. The study further established that organizational readiness, leadership commitment, and digital maturity are critical factors influencing successful AI implementation in construction project management practices.

Despite the identified barriers, the study highlights that the increasing advancement of digital technologies, growing awareness of AI benefits, and ongoing innovation initiatives present significant opportunities for the future integration of AI within the South African construction sector. The review therefore concludes that AI has the potential to transform construction project management by enhancing productivity, improving safety performance, reducing project delays, and supporting data-driven decision-making. However, achieving these benefits will require greater investment in digital infrastructure, professional training, supportive policy frameworks, and industry-wide collaboration. Further research is recommended to conduct empirical investigations into the practical implementation of AI technologies within South African construction projects, particularly among SMEs. Future studies should also explore the relationship between AI adoption and construction project performance, investigate AI readiness assessment models, and examine the ethical, regulatory, and workforce implications associated with AI-driven construction practices.

References

1) Aghimien, D., Aigbavboa, C., & Thwala, W. (2022). Artificial intelligence applications in construction project management and safety improvement. *Journal of Construction Engineering and Management,* 148(6).

2) Ayorinde, A., et al. (2025). Artificial intelligence-enabled construction project delivery and performance optimisation in South Africa. *International Journal of Construction Management,* Advance online publication.

3) Bajjou, M. S., et al. (2017). Lean construction and safety improvement using emerging digital technologies. *Procedia Engineering,* 196, 1030–1037.

The Seybold Report
ISSN 1533-9211
DOI: 10.5281/zenodo.20426049

4) Braun, V., & Clarke, V. (2019). Reflecting on reflexive thematic analysis. *Qualitative Research in Sport, Exercise and Health,* 11(4), 589–597.

5) CIDB (Construction Industry Development Board). (2021). *Construction industry development reports: Digital readiness and transformation.* Pretoria, South Africa: CIDB.

6) CIDB (Construction Industry Development Board). (2022). *State of the construction industry report.* Pretoria, South Africa: CIDB.

7) Daniel, N., et al. (2024). Barriers to artificial intelligence adoption in construction project management. *Journal of Engineering, Design and Technology,* 22(3), 455–472.

8) Department of Trade, Industry and Competition (DTIC). (2023). *South African national artificial intelligence strategy and innovation framework.* Pretoria, South Africa: DTIC.

9) Du, J. (2021). Integration of artificial intelligence and building information modelling for construction cost and time optimisation. *Automation in Construction,* 124, 103556.

10) Du, J., Wang, Y., & Li, X. (2021). AI and BIM integration for intelligent construction project management systems. *Journal of Construction Engineering and Management,* 147(9).

11) Elhegazy, M., et al. (2022). Artificial intelligence-based decision support systems in construction engineering and management. *Automation in Construction,* 135, 104123.

12) Kabirifar, K., Mojtahedi, M., Wang, C., & Tam, V. W. Y. (2020). Construction and demolition waste management: A systematic review and future directions. *Journal of Cleaner Production,* 263, 121–134.

13) Karaz, A., et al. (2021). Construction waste management and sustainability practices in the built environment. *Sustainability,* 13(8), 4215.

14) Li, H., & Love, P. E. D. (2018). Using data analytics for construction safety management and injury prevention. *Safety Science,* 101, 285–293.

15) Li, X., et al. (2023). Artificial intelligence applications for productivity improvement in construction projects. *Automation in Construction,* 140, 104423.

16) Mgolombane, M. (2023). Digital transformation and artificial intelligence adoption in the South African construction industry. *South African Journal of Construction Management,* 5(2), 77– 89.

17) Moyo, T., et al. (2023). Building information modelling and artificial intelligence adoption in South African construction project management. *International Journal of Project Management,* 41(5), 612–624.

18) Oesterreich, T. D., & Teuteberg, F. (2016). Understanding the implications of digitalisation and Industry 4.0 in construction. *Journal of Business Economics,* 86(6), 553–576.

19) Oke, A., & Aghimien, D. (2018). Awareness and adoption of digital technologies in construction project management. *Journal of Engineering, Design and Technology,* 16(5), 654–669.

20) Osunsanmi, T. O., Aigbavboa, C., & Oke, A. (2020). Digital construction technologies and sustainability in South Africa. *Smart and Sustainable Built Environment,* 9(2), 123–139.

21) Russell, S., & Norvig, P. (2021). *Artificial Intelligence: A Modern Approach* (4th ed.). Pearson.

22) Snyder, H. (2019). Literature review as a research methodology: An overview and guidelines. *Journal of Business Research,* 104, 333–339.

23) Zhang, J., & El-Gohary, N. M. (2021). Machine learning and natural language processing applications in construction engineering and management. *Automation in Construction,* 129, 103827.