# EXPLORING THE RISKS OF INTEGRATING GENERATIVE ARTIFICIAL INTELLIGENCE INTO CONSTRUCTION RISK MANAGEMENT: INSIGHTS FROM A SYSTEMATIC LITERATURE REVIEW

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## ABSTRACT

The rapid advancements in Generative Artificial Intelligence (GenAI) have unlocked transformative potential across various industries, including construction. With its ability to generate content, automate processes, and enhance decision-making, GenAI offers significant opportunities to improve the efficiency and accuracy of Construction Risk Management (CRM). However, its integration into CRM also brings a new set of risks and uncertainties that are unprecedented in traditional risk management frameworks. To this end, the purpose of this research is to identify and classify the key risks associated with integrating GenAI into CRM. To achieve this, a three-step systematic literature review was conducted, analysing 48 scholarly articles on GenAI for CRM from Scopus-indexed academic journals published between 2014 and 2024. A total of 25 risk factors associated with GenAI integration in CRM were identified and classified under seven key categories: financial risks, technological adaptability risks, information integrity risks, input quality risks, and ethical and governance risks. This study enhances the understanding of risk factors in GenAI integration by presenting a structured framework that categorises the associated risks of GenAI integration into CRM while highlighting their interconnectedness. It also lays the foundation for interdisciplinary approaches and future empirical research to validate and expand these insights across diverse construction contexts.

**Keywords:** Generative AI, GenAI risks, Construction Risk Management, Construction industry.

## 1. INTRODUCTION

The rapid advancement of Generative Artificial Intelligence (GenAI) offers transformative potential for industries like construction (Al-Mhdawi et al., 2023; Chenya et al., 2022). By leveraging predictive analytics, real-time insights, and automation, GenAI enhances decision-making, optimises workflows, and addresses the complex challenges of Construction Risk Management (CRM) (Nyqvist et al., 2024; Mohamed et al., 2024). These capabilities improve project outcomes, streamline operations, and reduce inefficiencies, making GenAI a game-changer in a sector defined by high costs, strict timelines, and diverse stakeholder demands (Jallow et al., 2023; Al-Mhdawi et al., 2023).

Despite its promise, integrating GenAI into CRM introduces significant risks that require careful evaluation. Data-related risks like unavailability, poor quality, and complexity can undermine AI-driven predictions (Adekunle et al., 2022; Holzmann and Lechiara, 2022). Ethical issues, including data biases, transparency gaps, and privacy concerns, further complicate adoption. Operational risks, such as disruptions from legacy system integration, inadequate workforce training, and cultural resistance, can exacerbate these challenges (Nabawy and Gouda, 2024; Regona et al., 2022). These risks threaten successful GenAI deployment, leading to delays, cost overruns, and reduced stakeholder satisfaction (Mohamed et al., 2025). While most research emphasizes GenAI's benefits in construction (e.g., Al-Mhdawi et al., 2023; Aladag, 2023; Hofert, 2023; Nyqvist et al., 2024), studies addressing the associated risks remain limited. Prior work has primarily focused on general AI applications, without systematically examining the specific risks unique to the integration of generative technologies into CRM. Additionally, there is a lack of structured frameworks to guide decision-makers in identifying, classifying, and mitigating these risks across different stages of the project lifecycle. While existing studies explore AI applications in CRM, the lack of structured frameworks addressing GenAI-specific risks highlights a critical gap in the literature. This research aims to bridge this gap by systematically categorizing these risks and proposing actionable insights.

To address these gaps, this research aims to identify and categorise the key risks associated with implementing GenAI into CRM. The findings contribute to the growing body of knowledge on risk management in technologically advanced construction settings and offer actionable insights for decision-makers to navigate the complexities of GenAI adoption effectively.

## 2. RESEARCH METHODOLOGY

This research adopts a structured, three-step approach to literature collection and analysis, aimed at thoroughly examining existing studies to identify the key risks associated with GenAI into CRM. The first step involves identifying relevant databases and journals to establish a solid foundation for the literature search. The second step focuses on strategically selecting articles through targeted keywords to ensure the inclusion of the most relevant studies. Finally, the third step involves conducting a systematic content analysis to extract meaningful insights. This methodology is informed by the frameworks proposed in several risk management studies, notably those by Al-Mhdawi et al. (2024a), Al-Mhdawi et al. (2024b), and Mohamed et al., (2024), as illustrated in Figure 1.

**Step One**: **Database and Journal Identification**

In this research Scopus database was chosen due to its comprehensive coverage of relevant research disciplines and their established use in comparable literature-based studies within construction management research. The selection of target journals for this study was based on the following criteria: (1) the journals must be published in English, (2) they must have a minimum impact factor of 1.0, and (3) they must be ranked in the top quartile of the Scopus database, recognised for their significant influence in shaping construction management research.

**Step Two: Keyword Identification and Article Selection**

In this step, a comprehensive search was conducted using the title/abstract/keyword (T/A/K) fields in the Scopus search engine. The search keywords included GenAI risks, GenAI, GenAI in CRM, and GenAI in construction project management. Papers containing these specific terms in the title, abstract, or keywords were deemed to have met the initial criteria for further analysis. These keywords were carefully selected to capture a broad range of studies addressing the risks and applications of GenAI in CRM and related domains. Papers containing these specific terms in any of the T/A/K fields were considered to meet the preliminary inclusion criteria. The results were further filtered to eliminate duplicate entries, irrelevant studies, and papers that lacked substantive focus on the intersection of GenAI and CRM. Additionally, articles were included if they focused on GenAI in CRM or related fields, published between 2014 and 2024. Exclusion criteria eliminated studies on general AI, non-construction domains, and those lacking methodological rigor or peer-review.

**Step Three: Content Analysis**

Hsieh and Barman et al. (2021) identify three approaches to content analysis: conventional, directed, and summative. This study employed conventional content analysis, an open-ended, data-driven method that allows categories to emerge naturally without relying on predefined frameworks (Blomkvist, 2015; Al-Mhdawi et al., 2024c). This approach, suitable for both qualitative and quantitative analysis, is ideal for exploring the emerging topic of integrating GenAI into CRM, as it captures detailed themes directly from the data (Kibiswa, 2019). Unlike directed analysis, it avoids constraints from existing theories, enabling a rich, context-specific understanding (Hsieh and Shannon, 2005; Krippendorff, 2018). Through this method, the study systematically narrowed 183 initial papers to 48, identifying key risks and categories associated with GenAI in CRM.

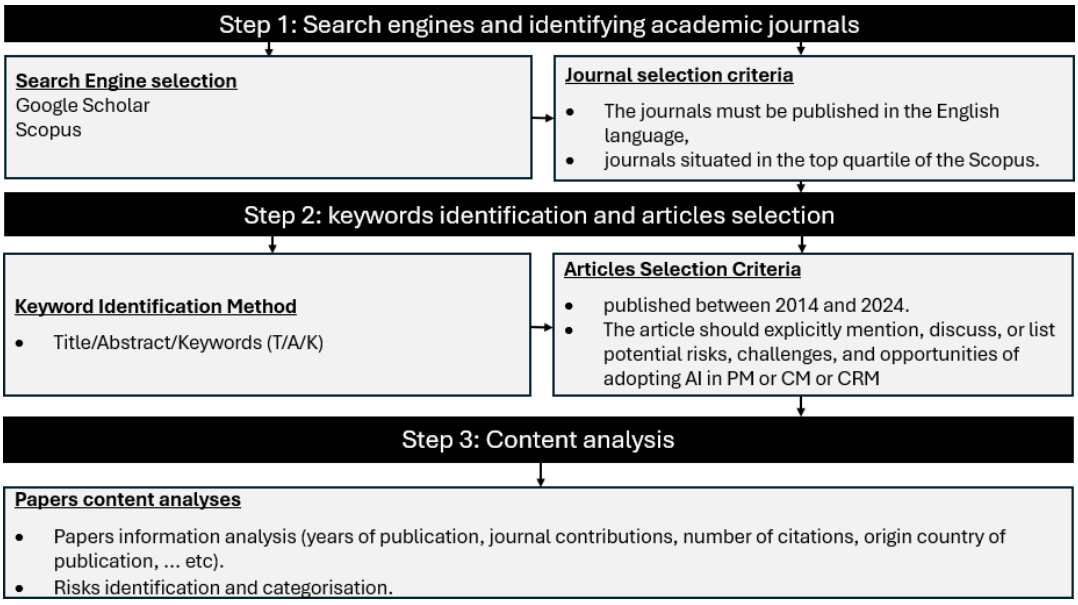


**Figure 1.** Adopted research methodology

## 3. RESULTS AND DISCUSSION

Based on the adopted research methodology, a total of 48 scholarly articles were analysed to identify the key risks of GenAI integration into CRM. This analysis yielded 25 key risk factors classified under five categories, namely: financial risks, input quality risks, technological adaptability risks, information integrity risks, and ethical and governance risks. Figure 2 illustrates the identified risks and their respective categories.

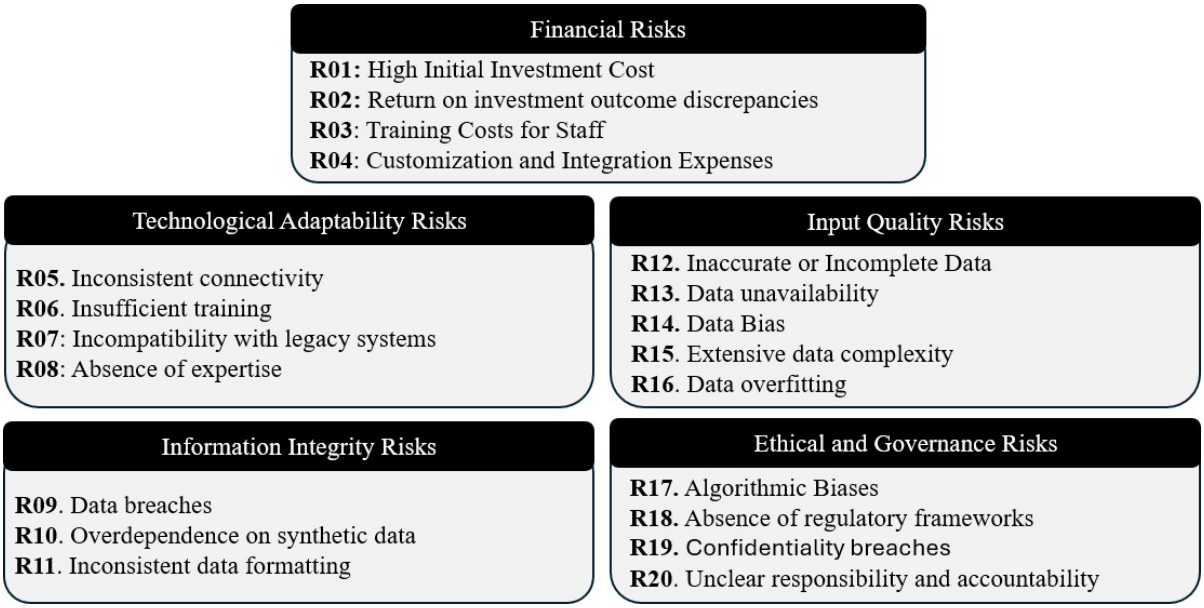


**Figure 2.** Identified Risks of Integrating GenAI into CRM

The findings reveal a complex interplay of technological, financial, operational, and ethical factors influencing the adoption of GenAI into CRM. Among these, financial risks stand out as a significant concern. Research by Chenya et al. (2022) and Nabawy and Gouda Mohamed (2024) highlights the necessity of conducting CRM-specific cost-benefit analyses (Al-Mhdawi et al. 2024d). These analyses not only clarify the economic feasibility of GenAI adoption but also help address stakeholder concerns by demonstrating potential long-term savings and operational efficiencies. For example, innovative financial models that account for both initial investment costs and operational gains could significantly bolster stakeholder confidence. This aligns with prior studies (e.g., Zhou et al., 2019), which highlight the critical role of financial viability in technology adoption.

Another vital dimension is information integrity risks, which are amplified by the interconnected nature of construction projects. Díaz-Curbelo et al. (2020) emphasise the prevalence of cybersecurity threats, such as data breaches, that can compromise project outcomes and stakeholder trust. Tackling these risks requires robust cybersecurity frameworks. Recent advancements, such as adversarial machine learning proposed by Mohamed et al. (2024), offer innovative solutions to protect sensitive project data. These findings resonate with broader calls for construction-specific cybersecurity measures, as highlighted by Smith et al. (2021). Input quality also emerges as a pivotal factor. The dynamic and complex nature of construction projects demands high-quality, contextually relevant data for GenAI systems to deliver accurate and actionable insights. Research by Ahuvia (2001) and Poh et al. (2018) highlights the importance of data relevance and completeness for effective decision-making. Aligning with these insights, Meng et al. (2022) advocate for integrating real-time data validation systems to enhance the reliability of AI outputs in construction applications.

Technological adaptability risks pose an additional layer of risks, particularly in resource-constrained settings. Pan and Zhang (2021) and Jallow et al. (2023) stress the need for resilient infrastructure and offline AI capabilities to maintain operational continuity under suboptimal conditions. The co-design of localised AI tools with industry professionals is especially critical for addressing site-specific challenges and ensuring the practical application of GenAI in diverse construction scenarios. This approach aligns with Marra and Kearney (2020), who emphasise co-creation strategies to bridge gaps between innovation and field-specific needs. Lastly, ethical and governance risks further complicate the integration of GenAI into CRM. Risks such as algorithmic bias, lack of transparency, and inadequate regulatory frameworks threaten equitable and effective adoption. Holzmann and Lechiara (2022) highlight the need for transparent governance mechanisms and evolving regulations to promote responsible innovation. Similarly, Pillai and Matus (2020) argue for stakeholder-inclusive policymaking to foster ethical AI practices. These perspectives align with global discussions, such as Floridi and Cowls (2022), which advocate for

accountability and equity in AI governance to build trust and ensure sustainable adoption. Additionally, organisational resistance, driven by a lack of awareness or reluctance to embrace AI-driven changes, poses a significant barrier to ethical adoption. Overcoming these challenges requires stakeholder engagement, educational programs, and collaborative policy development to build trust and acceptance.

## 4. CONCLUSIONS

This research aimed to identify the key risks associated with integrating GenAI into CRM. Through an analysis of 48 scholarly articles, 25 key risk factors were identified and categorised into five primary areas: financial risks, technological adaptability risks, information integrity risks, input quality risks, and ethical and governance risks. The findings highlight that integrating GenAI into CRM presents a complex interplay of risks spanning financial, operational, technological, and ethical dimensions. This study offers both practical and theoretical implications. Practically, it highlights the need for targeted risk mitigation strategies, such as cost-benefit analyses and innovative financial models to address financial risks, robust cybersecurity frameworks to safeguard information integrity, and real-time data validation systems to enhance input quality. Tailored technology solutions and co-created AI tools are recommended to tackle technological adaptability risks, while transparent governance mechanisms and stakeholder-inclusive policymaking can promote ethical AI practices. Building on these implications, specific mitigation strategies can be applied across different stages of the construction project lifecycle real-time data validation and bias audits in the design phase, financial risk models in planning, cybersecurity and training in execution, and monitoring with transparent governance in post-execution. Organisations are also encouraged to invest in capacity building to upskill their workforce for GenAI adoption. Theoretically, the study contributes to the understanding of risk factors in GenAI integration by providing a structured framework categorising financial, operational, technological, and governance risks, and emphasising their interconnectedness. Additionally, the findings lay the groundwork for interdisciplinary approaches and future empirical research to validate and expand these insights in diverse construction contexts.

Advancing the integration of GenAI into CRM requires a comprehensive and well-coordinated approach. A critical step involves investing in return on investment (ROI) models specifically designed to highlight the unique benefits of CRM applications. These models can effectively demonstrate long-term savings and operational efficiencies, offering a clear justification for stakeholders to support adoption by emphasising value beyond the initial costs (Regona et al., 2022). Alongside financial considerations, robust cybersecurity measures are essential to safeguard sensitive project data. Real-time threat detection systems powered by advanced algorithms provide proactive defences, while continuous monitoring within interconnected project ecosystems minimises the risk of data breaches (Díaz-Curbelo et al., 2020). To enhance reliability further, implementing data standardisation practices ensures consistent and accurate inputs for AI systems. Industry-wide protocols can improve interoperability, reduce errors, and facilitate seamless integration across diverse platforms (Anysz et al., 2021). Additionally, addressing the variability of construction site conditions necessitates the development of adaptable AI tools with offline capabilities. Such tools offer scalable solutions suited to resource-constrained environments (Pan and Zhang, 2021). Equally important is building trust, which can be achieved through transparent governance structures that mitigate biases and ensure accountability. At the same time, regulatory frameworks should evolve to balance fostering innovation with upholding ethical standards (Holzmann and Lechiara, 2022).

## REFERENCES


Adedokun, O.A., Aje, I.O. and Agboola, O.J., 2019. Investigation into the severity of factors predisposing construction projects to risks in Nigeria. *Journal of Building Performance ISSN*, *10*(1), p.2019.

Adekunle, P., Aigabvboa, C., Thwala, W., Akinradewo, O., & Oke, A. (2022). Challenges confronting construction information management. Frontiers in Built Environment, 8, 1075674.

Ahuvia, A. (2001). Traditional, interpretive, and reception-based content analyses: Improving the ability of content analysis to address issues of pragmatic and theoretical concern. Social Indicators Research, 54, 139–172

Aladağ, H. and Işik, Z., 2018. The effect of stakeholder-associated risks in mega-engineering projects: A case study of a PPP airport project. IEEE Transactions on Engineering Management, 67(1), pp.174-186.

Aladag, H., 2023. Assessing the accuracy of ChatGPT use for risk management in construction projects. *Sustainability*, *15*(22), p.16071.

Al-Mhdawi, M.K.S., O'Connor, A. and Qazi, A., 2024b. Structural equation modeling and Fuzzy set theory: Advancing risk assessment in oil and gas construction projects. *Environmental Impact Assessment Review*, *109*, p.107622.

Al-Mhdawi, M.K.S., Qazi, A., Alzarrad, A., Dacre, N., Rahimian, F., Buniya, M.K. and Zhang, H., 2023. Expert evaluation of ChatGPT performance for risk management process based on ISO 31000 standard. *SSRN Electronic Journal*, pp.1-6.

Al-Mhdawi, M.K.S., O'connor, A., Qazi, A., Rahimian, F. and Dacre, N., 2024a. Review of studies on risk factors in critical infrastructure projects from 2011 to 2023. *Smart and Sustainable Built Environment*.

Al-Mhdawi, M.K.S., O'Connor, A. and Qazi, A., 2024c. Structural equation modeling and Fuzzy set theory: advancing risk assessment in oil and gas construction projects. *Environmental Impact Assessment Review*, *109*, p.107622.

Al-Mhdawi, M.K.S., Qazi, A., Karakhan, A.A., Rahimian, F.P., Abualqumboz, M., Al Mhdawi, A.K. and Al-Raweshidy, H., 2024d. Implementation of a Combined Fuzzy Controller Model to Enhance Risk Assessment in Oil and Gas Construction Projects. *IEEE Access*.

Anysz, H., Apollo, M. and Grzyl, B., 2021. Quantitative risk assessment in construction disputes based on machine learning tools. *Symmetry*, *13*(5), p.744.

Chenya, L., Aminudin, E., Mohd, S. and Yap, L.S., 2022. Intelligent risk management in construction projects: Systematic Literature Review. IEEE Access, 10, pp.72936-72954.

Díaz-Curbelo, A., Espin Andrade, R.A. and Gento Municio, Á.M., 2020. The role of fuzzy logic to dealing with epistemic uncertainty in supply chain risk assessment: Review standpoints. International Journal of Fuzzy Systems, 22(8), pp.2769-2791.

Eber, W., 2020. Potentials of artificial intelligence in construction management. Organization, technology & management in construction: an international journal, 12(1), pp.2053-2063.

Floridi, L. and Cowls, J., 2022. A unified framework of five principles for AI in society. Machine learning and the city: Applications in architecture and urban design, pp.535-545.

Hofert, M., 2023. Assessing ChatGPT's proficiency in quantitative risk management. *Risks*, *11*(9), p.166.

Holzmann, V. and Lechiara, M., 2022. Artificial intelligence in construction projects: An explorative study of professionals' expectations. *European Journal of Business and Management Research*, *7*(3), pp.151-162.

Hu, Y. and Castro-Lacouture, D., 2019. Clash relevance prediction based on machine learning. *Journal of computing in civil engineering*, *33*(2), p.04018060.

Jallow, H., Renukappa, S., Suresh, S. and Rahimian, F., 2023. Artificial intelligence and the UK construction industry–empirical study. *Engineering Management Journal*, *35*(4), pp.420-433.

Lachhab, M., Béler, C. and Coudert, T., 2018. A risk-based approach applied to system engineering projects: A new learning based multi-criteria decision support tool based on an Ant Colony Algorithm. *Engineering Applications of Artificial Intelligence*, *72*, pp.310-326.

Louis, J. and Dunston, P.S., 2018. Integrating IoT into operational workflows for real-time and automated decision-making in repetitive construction operations. *Automation in Construction*, *94*, pp.317-327.

Mohamed, M.A.H., Al-Mhdawi, M.K.S., Dacre, N., Ojiako, U., Qazi, A. and Rahimian, F., 2024. Theoretical and practical instantiations of generative AI in construction risk management: An analytical exposition of its latent benefits and inherent risks. Available at SSRN: http://dx.doi.org/10.2139/ssrn.5007208

Mohamed, M.A.H., Al-Mhdawi, M.K.S., Ojiako, U., Dacre, N., Qazi, A. and Rahimian, F., 2025. Generative AI in construction risk management: a bibliometric analysis of the associated benefits and risks. Urbanization, Sustainability and Society, 2(1), pp.196-228.

Nabawy, M. and Gouda Mohamed, A., 2024. Risks assessment in the construction of infrastructure projects using artificial neural networks. *International Journal of Construction Management*, *24*(4), pp.361-373.

Nyqvist, R., Peltokorpi, A. and Seppänen, O., 2024. Can ChatGPT exceed humans in construction project risk management?. *Engineering, Construction and Architectural Management*, *31*(13), pp.223-243.

Obiuto, N.C., Adebayo, R.A., Olajiga, O.K. and Festus-Ikhuoria, I.C., 2024. Integrating artificial intelligence in construction management: Improving project efficiency and cost-effectiveness. *Int. J. Adv. Multidisc. Res. Stud*, *4*(2), pp.639-647.

Pan, Y. and Zhang, L., 2021. Roles of artificial intelligence in construction engineering and management: A critical review and future trends. *Automation in Construction*, *122*, p.103517.

Parveen, R., 2018. Artificial intelligence in construction industry: Legal issues and regulatory challenges. *International Journal of Civil Engineering and Technology*, *9*(13), pp.957-962.

Pillai, V.S. and Matus, K.J., 2020. Towards a responsible integration of artificial intelligence technology in the construction sector. *Science and Public Policy*, *47*(5), pp.689-704.

Poh, C.Q., Ubeynarayana, C.U. and Goh, Y.M., 2018. Safety leading indicators for construction sites: A machine learning approach. *Automation in construction*, *93*, pp.375-386.

Prasad Agrawal, K., 2024. Towards adoption of generative AI in organizational settings. *Journal of Computer Information Systems*, *64*(5), pp.636-651.

Regona, M., Yigitcanlar, T., Xia, B. and Li, R.Y.M., 2022. Opportunities and adoption challenges of AI in the construction industry: A PRISMA review. *Journal of open innovation: technology, market, and complexity*, *8*(1), p.45.

Schwarzkopf, D.L., 2006. Stakeholder perspectives and business risk perception. *Journal of Business Ethics*, *64*, pp.327-342.