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Bibliometric Analysis for Modeling in Construction Risk Management: A Literature Review

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Abstract

Effective risk management and strategic planning are critical determinants of success in construction projects. To explore the academic landscape surrounding construction risk management, a total of 284 scholarly sources were systematically reviewed. These included 222 journal articles, 36 conference proceedings, 21 books, one doctoral dissertation, two master's theses, and two patents, all published between 2000 and 2024. The literature was identified through rigorous searches of academic databases, digital libraries, and scientific search engines. The analysis reveals that while conventional approaches—such as Work Breakdown Structure (WBS), regional strategies, and equilibrium-based frameworks—remain in use, increasing scholarly attention has been directed toward mathematical modeling techniques grounded in optimization theory. These models are favored for their enhanced efficiency and efficacy in selecting risk response strategies within construction environments. The advanced model identified in the literature integrates multi-objective optimization, accounting not only for traditional parameters such as time, cost, and quality, but also for project resilience and resource fluctuation control. Notably, the incorporation of plan resilience and resource fluctuation control into an optimization-based risk management framework marks a significant innovation in the field. Furthermore, this model supports the concurrent identification and evaluation of both influential and affected risks, enabling the development of synchronized response strategies that foster synergistic risk mitigation. Application of this model in large-scale and high-rise construction projects demonstrates its potential to improve overall project outcomes by systematically balancing key performance objectives.

Keywords: *Construction management, risk management, bibliometric analysis, literature review.*

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1. Introduction

The construction industry is a fundamental driver of economic development, playing a crucial role in shaping infrastructure and enhancing quality of life on a global scale [1]. Employers and contractors in this sector are responsible not only for constructing roads, buildings, and workplaces but also for managing and modernizing the global physical infrastructure [2]. Given the complexity of construction activities, the importance of improving safety standards to ensure secure working conditions has been increasingly emphasized. This focus on occupational health and safety is critical, as it directly influences economic growth and has wide-ranging impacts on social development, including income distribution and standards of living. The industry supports national objectives such as education, healthcare, and housing through the provision of essential infrastructure and investment opportunities [3-6].

Non-compliance with safety regulations in the construction sector often results in cost overruns, project delays, compromised quality, reduced resilience, and disrupted resource control. Workplace accidents lead to additional expenses and prolonged timelines, ultimately affecting project quality. Moreover, sudden changes in planning, coupled with workforce and equipment losses, pose challenges to effective resource management. Therefore, safety is not only a matter of physical well-being but also a strategic element essential to project success [7]. Notably, large construction projects tend to exceed initial timelines by approximately 20% and surpass projected budgets by an average of 80%, underscoring the urgent need for robust risk assessment mechanisms to improve safety, cost efficiency, and project quality [5].

Risk encompasses both threats and opportunities, and thus demands an integrated approach through dynamic systems thinking [8]. As a multidisciplinary construct, risk is studied across various domains—statistics, psychology, and economics offer foundational insights, while fields such as biology and engineering focus on specific categories, such as environmental or technological risks. The discipline of risk analysis synthesizes these diverse perspectives, emphasizing the need to understand uncertainty and individual perceptions of risk within decision-making contexts. The absence of a universally accepted definition—given risk's overlap with concepts like hazard, safety, and uncertainty—further illustrates its conceptual complexity [9]. Risk has been aptly defined as "uncertainty that matters" [9], and its materialization can yield either positive or negative consequences across multiple project objectives [10]. When considered purely from a negative perspective, risk is synonymous with hazard.

Effective risk management in construction projects is instrumental in mitigating delays, reducing costs, and minimizing inefficiencies. Comprehensive identification, documentation, and planning of risk management indicators significantly enhance resource productivity and overall project performance. Moreover, beyond averting project failure or bankruptcy, successful risk management improves competitive advantage by minimizing losses, strengthening organizational reputation, and enhancing financial liquidity. An effective risk management framework must account for stakeholder-specific risk preferences and cognitive biases while simultaneously addressing tangible and intangible outcomes [4, 11-13].

The necessity of developing innovative and holistic risk management approaches has been further reinforced in light of global disruptions, such as epidemics, pandemics, geopolitical conflicts, energy crises, currency volatility, and international sanctions. The COVID-19 pandemic, in particular, exposed the limitations of traditional risk management practices and accentuated the demand for modern methodologies, including enhanced risk monitoring and adaptive control mechanisms. These crises have had a profound effect on the construction workforce, project costs, timelines, and quality—necessitating strategic responses that improve operational performance, safety standards, and health protocols. The need for further research aimed at cultivating resilience and adaptability in the face of future challenges has become increasingly evident, as these factors significantly affect project success and stakeholder satisfaction during periods of global instability [4].

Bibliometric analysis offers a systematic, quantitative methodology for evaluating scholarly literature to uncover structural patterns and emerging trends. This process typically involves the extraction of publication data from reputable databases such as Scopus or Web of Science, followed by data refinement and the application of advanced bibliometric techniques to derive actionable insights [14]. Bibliometric analysis is especially valuable for mapping the intellectual structure of a field, identifying frequently occurring terms, influential scholars, and emerging areas of inquiry. Its utility extends to analyzing co-word patterns, research frontiers, and institutional contributions [15].

This analytical approach has proven particularly insightful in tracing the evolution of research on risk management within the construction sector. It has illuminated key focus areas such as analytical risk modeling, stakeholder engagement, and the deployment of knowledge-based decision-support systems [16, 17]. Recent bibliometric trends underscore the growing relevance of risk management as a specialized domain within the broader field of project management. The literature reveals increased attention to the adoption of Industry 4.0 technologies in high-rise building projects, with innovations such as virtual reality training and automated workflows enhancing execution efficiency and workplace safety [18].

In light of these developments, this paper conducts a comprehensive systematic literature review to assess the current state of academic research on risk management modeling in the construction industry. The aim is to identify optimal methodologies for risk response selection that can enhance decision-making processes and project outcomes in this critical sector.

2. Methodology

This study employed a comprehensive literature review followed by a bibliometric analysis to identify key patterns and trends in the field of construction risk management. The literature was sourced from four main databases: Scopus, Web of Science, Google Scholar, and Iranpaper. Scopus is a widely used abstract and citation database, often compared with Web of Science, and both are considered vital tools for researchers, academic institutions, and governmental agencies due to their extensive coverage of peer-reviewed scholarly content. Google Scholar was also utilized as a valuable open-access tool for locating full-text academic publications. Its utility lies in its ability to provide free links to downloadable content, which is particularly beneficial for researchers in regions with limited access to paid databases. Iranpaper, a regional academic platform, offers access to scientific articles, books, theses, and standard documents, catering to students, researchers, and faculty members in Persian-speaking academic communities.

The primary objectives of this study are as follows: (i) to map the current body of knowledge by identifying key articles related to risk assessment and classification in the construction industry; (ii) to summarize the methodologies, tools, and techniques utilized in the field; (iii) to model risk management processes and optimize risk response selection based on the objectives of project managers, through classification of current research; and (iv) to highlight future research opportunities. This review-oriented method enables a structured understanding of core concepts and analysis of significant findings, forming a foundation for the development of new theoretical and practical insights. This study employs a three-stage approach: formulation of research questions, evaluation of existing evidence, and identification of research gaps.

2.1. Research Questions

To address these objectives, a set of research questions is provided. Due to the broad nature of Question 1, it is divided into three sub-questions—1.1, 1.2, and 1.3—for more targeted investigation. These questions guide the entire analysis and align with the study's overarching aim to explore methodologies, tools, and applications of artificial intelligence in construction-related risk management while also identifying emerging research needs.

1. What is the current status of optimization models applied to risk management in the construction industry between 2000 and 2024?
   1.1 What trends have existed in research publications on risk management modeling in the construction sector from 2000 to 2024?
   1.2 Which are the most influential and active journals in the field of risk management modeling research, and what is their significant contribution?
   1.3 What is the global spread of research activity in risk management modeling based on country studies?
2. What is the evolution of the conceptualization of risk management modeling stages and risk classification in construction sector research between 2000 and 2024?
3. What traditional and commonly used tools and techniques have been adopted to address risks in the construction industry from 2000 to 2024?
4. What is the impact of artificial intelligence on the identification and response to risks in the construction industry?

Each of these questions is addressed in subsequent sections of the study, contributing to the achievement of the stated research objectives. A specific set of keywords was used to guide the search process.

2.2. Keywords used for the search process:

"Risk management" OR "Modeling" OR "Multi-objective optimal model" OR "Interdependencies of risks" OR "Construction" OR "Multi-objective modeling" OR "Risk assessment" OR "Risk analysis" OR "Risk optimization" OR "Construction risks" OR "Risk management in construction projects" OR "Common construction risks" OR "Artificial intelligence" OR "Neural networks in risk management"

2.3. Inclusion and Exclusion Criteria

The search strategy was designed to identify academic literature focusing on risk management in the construction industry, particularly on optimization-based response strategies and model development. Inclusion criteria were defined to ensure the relevance and quality of the selected studies. Eligible studies were required to focus on construction-related risk management and present approaches for selecting risk responses. Additionally, studies employing artificial intelligence techniques in construction risk management were evaluated separately. Only peer-reviewed journal articles written in English and published in final, accessible formats were included to ensure rigor and reproducibility. The studies needed to present substantial content that could be referenced by researchers, practitioners, and stakeholders.

The exclusion criteria eliminated non-journal literature such as conference proceedings, book chapters, news articles, and posters. Furthermore, studies that were not directly related to risk management in the construction industry or were written in languages other than English were excluded. This ensured a focused and consistent analysis that would be accessible to a global academic and professional audience.

2.4. Selection Process of Sources

The source selection process followed a multi-stage filtering approach. In the first stage, duplicate entries were removed. In the second stage, titles and abstracts were screened, and non-relevant studies were excluded. In the third stage, the full texts of the remaining articles were reviewed, and those not meeting the inclusion criteria were eliminated. Data were then extracted from the final pool of selected studies.

This process began with a total of 800 retrieved articles. After the application of all inclusion and exclusion criteria, 284 references remained. These comprised 222 journal articles, 36 conference papers, 21 books, one doctoral dissertation, two master's theses, and two patents. All sources were published between 2000 and 2024, with the analysis focusing primarily on the 222 journal articles that met all quality and content requirements.

3. Findings and Results

3.1. Publication Activity Over Time

The bibliometric analysis revealed that research on risk management in the construction sector has significantly increased from 2000 to 2024. Table 1 displays the annual number of publications, and Figure 1 visualizes the trend.

Table 1. Publication Activity from 2000 to 2024

Year	Number of Records	Percentage	Year	Number of Records	Percentage
2000	2	1.35%	2013	7	4.74%
2001	1	0.68%	2014	7	4.73%
2002	2	1.35%	2015	7	4.73%
2003	3	2.03%	2016	8	5.41%
2004	2	1.35%	2017	9	6.08%
2005	3	2.03%	2018	10	6.76%
2006	4	2.70%	2019	5	3.38%
2007	4	2.70%	2020	7	4.73%
2008	5	3.38%	2021	8	5.41%
2009	5	3.38%	2022	9	6.08%
2010	6	4.05%	2023	10	6.76%
2011	6	4.05%	2024	15	10.14%
2012	6	4.05%			

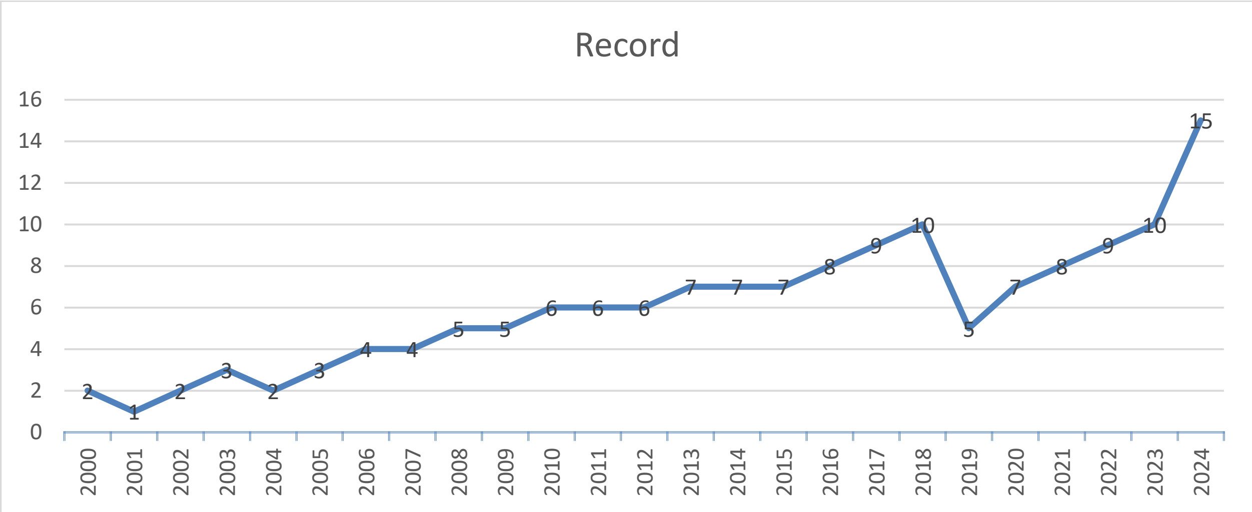

Figure 1. Annual publication activity in construction risk management from 2000 to 2024.

This table presents the annual distribution of publications on risk management modeling in construction from 2000 to 2024. It shows a gradual increase in publication activity over the years, with a significant peak in 2024 (15 records, 10.14%). The data indicate a growing research interest in this topic, particularly in the last decade.

3.2. *Research Areas of Risk Management in Construction*

This table identifies the primary research areas related to risk management modeling in construction. Civil Engineering accounts for the majority of publications (51.01%), followed by Industrial Engineering (35.98%). The data reflect the interdisciplinary nature of construction risk research, with contributions from various engineering subfields.

Table 2. Most Common Research Areas in the Web of Science Database

Research Area	Number of Records	Percentage
Civil Engineering	909	51.01%
Industrial Engineering	641	35.98%
Manufacturing Engineering	155	8.70%
Building Technology	45	2.53%
Multidisciplinary Engineering	16	0.90%
Engineering Manufacturing	15	0.88%

3.3. *Most Relevant Journals*

This table ranks the top 10 journals contributing to research on optimization in construction risk management. "Automation in Construction" leads with the highest number of articles and citations. High h-index and g-index values across journals suggest the presence of influential and highly cited research in the field.

Table 3. Journals with the Highest Number of Publications and Citation Metrics (2000–2024)

Journal Source	No. of Articles	h-index	g-index	Total Citations
Automation in Construction	66	16	30	1476
Annals of Operations Research	49	13	23	1100
IEEE Transactions on Engineering Management	46	10	21	1017
Journal of Construction Engineering and Mgmt.	40	12	35	933
Sustainability	53	14	26	1280
Reliability Engineering & System Safety	59	15	28	1361

Buildings	36	10	20	902
Journal of Portfolio Management	26	9	18	722
Environmental Eng. and Management Journal	23	8	15	574
International Journal of Civil Engineering	33	9	16	820

3.4. Geographic Distribution of Publications

The following figure illustrates the global distribution of publication activity. China leads in total contributions, followed by the United States, the United Kingdom, and Iran. These countries together account for 77.77% of all articles analyzed.

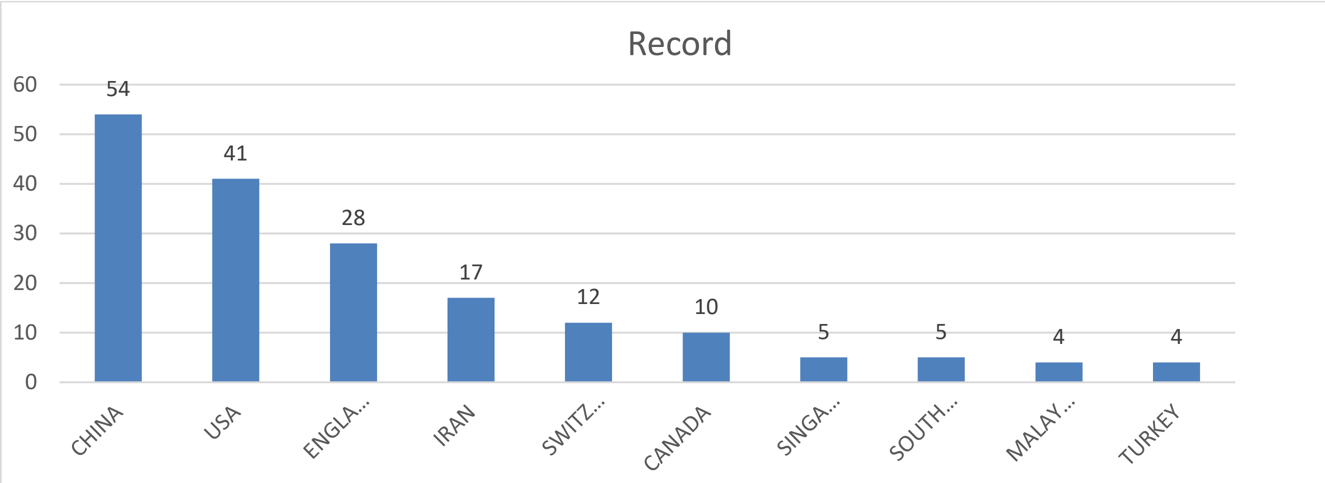

Figure 2. Top 10 countries by number of publications on risk management and modeling in the construction sector (2000–2024).

3.5. Comparative Analysis of Risk Response Approaches

The table compares the relative prevalence of four main risk response approaches—optimization, WBS-based, balance, and charting tools—across three key years: 2000, 2010, and 2024. The optimization approach shows consistent growth over time, indicating a shift in research and practice toward data-driven and analytical models.

Table 4. Distribution of Risk Response Approaches in 2000, 2010, and 2024

Year	Optimization Approach (%)	WBS Approach (%)	Balance Approach (%)	Charting Tools (%)
2000	25% (2 articles)	25% (2)	12.5% (1)	37.5% (3)
2010	42.8% (6)	21.4% (3)	7.1% (1)	28.5% (4)
2024	47% (15)	25% (8)	9.3% (3)	18.7% (6)

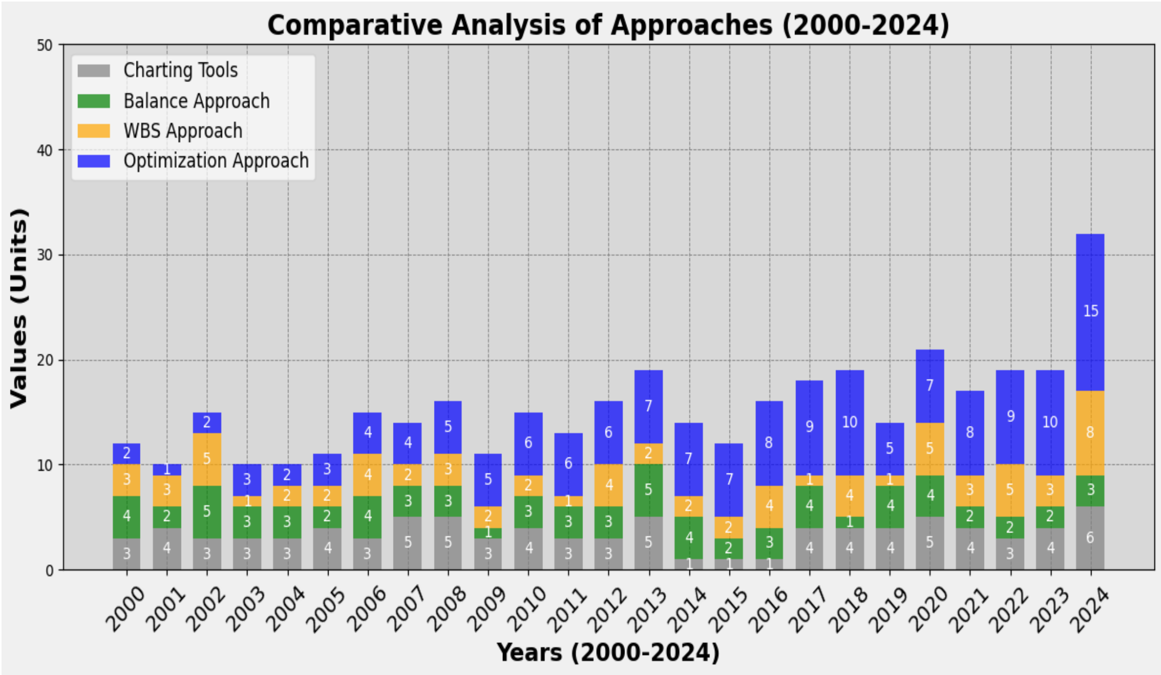

Figure 3. Application frequency of regional-based (chart), balance, WBS, and optimization approaches from 2000 to 2024.

4. Discussion and Conclusion

The findings of this bibliometric analysis demonstrate a clear upward trend in scholarly interest in construction risk management over the past two decades. The increase in publication activity, particularly between 2020 and 2024, signals a growing recognition of the critical role risk management plays in project success. This is consistent with global developments that have heightened awareness of risk, such as the COVID-19 pandemic, geopolitical tensions, and disruptions to global supply chains [19]. As noted in previous studies, the effective management of risk in construction has become central to project planning and execution, and researchers have increasingly responded by developing models and frameworks to address emerging challenges [8].

The results confirm the growing adoption of optimization-based models in risk response strategies, particularly in recent years. Optimization techniques offer significant advantages over traditional approaches by enabling project managers to assess multiple conflicting objectives simultaneously—such as cost, time, quality, and safety—and select the most balanced solution [20, 21]. These models are particularly valuable in complex construction environments characterized by uncertainty and interdependent risks. For instance, multi-objective optimization frameworks have been used to manage budget limitations while simultaneously addressing environmental and secondary risks [22].

The analysis also revealed that the most prolific research categories are Civil and Industrial Engineering, underscoring the inherently technical and interdisciplinary nature of risk management in the construction domain. This finding supports earlier research that identified these fields as central to risk analysis, especially in large-scale infrastructure and industrial projects [16]. The prominence of these disciplines also reflects the increasing application of engineering-based methodologies such as the DEMATEL method [23] and network-based uncertainty modeling [19].

Moreover, journals such as Automation in Construction, Reliability Engineering & System Safety, and Sustainability have emerged as key outlets for disseminating research on risk optimization. These journals not only demonstrate high productivity but also exhibit strong citation performance, suggesting that their articles have significant influence on shaping future research directions [23-25]. This supports the notion that impactful, high-visibility publications often serve as anchors for theoretical and applied advances in the field.

Geographically, China, the United States, and the United Kingdom dominate publication output, indicating both institutional capacity and strategic interest in managing risk within construction projects. This distribution aligns with broader global trends where leading economies invest in infrastructure development while concurrently emphasizing risk mitigation frameworks to protect those investments [3].

One of the most significant shifts identified in this review is the growing role of artificial intelligence (AI) in the modeling of construction risk. AI technologies—particularly machine learning, neural networks, and natural language processing—are increasingly used to forecast potential risks, identify correlations, and automate the selection of mitigation strategies [26]. Studies have shown that AI-based systems can outperform traditional statistical methods by processing larger volumes of data in real time and adapting to changing project conditions [27]. For instance, the integration of AI-driven image recognition tools has allowed project managers to detect safety issues through automated surveillance analysis, thereby enhancing site monitoring and preventive action planning [28].

Despite these advances, several research gaps remain. First, many studies still rely on conceptual frameworks without providing empirical validation through real-world case studies. As highlighted by Safaeian et al. (2024), the lack of data-driven testing limits the applicability of theoretical models in practical settings. Second, the literature tends to focus more on risk identification and assessment, while less attention is paid to the systematic evaluation of risk response alternatives and post-implementation outcomes [29, 30]. Third, few models explicitly account for stakeholder diversity in risk perception and decision-making, which is critical in large infrastructure projects involving multiple actors [31].

The integration of AI tools in risk assessment also faces several challenges. While these tools offer increased accuracy and speed, they often require high-quality, structured data, which may not be readily available on all construction sites. Moreover, the adoption of AI demands significant upfront investment in technology and skilled personnel, potentially creating barriers for smaller firms [13]. The ethical implications of relying on algorithmic decision-making in high-risk environments must also be considered [32].

Looking at traditional methods, the Work Breakdown Structure (WBS) and balance approaches continue to be used, particularly in developing contexts where computational resources may be limited [33, 34]. However, their declining prevalence compared to optimization models suggests a global transition toward data-centric strategies. While charting tools still offer visual advantages for communicating risk relationships, they lack the analytical depth required for dynamic risk environments. Hence, their use is expected to become increasingly complementary rather than standalone [17].

Another point of interest is the alignment of the PMBOK® framework with optimization modeling in risk management. The structured approach advocated by PMBOK®—which includes risk planning, identification, qualitative and quantitative analysis, response planning, and monitoring—provides a robust foundation that can be enhanced through mathematical modeling and AI integration [35]. Case studies have confirmed that applying PMBOK® principles along with modern analytical tools results in measurable improvements in project delivery outcomes [36].

Multilayer network analysis represents a novel and increasingly accepted approach for studying stakeholder interactions and their influence on risk propagation. By integrating quantitative modeling with qualitative stakeholder assessments, this method provides a more holistic view of risk scenarios. It also allows decision-makers to evaluate the resilience of entire project networks, rather than isolated components, which is particularly valuable in megaprojects where cascading risks are common [31].

A noteworthy observation in this review is the increase in bibliometric and scientometric studies aimed at evaluating the structure and evolution of risk management research itself. This meta-analytical perspective enhances transparency in the field and informs researchers of current trends and underexplored areas [14, 15]. Such studies are essential for shaping future research agendas, especially as the construction industry grapples with new challenges such as climate change, supply chain disruptions, and regulatory shifts.

This bibliometric review provides a comprehensive assessment of research developments in construction risk management from 2000 to 2024, with a particular focus on modeling strategies and optimization approaches. The analysis of 222 journal articles reveals a pronounced growth in scholarly output, a shift toward multi-objective optimization frameworks, and the emergence of artificial intelligence as a transformative tool in risk assessment and response.

The study identifies Automation in Construction, Reliability Engineering & System Safety, and Sustainability as leading journals in the field, with high productivity and impact. Geographically, research output is concentrated in technologically advanced and industrialized nations, particularly China, the United States, and the United

Kingdom. The findings indicate that the optimization approach has become the most frequently employed method for risk response in construction, surpassing traditional techniques such as WBS and visual charting tools.

Although the rise of AI presents new opportunities for proactive and predictive risk management, its successful integration requires overcoming technical, organizational, and ethical challenges. In parallel, the use of network-based stakeholder models and simulation techniques continues to enrich our understanding of dynamic risk environments.

Future research should aim to close existing gaps by increasing empirical validation of theoretical models, exploring the socio-cognitive dimensions of risk, and designing hybrid methodologies that combine AI with conventional project management tools. Additionally, expanding studies in underrepresented regions and low-resource contexts will help ensure that the global construction industry benefits from inclusive and scalable risk management solutions.

As the construction sector continues to evolve in response to digital transformation, climate imperatives, and economic volatility, the integration of robust, data-driven risk management practices will remain critical for sustainable and resilient project execution.

Authors' Contributions

Authors equally contributed to this article.

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Declaration of Interest

The authors report no conflict of interest.

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Ethical Considerations

All procedures performed in this study were under the ethical standards.

References

[1] H. Li *et al.*, "The High-Quality Development of the Construction Industry in the Context of the Digital Economy-Based on the Mediating Effect of Entrepreneurship," *Buildings*, vol. 14, no. 11, p. 3490, 2024, doi: 10.3390/buildings14113490.

[2] A. O. Alejo, C. O. Aigbavboa, and D. O. Aghimien, "Emerging Trends of Safe Working Conditions in the Construction Industry: A Bibliometric Approach," *Buildings*, vol. 14, no. 9, p. 2790, 2024, doi: 10.3390/buildings14092790.

[3] S. M. A. Al Qudah, J. L. Fuentes Bargues, and P. Gisbert, "Bibliometric analysis of the literature on risk management in the construction sector: Exploring current and future trends," *Ain Shams Engineering Journal*, p. 102843, 2024.

[4] K. Song and J. Choi, "Development of an Enhanced Risk Management System Utilizing Risk-Based Methods for Construction Defect Control in Industrial Plant Projects," *Industrial Engineering & Management Systems*, vol. 23, no. 4, pp. 505-514, 2024, doi: 10.7232/iems.2024.23.4.505.

[5] A. N. Swetha, M. Naik, and S. Gundurouthula, "A Study on Exploring and Prioritizing Critical Risks in Construction Project Assessment," *International Journal For Multidisciplinary Research*, vol. 6, no. 4, 2024, doi: 10.36948/ijfmr.2024.v06i04.26360.

[6] M. J. Thaheem, "Project Risk Management for Sustainable Restoration of Immovable Cultural Heritage: Lessons from Construction Industry and Formulation of a Customized PRM Model," *Journal of Cultural Heritage Management and Sustainable Development*, vol. 4, no. 2, pp. 123-145, 2014, doi: 10.1108/JCHMSD-12-2012-00681.

[7] D. Serogina, T. Pushkar, and H. Zhovtiak, "The Impact of the Construction Industry on the Social and Economic Development of Territories," *Scientific Bulletin of the National Academy of Statistics, Accounting and Audit*, vol. 1, no. 2, pp. 59-65, 2022, doi: 10.31767/nasoa.1-2-2021.08.

[8] M. H. Sebt, A. Gereei, and H. Toosi, "A comprehensive framework for integrated management of opportunities and threats by using dynamic system," *International Journal of Civil Engineering*, vol. 7, no. 2, pp. 123-134, 2009.

[9] D. Hillson, "Risk Is Uncertainty that Matters," *PM World Journal*, vol. VIII, no. IX, 2019.

[10] A. Jalali Sohi, M. Bosch-Rekveldt, and M. Hertogh, "Does flexibility in project management in early project phases contribute positively to end-project performance?," *International Journal of Managing Projects in Business*, vol. 13IS - 4, 2020, doi: 10.1108/IJMPB-07-2019-0173.

[11] R. Testorelli, A. Tiso, and C. Verbano, "Value Creation with Project Risk Management: A Holistic Framework," *Sustainability*, vol. 16, no. 2, p. 753, 2024, doi: 10.3390/su16020753.

[12] R. Troisi and P. Castaldo, "Technical and organizational challenges in the risk management of road infrastructures," *Journal of risk research*, vol. 25, no. 6, pp. 791-806, 2022, doi: 10.1080/13669877.2022.2028884.

[13] M. Shehadeh, E. E. Alharasis, H. Haddad, and E. F. Hasan, "The impact of ownership structure and corporate governance on capital structure of Jordanian industrial companies," *Wseas Transactions on Business and Economics*, vol. 19, no. 1, pp. 361-375, 2022, doi: 10.37394/23207.2022.19.32.

[14] I. Passas, "Bibliometric analysis: the main steps," *Encyclopedia*, vol. 4, no. 2, pp. 1014-1025, 2024, doi: 10.3390/encyclopedia4020065.

[15] S. Panahi, S. Ghaffari, and M. Lotfi, "A Bibliometric Analysis in Web of Science Publications for Obtaining Global Research Trends and Hot Topics in Library and Information Science," *International Journal of Information Science and Management (IJISM)*, vol. 21, no. 4, pp. 309-328, 2023, doi: 10.22034/ijism.2023.1977944.0.

[16] R. Osei-Kyei, T. Narbaev, and G. Ampratwum, "A scientometric analysis of studies on risk management in construction projects," *Buildings*, vol. 12, no. 9, p. 1342, 2022, doi: 10.3390/buildings12091342.
[17] S. Adamtey and L. Onsarigo, "Analysis of pipe-bursting construction risks using probability-impact model," *Journal of Engineering, Design and Technology*, vol. 16, no. 3, pp. 461-477, 2018, doi: 10.1108/JEDT-01-2018-0009.
[18] J. Aliu *et al.*, "Towards a new paradigm of project management: a bibliometric review," *Sustainability*, vol. 15, no. 13, p. 9967, 2023, doi: 10.3390/su15139967.
[19] R. Nyqvist and A. A. U. S. O. Peltokorpi, "Uncertainty network modeling method for construction risk management," *Construction management and economics*, vol. 42, no. 4, pp. 346-365, 2024, doi: 10.1080/01446193.2023.2266760.
[20] M. Safaeian, A. M. Fathollahi-Fard, K. Kabirifar, M. Yazdani, and M. Shapouri, "Selecting appropriate risk response strategies considering utility function and budget constraints: A case study of a construction company in Iran," *BuildingsVL - 12*, no. 2, p. 98, 2022, doi: 10.3390/buildings12020098.
[21] M. Safaeian, R. Moses, E. E. Ozguven, and M. A. Dulebenets, "An optimization- based risk management framework with risk interdependence for effective disaster risk reduction," *Progress in Disaster Science*, vol. 21, p. 100313, 2024, doi: 10.1016/j.pdisas.2024.100313.
[22] M. Parsaei Motamed and S. Bamdad, "A multi-objective optimization approach for selecting Risk response actions: Considering environmental and secondary risks," *Opsearch*, vol. 59, no. 1, pp. 266-303, 2022, doi: 10.1007/S12597-021-00541-5.
[23] F. Zhu, H. Hu, and F. Xue, "Risk assessment model for international construction projects considering risk interdependence using the DEMATEL method," *PLOS ONE*, vol. 17, no. 5, p. e0265972, 2022, doi: 10.1371/journal.pone.0265972.
[24] B. Zhang, L. Bai, and S. Kang, "Risk Response Strategies Selection over the Life Cycle of Project Portfolio," *Buildings*, vol. 12, no. 12, p. 2191, 2022, doi: 10.3390/buildings12122191.
[25] X. Zhang, M. Goh, S. Bai, and Z. Wang, "Risk response decisions for projects in project portfolios considering objective adjustments and project interdependencies," *Kybernetes*, vol. 53, no. 7, pp. 2217-2246, 2024, doi: 10.1108/K-09-2022-1344.
[26] M. Yazdi, E. Zarei, S. Adumene, and A. Beheshti, "Navigating the Power of Artificial Intelligence in Risk Management: A Comparative Analysis," *Safety*, vol. 10, no. 2, p. 42, 2024, doi: 10.3390/safety10020042.
[27] S. W. Bauguess, *The role of big data, machine learning, and AI in assessing risks: A Regulatory perspective*. 2017.
[28] R. Parekh and O. Mitchell, "Incorporating AI into construction management: Enhancing Efficiency and cost savings," *International Journal of Science, Technology & Research*, vol. 13, no. 1, pp. 1049-1058, 2024, doi: 10.30574/ijsra.2024.13.1.1776.
[29] I. Ben-David, G. Rabinowitz, and T. Raz, *Economic optimization of project risk management efforts*. The Israel Institute of Business Research, 2002.
[30] I. Ben-David and T. Raz, "An integrated approach for risk response development in project planning," *Journal of the Operational Research Society*, vol. 52, no. 1, pp. 14-25, 2001, doi: 10.1057/palgrave.jors.2601029.
[31] G. Castelblanco, E. M. Fenoaltea, A. De Marco, P. Demagistris, S. Petruzzi, and D. Zeppegno, "Combining stakeholder and risk management: Multilayer network analysis for complex megaprojects," *Journal of Construction Engineering and Management*, vol. 150, no. 2, p. 04023161, 2024, doi: 10.1061/JCEMD4.COENG-13807.
[32] E. Wassenius and B. I. Crona, "Adapting risk assessments for a complex future," *One Earth*, vol. 5, no. 1, pp. 35-43, 2022, doi: 10.1016/j.oneear.2021.12.004.
[33] D. Hillson, "Using a Risk Breakdown Structure in project management," *Journal of Facilities Management*, vol. 2, no. 1, pp. 85-97, 2003, doi: 10.1108/14725960410808131.
[34] D. Sitohang, Y. Latief, and L. S. Riantini, "Development of risk-based work breakdown structure (WBS) standard to improve scheduling planning of airport construction work," 2019, vol. 258, 1 ed., p. 012052, doi: 10.1088/1755-1315/258/1/012052ER -.
[35] A. Erfani *et al.*, "Data-driven approach to risk identification for major transportation projects: A common risk breakdown structure The Function of Risk Management in Improving Construction Project Implementation Efficiency An analytic network process model to prioritize supply chain risks in green residential megaprojects," *IEEE Transactions on Engineering Management*, vol. 71, no. 1, pp. 6830-6841, 2023, doi: 10.1109/TEM.2023.3279237 10.6007/ijarafms/v14-i1/20435 10.1007/s12063-022-00288-2.
[36] M. Hinostroza, p. Chavez, V. Nunez, and C. Raymundo, "Application of PMBOK to Improve the Deadline of Projects in SMEs Engineering Consultancies," 2018, pp. 487-494, doi: 10.1007/978-3-030-16053-1_47.