Rapport de veille n° 79

BIM

31/01/2026

Objectif : *L'utilisation du BIM en phase de conception et de ses potentiels applications pour la prévention des risques*

La validation des informations fournies (exactitude, fiabilité, pertinence par rapport aux principes de prévention, etc.) est du ressort des auteurs des articles signalés dans la veille. Les informations ne sont pas le reflet de la position de l'INRS.

Les liens mentionnés dans le bulletin donnent accès aux documents sous réserve d'un abonnement à la ressource.

Table des matières

1. Articles scientifiques

Exploration and practice in the systematic application of intelligent construction [PDF]

H Su, J Zhang, G Zhang, Z Jia, Z Su, L Wang, F Li, S Li - Journal of Intelligent Construction, 2025, 15 p.

DOI : https://doi.org/10.26599/JIC.2026.9180115

This study systematically elaborates on the core connotation and implementation pathways of the intelligent construction system from the contractors' perspective. It analyzes a digitally-driven intelligent construction framework and proposes replicable and scalable systematic solutions for intelligent construction in practical engineering projects. Furthermore, by integrating theory with practice, it validates the significant effectiveness of intelligent construction systems in enhancing efficiency, optimizing management, and mitigating risks. It can provide a reference for industry transformation and upgrading, promote the deep integration of intelligent construction technologies with engineering practices, and ultimately support the achievement of high-quality project delivery and whole-lifecycle value enhancement.

Building Information Modelling And Risk In Industrialised Building System Projects: A Scientometric Review

NA Saipudin, N Ishak - Journal of Surveying, Construction and Property, Volume 16, 2025, Issue 2, pp.76-90

The scholarly exploration of Building Information Modelling (BIM), risk management, and Industrialised Building System (IBS) research has expanded rapidly, reflecting the construction industry's increasing reliance on digital and prefabricated technologies. Despite this growth, there remains a fragmented understanding of how research in these areas has developed over time, including dominant themes, influential contributors, and methodological trends. This study addresses this gap through a scientometric review of 1,153 publications retrieved from the Scopus database between 2010 and 2025. Using VOSviewer and Scopus analytical tools, publication trends, document types, co authorship networks, and keyword co-occurrence were systematically examined to provide a structured overview of the field. The analysis reveals a steady increase in scholarly output, particularly after 2015, indicating rising global interest in technology-driven risk management and prefabricated construction methods. Journal articles constitute the majority of the literature, followed by conference papers and reviews, reflecting the evolution of research dissemination. Geographical and citation analyses show that countries such as China, Malaysia, and the United Kingdom dominate the field, while highly cited authors provide conceptual and methodological foundations for emerging studies. Keyword analysis highlights recurring themes of safety, process optimization, digital innovation, and project management. Despite the rapid expansion of literature, persistent gaps remain, including limited empirical validation, uneven adoption across industry contexts, and the lack of standardized methodologies. By mapping these patterns and gaps, this scientometric review offers a critical lens on the evolution of BIM, Risk, and IBS research, providing scholars and practitioners with actionable insights on knowledge trends, collaborative networks, and potential directions for future investigation. Overall, this work supports informed decision-making and fosters the development of rigorous, context-sensitive research agendas in construction studies.

Structural Analysis of Construction Risk Management Assessment Model Based on Digital Twins [PDF]

B Deng, A Osmadi, Y Deng - Journal of Construction in Developing Countries, 30 (Supp. 2), 2025, pp. 217–238

DOI : https://doi.org/10.21315/jcdc.2025.30.s2.10

Construction risk categories are complex and the most current assessment platforms tend to place focus on theoretical assessments. There is an urgent need to simulate construction risks to manage projects effectively. As such, this article proposes a digital twin construction risk assessment model (DTCRAM) based on Delphi

and a case study for predicting and controlling construction risk to reduce project loss. The model has been proven to detect risks quickly and match strategies efficiently. The outcomes revealed that DTCRAM displayed better results (key risks) in predicting and controlling construction management (more than 1% probability reduction/project) while simultaneously improving management efficiency (screen out risk factors). As a result, scholars and companies can gain risk management experience by using this tool in advance.

Implementation Of Information Modeling In Modern Occupational Health And Safety Management Systems

VE Abrakitov, YS Levashova, NO Kosenko - Labour protection problems in Ukraine, 2025, 41(3-4), pp. 49-54
DOI : https://doi.org/10.36804/nndipbop.41-3-4.2025.49-54

The article examines the transformative role of information modeling in the field of occupational health and safety as a tool for transitioning from traditional reactive approaches to modern proactive risk management strategies. The authors explore the possibilities of integrating digital technologies to create comprehensive models that combine geometric, physical, functional and safety parameters of work environments. Particular attention is paid to practical aspects of the application of different types of models, including BIM modeling for hazard identification at the design stage, simulation models for analyzing accident scenarios, and digital human models for assessing ergonomic risks. The key areas of information modeling implementation are analyzed in detail: identification and assessment of risks with the ability to visualize potential hazards, planning safe working conditions by developing optimized equipment placement and evacuation plans, organizing training using virtual simulations, and emergency management based on modeling various accident scenarios. The importance of integrating information models with real-time monitoring systems for monitoring the condition of workers and environmental parameters is emphasized. The article objectively assesses the benefits and challenges of implementing the technology, including a proactive approach to safety, improved communication between project participants and economic feasibility on the one hand, and high cost, the need for qualified personnel and the complexity of integration with existing systems on the other. The synergy of information modeling with advanced digital technologies, such as artificial intelligence for predictive analytics, IoT for data collection, VR/AR for training and blockchain for ensuring data transparency, is separately considered. Promising areas of development are identified, in particular, the creation of digital twins of production facilities, the development of autonomous security systems and the personalization of security measures based on individual employee data. The conclusion is drawn about the need for a comprehensive approach to the implementation of information modeling, which includes strategic planning, investments in infrastructure and training of personnel to realize its potential in the revolutionary transformation of the field of occupational safety.

Systematic literature review on the integration of Building Information Modelling and Prevention through Design (PtD) for safety risk management [PDF]

H He, AS Ismail, K Nita Bte Ali - Journal of Asian Architecture and Building Engineering, 2026, pp. 1–16
DOI : https://doi.org/10.1080/13467581.2025.2611515

Construction safety remains a pressing global concern, as complex projects such as high-rise buildings often expose workers to serious hazards including falls, electrocution, and equipment-related injuries. Proactive risk management is therefore essential to prevent accidents before they occur. Prevention through Design (PtD) emphasizes identifying and eliminating hazards during the early design phase, while Building Information Modeling (BIM) provides a powerful digital environment to visualize, analyze, and manage safety risks. This study conducts a systematic literature review (SLR) of recent research on the integration of BIM and PtD for safety risk management. Using the PRISMA framework, 22 peer-reviewed studies published between 2013 and 2024 were analyzed to identify major applications, limitations, and emerging trends. Findings reveal that BIM significantly strengthens PtD implementation by enabling knowledge-based systems and automated rule-

checking tools that support early hazard detection and compliance with safety standards. Although most studies focus on fall-related risks, the review highlights the growing potential of BIM-PtD integration to address diverse and dynamic construction hazards. Future research should expand the range of risk types, promote international standardization, and enhance real-world implementation of BIM-based PtD frameworks to achieve safer and more resilient construction environments.

Systematic Literature Review of Human–AI Collaboration for Intelligent Construction

J Du, R Gu, X Tang, V Sugumaran - Applied Sciences, 2026, 16(2), 597

DOI : https://doi.org/10.3390/app16020597

Artificial intelligence (AI) technology, serving as an indispensable component within intelligent construction systems, has become a cornerstone for driving the digital and intelligent transformation of the construction industry. Although AI demonstrates autonomous decision-making capabilities in specific operational contexts, because of the dynamic and often unforeseeable nature of construction workflows, human–AI collaboration (HAIC) still dominates the operational paradigm. This study undertakes a systematic review of the prior research on human–AI collaboration in intelligent construction. Through a bibliometric search, scientometric analysis, and in-depth literature classification, 191 highly cited articles in the past five years, which are in the top 10% by citation count within the dataset (as of May 2025, based on Scopus, Google Scholar, and WOS), were screened, and four research streams were formed based on a co-citation analysis and clustering, namely, construction robotics, productivity and safety, intelligent algorithms and modelling, and factors related to construction workers. Finally, a three-dimensional knowledge framework covering the technical layer, application layer, and management layer was constructed. Through this comprehensive synthesis, the study developed a human–AI collaboration knowledge framework in the field of construction science that integrates technology, scenarios, and management dimensions, revealing the co-evolutionary path of artificial intelligence technology and industry digital transformation.

Barriers of Adopting Emerging Technology for Construction Safety and Health in Sarawak

NC Ting, SK Kong - Borneo Journal of Social Sciences & Humanities, December 2025, Vol. 7, No. 2

DOI : DOI:10.35370/bjssh.2025.7.2-03

As technology adoption advances, tools like wearable sensors, robotics, virtual reality (VR), Unmanned Aerial Vehicles (UAV) and Building Information Modelling (BIM) offer significant improvements in construction safety. However, Sarawak's construction industry continues to face challenges in maintaining worker health and safety, with limited adoption of these emerging technologies. This study investigates the adoption level of emerging technologies among Grade 7 contractors in Sarawak and identifies and prioritizes the barriers hindering their implementation. Safety technologies such as Building Information Modelling (BIM), Camera Network Systems, and Unmanned Aerial Vehicles (UAV) are among the most favored due to their safety benefits and ease of use. However, overall adoption remains moderate, with many construction companies still relying on traditional methods. The study found that among the various barriers, financial and market factors were the most significant in hindering technology adoption. Quantitative data collection was followed by descriptive and Relative Importance Index (RII) analyses. Financial constraints, such as high capital costs and lack of demand, emerged as the most critical barriers, alongside technological immaturity and resistance to change. This study fills a knowledge gap by highlighting the main barriers to technology adoption in construction safety and offers practical insights for industry stakeholders in Sarawak and other developing regions.

AI-Driven Transformation of the Construction Industry: A State-of-the-Art [PDF]

V Patel, K Kumar - International Journal of Web of Multidisciplinary Studies, Vol.3 No.01, January 2026
DOI : https://doi.org/10.71366/ijwos

The construction industry has been dealing with constant challenges of cost overruns, schedule delays, low productivity, and safety risks mainly due to the environmental factors of project complexity, dynamic site conditions, and high rate of uncertainty. Recent progress in artificial intelligence (AI) has opened up new opportunities for data-driven, predictive and adaptive decision making in construction management. This paper discusses a comprehensive review of applications of AI technologies, including machine learning, deep learning, computer vision and natural language processing, in the major construction management functions. The article examines how the use of AI is helping in project planning by better cost estimation and design optimization, scheduling through delay prediction and productivity forecasting, and project control through monitoring progress in real-time, risk and performance identification, and project performance evaluation. Key implementation barriers are also analyzed, including data availability and quality, lack of model transparency, integration issues with existing platforms such as Building Information Modeling (BIM) and organizational readiness. Taking a lifecycle-oriented perspective, this study shows how AI systems can help informed decision-making during planning, execution and control phases. The paper has added a value to the literature on construction engineering and construction management by providing a structured synthesis of existing applications with the identification of future research directions for the explainable, scalable, and industry-ready AI solutions.

Literature Review of Occupational Safety and Health Risk Management in Foundation Work

T Susanto, A Nurdiana, MA Wibowo, MI Maromi - Rekayasa Sipil, 2026, Vol. 20, n°1, pp. 61-67
DOI : https://doi.org/10.21776/ub.rekayasasipil.2026.020.01.8

Identifying risks in construction projects is essential for anticipating hazards and developing effective risk management measures. The intricacy of construction projects encompasses numerous aspects that can impact their effective completion, including the risk of worker accidents in the field. This study aims to identify Occupational Safety and Health (OHS) risk factors in foundation work through a literature review using the Publish or Perish application. Literature was obtained through the Google Scholar and Crossref databases, with a maximum search limit of 100 articles, and was limited to the 2020–2025 period to ensure relevance to current conditions. Search phrases used included risk management, risk identification, occupational safety and health, and foundation, with literature selected based on the suitability of the title and its relevance to the research objectives. The study findings reveal 11 potential hazards, with five predominant risks: being struck by construction materials, being impacted or ensnared by heavy machinery, falling into dig sites, sustaining puncture or laceration injuries from sharp objects, and experiencing ocular ailments due to exposure to materials or dust. These findings affirm that foundation work presents a considerable hazard, necessitating the implementation of risk control hierarchy, such as elimination, engineering methods, administrative measures, enhancement of worker safety behavior, and adaptation to contextual dynamics to fortify the safety culture in construction projects.

2. Conférence / ouvrage / thèse

Integrating Artificial Intelligence into Construction Safety: A Systematic Review of OHS Standards

P Leshinka, C Kahanji, E Mwanaumo, W Thwala - In: Aigbavboa, C., Awuzie, B., Aghimien, D., Oke, A.E., Omotayo, T. (eds) Facilitating Inclusivity in Multi-, Inter-, and Transdisciplinary Sustainable Built Environment Research in Emerging Economies . SURE-Built 2025. Lecture Notes in Civil Engineering, vol 772. Springer, Cham, pp. 245-253

DOI : https://doi.org/10.1007/978-3-032-08992-2_21

The construction industry continues to face major safety challenges, with high rates of workplace injuries and fatalities. Traditional safety methods are often manual, time-consuming and prone to errors, making them less effective in managing these risks. Artificial Intelligence offers powerful solutions using tools such as predictive risk assessments, real-time hazard detection and enhanced safety monitoring. However, most global and regional safety standards do not have clear guidelines for using AI resulting in regulatory, ethical and practical challenges. This study addressed this gap by systematically reviewing the existing Health and Safety legal frameworks and evaluated their readiness for AI integration into construction safety. Findings revealed disparities between developed and emerging nations, with robust regulatory frameworks in regions like the European Union and the United States, contrasted by outdated and underdeveloped standards in Africa. The study identified critical gaps in AI-specific guidelines, highlighted potential safety improvements through Artificial Intelligence applications and emphasized the need for regulatory updates to ensure ethical and effective AI-OHS implementation. The study recommendations included developing comprehensive AI-inclusive OHS guidelines, enhancing training programs and fostering international collaboration to address technological and resource disparities in emerging economies. The study contributed to advancing construction safety and aligned with global efforts to digitalize safety practices in the construction industry.

The Evolution of Building Information Modeling (BIM) in Construction Safety: A Review of Technological Advancements

D Bharsakle, V Kamble, A Mahajan, S Hire - In: Rahman, R.A., Farazdaghi, E., Venkataramana, K., Antony, J., Kavitha, P.E., Sreerath, S. (eds) Proceedings of SECON'25. SECON 2025. Lecture Notes in Civil Engineering, vol 742. Springer, Cham, pp. 167-181

DOI : https://doi.org/10.1007/978-3-032-04178-4_15

Construction sites encompass hazardous activities, with workers facing numerous risks leading to unsafe working conditions. Traditional safety management methods often fail to address the dynamic nature of construction environments. Over the years, Building Information Modeling (BIM) and automation technologies have offered significant potential applications to improve construction site safety through hazard detection, real-time monitoring, and predictive risk assessments, to name a few. This study provides a comprehensive review of the BIM-driven approaches to prevent hazards on construction sites. This paper identifies key trends, technological advancements, challenges, and future research directions by synthesizing findings from various studies. This paper provides insights into how BIM, coupled with advanced safety technologies, can play a crucial role in transforming construction safety practices, reducing accidents, and optimizing project delivery.