Rapport de veille n° 76

BIM

31/10/2025

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

A comprehensive review on building information modelling (BIM), its implementations and applications
R Kaur, BJ Mwambegele, AG Abraham, SA Basheer… - Discover Civil Engineering, Volume 2, 2025
DOI : https://doi.org/10.1007/s44290-025-00342-5
The review article advances the discourse on Building Information Modelling (BIM) by offering first integrative, globally scoped analysis that synthesizes fragmented research across various domains such as construction management, structural, architectural and transportation engineering etc., domains that are often neglected and treated in isolation in previous reviews. To highlight the practical insights from existing literature, different case studies were chosen based on the diversity of domains, BIM maturity (due to high profile international projects) and diversity of regions across the globe. Through a systematic review of articles from 2008 to 2024 and critical evaluation of tools such as Revit, Navisworks, Green Building Studio, and IES-VE, we identify critical interoperability gaps and underutilised plugin ecosystem as barriers. Although the frequency of BIM application for energy and structural analysis is estimated to be 25% and 27%, respectively, its primary usage seems to be for 3D coordination and faster construction of 3D geometric models, with an application rate of 60%. While BIM has been touted as a solution to common challenges in the construction sector, it is observed that there appears to be a widening disparity between the BIM solutions and its actual implementation in mainstream industry practices. Thus, the findings of this review will be helpful for the professionals, developers, researchers dealing with the usage and implementation of BIM.

Consideration of a project lifecycle using BIM in design review practice toward safe design
AR Zulkifli, CKIC Ibrahim - AIP Conference Proceedings, Volume 3322, October 2025
DOI : https://doi.org/10.1063/5.0290180
Integrating Building Information Modelling (BIM) into the construction project lifecycle improves the design review process, which encourages the use of safer design option and methods. BIM offers a methodical approach to managing and distributing extensive information throughout the the whole lifecycle of a project which include construction, operation and maintenance. By integrating Building Information Modelling (BIM) capabilities with the concepts of Prevention through Design (PtD), stakeholders can detect and address possible safety issues at an early stage of the design process. By adopting a proactive approach, safety considerations are included into the design, hence minimising hazards during construction and enhancing the overall project outcomes. BIM enhances communication and collaboration among project teams, leading to improved decision-making and efficient project management. Incorporating Building Information Modelling (BIM) into the design review process ultimately promotes the advancement of sustainable infrastructure development and improves safety in construction projects. This paper revealed usage of BIM in PtD design review practices from the perspectives of consideration of a project lifecycle.

Evaluating The Occupational Safety And Health Instruments For Prevention Through Design Implementation In Malaysian Construction
Herda Balqis Ismail, Noor Nabilah Sarbini, Hamizah Liyana Tajul Ariffin, Mohd Fairuz Ab Rahman, Mohd Syamir Senin - PLANNING MALAYSIA: Journal of the Malaysian Institute of Planners, Volume 23, Issue 4, October 2025, pp. 384-398
DOI :10.21837/pm.v23i38.1800
Prevention through Design (PtD) is a proactive approach widely practiced in developed countries to reduce construction-related accidents. In Malaysia, however, its implementation remains limited due to low awareness and understanding among practitioners. This study aims to explore and classify existing Occupational Safety

and Health (OSH) instruments published by the Department of Occupational Safety and Health (DOSH) and the Construction Industry Development Board (CIDB), and to determine their alignment with PtD principles. A qualitative content analysis was conducted on official documents, and the instruments were grouped into three categories: technical documents, assessment tools, and digital tools. The findings shows that PtD elements are present in instruments such as the HIRARC framework and Building Information Modelling (BIM), though the level of integration remains inconsistent. By mapping this alignment, the study highlights the current readiness of these instruments to support PtD practices and provides a foundation for enhancing safety planning in the design phase, in line with the OSHCIM 2017 guideline.

Augmented Reality for On-Site Construction Coordination with BIM Integration

R Fara, AM Hamdan, A Agazada - Engineering and Technology Journal, Volume 10, Issue 10, October 2025
DOI :10.47191/etj/v10i10.12

The integration of Augmented Reality (AR) with Building Information Modeling (BIM) has emerged as a transformative approach to improving construction coordination, particularly in complex, dynamic on-site environments. BIM provides comprehensive, data-rich digital models that encapsulate geometric, material, and scheduling information, while AR overlays this virtual content onto physical construction sites through devices such as tablets, head-mounted displays, and AR-enabled helmets. This combination creates an immersive, context-aware environment that enhances design visualization, progress monitoring, and collaboration among stakeholders. On-site application of AR-BIM systems enables workers and project managers to align as-designed models with as-built conditions, thereby facilitating early detection of errors, discrepancies, or clashes between structural and mechanical systems. Such real-time visualization reduces rework, accelerates decision-making, and improves installation accuracy, particularly for mechanical, electrical, and plumbing (MEP) coordination. Additionally, AR provides interactive guidance for construction tasks, supports quality assurance by aligning real-time progress with BIM schedules, and improves safety management through the visualization of hazard zones. By enabling remote access to on-site visualizations, AR also enhances stakeholder communication, bridging the gap between design offices and field operations. Despite these advantages, challenges remain. High-fidelity AR-BIM integration requires robust data synchronization, accurate spatial tracking, and device compatibility, while issues such as model complexity, large file sizes, and hardware limitations pose barriers to widespread adoption. Human factors, including the need for worker training and acceptance, further influence implementation success. Nevertheless, ongoing advancements in cloud computing, interoperability standards, and wearable technologies, alongside the integration of artificial intelligence and Internet of Things (IoT) sensors, are expected to expand AR-BIM applications. AR-enabled BIM integration significantly strengthens on-site construction coordination, offering measurable benefits in productivity, safety, and quality. As technology matures, it promises to become an essential component of digital construction workflows.

BIM as a Tool for Developing Smart Buildings in Smart Cities: Potentialities and Challenges

CEG Souza, CK Chinelli, CAP Soares, OC Longo - Architecture, 2025, 5(4), 103
DOI : https://doi.org/10.3390/architecture5040103

Building Information Modeling (BIM) has established itself as a strategic and indispensable tool for designing and implementing smart buildings within the context of smart cities. This study explores the potentialities and challenges of using BIM across the main stages of the smart building lifecycle: design, construction, and operation and maintenance. We conducted comprehensive, detailed, and interpretative literature research to extract the main concepts and knowledge, enabling us to identify the main potentialities and challenges and classify them by life-cycle phase for smart buildings. Potentialities and challenges were prioritized based on the number of projects that cited them. The inclusion criteria for identifying potentialities and challenges were based on their key attributes: significant impact, information modeling potential, integration capability with

other tools and methods, and improved performance in processes and services across all life cycle phases and BIM dimensions. The findings reveal that the main potentials include optimizing information management, reducing operating costs, enhancing environmental sustainability, and enhancing decision-making processes. Furthermore, the study highlights BIM's role in integrating technologies such as IoT, augmented reality, and energy simulations, contributing to the development of more sustainable and functional buildings. However, challenges to its full adoption persist, including financial constraints, interoperability issues between systems, a lack of specialized technical skills, and organizational resistance to change. The dependence on advanced technological infrastructure and robust connectivity poses an additional challenge, especially in developing countries, where such resources may be scarce or inconsistent. Finally, this study suggests that future research should explore the integration of BIM with emerging technologies, such as artificial intelligence and digital twins, further expanding its applicability in the smart urban context.

2. Conférence / ouvrage / thèse

Limiting Factors For The Use Of Vr Technology In Occupational Safety And Health Training

Vajkić, Mile and Vranješ, Biljana and Đapan, Marko and Jevtić, Anđela - Conference: 21st International Conference "Man and Working Environment" – SEMSIE 2025At: Niš, September 2025

DOI : 10.46793/SEMSIE25.121V

This paper presents the current limiting factors in the application of virtual reality (VR) in the training process for safety and health at work. Although VR offers significant advantages in occupational safety and health training, such as the simulation of hazardous situations and the enhancement of interactive learning, several factors may limit its widespread implementation. The main limiting factors include technical barriers and high implementation costs. Additionally, the need for specialized equipment, as well as the psychological effects on workers during training, can pose constraints on its application. Furthermore, various organizational factors, along with the lack of qualified personnel for VR content development, represent additional limitations to its implementation. The paper analyzes these limitations and proposes possible solutions to overcome them, aiming to enable a broader use of VR technology in occupational safety and health training.

Towards Data-Driven Occupational Health and Safety in the Construction Industry

Torrecilla-García, J.A., Skotnicka, A.G., Anaya-Aguilar, R.M., Perez, V.H., Rubio-Romero, J.C. – In Baptista, J.S., et al. Occupational and Environmental Safety and Health VI. Studies in Systems, Decision and Control, vol 231. Springer, Cham, pp. 573-582

DOI : https://doi.org/10.1007/978-3-031-82291-9_41

Traditionally, OHS practices in construction were reactive, but with data, a forward-thinking approach can be adopted to detect and resolve potential dangers before accidents occur. The present work discusses the pillars of a data-driven approach and performance considerations and highlights the benefits and challenges of adopting these approaches. It emphasizes the importance of general Data-driven firm Strategy, OHS data collection and Preventive risk Measurement considerations that concern a high-performance Data-driven OHS Strategy. A Data-Driven OHS Strategy demands a firm dedication to data accuracy and confidentiality, along with thoughtful deliberation of ethical and legal concerns. The study conducts a systematic literature review and utilizes the fuzzy-set Qualitative Comparative Analysis (fsQCA) methodology to analyze complex causal relationships and identify configurations of variables that lead to specific outcomes based on 36 construction companies' inquiries. The research aims to propose effective safety enhancing Data-driven OHS Strategies aligned to the construction industry's unique challenges and ultimately seeks to customize these strategies to meet the industry's needs. This work endeavors to highlight potential alignments between Data-driven Strategy performance and OHS performance, aiming to uncover avenues for refining safety protocols and operations.

Risk Associated with Digitalization in the Construction Industry: A Bibliometric Review of Present and Future Trends

MA Ogungbe, C Aigbavboa, AE Oke, M Ikuabe - In: Arai, K. (eds) Proceedings of the Future Technologies Conference (FTC) 2025, Volume 3. FTC 2025. Lecture Notes in Networks and Systems, vol 1677. Springer, Cham, pp. 487-501

DOI : https://doi.org/10.1007/978-3-032-07995-4_32

The construction industry is undergoing a transformative shift through the adoption of digital technologies such as Building Information Modeling (BIM), Artificial Intelligence (AI), and Internet of Things (IoT). While these innovations promise significant benefits in terms of efficiency, cost reduction, and safety, they also introduce new risks that must be carefully managed. This study conducts a bibliometric review to explore the risks

associated with construction digitalization, analyzing trends, key contributors, and emerging research topics in the field. By examining 32 peer-reviewed articles from the Web of Science (WoS) database from 2014 to 2024, this study, using Vosviewer, identifies publications and citations over time, the most prolific authors, and co-occurrence keywords. The study reveals that digitalization and associated risks have gained substantial scholarly attention, particularly in the last few years, with a marked increase in both publications and citations. The findings highlight the dominance of topics such as AI, robotics, and digital twin technology, while also pointing out the need for further exploration in areas like digital partnerships and IoT applications. This review not only maps the current landscape of research but also identifies gaps and provides directions for future studies to ensure a smooth and secure transition to digitalization in the construction industry. As this literature review has limitations related to its scope and search criteria, future studies can provide a broader investigation into these areas.