

Editorial

Data to Decisions for Infrastructure Asset Management through Digital Innovations

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Infrastructure asset management is widely recognised as a critical discipline within the built environment, underpinning the functionality, resilience and sustainability of infrastructure networks and facilities. Robust asset management enhances economic productivity, safeguards public welfare and supports environmental objectives across the asset life-cycle. Nevertheless, practitioners must now address increasingly complex challenges, including intensified climate-related hazards, stringent resource constraints, an ageing asset base and the disruptive velocity of technological change.

Recent research and international standards, such as the ISO 55000 and PAS 55, highlight the need for proactive, strategic management approaches incorporating lifecycle thinking and comprehensive risk management. These frameworks promote systematic methodologies that optimise asset performance, minimise risks, and maximise return on investment over the asset lifecycle. Digital innovation, including advanced data analytics, Building Information Modelling (BIM), and Artificial Intelligence (AI), has emerged as a central theme within these strategic frameworks. Digital technologies offer unprecedented capabilities in predictive maintenance, real-time monitoring, lifecycle optimisation, and informed decision-making, significantly enhancing operational efficiencies and asset resilience.

Adoption of advanced digital tools is now firmly embedded within global and national policy frameworks. Internationally, the United Nations 2030 Agenda calls for resilient infrastructure (SDG 9) and inclusive, sustainable cities (SDG 11) (UN, 2015). Regionally, instruments such as the EU Taxonomy for Sustainable Activities (EU, 2023) and the OECD Recommendation on the Governance of Critical Infrastructure Resilience (OECD, 2024) explicitly promote data-driven asset management and whole-life-cycle carbon assessment. The UK government's cross-cutting strategy for social, economic and housing infrastructure highlights the undisputed role of digital infrastructure in boosting productivity. These policy levers reinforce empirical evidence that digitalisation enhances operational efficiency, lowers resource consumption and strengthens adaptive capacity. Consequently, infrastructure owners are better positioned to anticipate, absorb and recover from disruptive events, thereby ensuring the continuity of essential services.

This special issue presents a curated selection of contemporary research articles showcasing innovative methodologies and digital solutions that address critical challenges within infrastructure asset management across diverse sectors.

Collectively, these contributions provide insights into how modern asset management strategies can be effectively implemented to deliver tangible improvements in asset performance, resilience, and sustainability.

Opening the issue, Sun et al. (2025) investigate facility management practices within higher education institutions (HEIs). The authors critically analyse inefficiencies inherent in current space occupancy management and energy utilisation practices. Employing a phenomenological approach, they highlight significant gaps and recommend the integration of BIM technology to enhance real-time data utilisation. Their findings underline BIM's capability to significantly improve operational efficiency, occupant comfort, and overall energy management, thereby substantially contributing to institutional sustainability efforts.

Complementing this discussion on BIM, Yilmaz (2025) offers a comparative analysis of BIM capabilities in railway projects managed by Network Rail in the UK and a local Turkish authority. The paper reveals the profound impact of mandated national BIM standards in the UK, leading to notable enhancements in project efficiency, collaboration, and quality across multiple design disciplines. The more selective and fragmented application of BIM practices in Turkey underscores the critical role of coherent national frameworks and standards in maximising BIM's potential. The paper provides valuable insights for policymakers and infrastructure managers on the importance of strategic leadership in driving successful BIM adoption.

Expanding beyond BIM, Tjebane and Musonda (2025) present a comprehensive bibliometric and systematic review focused on the application of AI in healthcare facility asset management. Their review identifies a notable gap between existing theoretical research and practical implementation within healthcare settings. The authors emphasise AI's significant potential to enhance asset lifecycle management, optimise maintenance schedules, and improve overall operational effectiveness. They advocate for greater stakeholder involvement, robust ethical guidelines, and further empirical studies to overcome implementation barriers. This paper provides a clear pathway for healthcare infrastructure managers aiming to leverage AI for superior asset management outcomes.

Concluding the issue, Litherland and Andrews (2025) explore whole system modelling approaches using Petri nets for railway infrastructure management. Their study addresses the complex interdependencies within railway systems, promoting a comprehensive lifecycle analysis to inform maintenance and renewal decisions. Through advanced modelling techniques, infrastructure managers can achieve improved accuracy in decision-making processes, enhanced financial planning, and superior resilience and reliability across railway operations. This methodological contribution underscores the importance of integrated, system-wide analysis in contemporary asset management practices.

Together, these research articles exemplify a progressive shift towards data-driven, integrated approaches to infrastructure asset management. They highlight critical innovations in digital technologies and methodologies, offering practical solutions to contemporary infrastructure management challenges.

Readers are encouraged to further explore our extensive range of research articles published Ahead of Print on our Virtual Library homepage, ensuring prompt access to the latest developments and insights in infrastructure asset management.

We believe that this issue will stimulate robust discussion and inspire further research, collaboration, and implementation of innovative asset management practices, ultimately contributing to the resilience, efficiency, and sustainability of our built environment.

References

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