Editorial: Human-centric innovation in the built environment

The shift from traditional system-centred approaches to human-centred designs in building environments is not just a change in methodology. It completely rethinks how we design, build and use our spaces. While traditional methods have focused mainly on efficiency, quality improvement and cost reduction, Industry 5.0 (I5.0) bring a new perspective. They highlight the importance of human well-being, social interactions and cultural contexts in technology development (Lu *et al*., 2022; Motiei *et al*., 2024; Resendiz-Villasenor *et al*., 2025; Yitmen *et al*., 2025). This transformation focuses on improving how people experience the built environment in several ways.

Construction and design are social and technical systems. They involve how technology is used, how people behave and the cultural factors that come into play. These elements connect in complex ways. Instead of considering people as just technology users, this approach recognises them as active participants. Their views, choices, and interactions influence how built environment innovations succeed and last (Nair *et al*., 2025).

The human element appears in many areas, from individual worker safety and comfort to community changes. It includes different cultural work habits and raises concerns about privacy in smart cities. Specifically, this involves understanding how people perceive and adopt new technologies, how their backgrounds and cultures shape collaboration, and how the design of the environment has a direct impact on human health and ecological sustainability (Najafi and Rahimian, 2024).

Further, using advanced technologies in Construction 5.0, like IoT, AI and digital twins (DTs) (Najafi *et al*., 2025) requires careful attention to how people interact with them. These systems create a lot of data about how people act and how the environment functions. This raises another important question about privacy, user control and how to balance what technology can do with designs that focus on people. However, the main challenge is not only to create smart technologies but also to design systems that improve human experience and support well-being.

This special collection presents 17 empirical studies that explore the human dimensions of built environment innovation across diverse contexts, from worker safety and technology adoption to cross-cultural collaboration and smart city privacy concerns. Each paper contributes essential insights into how behavioural, social, and cultural factors shape the success of sustainable and resilient construction practices, demonstrating that practical innovation requires understanding both technical capabilities and human experience.

In their study, Nazari *et al.* (2025) uses the NSGA-II optimisation algorithm to compare window and shading designs for office buildings in Tehran and Auckland, two cities with similar latitudes but in different hemispheres. The research finds that slat number and wall distance are the most important shading variables in both cities, with Auckland providing better thermal comfort while Tehran receives more daylight and can achieve greater energy savings through proper shading and window-to-wall ratios. The study provides the first hemispheric comparison of these design parameters, offering practical guidance for architects and a methodology for researchers studying building performance optimisation across different climates.

Abdul Ghafar and Ibrahim (2025) compare cross-cultural productivity between Malaysian and UK AEC professionals in industrialised building projects using cognitive organisational theory protocols tested in SimVision®. The research finds that BIM technology intervention improves exception handling, coordination and decision-making, while national culture

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factors must be considered when selecting organisational structures to ensure acceptance. The study shows that combining reciprocal task intensity with BIM technology produces similar productivity gains to flattening hierarchical structures, providing guidance for international project collaborations between developing and developed countries, though it is limited by confidentiality constraints and focuses specifically on human factors during integrated project delivery.

In this study, El Samaty (2025) examines how urban transformation projects in Riyadh, Saudi Arabia, contribute to big data generation for smart city solutions by analysing a neighbourhood humanisation initiative. The study maps design features against big data characteristics and finds that while design components show high readiness for IoT integration and smart transformation, actual implementation falls short due to insufficient strategies, supportive environments and secure datasets. The research addresses whether smart city applications should be technology-based or human-centred, guiding the balancing of technological capabilities with human-focused urban design in transformation projects.

Sudhakaran *et al.* (2025) investigate UK youngsters' perceptions of Earthship buildings as affordable and sustainable housing alternatives using immersive virtual reality technology compared to traditional two-dimensional drawings. Through a three-phase experimental survey, the study finds that youngsters showed remarkably positive attitude changes toward Earthship adoption after VR visualisation, while sustainability experts remained concerned about UK viability. Both groups agreed VR was superior to 2D drawings for visualisation. The research addresses the critical awareness gap about Earthship buildings among UK youth, who are most affected by the housing crisis, using near-real-life VR experiences to educate this demographic about alternative sustainable housing solutions.

Charousaei *et al.* (2025) examine visual aesthetics in campus open spaces at Iran University of Science and Technology using visibility analysis and visual quality standards to enhance productivity. Through surveys, user satisfaction ratings and ISOVIST simulation techniques across three campus areas, the research finds that students prioritise green areas, gathering spaces and architectural elements when evaluating visual quality. "Open Space One" ranked highest due to its sensory richness, complexity, mystery and wide field of view, providing openness. This study offers original insights into how students' experiences and visual analyses influence their use of university spaces, providing valuable guidance for campus design optimisation that emphasises user experiences in planning decisions.

Alremeithi *et al.* (2025) investigate recycling behaviour in the UAE to identify factors hindering citizen participation and develop improvement strategies. Using stakeholder theory, interviews with experts and families informed a seven-construct model tested via a survey of waste management professionals, analysed through structural equation modelling. The findings reveal that laws and regulations, willingness to sort and recycle, and recycling benefits are the most significant determinants, with strategies including awareness creation, waste control facilities and implementing fines showing improvement potential. This study provides original empirical insights into UAE recycling behaviour from a stakeholder perspective, offering a foundation for cross-cultural comparisons.

Galal Ahmed *et al.* (2025) develops a five-phase thermal retrofitting method for public housing in the UAE that combines technical innovation with genuine resident participation through an advanced "e-participatory" process utilising immersive metaverse technology. Using BIM and digital twin models, the study creates a platform that translates complex technical data into accessible formats, enabling residents to comprehend, compare, and select among thermal retrofitting alternatives based on technical criteria and social perceptions. The findings demonstrate that this participatory approach achieves 30% energy consumption reductions while ensuring genuine community engagement in decision-making. The study provides original value by showing how advanced digital technologies can democratise access to complex building performance information and empower residents to make informed decisions about their living environments, supporting the editorial's emphasis on recognising

people as active participants whose choices directly influence the success and sustainability of built environment innovations.

Gonsalves *et al.* (2025) evaluate how social influence affects construction workers' intention to use back-support exoskeletons for addressing low back disorder, a prevalent industry injury. Through a field study with construction workers using questionnaires and interviews, the research finds that workers perceive exoskeletons as easy to use, with employer provision and requirement being the primary drivers of usage intention rather than worker attitudes or peer/supervisor perceptions, though subjective norms positively influence adoption. This study contributes original insights into social influence on exoskeleton adoption and highlights how workplace factors affect behavioural intention in construction settings.

Ofori *et al.* (2025) examines the ethical, social and psychological dimensions of exoskeleton adoption in construction through empirical investigation of both active and passive exoskeletons during masonry tasks. The research reveals that while these technologies enhance productivity and reduce musculoskeletal disorders, their adoption raises significant concerns about informed consent, health data procurement, unequal access and cost equity among workers. The study finds that participants demonstrated greater trust in passive exoskeletons compared to active systems, with a strong positive relationship between ethical and social risks and trust levels. This study contributes original value by systematically examining the ethical and social implications of exoskeleton use in construction, providing evidence-based guidance for implementing these technologies in ways that prioritise worker well-being, trust and social equity—principles that align with the editorial's emphasis on human-centric innovation and the recognition that technology success depends fundamentally on understanding and addressing human factors rather than focusing solely on technical capabilities.

Eisazadeh *et al.* (2025) holistically assesses window environmental performance in patient rooms for less mobile people by integrating life-cycle assessment with dynamic energy analysis, comfort and daylighting evaluation. The research investigates the environmental impacts of different glazing types, frames and fire safety doors, finding that flat glass amount is the main contributor to glazing impacts while global warming, human toxicity and particulate matter formation are the most significant environmental costs driven by production and operational energy use. This study provides original value through an integrated approach linking window design parameters to energy use, comfort and environmental impacts, expressing costs in monetary terms (euros).

Khurshudov (2025) examine the evolution of smart cities and their comprehensive data collection requirements, addressing the growing tension between urban technological needs and citizens' privacy concerns. The analysis highlights how smart cities increasingly offer conveniences in exchange for personal data, creating a contradiction between city functionality and inhabitants' desires, with people responding differently to gradual versus abrupt technological changes. The findings emphasise that as cities become progressively smarter, pressure on personal privacy will escalate, requiring a focus on future privacy challenges to ensure sustainable transitions. The commentary provides original value by identifying gaps in understanding between smart cities' data needs and citizens' awareness of future privacy sacrifices, highlighting the risk of gradual privacy erosion for urban conveniences.

Wu *et al.* (2025) evaluate Azheke village's ecosystem and ecological features within China's Hani Rice Terraces World Cultural Heritage to explore urban design approaches for improving human–nature relationships and creating sustainable smart urban ecology. Through a systematic review, the research finds that Azheke sustains long-term harmony through traditional ecological knowledge and efficient resource use, suggesting that incorporating biophilic design, nature-based solutions and biodiversity-friendly planning can boost urban ecosystem health. The study provides original value by offering new perspectives and strategies for sustainable urban ecology design, serving as a reference for urban planners,

designers and decision-makers, though it focuses primarily on human-nature relationships rather than broader socio-cultural and economic components.

Anthony (2025) develops a decentralised peer-to-peer electric car sharing prototype framework addressing trust and pricing issues in centralised platforms that require intermediaries for data and transaction management. Through systematic review and use case validation, the research presents a framework based on IOTA technology, smart contracts and IOTA eWallet that enables trustless sharing via distributed ledger technologies. The findings demonstrate improved cost transparency, fairness guarantees and incentivised monetisation mechanisms that promote sustainable transportation by increasing electric vehicle utilisation and reducing road vehicle usage. The study provides original value by introducing a decentralised framework without central control that improves transparency compared to centralised platforms, unlocking distributed ledger technologies' (DLT) potential for sustainable transportation and collaborative emission reduction.

Ghansah (2025) consolidates fragmented literature on DTs implementation for smart buildings at the facility management stage, exploring enablers, applications and challenges in this under-researched area requiring complex physics modelling. Through a systematic review, the research identifies six enabler categories (perception, network, storage, application technologies, knowledge-building and design processes) and three application categories (operation monitoring, energy management and maintenance). The study reveals four major challenges: lack of systematic reference models, real-time data integration, data complexity and visualisation issues, proposing an integrative framework examining relationships among these elements. The findings guide facility managers in understanding DT implementation for improving smart building performance, contributing original value by identifying specific enablers, applications and challenges for facility management stage DTs.

In their study, Zeng and Pishdad (2025) analyse the 30-year evolution of sustainable building rating tools (SBRTs) in the United States, examining their shift from purely environmental focus to a holistic approach incorporating economic and social considerations, providing guidance for tool selection and future developments. Through a comprehensive literature review and analysis, this study systematically examines differences among SBRTs and establishes a decision-making support framework for stakeholders. This research contributes original perspectives on the dynamic nature of sustainable building practices and offers practical value through its decision-making framework, assisting stakeholders in certification selection and providing insights for future sustainable building developments.

Likita *et al.* (2025) explore how the integration of BIM and lean construction practices can support human-centric construction performance through structured workflows and stakeholder collaboration. Drawing from a review of BIM–lean synergies and expert interviews, the study develops a guideline that aligns digital construction tools with lean principles, enhancing team coordination and waste reduction. The findings emphasise the importance of workflow visualisation and shared responsibility, showing that when BIM–lean frameworks are applied through a human-focused lens, construction teams experience greater efficiency, reduced conflict and stronger ownership of quality outcomes. This study contributes guidance for practitioners seeking to improve process integration through people-oriented implementation strategies.

Tumpa *et al.* (2025) investigate the role of digital tools in supporting decision-making and stakeholder engagement at the project level, using case studies of construction planning platforms with user-centred features. The study finds that platforms with visual dashboards, scenario modelling and collaborative access improve transparency, stakeholder satisfaction and responsiveness to change. The research highlights that user-friendliness, trust and participation are critical human factors often overlooked in digital construction technologies. By linking platform design features to psychological engagement, the study contributes value

by bridging technological adoption with stakeholder empowerment and providing insights into designing more inclusive and responsive digital ecosystems in construction projects.

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References

Abdul Ghafar, M. and Ibrahim, R. (2025), "Quantifying AEC professionals' cross-work culture productivity: comparison between Malaysian and UK projects during industrialized building project", *Smart and Sustainable Built Environment*, Vol. 14 No. 4, pp. 921-942, doi: 10.1108/SASBE-03-2023-0059.

Alremeithi, A.A., Riaz, Z. and Khan, M. (2025), "What constitutes citizens' recycling behavior: insights from handling municipal solid waste in the UAE", *Smart and Sustainable Built Environment*, Vol. 14 No. 4, pp. 1017-1037, doi: 10.1108/SASBE-11-2022-0261.

Anthony, B. Jr (2025), "A decentralized prototype framework for peer-to-peer based electric car sharing services towards sustainable road transportation", *Smart and Sustainable Built Environment*, Vol. 14 No. 4, pp. 1172-1193, doi: 10.1108/SASBE-05-2023-0124.

Charousaei, M., Faizi, M. and Khakzand, M. (2025), "The impact of the visual layout of university open space on students' behavior and satisfaction level: the case of Iran University of Science and Technology", *Smart and Sustainable Built Environment*, Vol. 14 No. 4, pp. 992-1016, doi: 10.1108/SASBE-02-2023-0028.

Eisazadeh, N., De Troyer, F. and Allacker, K. (2025), "Environmental performance of patient rooms using an integrated approach considering operational energy, daylight and comfort analysis", *Smart and Sustainable Built Environment*, Vol. 14 No. 4, pp. 1117-1142, doi: 10.1108/SASBE-07-2023-0173.

El Samaty, H.S. (2025), "Readiness of urban design projects for integration with big data. Case study: humanizing neighborhoods initiative–KSA", *Smart and Sustainable Built Environment*, Vol. 14 No. 4, pp. 943-959, doi: 10.1108/SASBE-03-2023-0048.

Galal Ahmed, K., Hamza, N., Kordi, A.O. and Shareef, O.S.M. (2025), "Retrofit with residents: proposed locally responsive participatory method for technical thermal retrofitting of public housing in the United Arab Emirates", *Smart and Sustainable Built Environment*, Vol. 14 No. 4, pp. 1038-1072, doi: 10.1108/SASBE-11-2024-0494.

Ghansah, F.A. (2025), "Digital twins for smart building at the facility management stage: a systematic review of enablers, applications and challenges", *Smart and Sustainable Built Environment*, Vol. 14 No. 4, pp. 1194-1229, doi: 10.1108/SASBE-10-2023-0298.

Gonsalves, N., Afolabi, A. and Akanmu, A.A. (2025), "Impact of social influence on construction workers' intention-to-use exoskeletons", *Smart and Sustainable Built Environment*, Vol. 14 No. 4, pp. 1073-1090, doi: 10.1108/SASBE-06-2023-0153.

Khurshudov, A. (2025), "The smart city conundrum: technology, privacy, and the quest for convenience", *Smart and Sustainable Built Environment*, Vol. 14 No. 4, pp. 1143-1149, doi: 10.1108/SASBE-12-2023-0377.

Likita, A.J., Jelodar, M.B., Vishnupriya, V. and Rotimi, J.O.B. (2025), "A guideline for BIM and lean integrated construction practice", *Smart and Sustainable Built Environment*, Vol. 14 No. 4, pp. 1264-1291, doi: 10.1108/SASBE-03-2024-0098.

Lu, Y., Zheng, H., Chand, S., Xia, W., Liu, Z., Xu, X., Wang, L., Qin, Z. and Bao, J. (2022), "Outlook on human-centric manufacturing towards Industry 5.0", *Journal of Manufacturing Systems*, Vol. 62, pp. 612-627, doi: 10.1016/j.jmsy.2022.02.001.

Motiei, M., Iyer-Raniga, U. and Andamon, M.M. (2024), "IOP conference series: earth and environmental science 1363 (2024) 012039".

Nair, A., Pillai, S.V. and Senthil Kumar, S.A. (2025), "Towards emerging Industry 5.0 – a review-based framework", *Journal of Strategy and Management*, Vol. 14 No. 4, pp. xx, doi: 10.1108/JSMA-04-2023-0067.

Najafi, M. and Rahimian, F. (2024), "Editorial: the role of sustainable development in addressing climate change", *Smart and Sustainable Built Environment*, Vol. 13 No. 5, pp. 1069-1073, doi: 10.1108/SASBE-09-2024-409.

Najafi, M., Hosseini, M.R. and Rahimian, F. (2025), "Editorial: digital frontiers in construction, materials and infrastructures for smart and sustainable built environment", *Smart and Sustainable Built Environment*, Vol. 14 No. 3, pp. 577-581, doi: 10.1108/SASBE-05-2025-527.

Nazari, S., Keshavarz Mirza Mohammadi, P., Ghaffarianhoseini, A., Ghaffarianhoseini, A., Doan, D.T. and Almhafdy, A. (2025), "Comparison of shading design between the northern and southern hemispheres: using the NSGA-II algorithm to reduce building energy consumption and improve occupants' comfort", *Smart and Sustainable Built Environment*, Vol. 14 No. 4, pp. 889-920, doi: 10.1108/SASBE-11-2022-0248.

Ofori, J.N.A., Tomori, M. and Ogunseiju, O. (2025), "Assessing the ethical, social and psychological risks of active and passive exoskeletons in the construction industry: trust, productivity and stress levels", *Smart and Sustainable Built Environment*, Vol. 14 No. 4, pp. 1091-1116, doi: 10.1108/SASBE-09-2024-0394.

Resendiz-Villasenor, C., Pour Rahimian, F., Najafi, M., Carnemolla, P. and Rodriguez, S. (2025), "Contextualised strategies and interventions for ageing in place in low-population density areas", *Archnet-IJAR: International Journal of Architectural Research*, Vol. 14 No. 4, pp. xx, doi: 10.1108/ARCH-04-2024-0154.

Sudhakaran, G.M., Prabhakaran, A., Mahamadu, A.-M., Booth, C.A. and Wiejak-Roy, G. (2025), "Feeling the Earthship house: eliciting a perspective of posterity through immersive virtual reality", *Smart and Sustainable Built Environment*, Vol. 14 No. 4, pp. 960-991, doi: 10.1108/SASBE-05-2023-0122.

Tumpa, R.J. and Naeni, L. (2025), "Improving decision-making and stakeholder engagement at project governance using digital technology for sustainable infrastructure projects", *Smart and Sustainable Built Environment*, Vol. 14 No. 4, pp. 1292-1329, doi: 10.1108/SASBE-10-2024-0451.

Wu, Y., Azmi, A., Ibrahim, R., Ghafar, A.A. and Salih, S.A. (2025), "Creating a sustainable urban ecosystem: the Azheke village model", *Smart and Sustainable Built Environment*, Vol. 14 No. 4, pp. 1150-1171, doi: 10.1108/SASBE-10-2023-0292.

Yitmen, I., Almusaed, A. and Alizadehsalehi, S. (2025), "Facilitating Construction 5.0 for smart, sustainable and resilient buildings: opportunities and challenges for implementation", *Smart and Sustainable Built Environment*, Vol. 14 No. 4, pp. xx, doi: 10.1108/SASBE-04-2024-0127.

Zeng, Q. and Pishdad, P. (2025), "The evolution of sustainable building rating tools: a systematic literature review", *Smart and Sustainable Built Environment*, Vol. 14 No. 4, pp. 1230-1263, doi: 10.1108/SASBE-12-2023-0381.