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Editorial Article

From Systems Awareness to Situated Action: Pathways Toward Sustainable Built Environments

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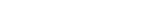
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Abstract

The rapidly growing environmental, social, and technological challenges facing the built environment demand renewed attention to how sustainability is conceptualised, operationalised, and evaluated across scales of practice and research. Architecture, construction, and urban development are increasingly called upon to counter climate change and resource constraints, in addition to questions about social value, institutional capacity, and long-term resilience. This editorial article frames the contributions of the present issue of *ABC2: Journal of Architecture, Building, Construction, and Cities* (2026–02) within these broader imperatives. It situates them as requirements for achieving Sustainable Development Goals and within contemporary debates on systems thinking, circularity, digitalisation, and urban well-being. The articles jointly demonstrate how sustainability is pursued through material and biological innovation, digital construction and data-driven systems, neighbourhood-scale decision support, circular performance assessment, public space analysis, and pedagogical experimentation. Rather than advancing an exclusive model or solution, the issue highlights multiple pathways through which sustainability is translated from conceptual ambition into situated action. Therefore, it reinforces the role of interdisciplinary scholarship, institutional learning, and inquiry-based practice in shaping more responsive, inclusive, and resilient built environments.



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Highlights

- Positions sustainability as the translation of global ambitions into situated practices across the built environment.
- Brings together material, digital, circular, and urban perspectives to elucidate how sustainability operates through interconnected socio-technical pathways.
- Emphasise the role of interdisciplinary research and educational innovation in advancing responsible and resilient built environment futures.

1 Situating the Built Environment within Accelerating Sustainability Imperatives

The built environment occupies a central position in contemporary sustainability discourse, accounting for a substantial share of global resource consumption, carbon emissions, and land transformation while simultaneously shaping social interaction, economic activity, and everyday well-being. As urbanisation increases and construction practices evolve under technological and environmental demands, the responsibilities placed on architecture, building, and urban systems have expanded in both scope and urgency. Sustainability, once framed primarily in terms of energy efficiency or environmental mitigation and the quantifiable attributes, is now understood as a multidimensional challenge encompassing ecological integrity, social equity, institutional governance, and long-term adaptability.

International frameworks such as the United Nations Sustainable Development Goals (UN, 2015) have reinforced the interconnected nature of these challenges, particularly through goals addressing sustainable cities and communities (SDG11), responsible consumption and production (SDG12), climate action (SDG13), and quality education (SDG4). Within this context, the built environment functions as a site of technical intervention, and most importantly, as a socio-technical system through which global objectives are negotiated at local and regional scales. Scholars have increasingly argued that addressing these challenges requires approaches that transcend disciplinary silos and linear problem-solving models, prioritising systems-oriented, context-sensitive, and reflexive modes of inquiry (Elkington, 2018; Geels, 2019).

This expanded understanding of sustainability resonates with critical scholarship that positions architecture and the built environment as cultural, pedagogical, and societal practices, in which knowledge production, professional education, and social responsibility are central to long-term transformation (Salama, 2015; 2019). This issue of *ABC2* is situated within this dynamic landscape. The contributions reflect ongoing efforts to translate sustainability from abstract ambition into operational practice and practical realities across different domains of the built environment. They engage with material performance, digital intelligence, urban governance, circular design, and educational capacity-building, elucidating how sustainability is interpreted and legitimised through diverse yet interconnected research pathways.

2 Material and Biological Perspectives on Building Performance

One critical dimension of sustainable architecture and built environment lies in the reconsideration of material systems and their interaction with ecological processes. As designers and researchers seek alternatives to conventional passive building envelopes, biologically informed and bioreceptive approaches have gained increasing attention. These approaches challenge traditional notions of durability and control by embracing interaction, adaptation, and human co-existence with natural systems. The article by von Werder et al. (2026), *Bioreceptive Building Facades: Codesigning with Nature*, contributes to this discourse through examining how architectural facades can be designed to support biological growth while meeting performance and design criteria. Through framing bioreceptivity as a codesign process, not just a passive material quality, the study aligns architectural innovation with broader sustainability objectives related to biodiversity, climate adaptation, and urban ecosystem services. This work echoes Sustainable Development Goals concerned with sustainable cities (SDG11), climate action (SDG13), and life on land (SDG14), while also challenging predominant performance metrics that often disregard ecological value. Significantly, such material explorations highlight the need to reassess evaluation frameworks in building design. Sustainability in this context is not reduced to efficiency gains but is reconceptualised as an expanded consideration of performance that incorporates ecological relationships and long-term resilience.

3 Digital Systems, Data Intelligence, and Construction Processes

Parallel to material innovation, the digital transformation of construction processes has crystallised as a key avenue for improving sustainability outcomes. Digital twins, sensor networks, and data-driven platforms are increasingly employed to enhance transparency, predictability, and efficiency across project lifecycles. Yet their contribution to sustainability depends on how effectively digital intelligence is incorporated into decision-making processes. Recent research on digital twins and cyber-physical systems emphasises that the value of digitalisation lies in real-time data integration, and significantly in its capacity to support informed decision-making across interconnected technical, organisational, and human systems (Okonta *et al.*, 2025; Sheikhkhoshkar *et al.*, 2025b). Sheenan *et al.* (2026), in *IoT-Enabled Digital Twin for Autonomous Modular Construction Progress Monitoring*, examine how real-time data and digital twin environments can support construction monitoring in modular systems building on earlier efforts (Elghaish *et al.*, 2025). Enabling continuous feedback between physical processes and digital representations, the study demonstrates how construction efficiency, resource use, and project coordination can be improved. Such approaches align with Sustainable Development Goals related to industry, innovation, and infrastructure (SDG9), as well as responsible production (SDG12), while also raising questions about data governance, interoperability, and skills development.

Accompanying this perspective, Daoud *et al.*'s (2026) technical report, *Evaluating Digital-Construction Maturity and Pedagogical Innovation through the QUB-BUE Transnational Education Collaboration*, shifts attention to the educational and institutional dimensions of digital transformation. Through assessing digital construction maturity within a transnational pedagogical framework, the study highlights the role of education in enabling sustainable technological adoption. Within architectural and construction education, such approaches align with broader calls for pedagogical innovation that bridges technical competence with critical understanding, particularly within international and transnational learning contexts (Burton, 2023; Salama *et al.*, 2025; Patil *et al.*, 2025a). The work underscores that digital sustainability is as much about human capacity and institutional learning as it is about technological tools, directly engaging with Sustainable Development Goal targets related to quality education and capacity building (SDG4).

4 Neighbourhoods, Public Space, and Urban Well-Being

At the urban scale, sustainability is increasingly conceptualised and understood through the lens of neighbourhood systems and the quality of public space. Green infrastructure, public parks, and community-scale decision-making play a vital role in shaping urban resilience and social well-being, particularly in rapidly transforming cities.

On the one hand, Sohier *et al.* (2026), in *Accelerating the Transition to Green Building Neighbourhoods: A New Decision Support Platform*, address this scale by proposing a platform that integrates environmental, technical, and planning data to support sustainable neighbourhood development. The study illustrates how decision support tools can facilitate more informed and coordinated transitions toward low-impact urban environments, aligning with Sustainable Development Goals related to sustainable cities, climate action, and innovation. On the other hand, Aly and Dimitrijevic's (2026) article, *Cairo's Green Spaces Between Public Appreciation and the Threat of Official Trivialisation*, offers a corresponding perspective predicated in socio-spatial analysis. Focusing on public perceptions of green spaces in Cairo, the study reveals pressures between civic value, governance practices, and urban development priorities. Envisaging public engagement and lived experience as core scopes, the article reinforces the social dimension of sustainability and highlights the risks of reducing green spaces to symbolic or marginal urban elements. Together, these contributions emphasise that sustainable urban development requires not only technical solutions, but also governance structures and participatory frameworks that recognise social meaning and equity, which are significant and central concerns to critical discussions of public space and urban experience (Salama and Patil, 2025).

5 Circularity, Performance Assessment, and Design Decision-Making

Circular economy principles have become increasingly influential in shaping sustainability agendas within the built environment, particularly in response to resource scarcity and waste generation. However, operationalising circularity at the building and design level remains a significant challenge, requiring robust assessment tools and decision-making frameworks. Mani et al. (2026), in *Assessing Circularity in Building Design: Testing the Building Circularity Performance (BCP) Model Through a Case Study*, address this challenge by envisaging and testing a performance-based model for assessing circularity in design practice. Translating circular economy concepts into measurable indicators, the study contributes to bridging the gap between theoretical ambition and practical implementation (Patil et al. (2025b)). This work directly engages with Sustainable Development Goal targets on responsible consumption and production (SDG12), while also raising critical questions about standardisation, comparability, and the integration of circular metrics into design workflows (SDG9). In essence, the article reinforces a broader theme across the issue: sustainability gains power and cohesion when abstract principles are translated into tools, frameworks, and practices that can be meaningfully adopted by practitioners and institutions.

6 From Metrics to Meaning: Translating Sustainable Development into Built Environment Research and Practice

Viewed as a comprehensive set of contributions, the articles in this issue reveal that sustainability should not be treated as a fixed target or singular framework, but as a process of translation, between global ambitions and local conditions, between conceptual principles and operational tools, and between disciplinary knowledge and institutional research and practice. Across different scales and domains, the articles demonstrate how sustainability gains substance and cohesion when abstract goals are rendered meaningful through design decisions, technological systems, governance mechanisms, and educational practices.

Several contributions engage directly with the challenge of measurement and performance. The Building Circularity Performance model examined by Mani et al. (2026) advances the operationalisation of circular economy principles by transforming theoretical constructs into assessable design criteria. Similarly, the decision support platform proposed by Sohier et al. (2026) translates environmental and planning objectives into practical neighbourhood-scale insights. These efforts highlight the importance of metrics that inform, rather than constrain, design and planning processes, enabling practitioners to navigate complexity without reducing sustainability to compliance-driven checklists (Dessouky et al., 2023).

At the same time, other articles foreground dimensions of sustainability that resist straightforward quantification. The bioreceptive facade strategies explored by von Werder et al. (2026) challenge conventional performance paradigms through embedding ecological processes within architectural envelopes, while Aly and Dimitrijevic's (2026) analysis of Cairo's green spaces asserts the social, cultural, and perceptual values attached to urban parks and the managed version of nature. These studies warn against narrowly technocratic interpretations of sustainability, reminding us that environmental performance, social meaning, and public value are fully interconnected.

Digitalisation emerges as both an enabler and a test of sustainable practice. The IoT-enabled digital twin framework presented by Sheenan et al. (2026) illustrates how real-time data and autonomous monitoring can enhance construction efficiency and resource management. However, wider scholarship on socio-technical systems in the built environment stresses that such technologies become transformative only when embedded within supportive institutional, educational, and professional contexts (Sheikhkhoshkar et al., 2025a; Soltanmohammadi et al., 2025). Developing digital maturity, therefore, becomes a question of capacity building, knowledge transfer, and professional transformation, aligning closely with Sustainable Development Goals related to innovation, education, and institutional resilience.

Across the issue, strong alignment can be observed with Sustainable Development Goals addressing sustainable cities and communities (SDG 11), responsible consumption and production (SDG 12), climate action (SDG 13), industry and infrastructure (SDG 9), and quality education (SDG 4). Yet the contributions also reveal the limitations of treating these goals as discrete, siloed categories. On the contrary, they point toward an understanding of sustainable development as a relational and context-dependent endeavour, in which progress in one domain is often contingent upon advances in others.

For researchers, this issue of ABC2 (2026-02) asserts the value of integrative methodologies that integrate technical rigour with social and institutional awareness. For practitioners, it offers tools and insights that support informed decision-making across design, construction, and urban management. For policymakers, the findings emphasise the need for adaptive governance frameworks capable of accommodating innovation while protecting public interest and long-term environmental responsibility. Importantly, the articles suggest that sustainable transformation in the built environment is unlikely to emerge from individual interventions. It rather depends on the alignment of metrics, meanings, and capacities across scales, disciplines, and sectors.

6 Looking Ahead: Research Pathways and ABC2 Commitment

This issue reaffirms ABC2's commitment to advancing critical and interdisciplinary scholarship at the intersection of architecture, building, construction, and cities. By assembling contributions that span material innovation, digital construction systems, urban analysis, circular performance frameworks, and pedagogical experimentation, the journal continues to position sustainability not as an abstract ideal but as a set of practices, decisions, and responsibilities embedded within the production and governance of the built environment.

Looking ahead, research in this field will need to more closely examine the interactions between technological innovation, social equity, and environmental limits, particularly as climate pressures, urban transformation, and digitalisation intensify. The contributions brought together in this issue point toward research pathways that are context-sensitive, methodologically plural, and attentive to institutional capacity and public value. Advancing such pathways will require sustained attention to how research, education, and practice co-evolve—an orientation long advocated in critical architectural scholarship concerned with socially responsive design, knowledge integration, and institutional change. In doing so, the issue underscores the role of sustained scholarly dialogue in informing more responsible, inclusive, and resilient trajectories for the built environment.

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