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# Editorial: Circular economy and sustainable practices in the built environment

Buildings and infrastructure underpin productivity, connectivity and quality of life. Yet the built environment remains one of the most resource-intensive and environmentally impactful sectors globally. It accounts for substantial shares of material extraction, energy consumption and waste generation (Cervantes Puma *et al.*, 2024). Despite decades of sustainability discourse, policy reform and technological advancement, the sector operates largely under linear production and delivery models that constrain resource efficiency, lifecycle optimisation and long-term value creation (Moore and Manring, 2009; Söderholm, 2020). Consequently, the transformative potential of sustainability initiatives has yet to be fully realised at an industry scale.

## Circular economy as a systemic shift

In the built environment, circular economy (CE) strategies take multiple forms, such as design for disassembly and adaptability, modular and prefabricated construction, refurbishment and lifecycle extension, reverse logistics and digital material passports (Kasarda *et al.*, 2007; Palacios-Munoz *et al.*, 2019). These approaches seek not only to reduce waste but also to retain and regenerate value in materials, components and systems over time.

However, operationalising CE principles in construction remains complex. Built assets are long-lived, capital-intensive and embedded within fragmented supply chains and complex regulatory environments. Material specification and procurement decisions are often made at early design stages, whereas recovery, reuse or repurposing decisions may arise decades later. Bridging these temporal and organisational discontinuities requires robust information continuity, clearly defined accountability structures and business models that incentivise lifecycle thinking (Cloutier and Ravasi, 2020).

Circularity is therefore not merely a technical endeavour but also a managerial and governance challenge. Its success depends on alignment among stakeholders, supportive regulatory instruments and the development of appropriate professional competencies. Understanding how circular strategies can be embedded within project environments, scaled across asset portfolios and institutionalised within industry practice represents a focal area of research for the engineering, construction and architectural management community (Foster, 2020).

## Sustainability across the asset lifecycle

While CE offers a structured approach to resource management, sustainability in the built environment includes broader environmental, economic and social considerations. Sustainable practice spans low-carbon material selection, energy-efficient and climate-responsive design and resilient infrastructure planning towards performance-based facility management (Liang *et al.*, 2022; Salah *et al.*, 2018).

Lifecycle assessment, performance monitoring systems and sustainability metrics have enhanced the industry's capacity to quantify environmental impacts and inform decision-making. Nevertheless, effective implementation also relies on organisational capability, professional expertise and alignment between sustainability objectives and project delivery models (Chen *et al.*, 2024; Gomes Silva *et al.*, 2022). The critical challenge lies not merely in developing analytical tools but in embedding sustainability considerations within routine managerial decision-making, procurement processes and professional practice.



### Digitalisation as an enabler of circular and sustainable practices

Rapid advances in digital technologies are changing the conditions under which circular and sustainable practices can be implemented. Digital twins, the Internet of Things (IoTs), artificial intelligence and advanced data analytics are increasingly deployed to enhance transparency, traceability and evidence-based decision-making across asset lifecycles (Chen *et al.*, 2022).

Digital infrastructures enable more precise material tracking, real-time performance monitoring, predictive maintenance and scenario-based lifecycle evaluation. They offer mechanisms to reduce fragmentation among project stakeholders and to strengthen information continuity across traditionally siloed phases of delivery and operation (Gupta *et al.*, 2023). In principle, such capabilities provide critical enablers for both CE implementation and sustainability optimisation. However, the contribution of digital technologies to circular and sustainable outcomes is contingent upon their effective integration within organisational processes, contractual arrangements and governance frameworks. Digital capability alone is insufficient; systemic alignment and institutional adaptation are equally critical.

### Scope and overview of contributions

Against this backdrop, this Special Issue brings together a set of contributions that advance understanding of CE and sustainability in the built environment through an integrated lens. The nine papers, while diverse in scope, converge around four interrelated themes spanning the *technological*, *organisational* and *institutional* dimensions of circular and sustainable transformation.

- (1) *Digital enablement of circular practices.* Several contributions demonstrate how advanced digital technologies enhance circularity and sustainability through improved data integration, monitoring and predictive capabilities.  
Elghaish *et al.* (2026) develop a digital twin-based system for construction resource monitoring that integrates BIM, IoT and machine learning, enabling real-time tracking and prediction of resource usage. Their work highlights the potential of data-driven systems to optimise resource allocation and minimise waste.  
Xu *et al.* (2026) further extend the role of digitalisation by integrating deep neural networks with refined computational fluid dynamics to reconstruct indoor thermal environments. This approach enables detailed spatiotemporal analysis of thermal comfort, supporting energy-efficient building operation and environmental optimisation.
- (2) *Governance, institutional and system-level barriers to circular transition.* A second group of papers examines the institutional, organisational and systemic constraints shaping the adoption and effectiveness of circular and sustainable practices.  
Tian *et al.* (2026) investigate governance mechanisms in hydropower EPC megaprojects and develop the CORE framework, highlighting interdependencies among capability configuration, organisational structure, relational collaboration and institutional environment in achieving sustainable value co-creation.  
Najafi *et al.* (2026) provide a complementary perspective, demonstrating that the limited implementation of circular construction is rooted in regime-level dynamics rather than individual behaviour. Their findings show how cognitive, normative and regulative structures reinforce linear practices, calling for coordinated, context-specific interventions to overcome systemic lock-in.  
Doan *et al.* (2026) focus on construction waste management in New Zealand, proposing an integrated challenge-strategy framework that links barriers with coordinated policy, governance and stakeholder-driven solutions.
- (3) *Organisational capabilities and stakeholder behaviour.* The transition to circular construction also depends on the development of appropriate knowledge bases,

professional competencies and stakeholder alignment.

Nadeetharu *et al.* (2026) examine the knowledge requirements of design professionals in implementing CE principles and propose a “knowledge wheel” framework integrating values, information and skills as key enablers of circular design. Their findings demonstrate the role of professional capability in operationalising circularity at the design stage.

Lu *et al.* (2026), through a bibliometric analysis of retro-commissioning research, identify a fragmented knowledge landscape and limited collaboration across research communities. Their study highlights the need for stronger knowledge integration and interdisciplinary engagement to advance sustainability practices.

- (4) *Lifecycle integration and implementation strategies.* A final group of papers adopts a lifecycle perspective, examining how circularity and sustainability can be embedded across the full lifespan of built assets.

Wijewickrama *et al.* (2026) provide a systematic review of reverse logistics in construction, identifying key themes and research gaps related to demolition waste management, stakeholder decision-making and implementation.

Rafiei *et al.* (2026) investigate CE implementation in regenerative design through an analysis of Living Building Challenge projects. Their findings reveal strong adoption of material transparency and closed-loop systems, but limited integration of design for disassembly and reverse logistics.

Doan *et al.* (2026), in addition to its governance focus, contributes to this theme by addressing lifecycle challenges in construction waste management and emphasising the need for coordinated strategies across project stages.

Across these four themes, a consistent insight emerges: while technological innovation is essential, it is insufficient on its own. Advancing circular and sustainable construction requires the integration of digital capabilities, governance structures, organisational competencies and lifecycle thinking into a coherent system of practice.

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