

Review

Business Models for Building Sustainability: An Exploratory Integrative Literature Review on Circular Economy, Health and Safety, Digitalization, and Stakeholder Collaboration

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Abstract

The sustainability of buildings and the built environment extends beyond energy and environmental performance to circular resource use, health and safety, digital infrastructure, and stakeholder collaboration. This exploratory integrative literature review examines how these established but insufficiently connected domains reshape business models in the built environment. Since the built environment is a major source of global carbon emissions and waste, a primary research stream concerns the transition toward circular economy principles beyond traditional profit-maximization logics. The literature also highlights the potential of health- and safety-oriented innovations to reduce risks and improve indoor environments. Other studies highlight the potential of digital innovations to improve life-cycle management, resource efficiency, and risk mitigation. However, their widespread adoption faces systemic barriers, including data interoperability and cybersecurity issues, implementation costs, skills shortages, organizational resistance, and regulatory and governance challenges. The literature often emphasizes technical potential while paying less attention to value-capture mechanisms and the allocation of costs, risks, benefits, and responsibilities among the actors involved. Integrating sustainable practices, digital infrastructures, circular-economy principles, and collaborative governance is therefore essential to develop economically viable, organizationally feasible, and ethically responsible business models for the built environment, across the building life cycle and among public and private stakeholders.



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Keywords: building sustainability; business model innovation; circular economy; health and safety; building information modeling (BIM); artificial intelligence (AI); stakeholder collaboration

1. Introduction

The increasing pace and severity of climate-related risks show that the current hyper-consumerist, resource-depleting global system is no longer sustainable because production, consumption, and disposal practices threaten the planet's livability and ecosystem resilience, both of which are vital for survival [1].

Current incremental approaches to addressing socio-ecological challenges, such as gradual adjustments to standard industrial practices, are proving unable to deal with the

underlying causes of unsustainable development. Clearly, a significant shift in development processes is both needed and achievable, provided that the private sector drives this transformative effort. Indeed, business models—which define how a business creates, captures, and delivers value—are central to this change. To address today’s issues, whether social or environmental, business models should evolve to serve community goals and respect ecosystem limits [2]. The built environment, when the entire life cycle of buildings is considered, is one of the sectors that contribute most significantly to greenhouse gas emissions and climate change [3]. However, innovative business models in this sector have only recently begun to receive attention in the scientific literature [4] and mainly from the perspective of energy retrofitting [5]. This exploratory integrative literature review, starting from the existing interpretations [6] and considering the different specific characteristics of the phenomenon across economic sectors [7–9], explores four domains that may constitute elements for further innovation or for rethinking business models in the construction sector: the sustainability of the built environment; human well-being-related aspects; the potential offered by digital innovation and some of its more promising tools; and the need for collaboration among public and private stakeholders. Although these topics are well established, the scientific literature has generally addressed them as separate research streams, including in the context of business model innovation. Therefore, this review addresses the following research question: How can the literature on sustainability, health and safety, digital innovation, and stakeholder collaboration inform the development of innovative business models for the built environment, particularly with regard to value proposition, value creation and delivery, value capture, and allocation of costs, risks, benefits, and responsibilities?

Accordingly, this literature review aims to analyze the four domains in relation to the barriers to the development of business models [10], as well as the potential areas that may instead support their development, considering, among other factors, the driving role of new technologies [11]. The paper is structured as follows: Section 2 presents the methodology adopted for the literature search. Sections 3–6 review four interrelated domains: sustainable and circular principles; health, safety, and well-being; digital innovation; and stakeholder collaboration. Section 7 discusses and summarizes the results. Finally, Section 8 concludes by providing theoretical, managerial, and policy implications and a future research agenda.

2. Research Methodology

The relevant literature was initially identified using three thematic search strings, subsequently complemented by targeted searches addressing the four domains examined in this review. Stakeholder collaboration was not included as a separate thematic search string because of its cross-cutting nature. The following search strings were used in Google Scholar:

- “building sustainability” “business models” “climate change” “risk”;
- “building sustainability” “business models” “safety and health”;
- “building sustainability” “business models” “building information modeling” “artificial intelligence”.

While the first search string included “climate change” and “risk”, the screening process revealed a particularly strong focus on circular economy principles. The circular economy was therefore selected as a domain and further investigated during the following phase of targeted searches. Google Scholar was selected as it is known to be the most comprehensive academic indexing database. The searches were performed on 3 February 2026. For each search string, the first 50 results were selected according to Google Scholar’s relevance ranking. This procedure yielded a list of 150 records, for which metadata were

retrieved using a custom Python script, including title, authors, source, year, DOI, webpage link, first and last pages, volume, and issue. Using DOIs as identifiers, keywords and abstracts, where available, were retrieved from CrossRef, Elsevier Scopus, Semantic Scholar, and OpenAlex, using purposely built Python scripts. Records with no abstract and records appearing in more than one of the three sets of search results were removed, reducing the initial set to 111 unique records. Then, the remaining records were analyzed based on their abstracts and, if necessary, full text to identify the most relevant literature sources for this review. Therefore, articles written in English, relevant to the topic of business models in the built environment, and addressing at least one of the selected domains were considered; peer-reviewed journal articles, book chapters, and conference proceedings indexed in Scopus and/or Web of Science were included. Moreover, preference has been given to recent studies, particularly those published in the last five years; however, older literature has been retained when considered relevant for the review. A total of 45 studies were retained for closer assessment and included in the initial corpus. Additional targeted searches—especially in the publications cited by or citing selected literature sources—were carried out, applying the mentioned inclusion and exclusion criteria to ensure that significant articles were not missed. Further investigations were carried out following the review process. After combining the results of the initial searches with those of the targeted supplementary searches, the final corpus comprised 92 publications: 82 journal articles, 6 book or proceedings chapters, and 4 conference papers. Of these, 50 were published between 2022 and 2026, 34 between 2017 and 2021, and the remaining 8 before 2017. The identification, screening, and inclusion stages of the literature search process are summarized in Figure 1.

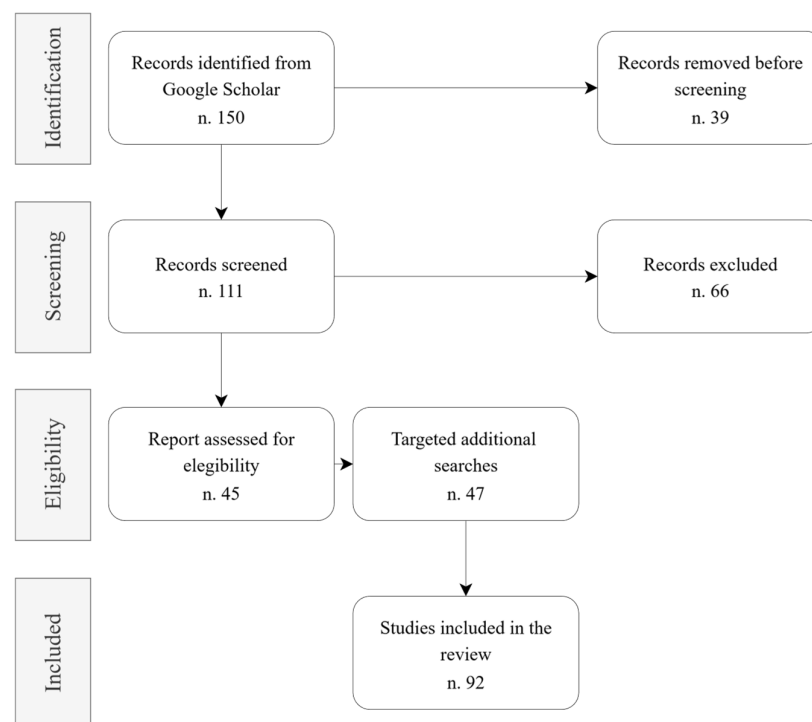


Figure 1. Literature search process diagram.

3. Sustainable and Circular Principles

Since the built environment accounts for up to 40% of global carbon emissions, and possibly an even larger share of waste production, sustainability management is essential in the construction industry. A significant challenge in this field is the potential lack of a common understanding of what building sustainability truly means. The well-known

management motto “what we cannot measure, we cannot improve” implies a shared definition that might be missing among both researchers and practitioners, which could hinder progress [12].

The journey toward sustainability often requires innovation in business models. Tentative adoption of new business models can help companies better adapt to current and emerging market conditions. It is not just about technical upgrades, but also about changing the main shareholder value approach. Studies indicate that sustainability strategies are most effective when they align with the overall business strategy. Sustainability governance, along with senior management’s commitment [13], relies on shared values within organizational structures and collaborative relationships among various stakeholders [14,15], elements that have not yet been fully incorporated into the building industry [16]. However difficult it may be, operationalizing this change is likely to transform the pursuit of sustainability from a compliance burden into a driver of internal engagement and external collaboration.

A company’s value might not be based solely on its profit margin, as reputation, social responsibility, environmental efforts, and other intangible factors are also important. Rather than simply emphasizing financial return, as the dominant logic of value creation dictates, improving community engagement and collaboration also enhances a company’s value [17,18]. As a matter of fact, research shows that a narrow view of the interaction between business and society, which only prioritizes throughput as the way to gain profit maximization, is ill-equipped to address the challenges posed by climate risk and its related feedback loops [2,19].

Overall, it can be stated that integrating circular economy principles into business model innovation requires companies to adopt different practices and management approaches as a necessary step to reduce resource dependence and lower emissions and waste [20]. Firms must redesign their business models to combine value creation with sustainability-oriented innovation, taking into account environmental, social, and energy-transition aspects [21]. To support this transformation, it is necessary to integrate the concept of sustainability into strategic control systems by focusing on short-term objectives capable of achieving long-term sustainability goals [22]. In this context, such principles may also take the form of innovative service-oriented contractual arrangements for energy efficiency, in which the contractors’ involvement and the identification of economically sustainable conditions, in terms of incentives and investment payback time, become fundamental [4]. Among the solutions developed to facilitate this transition, one-stop-shop models applied to renovation have become particularly widespread, allowing the aggregation of all products and services under a single entity, thereby reducing process fragmentation and eliminating barriers to energy renovation [23].

Furthermore, in the construction sector, the integration of deconstruction strategies into the design phase promotes the reuse and recycling of building components, thus reducing waste generation [24]. Nevertheless, this transition requires greater awareness of the circular economy among all actors involved in the building process, as well as incentives, metrics, tools, and guidelines that make design for disassembly and reuse economically credible [25]. In this regard, firms must adopt collaborative processes that involve a plurality of disciplines from the outset, extending responsibilities throughout the entire supply chain while experimenting with new businesses and ownership models [26].

However, the transition introduces time-related dynamics that are often ignored, such as adjustment delays—meaning the time lag between adopting a sustainable practice and seeing its benefits. These delays exert pressure on companies that may lack the resilience needed to withstand the challenges of the transition, as they wait to harvest the long-term benefits like increased sales and improved reputation [14]. Therefore, future business

models should be supported by governance structures that promote long-term stewardship rather than short-term gains [13].

4. Safety, Health, and Human Well-Being

Over time, the meaning of sustainable building has shifted from a narrow focus on energy efficiency and carbon footprint to a broader perspective that also embraces safety and health. New business models are increasingly considering human well-being in the construction and management of projects. Although most sustainability studies focus primarily on environmental issues, with much less emphasis on social aspects [27], some works acknowledge that health and safety are core concerns of sustainable development [28,29]. Accordingly, sustainability is understood as encompassing not only environmental and climate-related concerns but also public health, safety, gender equality, digital security, and other related issues.

Regarding safety, the potential of digital platforms to reduce construction-site risks and prevent accidents through continuous monitoring of site rules and conditions is emphasized [30]. Incorporating safety into the workflow allows companies to implement more predictive and proactive risk management strategies. Digital twins can improve these benefits by linking physical and digital systems throughout the building's life cycle [31]. Digital twin-based models not only reduce the risk of accidents during construction but also help ensure safety for long-term building occupants. However, the ability to leverage advanced technologies depends on significant changes in how construction projects are managed.

Concerning health and well-being, innovative business models are thought to facilitate both targeted energy retrofit solutions and public health management in smart cities and smart buildings. With regard to the first topic, identifying innovative business models that account for health and well-being benefits is considered particularly important when energy retrofits generate a rebound effect that reduce expected energy savings. This applies, for instance, when retrofits are carried out in dwellings with under-served indoor environments [32]. The reduction of GHG emissions through the retrofit of the existing building stock should be achieved through deep retrofit. In these works, innovation of business models and decision-making processes becomes particularly important, alongside maximizing social benefits, including health and environmental aspects [33]. Promoting benefits such as improved health and indoor air quality is considered a strategy to motivate American homeowners to renovate their real estate stock, together with incentives and business models that enable the achievement of a critical mass of retrofits [34]. Moreover, the issue of healthy renovation is particularly important in buildings with specific functions. In this regard, an innovative business model has been developed based on the United Nations' Sustainable Development Goal 3—to ensure healthy lives and promote well-being for all at all ages—identifying public-private partnerships as a promising strategy for market development in the field of smart and healthy renovation of public schools [35].

Regarding the second topic, the need for greater integration and interoperability between the individual building and the smart city itself is identified instead [36,37]. More broadly, the analysis of smart building service providers in Europe reveals underexploited opportunities to improve these solutions in terms of health and well-being and highlights the growing diffusion of service-based and subscription-based contracts [38]. Once again, new digital tools such as city information modeling are designed to manage complex dynamics, aiming to improve healthcare services and prevent secondary health crises in the aftermath of natural disasters [39]. The application of the Internet of Things to urban development appears promising for public safety and healthcare, among others, especially

when integrated with other digital tools and supported by the development of innovative business models [40].

The literature in this field is strongly oriented toward identifying technologies capable of improving health and safety. Indeed, with few exceptions, it remains unclear how these technologies can be implemented to measure, capture and distribute value among the actors involved. The insurance sector provides an example of possible business model mechanisms: such technologies can reshape the interaction between insurer and customer, decision-making and risk assessment, and the modification and creation of new insurance products [41]. Another area of business innovation refers to the monetization of safety data, for instance, by linking safety performance to insurance premiums and project financing rates, or by automating safety incentives in construction through smart contract networks [42].

5. Digital Technologies and Data-Driven Innovation

Digital innovation is driving an unprecedented transformation in the construction industry that will probably also impact its focus on sustainability.

The core of digital innovation lies in Building Information Modeling (BIM) and Artificial Intelligence (AI), which have the potential to change how we design, construct, and manage buildings and urban environments. Advanced modeling has been found to enhance energy-efficient building design and circular economy principles [43]. Smart building and city management can significantly help counteract climate change and its adverse effects by managing energy, waste, water resources, agriculture, and risk factors more efficiently [44]. Sustainability factors, such as carbon footprint and energy consumption, can be addressed from the earliest design stages through to commissioning with the support of digital twins, BIM, virtual reality, and smart technologies. The use of digital twins and blockchain allows the real-time assessment of building performance for implementation of performance-based smart contracts, connecting performance data with contractual mechanisms [45]. More generally, integrating BIM into the design stage can enable more precise processes, improve project performance, and reduce cost-associated risks [46]. Digitalization allows real-time project monitoring, enabling better decisions and more collaborative management among stakeholders.

Beyond their technical potential, the adoption of these technologies depends on their integration into organizational processes, which can be supported by innovative business models. Property Technology startups appear promising for both the digitalization of maintenance operations and the creation of innovative business models. However, several barriers remain, linked to both technologies and the processes and actors involved, which require adequate investigation in order to foster integration [47]. Critical success factors related to the joint adoption of BIM and digital twins in the construction sector mainly concern organizational readiness, the availability of professionals, standards and codes, skills, and investments [48]. In infrastructure construction, accessible and visible data stored in BIM models can drive innovative business models by translating transparency and operational learning into strategic and organizational innovation [49]. A similar relationship between technological and organizational innovation emerges in the prefabrication sector. Among small and medium-sized enterprises, resistance to change, risk perception, the ever-present issues of interoperability and scalability, and skill shortage constitute the main barriers [50]. Within Construction 4.0, which integrates BIM, Internet of Things, robotics and other advanced digital technologies, these barriers are compounded by limited public-policy support [51].

A major field of application concerns the use of BIM and related technologies in circular economy strategies across the building life cycle. 6D BIM, which includes energy

and life-cycle performance data, is often combined with innovative physical technologies and complex decision-support models to examine their potential to foster the circular economy [52]. With regard to value engineering, BIM and advanced algorithms offer significant potential for functional optimization, although barriers remain such as incomplete databases, life-cycle integration challenges, and resistance to change [53]. In building sustainability certification systems, BIM adoption requires improved conceptual frameworks to align information modeling requirements with certification logics [54]. The combination of BIM and Radio-Frequency Identification may also enable the development of new business models in the circular economy, particularly for the reuse of building components, provided that appropriate policy support and information management along the supply chain are ensured [55].

Digital tools applied to construction and demolition waste management represent another important area of research from a circular economy perspective. Concrete recycling receives significant attention in the literature that identifies BIM and Life Cycle Assessment as supporting tools while highlighting costs and interoperability barriers [56]. The diffusion and potential of BIM technology are reflected by acronyms such as RecycleBIM [57], related to deconstruction and definition of information requirements for data and open formats that may unlock new opportunities. Similarly, BIMfD (BIM for Deconstruction) supports the transition from demolition to deconstruction, driven by experts, adaptable business models, and industry acceptance [58].

At the urban scale, interactions among smart city technologies, the circular economy, and digital technologies such as BIM and sensing technologies can support the reuse of materials derived from urban mining, especially if associated with policy interventions and innovative business models [59].

Digital innovation also offers promising applications for developing business models in cultural heritage and urban management. Heritage Building Information Modeling, or hBIM [60], can improve cultural heritage accessibility through 3D modeling, Virtual Reality and Augmented Reality, if supported by economically sustainable business models. In cultural heritage conservation and sustainable tourism development, BIM and the related disciplines offer potential for promotion, dissemination, and expert collaboration [61]. At the urban level, digital twins applied to Positive Energy Districts show potential despite limitations in interoperability, data security, and governance systems [62]. These applications highlight the potential value of digital technologies to the city, although their application requires suitable organizational and governance frameworks.

AI can improve building sustainability by optimizing performance and impacts through data-driven forecasting and machine learning in building design, construction, and operation [63]. AI also appears to have the potential to improve the performance and organizational innovation of construction firms, particularly if associated with exploratory innovation and new business models [64]. Nevertheless, the introduction of AI in this phase of transition is not immune to ethical implications. This has fostered the introduction of frameworks such as the Corporate Digital Responsibility to guide the innovation of business models toward an integration of these technologies, exploiting benefits without exacerbating risks [65].

However, several challenges and obstacles still emerge when implementing these tools. Data interoperability is needed to exchange information efficiently across different digital systems, ensuring continuous, seamless data flow, usefulness, and accessibility [66]. Resource needs, high costs, and a shortage of qualified professionals are among the most urgent challenges [67]. These recurring barriers highlight that digital and technological innovation requires an adequate economic, social and institutional context. Innovative business models can be a tool to make the introduction of such technologies economi-

cally viable, supporting cultural development that can anticipate, if not stimulate, the introduction of specific policies.

Lastly, it is important to recognize the unique difficulties of implementing sustainable practices in developing countries, where resource constraints and diverse regulatory landscapes may lead to prioritizing basic economic survival over the adoption of advanced digital systems [68].

Overall, BIM, digital twins, AI, and related digital technologies can support sustainability by improving design optimization, certification processes, component reuse, waste management, and access to building and life-cycle data; however, their contribution depends on organizational readiness, professional skills, investment, standards, policy support, life-cycle information management, and supply chain coordination. Most of the studies reviewed focus on the technical value of these technologies while providing limited insight into their economic implications and the mechanisms through which the value generated can be captured.

6. Stakeholder Collaboration

Building sustainability is rarely achieved by a single actor alone. Buildings are designed, financed, constructed, maintained, and eventually transformed through interactions among developers, contractors, suppliers, municipalities, utilities, investors, and users. For that reason, sustainability in the built environment should not be framed only as a firm-level business model challenge, but increasingly as a question of collective action and corresponding collaborative business models [26,69], in which value proposition, value creation, value capture, and governance are interrelated across several interdependent actors. Collaborative sustainability business models specify how interdependent actors jointly create and deliver sustainability value, how each actor captures enough value to remain engaged, and how decision rights, investments, risks, and responsibilities are allocated. This broader view resonates with recent scholarship in sustainability, organization, and architecture research, which treats sustainability challenges as spanning across sectoral boundaries and focuses on how business model elements are shaped by collaborative stakeholder ties [26,70].

The need for a collective perspective arises from a recurrent mismatch between the level at which sustainability value is created and the level at which it can be captured. This is especially relevant for building sustainability because many promising solutions (e.g., circular material flows, deconstruction and reuse, district-level energy systems, mobility hubs, and shared digital infrastructures) generate benefits collectively while distributing costs, risks, and rewards unevenly across actors. In such settings, what is beneficial for society does not necessarily translate into immediate gains for each participating organization. As a result, individual business models may capture benefits and costs too narrowly and thus need to be complemented by a collective-level perspective. For example, sustainability outcomes should be assessed across organizational, inter-organizational, and societal levels rather than reducing them to a narrow firm-level logic [71]. Likewise, the benefits of circularity in buildings often arise at the group level: they depend less on the isolated effort of one actor and more on how different actors combine their activities, coordinate resource flows, and support one another in creating and retaining value [72].

Importantly, our review shows that the coordination problem varies across different types of business models. Circular models require credible commitments among designers, owners, contractors, deconstruction firms, and secondary-material markets concerning component quality, information continuity, take-back obligations, and residual value [26,73]. Health-oriented models face split incentives when developers or owners pay for healthier buildings while benefits accrue to occupants, employers, insurers, or

public-health systems [74]. Digital models create questions about who funds data infrastructure, owns and accesses life-cycle data, captures platform or service revenues, bears cybersecurity liability, and becomes dependent on proprietary vendors [75,76]. Digital tools may support collaboration as shared boundary infrastructures, but they can also reinforce asymmetries if data rights and interoperability are left unspecified [77].

From this collective perspective, the business model for building sustainability becomes as much a governance task as a design task. The key questions are not only what sustainable value is offered, but also how actors align around a shared purpose, who makes and bears investments and risks, how collective value capture is organized, and who orchestrates collaboration over time [78]. Research on sustainability collaboration points to the importance of involving the right actors, developing shared decision rules, and designing value capture models around collective outcomes [26]. In the built environment, recent evidence further highlights municipalities and developers as potential keystone actors in circular building ecosystems [79]. Empirical studies further suggest that the successful implementation of such collaborative public–private business models for sustainability depends on how partners’ potentially conflicting logics and different institutional roles are governed under conditions of inherent inter-organizational tensions. Importantly, these tensions should be understood not as constraints, but rather as opportunities to leverage diverse views, interests, and expertise [80].

7. Discussion

The literature reviewed identifies common gaps across the four domains.

Circular, health-oriented, and digital innovations are discussed extensively in terms of their technical or societal potential, but the literature provides less evidence on how those benefits become a value proposition for stakeholders, how complementary activities are coordinated, how returns are captured, and how costs, risks, and responsibilities are allocated. Stakeholder collaboration is the cross-cutting governance response to this problem, but collaboration itself creates coordination costs, power asymmetries, and new forms of dependency. Table 1 compares the business-model consequences of the four research streams. The comparison makes visible that the central research gap is distributive rather than purely technological: value is often created collectively and across time, whereas investment decisions, liabilities, and value capture remain actor-specific.

Table 1. Cross-domain synthesis of business-model mechanisms and governance challenges.

Domain	Business-Model Mechanism	Distributive and Governance Challenge
Circular economy	Creates and retains life-cycle value through durability, reuse, recovery, service, take-back, and residual-value arrangements	Upfront design, information, and deconstruction costs are borne before reuse value is known; quality, ownership, take-back obligations, and residual-value sharing require intertemporal contracts
Health, safety, and well-being	Creates value through fewer accidents, healthier indoor environments, productivity, reduced absence, and lower public-health or insurance costs	Those who finance improvements may differ from occupants, employers, insurers, and public bodies that receive benefits; outcome metrics and benefit-sharing are underdeveloped
Digitalization	Creates value through prediction, optimization, transparency, automation, life-cycle information, and data-enabled services or performance contracts	Implementation and cybersecurity costs, data ownership, interoperability, platform revenues, liability, and vendor lock-in can redistribute value and control
Stakeholder collaboration	Combines complementary resources and aligns value propositions, activities, value capture, and adaptation across actors and life-cycle stages	Orchestration, decision rights, power asymmetry, conflict, coordination costs, and the allocation of costs, risks, benefits, and responsibilities must be designed explicitly

Figure 2 synthesizes the conceptual framework of the review. The four domains are interdependent components of business model innovation in the built environment. The focus shifts from the technical, environmental, or social potential of each domain to the process through which value is created, captured, and delivered and to the distributive question of how costs, risks, benefits, and responsibilities are allocated among the involved actors. Barriers and governance issues influence the integration of the four domains in delivering sustainability outcomes.

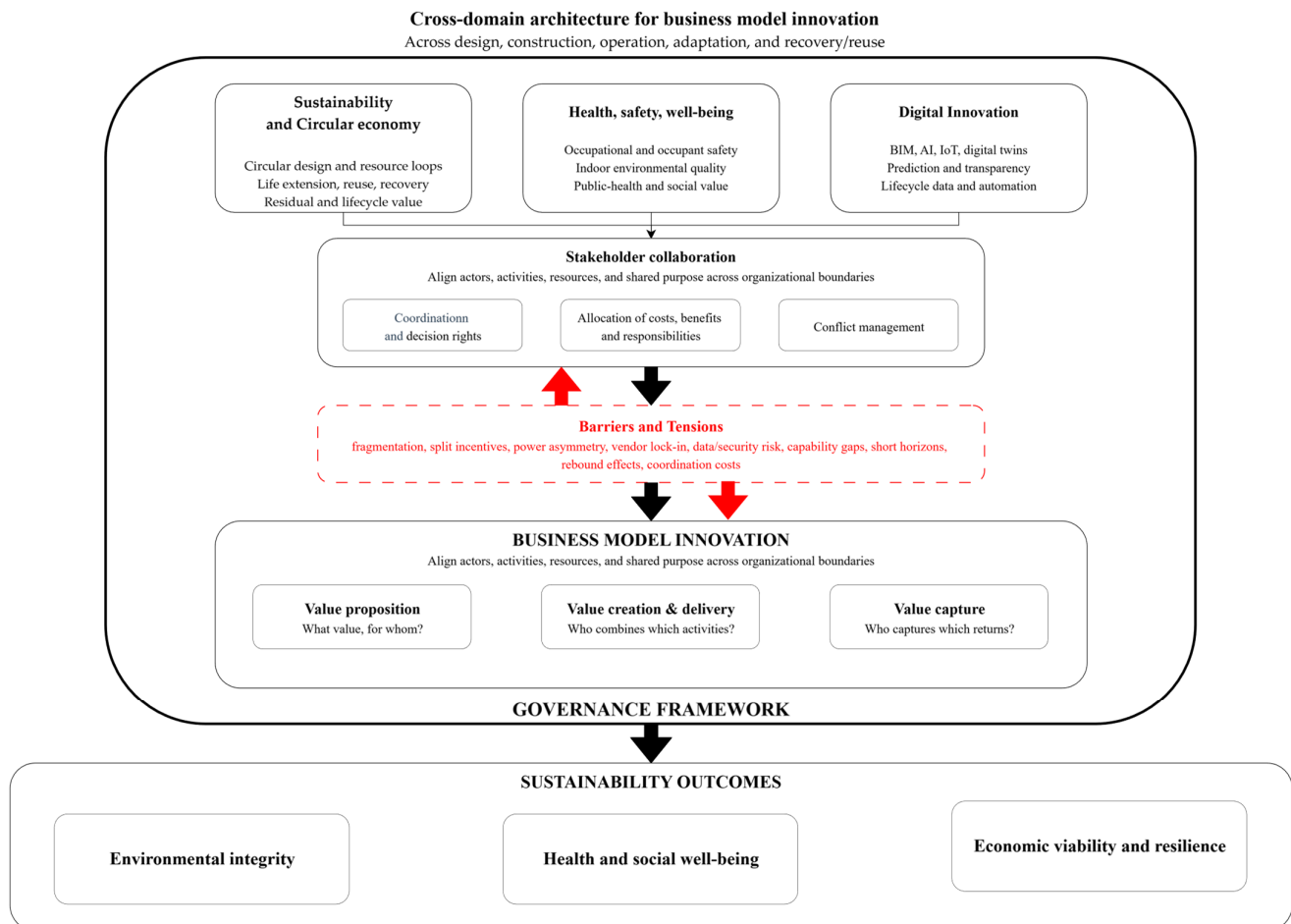


Figure 2. Integrative framework for business model innovation in built-environment sustainability.

The cross-cutting distributive challenge becomes particularly evident when the costs and risks of circular and digital innovation are considered. The cybersecurity risks associated with digital twins have been described as “a perfect storm” because of their potential extension to the physical components of the built environment [81]. This is particularly relevant in the building industry, where attention to data security has historically been lower than in other sectors. Rebound effects in the circular economy can lead to a paradox, whereby improvements in efficiency in the built environment increase resource consumption elsewhere [82]. As discussed in Section 3, an excessive emphasis on the technological side of efficiency may legitimize excessive consumption. The use of AI, which can optimize energy consumption and performance throughout the building life cycle, is also contributing to the global growth in data center-related energy demand. The demand is approaching that of a country the size of the United Kingdom, although evidence regarding AI’s environmental impacts in terms of its carbon and water footprints remains limited [83].

The distributive challenge is also a cross-scale issue. At the urban level, innovative smart-city projects have encountered major implementation problems because of the lack

of governance models suited to the specific solutions proposed [84]. At the firm level, resistance to technology adoption, for example among design engineers, also depends on unclear perceptions regarding the distribution of costs and benefits [85].

These findings should be interpreted in light of the review scope and design limitations. Google Scholar offers broad interdisciplinary coverage, but its relevance ranking is dynamic and the decision to inspect the first 50 results per initial query may have excluded relevant publications. The targeted citation-based searches improved conceptual coverage but reduce exact reproducibility unless their strings, dates, screening counts, and decisions are fully documented. The corpus also combines conceptual and empirical studies, different building types and life-cycle stages, and diverse institutional contexts; it therefore supports analytical integration rather than effect-size comparison or universal causal claims. Future reviews could test the framework through preregistered searches across Scopus, Web of Science, and discipline-specific databases and through transparent quality appraisal.

8. Conclusions and Implications

This literature review highlights the importance of systemic innovation in promoting the adoption of circular economy principles within the built environment [86,87]. In this context, digital tools are often considered essential for acquiring control over critical information needed to manage cities and buildings throughout their life cycle [88–90]. To thrive in the construction industry, organizations must rely on projects and programs that incorporate and prioritize comprehensive sustainability criteria, including social impact [91,92]. Therefore, the transition toward a sustainable built environment cannot be based solely on circular or digital technologies, but needs business models able to connect circular principles, safety and health considerations, digital tools and stakeholder collaboration during the building life cycle. The distributive challenge becomes central, and business models must therefore provide reliable and feasible mechanisms for coordinating and allocating value, costs, risks, benefits and responsibilities among stakeholders.

This review provides two main theoretical contributions. The first lies in understanding four previously fragmented research streams as components of a common business model framework. The second identifies the cross-cutting distributive challenge as central to business model innovation. Future research should further examine how costs, risks, benefits, responsibilities, and decision rights are allocated across building life cycle and among stakeholders involved in the construction process.

From a managerial perspective, the framework highlights the complexity of mapping risks and identifying the actors to whom they are allocated, and measuring the value created. At the operational level this requires employee involvement and training, clarification of roles, and the need to explain how newly adopted practices and technologies affect working methods and practices.

Policy implications are perhaps the most significant for the development of innovative business models. Public support should go beyond incentivizing the adoption of individual technologies by creating the institutional conditions required for private-sector coordination and self-organization throughout the entire building life cycle. Business model innovation could be stimulated, for example, by incorporating appropriate standards or, more specifically, evaluation criteria into public procurement procedures.

Three main research streams that deserve further investigation emerge. First, case studies are needed to test the actual effectiveness of integrating the domains. Second, empirical research should examine how costs and risks are allocated, whether trade-offs exist among them, and how value is created throughout the entire life cycle of built assets, including the role of public policies in supporting coordination. Third, financial,

environmental and organizational costs of digital technologies and possible rebound effects should be included in assessment frameworks.

In conclusion, the transition toward a circular and sustainable built environment should not be treated merely as a matter of technology adoption. Rather, it depends on how business models are designed; how the stakeholders involved interact in the processes of value creation, capture, and delivery throughout the entire life cycle; and how risks and costs are allocated. It also depends on the existence of a governance framework that supports business model innovation.

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