

Towards a regenerative built environment: A circular economy business model approach

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ABSTRACT

This study explores how a Regenerative Built Environment and a Circular Economy Business Model Approach influence sustainable transformation in Ghana's construction sector, with an anchoring in sustainability transition theory. Adopting an interpretive qualitative design, the study conducted 20 semi-structured interviews with construction professionals across public and private organisations. The study targeted construction professionals and used purposive sampling to select experienced participants in project auditing and infrastructure delivery. Thematic analysis using NVivo enabled the identification of strategic drivers, implementation practices, and impact evaluation frameworks, triangulated with policy and industry documents. Results show that the adoption of the circular economy in Ghana is strategically driven by client expectations, regulatory evolution, and corporate sustainability goals. Multinational firms demonstrate stronger integration through digital tools and partnerships, while local firms face challenges of limited capacity and infrastructure. Environmental benefits such as waste reduction and resource recovery are evident, though comprehensive evaluation metrics remain underdeveloped. Policy gaps, leadership commitment, and cross-sector collaboration were found to critically shape the scalability of the circular economy. This research shows that circular business models support low-carbon construction. The study suggests that governance, coupled with digital traceability, the development of technical skills, fiscal policies, and collaboration among stakeholders, will support the integration of the circular economy. This paper extends sustainability transition and business model innovation theory by contextualising the implementation of the circular economy in an emerging economy. It develops a multidimensional framework that links the strategic, environmental, and socio-economic dimensions of circular construction. The study informs policymakers and industry leaders on how to align governance, digitalization, and financial incentives to mainstream the circular economy. It also provides practitioners with insights into embedding lifecycle thinking, material traceability, and collaborative value creation in project delivery. The study's qualitative scope and focus on Ghana limit statistical generalization, though its analytical depth supports theoretical transferability to similar developing contexts. The study concludes that the full potential of circular construction can only be achieved through improved governance and leadership, institutional resilience, and collaboration across the construction sector and among stakeholders. Future studies need to establish context-relevant frameworks and metrics to evaluate circular value creation in Ghana's construction sector.

Keywords: Business Models, Circular Economy, Digitalisation, Ghana, Sustainable Construction

I. INTRODUCTION

The global construction industry faces intensifying pressure to decouple economic growth from resource depletion, as it accounts for nearly 37% of global carbon emissions and generates vast amounts of construction and demolition waste (United Nations Environment Programme (UNEP), 2022). In response, the circular economy (CE) has emerged as a transformative paradigm that redefines how materials, resources, and value are managed throughout the construction lifecycle. Unlike linear "take-make-dispose" systems, CE promotes restorative and regenerative processes, enabling material reuse, design for disassembly, and closed-loop value chains (Krajewska & Siewczyńska, 2025). As sustainability transitions accelerate under climate-neutrality targets, integrating circular-economy-driven business models (CBMs) into construction presents both an environmental necessity and a strategic innovation pathway (Geissdoerfer et al., 2016).

Despite rising academic and policy attention, CE adoption in construction remains uneven and under-conceptualised. Existing research has predominantly examined technological solutions, waste management, and material flows, while overlooking the strategic and organisational dimensions of CE-driven business models (Finamore & Oltean-Dumbrava, 2024; Yu et al., 2022). There is limited understanding of how construction firms translate circular principles into operational strategies, governance structures, and measurable sustainability impacts. Furthermore, current frameworks often neglect the socio-economic and institutional contexts that shape CE uptake across markets,

especially in developing economies, where regulatory and financial barriers persist (Lara et al., 2025). This knowledge gap underscores the need for a systematic assessment of how CE-driven business models enable sustainable transformation in construction practice.

Accordingly, this study aims to explore and critically assess how circular-economy-driven business models influence sustainable construction practices, with an emphasis on strategic implementation processes, value-creation mechanisms, and measurable sustainability impacts. By synthesising conceptual models and empirical insights, this research advances theoretical understanding of CBMs in the built environment and identifies policy and managerial strategies to enhance their scalability. Anchored in sustainability transition theory and business model innovation frameworks (Bocken et al., 2013; Pomponi & Moncaster, 2016), the study contributes to bridging theory and practice by proposing a multidimensional model for evaluating the strategic, environmental, and socio-economic impacts of circular construction. The outcomes aim to inform policymakers, industry leaders, and academics seeking to operationalise CE principles to advance a regenerative, low-carbon construction future.

The remainder of this paper is structured as follows. Section 2 presents a comprehensive review of the existing literature on circular economy (CE) concepts and business models within the construction sector, establishing the theoretical foundations and identifying key gaps in current knowledge. Section 3 outlines the methodological framework for investigating the strategic implementation and impact of CE-driven business models, detailing the research design, data collection, and analytical procedures. Section 4 presents the results and findings, highlighting emerging patterns in CE adoption, organizational strategies, and sustainability outcomes. Section 5 discusses the implications of these findings for existing theories and global best practices, offering insights into how circular business models can drive sustainable transformation in construction. Finally, Section 6 concludes the paper by summarising the key contributions, identifying practical and policy implications, and proposing future research directions to advance the integration of the circular economy within the built environment.

1.1 Research Objective

The main objective of this study is to critically assess how circular-economy-driven business models influence sustainable construction practices, with an emphasis on strategic implementation processes, value-creation mechanisms, and measurable sustainability impacts within the construction industry.

II. LITERATURE REVIEW

2.1 Theoretical Review

The circular economy (CE) represents a transformative shift from linear, resource-intensive construction processes toward regenerative systems that prioritise reuse, recycling, and material recovery. Within the construction sector, responsible for nearly 37% of global CO₂ emissions, this paradigm underpins sustainable transformation through design for disassembly, lifecycle thinking, and closed-loop material flows (United Nations Environmental Program [UNEP], 2022; Krajewska & Siewczyńska, 2025). This literature review critically examines three dimensions of CE-driven business models (CBMs) in construction. First, it explores their conceptual foundations, highlighting frameworks and value propositions that redefine how resources and materials are used. Second, it analyses strategic implementation, focusing on digital traceability, collaborative value networks, and regulatory mechanisms enabling CE adoption. Finally, it assesses impact measurement and value creation using tools such as Life Cycle Assessment (LCA), embodied-carbon metrics, and circularity indicators. Together, these sections provide a comprehensive synthesis of theoretical insights, empirical evidence, and methodological approaches shaping circular transitions in sustainable construction.

2.1.1 Sustainability Transition Theory

This study is theoretically underpinned by sustainability transition theory, which explains how societies, industries, and socio-technical systems move from unsustainable practices towards more sustainable configurations (Huttunen *et al.*, 2022). In the context of construction, the theory is useful because CE adoption requires more than technical improvements; it demands systemic change in business models, procurement systems, institutional rules, stakeholder behaviour, organizational culture, and value chain coordination. Sustainability transition theory, therefore, provides a lens for understanding how circular-economy-driven business models can transform material use, governance structures, operational practices, and value creation in construction. It also highlights the importance of innovation, collaboration, experimentation, policy support, and learning in enabling long-term sustainable transformation (Huttunen *et al.*, 2022).

2.1.2 Conceptual Foundations and Business Models of the Circular Economy in Construction

The circular economy (CE) represents a transformative shift from the traditional linear model towards a regenerative system in which materials, resources, and components circulate in closed loops to minimise waste and environmental impact. In the construction sector, this paradigm promotes the reuse, recycling, and upcycling of materials to achieve sustainability across the building lifecycle (Krajewska & Siewczyńska, 2025). Life Cycle Analysis (LCA) provides a quantitative basis for assessing this transition by evaluating environmental performance from material extraction through demolition and reuse. As construction contributes nearly 37% of global CO₂ emissions, integrating CE principles through material recovery, selective demolition, and design for disassembly is critical to decarbonization efforts (UNEP, 2022; Nadazdi *et al.*, 2022).

Circularity in construction encompasses processes and materials management strategies that aim to maintain resources in continuous use. For instance, reusing concrete aggregates, steel beams, or timber components from demolition activities directly supports closed-loop systems. The construction industry's shift from open, linear processes to circular systems involves designing buildings for adaptability, enabling deconstruction, and using material passport tools to ensure traceability and facilitate secondary use (Ranasinghe *et al.*, 2024). Case studies across Europe and Asia demonstrate that implementing CE-driven material reuse not only reduces embodied carbon but also fosters innovation in material science, logistics, and digital construction platforms such as Building Information Modelling (BIM) (Krajewska & Siewczyńska, 2025).

Circular business models (CBMs) operate this conceptual shift by redefining how value is created, delivered, and captured within construction ecosystems. Unlike traditional models focused on linear throughput and ownership, CBMs emphasize longevity, regeneration, and collaborative networks (Islam *et al.*, 2025). They differ from sustainable business models by integrating restorative logic that extends beyond minimising impact to actively regenerating resources (Geissdoerfer *et al.*, 2016). For construction organizations, CBMs include models based on resource recovery, product-as-a-service, and design for disassembly. Frameworks such as those proposed by Pomponi and Moncaster, (2016) and Bocken *et al.*, (2013) map CE business logic through five key components: value proposition (e.g., extending building lifespan), value creation (through digital traceability, material reuse), value delivery (collaborative stakeholder ecosystems), value capture (economic gains from resource efficiency), and value network (cross-sector partnerships).

Despite growing momentum, research gaps persist. There is limited conceptual consensus on how to define CE-driven business models in construction, and empirical work remains scarce compared to the manufacturing sector (Finamore & Oltean-Dumbrava, 2024). Developing economies face unique barriers, such as weak regulatory frameworks, limited digital infrastructure, and high upfront costs that constrain the full implementation of CE (Yu *et al.*, 2022). Consequently, context-specific CBMs that reflect local institutional, economic, and cultural realities are required. Integrating CE principles into construction business strategies demands systemic change encompassing regulatory reform, financial innovation, and capacity building. Therefore, advancing CE-driven business models in construction requires aligning sustainability metrics with strategic value creation and developing robust assessment tools for measuring circular performance and socio-environmental impact.

2.2 Empirical Review

2.2.1 Strategic Implementation of Circular Economy-Driven Business Models in Sustainable Construction

The strategic implementation of circular economy (CE)-driven business models in sustainable construction signifies a paradigmatic shift from linear, resource-depleting systems to regenerative, value-retaining frameworks (Finamore & Oltean-Dumbrava, 2024). Central to this transformation are design for disassembly (DfD), material reuse, lifecycle thinking, and business model innovation, which together enable the construction sector to move beyond incremental sustainability toward systemic circularity. As Finamore and Oltean-Dumbrava (2024) observe, DfD principles ensure that materials and components can be efficiently separated and reused, extending their life cycles and significantly reducing embodied carbon in buildings. This approach aligns with the Ellen MacArthur Foundation's model of restorative industrial systems that promote longevity and eliminate waste through superior material planning (MacArthur, 2013). Furthermore, the integration of lifecycle-based thinking and cradle-to-grave design expands traditional sustainability metrics by embedding resource efficiency, social equity, and environmental regeneration across project stages (OECD, 2019).

At the organisational and supply chain levels, CE implementation relies on collaborative value networks that integrate contractors, suppliers, designers, and waste processors. The study, *Circular Business Models for Construction Companies*, highlights that value co-creation depends on digital and informational coordination across firms, facilitated by Building Information Modelling (BIM), digital twins, and Building Material Passports (BMPs) (Zhang *et al.*, 2025). These technologies provide traceability and data transparency, ensuring that materials can be reintroduced into production cycles and reused in multiple projects. Similarly, Finamore and Oltean-Dumbrava (2024) stress that BMPs enhance material recovery efficiency and operationalise lifecycle data to support decision-making during the design and

demolition phases. The use of digital tools thus serves as a key strategic mechanism for enabling CE adoption by linking physical and digital asset management in circular supply chains.

Despite these advances, the transition toward circular business models remains constrained by persistent technical, financial, and institutional barriers. Limited recycling infrastructure, high upfront costs, and the absence of harmonised CE regulations hinder large-scale implementation, particularly in developing contexts (Lara *et al.*, 2025). Moreover, cultural resistance, risk aversion, and fragmented governance systems exacerbate slow adoption rates (Finamore & Oltean-Dumbrava, 2024). Yet, policy incentives, cross-sector collaboration, and education programmes have emerged as powerful enablers for change, driving organisational learning and innovation within construction ecosystems (Organization for Economic Cooperation Development [OECD], 2019).

Strategic CE adoption ultimately links business model transformation with tangible sustainability outcomes (Aryee & Kanda, 2024). Integrating circular strategies into construction delivers resource efficiency, waste minimisation, cost savings, and improved social value outcomes, reinforcing both corporate competitiveness and environmental resilience (MacArthur, 2013; OECD, 2019). By embedding CE principles into strategic implementation processes, the construction sector can evolve from a major consumer of resources to a regenerative agent that contributes to net-zero and circular transitions worldwide.

2.2.2 Impact Assessment and Value Creation of Circular Economy Business Models in Construction

The assessment of Circular Economy (CE) impacts within the construction industry has become central to evaluating how Circular Business Models (CBMs) create measurable environmental, social, and economic value. Existing frameworks and indicators, such as Life Cycle Assessment (LCA), embodied carbon quantification, waste-reduction metrics, and resource-efficiency indices, are widely used to assess sustainability performance (De Angelis, 2021). LCA-based tools enable comprehensive evaluation of energy use and emissions across a building's lifecycle, while assessments of embodied carbon and waste generation capture material and end-of-life impacts. More recent approaches also integrate circularity indicators, such as the Material Circularity Indicator (MCI) developed by the Ellen MacArthur Foundation, and resource productivity ratios that measure the effectiveness of material loops in construction systems (MacArthur, 2013).

Empirical evidence highlights successful CE-driven initiatives across various construction contexts. Case studies on selective deconstruction and the reuse of structural components such as concrete panels, steel frames, and timber elements demonstrate both environmental gains and new business opportunities (Küpfer *et al.*, 2022). Closed-loop material flows in large-scale projects, including urban regeneration schemes, exhibit reduced dependence on virgin materials and enhanced asset residual value (Kara *et al.*, 2022). However, challenges persist; limited standardisation in impact assessment and inconsistent data quality hinder comparability across projects (Sin *et al.*, 2024). These findings underscore the importance of adopting multidimensional evaluation tools that combine LCA with economic and social value assessments to capture the holistic impacts of CBMs.

In terms of value creation, CE-based business models generate multiple forms of value—economic (cost savings and new revenue streams from material recovery), ecological (reduced waste and emissions), and social (job creation and stakeholder inclusion) (Islam *et al.*, 2025). De Angelis (2021) identify that CBMs embody a systemic logic of value co-creation, where firms collaborate with stakeholders across the value chain to sustain resource loops and innovate service-based models. This systemic perspective extends the traditional notion of value capture from firm-level profitability to network-level resilience and environmental stewardship.

Nonetheless, barriers to realising CE impacts remain. Cost and regulatory misalignments, lack of clear valuation methods, and industry fragmentation impede large-scale adoption (Zighan *et al.*, 2025). Moreover, impact measurement is often limited to environmental metrics, neglecting social and long-term economic effects. Scholarly reviews and bibliometric analyses (e.g., Goyal *et al.*, 2020) call for deeper empirical exploration, particularly in developing contexts where construction waste management systems and CE policies are still evolving.

III. METHODOLOGY

3.1 Research Design

This study examined the conceptualisation, implementation, and evaluation of the Regenerative Built Environment and Circular Economy Business Model Approaches within Ghana's construction industry. It focused on how professionals and institutions interpret and apply circular economy principles. The study was grounded in the interpretivist paradigm. According to Creswell and Poth (2018), social realities are representations of individuals' experiences and the meanings and interpretations they attach to them in given contexts. This approach was considered appropriate because the adoption of the circular economy in construction is built on social constructs shaped by professionals' roles, interrelationships, and partnerships among institutions, the regulatory framework, and the industry's culture. A qualitative research design was used, with Ghana as the sole focus of an extensive case study.

3.2 Study Area

This research focused on Ghana's construction industry. Ghana was selected for this research due to the importance of its construction industry in providing critical infrastructure, housing, and urbanisation, as well as the country's economic growth. However, the construction industry in Ghana also faces sustainability challenges, including significant construction material waste and inefficient resource use, coupled with poor recycling and even poorer circular procurement practices. Hence, the case study focused on a developing economy to explore the implementation of circular economy principles. The case study approach was based on models of strategic, operational, and institutional innovations in circular business models and, in particular, on the frameworks provided by Finamore and Oltean-Dumbrava (2024) and Islam et al. (2025), which consider the contextual nature of circular business models.

3.3 Target Population

The study population comprised professionals directly engaged in construction management, policy formulation, sustainability research, and circular economy-related practices. These participants were considered appropriate because they possessed practical, technical, managerial, and institutional knowledge of Ghana's built environment. The target population included senior project managers, sustainability and innovation managers, architects, quantity surveyors, academics, and government officials. Their professional backgrounds ensured that insights were obtained from different levels of the construction value chain, including design, procurement, project management, policy implementation, sustainability assessment, and construction operations. This diversity supported a balanced understanding of circular economy adoption from both public- and private-sector perspectives.

3.4 Sampling and Sample Size

A purposive sampling technique was used to select participants with relevant expertise and direct involvement in circular economy-related practices. This technique was appropriate because the study required information-rich participants capable of providing detailed insights into how circular principles are understood, adapted, and applied within Ghana's construction industry. A total of 20 participants were selected for the study. The sample reflected a balanced mix of technical, managerial, academic, and institutional perspectives. Although the sample size was not intended for statistical generalisation, it was adequate for qualitative inquiry because the emphasis was on depth, contextual understanding, and thematic richness. The selected participants provided useful perspectives on opportunities, constraints, implementation pathways, and institutional conditions influencing circular economy business models in Ghana's construction sector.

3.5 Data Collection Instruments and Procedures

Primary data were gathered through semi-structured interviews. This instrument was chosen because it allowed the researcher to explore participants' experiences while maintaining thematic consistency across interviews. Before data collection, initial visits and contacts were made to confirm participants' willingness to participate and to agree on suitable interview modalities, either in person or virtually. Each interview lasted between forty-five and sixty minutes and was conducted using an interview guide. The guide encouraged open reflection and enabled probing into emerging issues related to regenerative built-environment practices, circular business models, strategic implementation processes, operational mechanisms, institutional support, barriers, and sustainability impacts.

All interviews were audio-recorded with informed consent and supported by field notes to capture contextual nuances. Interviews conducted in a local language were translated into English before transcription to preserve meaning and ensure accuracy. Member checking was used by sharing summaries with participants for confirmation, thereby validating the accuracy of interpretations (Birt et al., 2016). To strengthen analytical validity, secondary sources, including government policy documents, industry reports, academic publications, and professional association papers, were reviewed. These materials provided an institutional and regulatory context and enabled triangulation of interview findings.

3.6 Data Analysis

All interview transcripts, field notes, and supporting documents were imported into NVivo 14 to facilitate systematic data organisation and coding. Thematic analysis was used to identify, analyse, and interpret recurring patterns within the qualitative data. The analysis followed the five-step procedure outlined by Braun and Clarke (2006) and Morris (2015), involving familiarisation with the data, generation of initial codes, identification of themes, refinement of thematic categories, and interpretation of meaning.

Coding was conducted inductively, allowing themes to emerge from the data rather than imposing predetermined categories. The analysis focused on recurring patterns and relationships related to strategic drivers, operational mechanisms, stakeholder roles, impact assessment, circular value creation, and institutional barriers. The codes were refined into broader thematic clusters aligned with the study objectives. Verbatim quotations were used to



support interpretation and ensure that participants’ voices were authentically represented in the findings (Fossey et al., 2002).

3.7 Ethical Considerations

Ethical principles were observed throughout the study. Participants were informed about the purpose of the research, their voluntary participation, confidentiality, and the right to withdraw at any stage. Informed consent was obtained before each interview, and participants’ identities were protected through coding and anonymisation. Research data were securely stored and used only for academic purposes.

Trustworthiness was ensured through credibility, dependability, confirmability, and transferability. Credibility was enhanced through member checking and triangulation. Dependability was achieved by maintaining an audit trail of coding and analytical decisions in NVivo. Confirmability was supported through reflective memo writing and peer debriefing with academic supervisors. Transferability was promoted through thick descriptions of the Ghanaian construction context, thereby enabling analytical relevance to similar settings in developing economies.

Table 1.

Respondents Demographic

Profession	Role	Affiliation	No
Senior project managers	Technical roles	Private construction firms (medium–large scale)	5
Sustainability and innovation managers	Strategic policy roles	Multinational and local firms	4
Architects	Design for disassembly & lifecycle planning	Design firms and consultancies	3
Quantity Surveyors	Financial assessment of CE	Construction cost firms	2
Academics	Knowledge integration / CE metrics	Universities & research institutions	3
Government officials	Policy and institutional frameworks	Ministry of Works, EPA, or local authorities	3

IV. FINDINGS & DISCUSSION

4.1.1. Strategic Principles and Drivers of Circular Economy (CE) Adoption

Across all respondent categories, there was a shared understanding that CE adoption is increasingly tied to broader sustainability agendas, client expectations, and competitive positioning. Senior project managers and sustainability managers emphasised that the transition to CE was no longer optional but had become a standard in emerging markets.

“We started looking seriously at circularity because clients, especially international developers, now request evidence of resource recovery and material efficiency.” (Senior Project Manager 19.12.2025)

“Our sustainability policy now positions CE as a pillar for achieving long-term environmental compliance and reputation enhancement.” (Sustainability and Innovation Manager, 19.12.2025)

Government officials further highlighted regulatory signals and institutional mandates as primary enablers.

“The Ministry is integrating CE into building codes and procurement frameworks to push firms beyond traditional waste management.” (Government Official 20.12.2025)

Academics viewed CE as a knowledge-driven framework capable of linking construction productivity to environmental performance:

“Circular economy is redefining sustainability metrics in our built environment research, connecting waste minimization directly to design innovation.” (Academic, 19.12.2025)

4.1.2 Operationalization of CE Strategies

Respondents described varying degrees of CE integration into organizational and project processes. Technical professionals (architects, project managers, and quantity surveyors) noted that digital tools and collaborative models, particularly Building Information Modelling (BIM), were instrumental for lifecycle design and material tracking.

“BIM allows us to trace materials from design to demolition, which is key for reusing components in future projects.” (Architect 19.12.2025)

“Our cost evaluations now include lifecycle costing and residual value recovery to reflect circularity principles.” (Quantity Surveyor 19.12.2025)

Multinational firms appeared more advanced in implementing structured CE strategies, leveraging partnerships with waste recovery companies and digital data platforms.

“Partnerships with material suppliers who can provide data on recyclability have become central to our circular construction model.” (Sustainability Manager 19.12.2025)

However, local firms cited challenges of limited digital infrastructure and knowledge capacity.

“We understand the concept but lack the technical systems and training to operationalise CE beyond pilot projects.” (Project Manager 19.12.2025)

4.1.3 Evaluation of Sustainability Impacts

Respondents measured sustainability performance using a mix of qualitative and quantitative indicators. Environmental impacts such as waste reduction, embodied carbon savings, and resource efficiency were most frequently mentioned. Economic and social impacts were tracked less formally but were acknowledged as emerging areas of interest.

“We estimate material recovery rates and waste diversion percentages, but a unified metric for circular performance is still missing.” (Sustainability Manager 19.12.2025)

“The cost benefits are becoming clearer; reusing materials saves procurement costs and improves project image.” (Quantity Surveyor 19.12.2025)

Academics and government officials noted the need for institutionalised performance indicators:

“We are developing frameworks to quantify CE benefits in terms of employment creation, innovation, and carbon footprint” (Government Official 20.12.2025).

“There’s a growing demand for evidence-based metrics that demonstrate how circular construction translates into measurable sustainability outcomes.” (Academic 19.12.2025)

4.1.4 Barriers, Enablers, and Policy Implications

Common barriers included high upfront costs, lack of clear policy direction, fragmented stakeholder collaboration, and limited awareness of CE’s long-term value proposition. Public agencies and academics pointed to policy incoherence and the absence of standardised CE guidelines in Ghana’s construction regulations.

“Our biggest challenge is the absence of national standards or incentives for circular design and procurement.” (Government Official 20.12.2025)

“Circular economy remains a policy aspiration until it’s backed by enforcement and fiscal incentives.” (Academic 19.12.2025)

Conversely, enablers identified included leadership commitment, cross-sectoral partnerships, and knowledge exchange platforms.

“The shift will accelerate when government, universities, and private firms collaborate through shared CE innovation hubs.” (Sustainability Manager 19.12.2025)

“Executive leadership is key when top management sees CE as part of corporate strategy; the rest of the team aligns naturally.” (Senior Project Manager 19.12.2025)

4.2 Discussion

4.2.1 Strategic Principles and Drivers of CE Adoption

Findings reveal that the Ghanaian construction sector is undergoing a gradual strategic shift toward integrating Circular Economy (CE) principles into corporate and project strategies. Across respondent categories, CE adoption was framed not merely as an environmental responsibility but as a strategic imperative driven by client expectations, market competitiveness, and institutional reputation. As one Senior Project Manager explained, “We started looking seriously at circularity because clients, especially international developers, now request evidence of resource recovery and material efficiency.” This indicates clear alignment with international trends linking CE integration to market differentiation and regulatory compliance (Geissdoerfer et al., 2016; Islam et al., 2025).

From a policy perspective, Government Officials emphasised the state’s growing role in embedding circularity within national standards: “The Ministry is integrating CE into building codes and procurement frameworks to push firms beyond traditional waste management.” This aligns with Lara et al. (2025), who highlight those regulatory frameworks act as catalysts for CE mainstreaming in emerging markets. Furthermore, Sustainability and Innovation Managers positioned CE as a strategic instrument for corporate transformation: “Our sustainability policy now positions CE as a pillar for achieving long-term environmental compliance and reputation enhancement.”

Academics extended this narrative by situating CE within research and knowledge transfer systems, observing that “Circular economy is redefining sustainability metrics in our built environment research, connecting waste minimisation directly to design innovation.” Such strategic positioning reflects Aryee and Kanda’s (2024) assertion that learning and knowledge capabilities are key determinants of effective CE transitions. Overall, these insights reveal that Ghana’s CE agenda is strategically anchored but still maturing operationally, mirroring Finamore and Oltean-Dumbrava’s (2024) depiction of global CE evolution from conceptual to institutional integration.

4.2.2 Operationalization of CE Strategies

Respondents described varying degrees of progress in embedding CE practices into project operations. Technical professionals underscored digitalisation as the cornerstone of circular practice. An Architect highlighted that “BIM allows us to trace materials from design to demolition, which is key for reusing components in future projects.” Likewise, a Quantity Surveyor noted, “Our cost evaluations now include lifecycle costing and residual value recovery to reflect circularity principles.” These findings align with those of Finamore and Oltean-Dumbrava (2024) and Zhang et al. (2025), who emphasise that Building Information Modelling (BIM) and material passports are strategic enablers for CE implementation.

For multinational construction firms, CE operationalisation was more structured. One Sustainability Manager remarked, “Partnerships with material suppliers who can provide data on recyclability have become central to our circular construction model.” This aligns with OECD (2019) and Yu et al. (2022), who underscore the importance of cross-sector partnerships and digital data platforms in advancing circular supply chains. However, the narrative diverged for local firms. A Project Manager admitted, “We understand the concept but lack the technical systems and training to operationalise CE beyond pilot projects.” This highlights persistent capability gaps that constrain circular practice, particularly in data infrastructure, technical training, and financial resources. These findings affirm Finamore and Oltean-Dumbrava’s (2024) view that CE adoption in developing economies is often conceptual rather than systemic, shaped by institutional learning trajectories and uneven technological readiness.

4.2.3 Evaluation of Sustainability Impacts

Respondents assessed CE performance through mixed environmental and economic lenses, focusing primarily on waste reduction, material recovery, and embodied carbon savings. A Sustainability Manager observed, “We estimate material recovery rates and waste diversion percentages, but a unified metric for circular performance is still missing.” This reflects De Angelis’s (2021) critique that CE evaluation globally remains fragmented and heavily skewed toward environmental indicators. Economic and social dimensions were acknowledged as secondary but emerging areas of interest. A Quantity Surveyor explained, “The cost benefits are becoming clearer; reusing materials saves procurement costs and improves project image.” This perception aligns with that of Aryee and Kanda (2024), who link CE to business performance via resource efficiency and brand enhancement.

Institutional actors also stressed the urgency of developing national evaluation frameworks. A Government Official shared, “We are developing frameworks to quantify CE benefits in terms of employment creation, innovation, and carbon footprint.” Similarly, an Academic emphasised, “There’s a growing demand for evidence-based metrics that demonstrate how circular construction translates into measurable sustainability outcomes.” Such institutional focus aligns with OECD (2019) which advocate for integrated CE metrics that capture environmental, social, and innovation outcomes. Ghana’s context thus reveals an emergent stage in impact evaluation, in which evidence generation precedes metric standardisation.

4.2.4 Barriers, Enablers, and Policy Implications

Despite strategic intent, several systemic barriers continue to inhibit CE mainstreaming in Ghana’s construction sector. High upfront costs, policy incoherence, and limited technical capacity were recurrent themes. A Government Official lamented, “Our biggest challenge is the absence of national standards or incentives for circular design and procurement.” Similarly, an Academic cautioned, “Circular economy remains a policy aspiration until it’s backed by enforcement and fiscal incentives.” These challenges align with those of Zighan et al. (2025) and Lara et al. (2025), who attribute the slow uptake of CE in emerging economies to weak institutional coherence and fragmented stakeholder ecosystems.

Nonetheless, respondents identified strong leadership, partnerships, and knowledge-sharing as critical enablers. A Sustainability Manager stressed, “The shift will accelerate when government, universities, and private firms collaborate through shared CE innovation hubs.” This view supports Sin et al. (2024), who advocate multi-stakeholder collaboration as a catalyst for CE scalability. Similarly, a Senior Project Manager affirmed, “Executive leadership is key when top management sees CE as part of corporate strategy; the rest of the team aligns naturally.” Leadership-driven alignment, as Aryee and Kanda (2024) note, is a defining determinant of organisational transition toward CE maturity.

Overall, Ghana’s CE landscape demonstrates that policy direction, leadership commitment, and cross-sector collaboration remain the most powerful levers for transformation. Embedding CE in construction requires not only technological innovation but also institutional integration, policy coherence, and adaptive learning. When positioned within Pomponi and Moncaster’s (2016) circular framework, Ghana’s trajectory extends the model by illustrating how institutional capability development functions as both a precondition and outcome of circular transition.

V. THE STUDY IMPLICATIONS FOR POLICY, PRACTICE, AND RESEARCH

The study highlights an urgent need for a coherent, enforceable policy framework that embeds circular economy principles throughout Ghana's construction sector. Although early policy signals have emerged through building codes and sustainability initiatives, there remains a lack of consistent standards, fiscal incentives, and institutional mandates to guide implementation. For circular construction to become mainstream, the state must move beyond aspirational sustainability policies toward clear regulatory mechanisms that define, monitor, and reward circular performance.

A national circular construction policy would provide the necessary coordination among ministries, local authorities, and industry actors. Such a framework should establish measurable targets to reduce waste, promote material reuse, and reduce embodied carbon, while promoting resource efficiency through design standards. This would ensure that circularity becomes a compliance requirement rather than a voluntary commitment. Integrating lifecycle assessment and material recovery obligations into building permits and procurement processes could make circular practices the norm rather than the exception.

Fiscal incentives and market-based instruments are equally essential to drive adoption. Tax rebates, preferential procurement for circular projects, and access to green financing could offset the high upfront costs that many firms identified as a barrier. Establishing a public circular construction fund or providing low-interest loans for retrofitting, recycling infrastructure, and digital traceability tools would encourage private investment and technological innovation. In addition, government-led pilot projects could serve as demonstrators, showing the practical and economic feasibility of circular construction.

Institutional capacity building is another critical area. Policymakers, regulators, and local government officers need training in lifecycle thinking, resource accounting, and digital monitoring to effectively enforce circular principles. Integrating these competencies into urban planning and environmental management curricula would strengthen technical capacity across the ecosystem. Policy coherence can also be enhanced through inter-ministerial coordination platforms that link the ministries responsible for works, housing, the environment, and finance to develop a unified strategy for circular construction.

From a practical standpoint, the findings demonstrate that the transition to circular construction requires big organisational change, technological integration, and leadership commitment. Firms must embed circularity into their core business models rather than treating it as an isolated sustainability initiative. For project managers and contractors, this means adopting lifecycle-based planning and performance management from design to deconstruction.

A key priority is to strengthen digital capabilities across the industry. Building Information Modelling, digital twins, and material passports emerged from the study as critical enablers for traceability and resource management. Firms that invest in these tools can monitor material flows, calculate residual value, and identify reuse potential across projects. Expanding the use of digital data platforms would enhance collaboration between designers, suppliers, and waste processors, ensuring that materials retain value through multiple construction cycles.

Capacity building within firms is also essential. The study revealed that local contractors often lack the technical expertise and resources to operationalise circular strategies. Establishing in-house sustainability teams or partnering with academic institutions could bridge this gap. Continuous professional development programs focusing on design for disassembly, lifecycle costing, and resource-efficient construction should become part of mainstream industry training. Professional associations can play a vital role in accrediting such programs and disseminating best practices.

Collaboration and leadership emerged as decisive factors for successful implementation. The findings show that when top management aligns circular goals with corporate strategy, operational teams are more willing to adopt new processes and technologies. Executive leadership, therefore, needs to create internal accountability systems that link sustainability targets to performance appraisals and project outcomes. Cross-sectoral collaboration among construction firms, waste management companies, and technology providers can create shared innovation hubs to test new materials, recycling technologies, and business models.

At the project level, lifecycle costing should replace the traditional lowest-bid procurement approach. Decision-makers should assess total project value, including maintenance, adaptability, and end-of-life reuse potential. Adopting circular procurement frameworks would help clients and contractors evaluate long-term value creation rather than immediate capital savings. This shift would also enhance transparency and reduce waste, making projects both economically and environmentally sustainable.

The study opens several important avenues for future research in circular-economy-driven construction. Although progress has been made in understanding strategic drivers and organisational readiness, empirical evidence on long-term performance outcomes remains limited. Future research should focus on developing robust metrics to assess how circular practices influence financial performance, innovation, and social value creation within construction ecosystems.

There is also a need for longitudinal studies that track the implementation of circularity across multiple project cycles. Such research could reveal how learning, leadership, and collaboration evolve and how institutional contexts

affect adoption patterns. In emerging markets such as Ghana, the interaction among regulatory frameworks, market incentives, and corporate strategy warrants detailed investigation. Comparative studies of public and private-sector projects could further illuminate the contextual factors that enable or hinder circular transitions.

Methodological advancements are equally crucial. Most existing assessment tools focus on environmental indicators such as waste diversion and carbon reduction, but they rarely capture social and economic dimensions. Developing multi-dimensional evaluation models that integrate economic resilience, employment creation, and innovation outcomes would provide a more holistic understanding of circular value creation. This would also allow policymakers and practitioners to measure the return on investment from circular construction beyond environmental metrics.

Another promising avenue is to explore digitalisation and data governance to support circular construction. Research could examine how digital twins, material passports, and blockchain systems contribute to transparency, traceability, and performance monitoring. Such studies would help identify the most efficient digital configurations for resource tracking in developing countries with limited infrastructure.

Furthermore, the behavioural and cultural dimensions of CE adoption remain underexplored. Understanding how professional attitudes, organisational culture, and stakeholder perceptions influence circular behaviour could inform strategies to overcome resistance and enhance engagement. Future research might also investigate the role of education and public awareness in shaping consumer and client demand for circular construction.

The study's overall implication is that circular construction should be viewed not merely as a sustainability initiative but as a transformative business and policy agenda. Its success depends on integrating governance, technology, finance, and human capital. In policy terms, this means aligning environmental regulations with economic competitiveness; in practice, it requires redesigning business models to capture long-term value; and in research, it calls for multi-disciplinary inquiry that bridges engineering, management, and social science perspectives. By translating circular principles into measurable outcomes, Ghana's construction sector can move toward a regenerative model that supports both environmental stewardship and economic resilience. The integration of lifecycle thinking, digital technologies, and collaborative governance can position the industry as a regional leader in sustainable innovation. Ultimately, the shift to a circular economy in construction is not only about reducing waste but also about reimagining value creation, in which materials, knowledge, and social benefits circulate continuously to support a low-carbon and inclusive built environment.

VI. CONCLUSION & RECOMMENDATIONS

6.1 Conclusion

Circular economy-driven business models offer a valuable opportunity to reshape Ghana's construction sector from a resource-intensive model to a regenerative, low-carbon system. The findings suggest that disassembly design, material reuse, lifecycle thinking, and digital traceability may reduce waste, embodied carbon, and resource depletion while enhancing the sector's economic and social potential. The main barriers to the adoption of these practices include a lack of technical capacity and policy, and poor digital infrastructure. The full potential of circular construction will only be achieved through improved governance and leadership, institutional resilience, and collaboration of the construction sector and stakeholders.

6.2 Recommendations

The adoption of circular economy approaches to construction will require the development of clear policy frameworks, fiscal measures, and formal construction waste management standards by the government and regulators. Construction firms need to prioritize employee development and invest in digital infrastructure, lifecycle assessments, and material tracing. Circular economy construction will only be achieved through a commitment to circular design in procurement and project delivery, endorsed by construction clients and professional associations. Future studies need to establish context-relevant frameworks and metrics to evaluate circular value creation in Ghana's construction sector.

Declaration of Interest

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