

IDENTIFYING CRITICAL BARRIERS TO CIRCULAR CONSTRUCTION ADOPTION FROM A CROSS-COUNTRY PERSPECTIVE

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Circular construction (CC) is a transformative approach in the construction industry, emphasizing the integration of circular economy (CE) principles to overcome sustainability barriers, reduce waste, and optimize resource efficiency. This innovative methodology prioritizes material design, deconstruction, and reuse while fostering collaboration to drive systemic change. However, CC adoption faces significant challenges across countries, which has limited global understanding and implementation. These disparities highlight the need for targeted research to address barriers specific to various national contexts. Transitioning to CC offers an opportunity to decouple construction activities from resource depletion and environmental degradation. Yet, the limited research on CC adoption, particularly regarding its impact on project performance, underscores the urgency of identifying hindering factors. Therefore, this study aims to systematically identify, classify, and prioritize critical barriers through a systematic literature review (SLR). Barriers will be categorized based on their occurrence in countries with differing development levels, enabling cross-country insights and comparisons. The findings will illuminate the most critical obstacles to CC adoption and propose key indicators and strategies to address them. This research seeks to facilitate CC adoption globally by offering actionable insights, contributing to enhanced construction management practices, and sustainable development.

Keywords: Circularity, Circular economy, Construction industry, Sustainability, Systematic literature review.

1 INTRODUCTION

The construction industry is highly resource-intensive, consuming vast natural resources and generating significant waste, contributing to global challenges such as resource depletion and climate change (Véliz *et al.* 2023). Addressing these impacts requires the integration of sustainability-focused strategies across the construction process. Among the proposed solutions, Circular Construction (CC) has gained prominence as a Circular Economy (CE)-based model aimed at promoting circularity in the sector. The traditional linear model results in short product lifecycles, high waste generation, and environmental degradation, whereas CC adopts a regenerative approach focused on resource reuse and process innovation (Sajid *et al.* 2024). Effective CC implementation requires coordinated efforts from policymakers, industry stakeholders, and researchers. While its potential is widely recognized, concerns remain about whether current conditions support its uptake. Adoption is hindered by barriers shaped by regional economic, social, and environmental differences—highlighting the need for context-specific strategies. Like other sectors, construction faces both common and localized challenges, requiring

classifications that reflect national and local realities. In response, scholars have increasingly examined CC barriers within specific geographic contexts. For example, Sofolahan *et al.* (2024) investigate barriers to digital technology adoption in Nigeria's CC transition, while Shooshtarian *et al.* (2022) examine both barriers and enablers in Australia. Zu Castell-Rüdenhausen *et al.* (2021) analyze policy support for CE-related businesses in the Nordic region, and Adams *et al.* (2017) explore CE awareness, challenges, and enablers in the UK construction sector. Additionally, Bhavsar *et al.* (2023) assess barriers in India, and Véliz *et al.* (2023) examine inhibitors in Chile.

The diversity of country perspectives highlights the need for comparative analysis that accounts for national contexts while identifying shared challenges. Addressing this, the study uses a systematic literature review (SLR) to extract and rank barriers to CC adoption through a country-specific lens. Barriers are prioritized by frequency, and countries are classified as developed or developing. This enables a comparison of barrier prevalence across groups, revealing both common and context-dependent challenges and providing a structured view of how barriers vary by development level.

2 METHODOLOGY

This study identifies barriers to CC adoption through a SLR, ranks the most critical based on frequency, and examines how they vary across countries and development levels through cross-country comparison.

2.1 Systematic Literature Review

To minimize potential bias and enhance the reliability of the selection process, a SLR was conducted using established protocols (Yu *et al.* 2022). The review adhered to the PRISMA framework and applied a structured three-stage procedure—identification, screening, and inclusion—to ensure methodological rigor and transparency. It focused on peer-reviewed publications indexed in the Web of Science (WoS) database. The search query applied in the “All Fields” category was: (“circular economy” OR “circular econom*” OR “circularity”) AND (“construction industry” OR “construction”) AND (“barrier”) NOT (“infrastructure” OR “road”). To align with the WoS database algorithm, an asterisk (*) was added to “circular econom*” to capture related variations and ensure comprehensive results, even when specific terms were not explicitly included. Filters were applied for document type (articles, reviews, early access) and relevant WoS categories (e.g., Architecture, Civil Engineering) resulting in an initial dataset of 47,613 records. A keyword-based screening of titles, abstracts, and author keywords using construction-related terms (e.g., “construction”, “build”, “architecture”, and “AEC”) narrowed the dataset to 5,968 records. Articles unrelated to the sector or CC were excluded based on predefined inclusion and exclusion criteria. To ensure methodological rigor, only peer-reviewed journal articles indexed in SCI-E, SSCI, or AHCI were retained. The time frame was limited to 2015–2025 to capture emerging developments in this evolving field. English-language publications were selected, reflecting its dominance in international academic discourse. All eligible studies were independently reviewed by two researchers; discrepancies were resolved through structured discussion. A total of 199 articles were selected for full-text review and analysis.

2.2 Identification of Barriers and Country-Specific Sources

Of the 199 articles reviewed, 37 explicitly addressed CC barriers with identifiable country contexts. Barriers were ranked by frequency, and the most recurrent were compared across developed and developing countries to highlight contextual distinctions.

3 FINDINGS

To identify global barriers to CC adoption, this study examined 37 studies from the SLR, of which 11 included country-specific data suitable for cross-country comparison. Based on these, 20 critical barriers were extracted. Table 1 summarizes the barriers, the countries represented (developed and developing), their sources, and frequency of occurrence.

Table 1. Barriers to CC adoption by country.

Barrier(s)	Countries										
	Developed		Developing								
	Australia	United Kingdom	Chile	China	Ghana	India	Nigeria	Oman	Pakistan	Panama	Saudi Arabia
	Amarasinghe <i>et al.</i> (2024)	Adams <i>et al.</i> (2017)	Véliz <i>et al.</i> (2023)	Liu <i>et al.</i> (2021)	Agyekum and Amudjie (2024)	Bhavsar <i>et al.</i> (2023)	Sofolahan <i>et al.</i> (2024)	Al Hosni <i>et al.</i> (2020)	Hassan <i>et al.</i> (2023)	Beermann and Austin (2021)	Alotaibi <i>et al.</i> (2024)
(B1) High price of circular materials compared to virgin alternatives				•		•			•	•	•
(B2) Higher upfront and operational costs of CC compared to conventional approaches	•		•	•	•	•	•	•	•	•	•
(B3) Short-term investment vision prioritizing rapid profitability	•		•		•						
(B4) Limited CC funding and misaligned financial planning with long-term stakeholder benefits			•		•	•		•	•		
(B5) Weak, non-binding policies and lack of enforcement within a fragile regulatory system	•			•	•		•	•			•
(B6) Lack of innovation capacity and development					•			•			•
(B7) Lack of education, training, and technical support for CC					•	•					•
(B8) Weak management, coordination, communication, and lack of institutional support					•		•			•	
(B9) Shortage of skilled labor, expertise, and qualified professionals	•						•	•	•		•
(B10) Complex, fragile supply chains with weak partnerships and limited collaboration		•							•	•	
(B11) Lack of clearly defined national and regional goals, strategies, and targets, along with the absence of a coherent global vision for CC	•		•	•		•		•			•
(B12) Limited availability of circular materials and absence of a comprehensive reverse logistics network	•			•		•			•		
(B13) Lack of knowledge and information on CE principles, tools, materials, and strategies	•	•			•			•	•	•	

Table 1. Barriers to CC adoption by country (*contd.*)

Barrier(s)	Countries										
	Developed		Developing								
	Australia	United Kingdom	Chile	China	Ghana	India	Nigeria	Oman	Pakistan	Panama	Saudi Arabia
	Amarasinghe <i>et al.</i> (2024)	Adams <i>et al.</i> (2017)	Véliz <i>et al.</i> (2023)	Liu <i>et al.</i> (2021)	Agyekum and Annudjje (2024)	Bhavsar <i>et al.</i> (2023)	Sofolahan <i>et al.</i> (2024)	Al Hosni <i>et al.</i> (2020)	Hassan <i>et al.</i> (2023)	Beermann and Austin (2021)	Alotaibi <i>et al.</i> (2024)
(B14) Lack of technical expertise, and technological resources for implementing CC			•		•					•	
(B15) Lack of accessible databases for secondary materials and of high-quality data	•						•	•			•
(B16) Inadequate infrastructure, technical capacity, and facilities for recycling, recovery, and sorting			•	•	•	•					
(B17) Cultural rigidity, organizational resistance, inflexible business norms, and aversion to change	•				•		•			•	
(B18) Lack of publicity and campaigns for branding, and promotion of circularity		•		•					•		
(B19) Limited awareness, understanding, and engagement in CE principles, benefits, and practices across stakeholders	•	•		•	•	•	•	•	•	•	•
(B20) Limited successful business models, demonstration projects, and compelling case studies		•	•								•

4 DISCUSSIONS

Based on country-specific findings, the 20 barriers were ranked by their frequency of appearance across the analyzed studies, as shown in Table 1. The five most frequently cited barriers—each referenced in six or more studies—emerged as the most critical to CC adoption and are ranked in order of prominence as: (1) **B2**, (2) **B19**, (3) **B5**, (4) **B11**, and (5) **B13**.

Financial constraints and limited awareness emerged as the most critical barriers, consistent with existing literature. Sustainable approaches—of which CC is now a key component—often involve high upfront and operational costs, premium-priced materials, and specialized labor—factors that deter investment in a risk-averse, short-term-oriented sector (Sajid *et al.* 2024). Financial incentives—such as tax reliefs, targeted subsidies, and green procurement—are essential to mitigate perceived risks. Likewise, limited awareness, understanding, and stakeholder engagement in CE principles hinder effective CC adoption. Without a firm grasp of key concepts and long-term benefits, initiatives risk becoming fragmented or misapplied (Véliz *et al.* 2023). Targeted training, stakeholder engagement, and cross-sector knowledge exchange are crucial to embed circular thinking and enable institutional change (Bhavsar *et al.* 2023). Limited expertise in circular materials, tools, and strategies reinforces linear practices. Strengthening technical

capacity through open-access tools, pilot projects, and expert networks is essential. Policy barriers further constrain CC progress. Weak regulatory frameworks, fragmented governance, and the absence of long-term national targets create uncertainty and inaction (Véliz *et al.* 2023). Addressing these issues requires coherent, enforceable policies, measurable goals, and sustained political and institutional commitment at both national and global levels. Against this backdrop, understanding how CC adoption barriers vary across national contexts becomes essential.

This study highlights key contrasts: in developed countries, limited awareness and knowledge are the primary barriers, despite strong institutional and financial systems. In contrast, developing countries face broader challenges—including high material costs, limited financing, weak planning, and fragmented regulations—further compounded by the absence of national targets, global alignment, and reliable data, often linked to constrained institutional capacity and competing socio-economic priorities. While developed countries can build on existing sustainability frameworks, developing countries must frequently establish systems from the ground up, making the transition to CC more complex and resource-intensive (Sajid *et al.* 2024). These challenges are intensified by weak coordination among public bodies, limited long-term planning, and the lack of localized data and monitoring tools, hindering evidence-based policymaking (Zu Castell-Rüdenhausen *et al.* 2021). The absence of unified guidelines and binding commitments at the global level contributes to fragmentation and uncertainty, leaving industry actors without clear direction (Véliz *et al.* 2023). Moreover, many barriers in developing countries are shaped by global dynamics, such as material flows, donor agendas, and policy dependencies, underscoring that CC adoption is a shared international responsibility (Sajid *et al.* 2024).

Effective and inclusive CC adoption requires integrated strategies that combine tailored policy support, context-sensitive knowledge transfer, and institutional capacity-building. Addressing local needs, involving informal sectors, and promoting cross-regional learning are key to achieving scalable, equitable transitions. The recurring nature of barriers—often spanning financial, institutional, and informational domains—underscores their interdependence and the need for holistic responses. Siloed efforts risk limited impact, while coordinated, multi-level approaches targeting economic, educational, and policy dimensions are essential for systemic change.

5 CONCLUSIONS

The construction industry, while economically vital, places immense pressure on natural systems—posing a major threat to planetary sustainability. CC offers a promising solution, yet its adoption faces persistent, multi-level barriers. This study identifies and ranks the most frequently cited barriers using country-specific research, revealing five key obstacles. A frequency-based, country-inclusive approach provides evidence-based insights into global CC implementation challenges. The dataset—peer-reviewed articles with country-specific data from 2015 to 2025—reflects growing interest in context-sensitive issues, shaped by global goals like the Paris Agreement and sustainable development goals (SDGs) integration. This enables comparison between developed and developing countries, exposing both shared and distinct barriers. Accordingly, this study makes three key contributions. First, it systematically identifies and prioritizes barriers to CC adoption based on their frequency in the literature, treating the most frequently cited as the most critical, using transparent and replicable methods. Second, it synthesizes global patterns across financial, regulatory, and informational domains, providing sector-specific insights that support policy and practice through a cross-country, development-level lens. Third, it highlights underexplored areas—particularly regarding methodological diversity, regional comparisons, and policy evaluation—that can guide future research. Nevertheless, critical gaps remain. Most studies rely on qualitative or literature-based methods, with limited use of empirical models or longitudinal

data—restricting insights into long-term impacts. Cross-country comparisons are scarce, and key aspects such as socio-cultural dynamics, behavioral factors, and performance metrics remain underexplored. Research on publication trends, methodological patterns, and the evolution of scholarly activity is also limited. Future studies should adopt mixed-method approaches and develop context-sensitive frameworks grounded in political, economic, and institutional realities to support a more holistic and effective transition to circularity in the construction sector.

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