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FROM WASTE TO WORTH: DIGITALIZING SECONDARY MATERIALS MARKET IN CONSTRUCTION

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ABSTRACT

The construction industry remains one of the largest consumers of raw materials globally, contributing approximately 39% of energy-related carbon dioxide emissions and generating substantial volumes of construction and demolition waste (CDW). Despite growing recognition of circular economy (CE) principles as a pathway toward sustainable construction, the secondary construction material market continues to operate informally, with no structured discovery, valuation, or trust mechanism in place. This research addresses the critical gap of underdeveloped digital infrastructure for secondary material procurement in the Sri Lankan construction sector. The study pursues three objectives: (1) to review the current technological landscape and assess the potential of digital technologies to support CE practices; (2) to identify key limitations and barriers affecting material circularity in construction; and (3) to investigate challenges in integrating primary and secondary material markets within construction procurement systems. Adopting a narrative literature review complemented by a questionnaire survey administered to thirty-one construction industry professionals, the study systematically identifies barriers to secondary material reuse. The findings confirm the total absence of a formalised secondary material market in Sri Lanka, with procurement occurring exclusively through informal networks. Three structural failures are identified: no price determination mechanism, no quality assurance or certification pathway, and no organised discovery infrastructure. These findings collectively demonstrate the urgent need for a dedicated digital platform to bridge the information and trust gap between suppliers and buyers of secondary construction materials, thereby facilitating CE implementation in the construction industry.

Keywords: *Circular Economy; Construction and Demolition Waste; Digital Platform; Secondary Material Market; Sustainable Construction.*

1. INTRODUCTION

Construction industry is vital in addressing global environmental concerns, as it is one of the largest consumers of raw materials and generators of waste (Pomponi & Moncaster, 2017). Further, the construction sector is responsible for over 36% of global final energy use and nearly 39% of energy-related carbon dioxide emissions, while also consuming about 50% of global raw materials and generating a large proportion of solid waste (Jin et al., 2024). This unsustainable trajectory has largely been driven by the traditional linear economy model, which involves extracting raw materials, transforming them into products, and discarding them after use. This model results in massive resource depletion,

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increased waste, and elevated carbon emissions, particularly in material-intensive sectors such as construction (Afteni et al., 2022).

The circular economy (CE) concept promotes a regenerative model where resource inputs, waste, emissions, and energy leakage are minimised through long-term product use, reuse, remanufacturing, and recycling. Unlike the linear "take-make-dispose" model, the CE model facilitates continual material loops and has been increasingly recognised as essential for decarbonising material-intensive sectors such as construction (De Wolf et al., 2024). Studies have suggested that up to £130 million in gains could be made by reducing UK construction waste by only 5% (Oyedele et al., 2014).

The secondary market in the construction industry refers to the exchange and reuse of recovered or reprocessed materials from demolition waste, including bricks, metals, timber, fixtures, and other salvageable components (Tennakoon et al., 2022). This market plays a vital role in enabling CE practices, as it provides a mechanism for reintegrating materials from end-of-life buildings back into new construction projects, thereby minimising landfill use and preserving virgin resources. However, limited information on product quality, quantity, and availability hinders efficient market transactions (Rose & Stegemann, 2018). Furthermore, the absence of digital platforms impairs effective material matching and impedes transaction flows (Tennakoon et al., 2021).

Despite growing interest in CE, the construction industry continues to struggle with practical implementation due to limited awareness, multiple stakeholders with limited coordination, and a lack of standard practices that reduce the adoption of circular principles (Munaro & Tavares, 2023). A key technological knowledge gap is identified: the underdevelopment of digital platforms that can bridge the value chain and enable real-time coordination among stakeholders for material reuse, tracking, and redistribution (Byers et al., 2024). This creates a clear research problem: the absence of a dedicated, digitally enabled CE platform that facilitates transparent and efficient interaction among suppliers, buyers, and regulators in the secondary materials market within the construction sector (Pittri et al., 2025). The research problem therefore lies in the lack of a centralised, digitally enabled CE platform tailored for the construction industry, one that can close the gap between theory and practice by supporting reverse logistics, stakeholder engagement, and real-time secondary market operations.

In response, digital technologies and online marketplaces are increasingly viewed as transformative tools for enabling CE in construction. Digital platforms can bridge the information and trust gap between material suppliers, such as demolition firms, and buyers, such as contractors or architects, by providing searchable inventories, product certification details, geolocation features, and logistics integration (De Wolf et al., 2024). This study addresses the urgent need for sustainable practices in the construction sector by proposing a digitally enabled solution that enhances transparency, stakeholder collaboration, and decision-making efficiency. The aim of this research is to examine the barriers to secondary construction material procurement in the Sri Lankan construction sector and to identify the digital platform requirements necessary to facilitate a formalised, digitally enabled secondary materials market that supports CE implementation. The objectives of this study are to:

1. Review the current technological landscape in the construction industry and assess the potential of digital technologies to support CE practices.

2. Identify key limitations and barriers affecting the implementation of material circularity within the CE in construction; and
3. Investigate challenges in integrating primary and secondary material markets within construction procurement systems.

2. LITERATURE REVIEW

2.1 CONCEPTUAL FOUNDATIONS OF THE CIRCULAR ECONOMY IN CONSTRUCTION

The construction sector is among the most resource-intensive and environmentally impactful industries, contributing nearly 40% of global energy use and more than one-third of greenhouse gas emissions (Cervantes et al., 2025). Traditionally, the industry has operated under a linear model of "take, make, use, and dispose", which has led to significant resource depletion and environmental degradation (Ghisellini et al., 2016). In contrast, the CE offers an alternative paradigm that seeks to decouple economic growth from resource consumption by maintaining materials and components at their highest utility and value for as long as possible (Kirchherr et al., 2023).

The evolution of the CE concept can be traced through the progressive development of the "R" frameworks that define strategies for sustainable resource use. The earliest framework, based on the 3Rs-reduce, reuse, and recycle, originated in waste management discourses in the late twentieth century (Adams et al., 2017). Over time, this model expanded into more comprehensive versions including the 6Rs or more, encompassing refuse, rethink, reduce, reuse, repair, refurbish, remanufacture, repurpose, recycle, and recover (Dsilva et al., 2023). In the context of construction, these principles encourage a shift from waste-oriented management to resource-oriented regeneration, where buildings are viewed as material banks capable of supplying reusable components for future projects (Reike et al., 2018).

2.2 CIRCULAR ECONOMY AND RESOURCE EFFICIENCY IN CONSTRUCTION

The construction industry plays a vital role in driving economic growth; however, it also contributes significantly to environmental deterioration due to its excessive consumption of resources and the vast amounts of waste it generates (Rose & Stegemann, 2018). The sector's conventional adherence to a linear economic paradigm of "take, make, dispose" has exacerbated environmental challenges, resulting in high carbon emissions and mounting waste generation (Bui et al., 2022). CDW includes materials such as concrete, timber, bricks, steel, glass, metals, plasterboard, and plastics, many of which still possess high residual value but are underutilised due to fragmented recovery systems and weak market mechanisms (Joseph et al., 2023; Shooshtarian et al., 2022).

CE principles greatly cut operating costs, boost energy efficiency, and minimise carbon footprints. Using recycled resources can significantly cut material procurement costs and lower the environmental impact of extraction and processing. CE techniques also cut waste disposal costs and boost operating efficiency; for example, modular building and prefabrication optimise resource consumption by eliminating offcuts and construction waste, leading to budgetary savings (Finamore & Oltean-Dumbrava, 2024). CE can potentially cut primary material usage by 32% by 2030 and 53% by 2050.

2.3 CIRCULAR SUPPLY CHAINS: FORWARD AND REVERSE LOGISTICS

Circular Business Models (CBMs) serve as the organisational rationale and mechanism for how firms create, deliver, and capture value within a circular system, primarily by slowing, closing, or narrowing resource loops (Bestul & Gruis, 2024). Effective circularity begins at the earliest stages of the product lifecycle, necessitating a fundamental change in the design process. This forward integration relies heavily on Design for Disassembly (DfD), modularity, and digital tools like Material Passports and Building Information Modelling (BIM) (Chen et al., 2024). BIM, defined as the use of a shared digital representation of an asset throughout its lifecycle, acts as a foundational data supplier and contains static data essential for planning and construction documentation (Askar et al., 2024).

The reverse logistics aspect of CBMs focuses on managing materials once products reach their end-of-life, encompassing collection, processing, and reintroduction to the supply chain (Chen et al., 2024). Material recovery typically focuses on CDW streams, and key processes include acquisition of used products, disassembly, cleaning, rework, and assembly. However, managing this flow presents complex challenges, notably the variability of product quality and volume upon return. Despite clear environmental and potential economic benefits, several pervasive barriers spanning organisational, economic, regulatory, and technological domains hinder the seamless alignment of forward and reverse construction supply chains.

2.4 DIGITAL PLATFORMS FOR SECONDARY MATERIAL MARKETS

The need for web-based or IT-enabled platforms to facilitate demand–supply coordination, product listings, traceability, and online procurement is identified as a key enabler for improving the secondary market's performance (Shooshtarian et al., 2022). Key barriers in the secondary material market include low visibility of available materials, lack of quality certification mechanisms, inconsistent supply chains, and negative perceptions regarding reused materials (Idir et al., 2025). Moreover, many stakeholders, including demolition contractors, builders, and project managers, often lack the necessary information or incentives to engage in such exchanges (Tennakoon et al., 2023).

Digital platforms can bridge the information and trust gap between material suppliers and buyers by providing searchable inventories, product certification details, geolocation features, and logistics integration (De Wolf et al., 2024). For example, Loopfront, a platform launched in Norway, facilitates reuse by offering real-time listings of surplus building materials along with CO_2 savings data, thereby improving transparency and sustainability accounting. Empirical research identifies six distinct circular business model types focused on component reuse: up-cyclers, component-specific suppliers, material resellers, reuse platforms, reuse consulting offices, and deconstruction companies (Bestul & Gruis, 2024). These highlight the separation of functions across specialised actors rather than centralisation in a single organisation.

2.5 POLICY AND REGULATORY FRAMEWORKS

The transition toward material circularity in the construction sector is significantly influenced by policy and regulatory frameworks. The main barrier to the development of CE in the construction industry, especially in developing countries, is that there are

insufficiently strong and focused policies related to circularity in material usage and waste management (Weerakoon et al., 2023). In Sri Lanka specifically, the absence of coherent policies on waste management is compounded by governance issues, creating systemic weaknesses that limit the capacity of governments to design and enforce effective CE policies (Dewagoda et al., 2022).

In contrast, the EU's Circular Economy Action Plan establishes a global benchmark, yet implementation remains challenged by technical and standardisation concerns. The lack of harmonised end-of-waste criteria, chemical safety regulatory burdens, and limited standardised design values within structural codes collectively constrain the integration of recycled materials into mainstream construction projects. Globally, CE initiatives such as public procurement policies in Denmark, BIM-driven Digital Twin frameworks in North America, and mandatory waste segregation in Malaysia demonstrate that both policy-driven and industrial approaches are indispensable for driving CE adoption at scale.

Table 1: Thematic key areas

1: Awareness & Understanding of CE and Secondary Materials	***2: Current Practices & Challenges in Secondary Material Sourcing***
Familiarity with CE principles (reduce, reuse, recycle, recover) (1), (2), (3) Understanding of CDW as a recoverable resource (4), (5) Knowledge of secondary material types (bricks, timber, metals, concrete) (6), (7) Awareness of environmental & carbon implications of linear model (8), (9) Familiarity with global CE examples (Loopfront, EU CEAP, Malaysia) (10), (11), (12)	Current secondary material sourcing methods (formal vs. informal networks) (6), (13) Extent of CDW segregation at demolition sites (5), (4) Reverse logistics management (collection, disassembly, reintroduction) (14), (15) Use of digital tools (BIM, Material Passports) in procurement (16), (17) Inclusion of secondary materials in Bills of Quantities / project budgets (18), (19)
3: Barriers to Secondary Material Adoption	***4: Interest in & Requirements for a Digital Platform Solution***
Absence of price discovery / depreciation framework for secondary materials (20), (6) Lack of quality assurance and certification protocols (e.g., SLS equivalents) (21), (22), (11) No organised material discovery or matchmaking infrastructure (13), (10) Institutional inertia and resistance to circular procurement norms (23), (1) Regulatory gaps and absence of enforceable CE policies in Sri Lanka (12), (19) Negative stakeholder perceptions and liability concerns over secondary materials (11), (24)	Centralised searchable marketplace / material discovery interface (10), (25) Price transparency module with cost benchmarking and comparison tools (5), (26) Condition grading, certification and quality assurance system (13), (11) Geolocation and logistics integration for material tracking (10), (27) Sustainability impact quantification (CO_2 savings, waste diversion metrics) (25), (28) Administrative governance and authoritative oversight layer (25), (12)

[1] (Ghisellini et al., 2016), [2] (Kirchherr et al., 2023), [3] (Adams et al., 2017), [4] (Joseph et al., 2023), [5] (Shooshtarian et al., 2022), [6] (Tennakoon et al., 2022), [7] (Rose & Stegemann, 2018), [8] (Jin et al., 2024), [9] (Cervantes et al., 2025), [10] (De Wolf et al., 2024), [11] (Idir et al., 2025), [12] (Weerakoon et al., 2023), [13] (Byers et al., 2024), [14] (Chen et al., 2024), [15] (Chen et al., 2024), [16] (Askar et al., 2024), [17] (Honic et al., 2019), [18] (Pittri et al., 2025), [19] (Dewagoda et al., 2022), [20] (Hopkinson et al., 2018), [21] (Adams et al., 2017), [22] (Tingley et al., 2017), [23] (Munaro & Tavares, 2023), [24] (Pomponi & Moncaster, 2017), [25] (Bestul & Gruis, 2024), [26] (Tennakoon et al., 2023), [27] (Sivers et al., 2022), [28] (Finamore & Oltean-Dumbrava, 2024)

3. METHODOLOGY

This study adopted a two-phase methodology comprising a narrative literature review followed by a questionnaire survey. The literature review was conducted to establish the theoretical foundations of CE principles, secondary material markets, and digital procurement platforms in the construction sector. A systematic search of peer-reviewed literature was undertaken using the databases Scopus, Web of Science, and Google Scholar. The search combined keywords including "circular economy", "secondary materials", "construction and demolition waste", "digital platform", "material marketplace", "sustainable procurement", and "reverse logistics", applied individually and in combination using Boolean operators (AND, OR). The search was limited to peer-reviewed journal articles, conference papers, and institutional reports published between 2015 and 2025, supplemented by foundational earlier works where necessary. Articles were screened for relevance based on title and abstract, with full-text analysis applied to those addressing the study's core themes.

Following the literature review, primary data were collected through a questionnaire survey administered electronically to thirty-one construction industry professionals actively involved in the Sri Lankan construction sector. The questionnaire comprised a combination of closed-ended Likert-scale items (five-point scale), multiple-choice questions, and open-ended items, enabling both quantitative trend analysis and qualitative insight capture. The survey was piloted with three academic experts prior to full distribution to validate clarity and content relevance, and revisions were made accordingly.

Respondents were selected using purposive sampling, targeting professionals with direct involvement in construction procurement, project management, quantity surveying, sustainability consulting, and regulatory roles. Purposive sampling is particularly appropriate for exploratory industry studies where subject-matter expertise is the primary selection criterion (Tongco, 2007). This approach is well-established in construction management research, where the depth and relevance of respondent expertise are prioritised over large probabilistic samples (Naoum, 2012). The sample of thirty-one professionals represents a purposefully constituted expert group drawn from the principal stakeholder categories involved in secondary material procurement in Sri Lanka: contractors (32%), quantity surveyors (23%), academic and research professionals (16%), government and regulatory officers (16%), and environmental and sustainability consultants (13%). The adequacy of this sample size is justified on three grounds. First, given the exploratory and qualitative focus of this study, expert-based purposive samples of twenty to thirty-five participants are widely considered sufficient for achieving thematic saturation in construction management research (Naoum, 2012; Tongco, 2007).

Second, all five principal stakeholder categories involved in secondary material procurement are represented, ensuring that findings reflect the full spectrum of relevant professional perspectives rather than a single-sector viewpoint. Third, the study's primary contribution is the identification and contextualisation of structural market failures rather than the generation of generalisable statistical distributions, a goal for which depth of expertise is more analytically appropriate than sample size. Acknowledging this limitation, future research employing larger probabilistic samples would be valuable for validating and extending the descriptive findings reported here. Survey responses were analysed using descriptive statistics and frequency distributions, with open-ended responses subjected to content analysis to identify recurring themes. Figure 1 illustrates the overall methodological design adopted in this study.

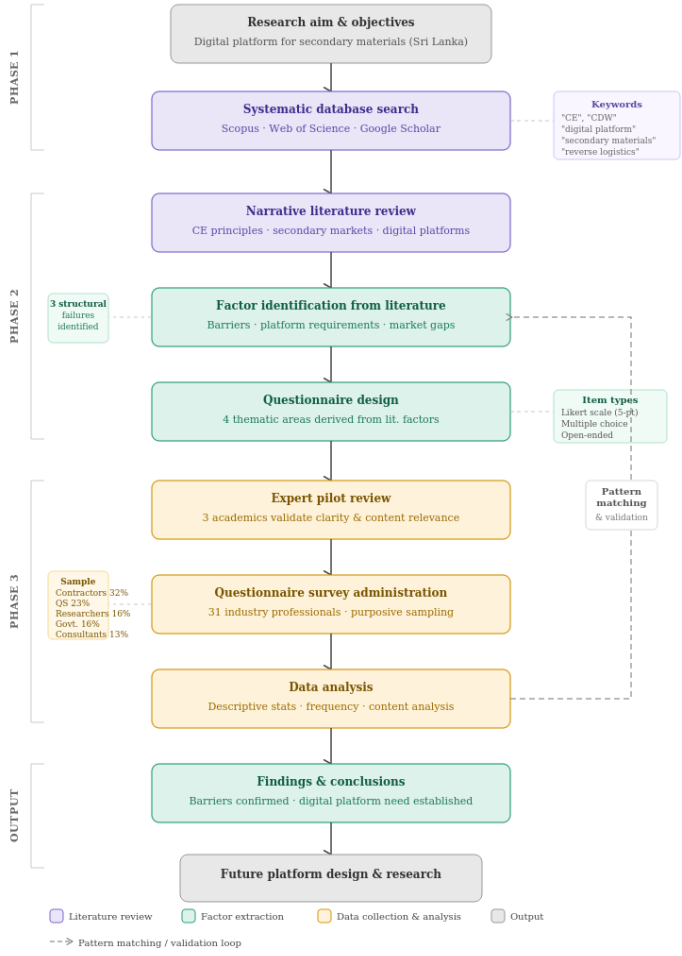

Figure 1: Methodology flow design

4. RESEARCH FINDINGS AND ANALYSIS

4.1 LITERATURE REVIEW FINDINGS

The literature review identified three overarching themes that collectively define the state of knowledge on secondary material markets and digital CE enablers in construction.

First, the review confirmed that CE adoption in construction globally remains largely theoretical, with implementation constrained by deeply embedded linear economy practices, institutional inertia, and weak regulatory enforcement. While European contexts have progressed further through policy mandates and digital innovation, developing economies including Sri Lanka exhibit pronounced gaps in both policy frameworks and market infrastructure for secondary materials (Weerakoon et al., 2023; Ghisellini et al., 2016).

Second, the literature consistently identifies three structural barriers to secondary material market functioning: the absence of price discovery mechanisms that appropriately discount secondary materials relative to new equivalents; the lack of standardised quality assurance and certification pathways; and the absence of organised discovery infrastructure enabling buyers to locate and evaluate available materials (Tennakoon et al., 2022; Byers et al., 2024; Idir et al., 2025). These barriers are mutually reinforcing: without price transparency, quality certification, or searchable supply, formal procurement channels cannot develop, and secondary material exchange remains confined to informal personal networks.

Third, the literature identifies digital platforms as the most viable mechanism for simultaneously addressing all three structural barriers. Evidence from operational platforms in Norway (Loopfront), the Netherlands, and the United Kingdom demonstrates that web-based material marketplaces incorporating condition grading, geolocation, pricing benchmarks, and administrative governance can catalyse secondary material market activity in contexts where informal exchange previously dominated (De Wolf et al., 2024; Sivers et al., 2022). The literature further identifies six functional requirements for effective secondary material platforms: centralised discovery, communication infrastructure, price transparency, quality certification, impact quantification, and authoritative governance (Bestul & Gruis, 2024). These literature-derived requirements provided the conceptual framework for the questionnaire instrument used in primary data collection.

4.2 QUESTIONNAIRE SURVEY FINDINGS

The questionnaire survey, administered to thirty-one construction industry professionals spanning contractors (32%), quantity surveyors (23%), academic and research professionals (16%), government and regulatory officers (16%), and environmental and sustainability consultants (13%), generated four critical research insights directly aligned with the study's objectives. The disciplines of the respondents are illustrated in Figure 2.

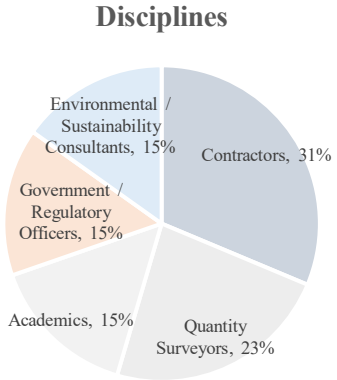

Figure 2: Disciplines of the respondents

First, all thirty-one respondents demonstrated awareness of CE principles, predominantly associating CE with waste reduction, reuse, and material loop closure. However, this awareness did not translate into practice, signalling structural rather than attitudinal barriers as the primary constraint on CE adoption. This finding is consistent with the literature's identification of implementation barriers as being systemic rather than individual. Notably, the gap between awareness and practice was most pronounced among contractors (32% of respondents), who, despite familiarity with CE terminology, reported that informal procurement norms, lack of standardised pricing, and client resistance rendered secondary material adoption practically untenable in commercial project environments. Quantity surveyors similarly reported that the absence of recognised rate schedules precluded formal inclusion of secondary materials in bills of quantities. In contrast, academic and sustainability professionals expressed stronger conceptual alignment with CE adoption, suggesting that the awareness-practice divide is not uniform across stakeholder groups but is shaped by professional role, procurement responsibility, and exposure to market-level risk. This distinction implies that digital platform interventions should primarily address the operational constraints of procurement-facing professionals particularly contractors and quantity surveyors rather than focusing solely on awareness-raising, which is already adequate across the sector (Pittri et al., 2025).

Second, all thirty-one respondents confirmed the total absence of any formalised secondary material marketplace in Sri Lanka. No respondent identified a formalised procurement channel; all described ad hoc and informal sourcing through personal networks and project-based contacts. This empirical confirmation of market absence validates the central research problem identified through the literature review: the gap is not one of awareness, but of infrastructure.

Third, the pricing challenge emerged as a critical structural barrier. The absence of any depreciation or price discovery framework for secondary construction materials means that such materials are frequently priced at or near the cost of new equivalents, eliminating the financial incentive for buyers to choose secondary options. Twenty-seven of thirty-one respondents (87%) identified the absence of a standardised pricing mechanism as a significant barrier. From a quantity surveying perspective, the absence of standard rates for secondary material valuation prevents these options from being included in bills of quantities on a comparable basis with new materials, effectively excluding them from formal project budgeting. This barrier has specific contextual roots in Sri Lanka: the construction industry's heavy reliance on informal, trust-based trading networks means that secondary material transactions are negotiated bilaterally without reference to any benchmarked rate, creating wide price variability that deters formal buyers. Additionally, the economic volatility experienced in Sri Lanka between 2021 and 2023 intensified material cost pressures, yet the secondary market failed to expand, suggesting that price instability alone does not drive adoption in the absence of institutional infrastructure. Government and regulatory respondents noted that no legislative basis exists for mandating or incentivising depreciation-based pricing of recovered materials, which distinguishes Sri Lanka from jurisdictions such as the Netherlands and the United Kingdom where fiscal instruments support secondary material market formation (Sivers et al., 2022). This contextual analysis reveals that the pricing barrier in Sri Lanka is not merely technical but is structurally embedded in the

intersection of informality, weak policy, and institutional inertia factors that a digital platform alone cannot resolve without accompanying policy reform.

Fourth, quality and liability concerns represented the most consistently cited demand-side barrier. Twenty-nine of thirty-one respondents (94%) identified the absence of any quality assurance or certification protocol as a critical gap. The lack of any equivalent to Sri Lanka Standards (SLS) certification for secondary materials was noted as making it professionally risky for contractors, architects, and quantity surveyors to specify such materials in formal project documentation. The nature of this concern, however, varied meaningfully across stakeholder groups. Contractors and quantity surveyors framed the barrier primarily in terms of legal liability: specifying materials without certification exposes them to professional and contractual risk if structural or performance failures arise. Government and regulatory respondents acknowledged that no formal certification framework for secondary construction materials exists within current regulatory structures, nor is one under active development. Environmental and sustainability consultants, in contrast, expressed greater willingness to accept condition-graded secondary materials if supported by documented quality assessments, indicating that risk tolerance is partially determined by the nature of professional responsibility rather than by scepticism about material quality per se. This divergence highlights a key tension within the secondary market: the actors most willing to engage with secondary materials (sustainability-oriented professionals) are rarely the decision-makers in procurement, while those who control procurement (contractors, quantity surveyors) face the highest institutional barriers to adoption. Addressing this structural mismatch requires not only quality certification mechanisms within a digital platform but also changes to procurement documentation norms and professional indemnity frameworks — areas where policy intervention is indispensable (Idir et al., 2025).

All thirty-one respondents expressed strong interest in a dedicated digital platform as the preferred solution to address these structural failures. The demand for platform features aligned closely with the six functional requirements identified in the literature: a centralised searchable marketplace, a seller dashboard for material listing, a buyer dashboard for discovery and tracking, a pricing transparency module with cost comparison, a condition grading and certification system, and an administrative governance layer. This convergence between literature-derived requirements and practitioner demand confirms that a digital platform represents both a theoretically sound and practically supported response to the identified market failures. Stakeholder group preferences for specific platform features, however, revealed instructive differences. Contractors prioritised real-time material availability and logistics integration, reflecting their operational need to manage procurement timelines. Quantity surveyors emphasised the pricing transparency module and its compatibility with standard bill of quantities formats. Government and regulatory respondents identified the administrative governance layer including oversight of material listings and dispute resolution mechanisms as the most critical component for ensuring the platform's credibility and regulatory acceptability. Environmental and sustainability consultants prioritised sustainability impact quantification (such as, CO_2 savings and waste diversion metrics), consistent with their professional focus on environmental performance reporting. These differentiated preferences indicate that a one-size-fits-all platform design would be insufficient; effective implementation requires stakeholder-responsive interface design that foregrounds role-relevant features for each user category. The research contributions

of this study are therefore twofold: (1) it provides the first empirically grounded mapping of secondary material market failures in the Sri Lankan construction sector, disaggregated by stakeholder perspective; and (2) it establishes a theoretically and practically validated functional requirement set for a dedicated digital CE platform tailored to developing economy conditions, where institutional infrastructure, regulatory capacity, and market formality cannot be assumed.

4.3 SYNTHESIS AND PATTERN MATCHING

A pattern matching exercise confirmed the theoretical validity of the primary findings. The total absence of a formalised secondary material market in Sri Lanka, confirmed by all thirty-one survey respondents, is consistent with literature on developing economies where informal networks dominate material reuse and CE infrastructure remains nascent (Ghisellini et al., 2016). The pricing challenge specifically the absence of depreciation in secondary material pricing is consistent with theoretical arguments that price discovery mechanisms are essential conditions for secondary material markets to function (Hopkinson et al., 2018), while also representing a novel contribution regarding how cultural and institutional factors shape the price-finding problem in ways not fully captured by existing European literature. The quality assurance barrier replicates the pattern consistently identified in international literature (Adams et al., 2017; Tingley et al., 2017), while the universal stakeholder demand for a digital platform aligns with emerging evidence that web-based marketplaces are the most effective mechanism for operationalising secondary material exchange in both developed and developing construction markets (De Wolf et al., 2024; Sivers et al., 2022).

The findings collectively point to a clear conclusion supported directly by the empirical data: CE awareness exists among Sri Lankan construction professionals, but the absence of price discovery, quality assurance, and organised discovery infrastructure renders secondary material procurement practically impossible through formal channels. These three structural failures are directly evidenced by respondent data, specifically the 100% confirmation of marketplace absence, the 87% identification of pricing as a significant barrier, and the 94% identification of quality assurance as a critical gap. The proposition that a dedicated digital platform is both necessary and sufficient to address these failures, however, requires qualification: the data supports platform necessity and stakeholder demand, but the conditions under which a platform would function effectively including complementary policy reform, third-party certification authority establishment, and professional indemnity framework revision are proposed as prerequisites informed by the findings, not directly evidenced by them. Future research should focus on validating these platform design requirements through prototype development and testing, and on assessing the policy and institutional interventions required to create the enabling conditions for platform adoption at scale.

5. CONCLUSIONS

This study examined the current state of secondary material procurement in Sri Lanka and the barriers to CE implementation in the construction industry, through a two-phase methodology comprising a narrative literature review and a questionnaire survey of thirty-one construction industry professionals. The following conclusions are drawn directly from the empirical data. The secondary material procurement landscape in Sri Lanka is entirely informal, reliant on personal networks, and characterised by three

fundamental structural failures confirmed by all thirty-one respondents: no price determination mechanism, no quality assurance or certification pathway, and no organised discovery or matching infrastructure. The awareness-practice gap is not uniform across stakeholder groups; procurement-facing professionals (contractors and quantity surveyors) face the highest institutional barriers to adoption, while sustainability-oriented professionals demonstrate greater willingness to engage with secondary materials a tension that digital platform design must address through role-responsive interface architecture. The pricing barrier is structurally embedded in the intersection of informality, economic volatility, and absent policy frameworks specific to the Sri Lankan context, distinguishing it from pricing challenges documented in European literature. Quality assurance concerns are driven primarily by professional liability risk rather than general scepticism about material quality, indicating that certification infrastructure and procurement documentation reform are necessary complements to any digital platform intervention.

The research contributions of this study are twofold. For industry, the findings provide the first stakeholder-disaggregated mapping of secondary material market failures in Sri Lanka, directly informing the design priorities for a national digital CE platform and highlighting the policy and certification prerequisites without which such a platform cannot succeed. For research, the study establishes an empirically validated functional requirement set for digital secondary material platforms in developing economy contexts, extending the existing literature beyond its predominantly European focus and demonstrating that informality, institutional absence, and liability-driven procurement norms require distinct design responses not captured by existing platform models. The following conclusions are proposed as directions informed by the evidence but requiring further validation: that a dedicated digital platform, designed around the six functional requirements identified through literature-survey convergence, represents the most viable mechanism for simultaneously addressing price discovery, quality certification, and material discovery failures; and that government-mandated minimum reuse requirements for public sector projects, the establishment of a recognised third-party certification authority for secondary materials, and the development of a national depreciation framework for used construction materials are essential complementary policy measures. Future research should focus on the design and development of a functional digital platform prototype, followed by longitudinal evaluation of adoption patterns, quantitative assessment of CE impact metrics, and investigation of integration pathways with national green building certification frameworks such as GreenSL. Expanded survey research with probabilistic sampling would additionally strengthen the generalisability of the descriptive findings reported here.

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