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CONVERGENCE OF CIRCULAR ECONOMY STRATEGIES FOR SUSTAINABLE TIMBER USAGE IN SRI LANKA

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ABSTRACT

The construction industry is a major consumer of natural resources, creating increasing pressure for sustainable material utilisation. Timber, as a renewable construction material with favourable environmental characteristics, offers significant potential to support circular economy practices within the built environment. However, the effective application of circular economy strategies for timber utilisation remains limited in many developing construction contexts, specifically in Sri Lanka. This study investigates how circular economy strategies can be converged to enhance sustainable timber usage in the Sri Lankan construction industry. A qualitative research approach was adopted, using semi-structured expert interviews with 12 professionals with expertise in the research area. The collected data were analysed using qualitative content analysis to identify circular economy strategies relevant to sustainable timber utilisation. The analysis identified thirteen circular economy strategies that can support sustainable timber usage across the timber lifecycle. These include reclaimed timber utilisation, design for disassembly, prefabricated construction, lifecycle assessment-based design, materials passports and digital traceability, industrial symbiosis, modular thinking, circular public procurement, stakeholder education, commercial plantation regeneration, preservation and treatment for prolonged use, and engineered timber promotion. The findings indicate that the convergence of these strategies can improve timber lifecycle performance, enhance resource efficiency, and strengthen sustainable timber supply systems. Effective implementation requires alignment between design practices, supply chain transparency, industry awareness, and supportive policy mechanisms. The study contributes to circular construction research and provides practical insights to advance sustainable timber utilisation in the Sri Lankan construction industry.

Keywords: *Circular Construction; Circular Economy; Sustainable Timber Utilisation; Timber Construction.*

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1. INTRODUCTION

The construction industry plays a critical role in economic development (Ravinder, 2025). However, it is also recognised as one of the most resource-intensive sectors, contributing significantly to environmental degradation and resource depletion. The sector consumes large quantities of raw materials and energy while generating considerable waste and greenhouse gas emissions, placing increasing pressure on natural ecosystems (Kulah et al., 2022). Globally, the built environment accounts for a substantial share of energy demand and carbon emissions, underscoring the urgent need to adopt more sustainable construction practices and material utilisation. In response to these sustainability challenges, attention has increasingly shifted toward the use of environmentally responsible construction materials. Timber has emerged as a promising alternative due to its renewable nature, relatively low embodied energy, and capacity to sequester carbon during its growth cycle (Mosly, 2025). Compared with conventional materials such as steel and concrete, timber demonstrates significantly lower embodied carbon and energy values, making it a favourable option for sustainable construction (Ravinder, 2025; Koca, 2018). Furthermore, timber offers high strength to weight ratio and structural versatility, enabling its application in a wide range of construction systems including both traditional timber structures and modern engineered wood products (Ghobadi & Sepasgozar, 2026). Despite these advantages, the utilisation of timber within the Sri Lankan construction industry remains constrained by several logistic, practice and governance related challenges. Although timber continues to be widely used for various construction applications, the sustainable management and utilisation of timber resources face limitations associated with supply chain restrictions and inefficiencies (Praboda et al., 2017). In addition, limited investment in modern timber-processing technologies and have further constrained the development of a sustainable timber supply system in the country.

In parallel with these challenges, global sustainability discourse has increasingly emphasised the transition from traditional linear economic models toward circular economy approaches. The conventional “take make dispose” production model has been widely criticised for its dependence on continuous resource extraction and waste generation (Benachio et al., 2020). In contrast, the circular economy promotes regenerative systems in which the value of resources once extracted is retained for as long as possible through strategies such as reuse, refurbishment, remanufacturing, and recycling (Geissdoerfer et al., 2017). Within the built environment, circular economy principles encourage lifecycle thinking, efficient material utilisation, and design approaches that facilitate the prolongation of the use of building components (Zhang et al., 2026). Timber possesses several characteristics that make it particularly compatible with circular economy principles. Its renewable nature, ease of processing, and potential for reuse enable timber components to circulate within multiple life cycles when appropriate design and management strategies are adopted (Islam et al., 2026). Circular economy strategies such as design for disassembly, modular construction, lifecycle assessment, and material traceability have the potential to significantly enhance the sustainability of timber utilisation in construction (Timm et al., 2023). Through the implementation of such strategies, timber resources can be utilised more efficiently while reducing pressure on forest ecosystems. However, despite the increasing recognition of circular economy concept within the construction sector, limited research has examined how circular strategies can be systematically integrated to enhance the sustainable utilisation of timber in the Sri Lankan construction industry (Rahla et al., 2021). Existing studies largely focus on forest conservation, and timber supply dynamics, while the convergence of circular economy strategies for sustainable timber usage in construction remains insufficiently explored (Schukoske, 2009). Moreover, existing studies are focused on the applicability of CE strategies in general in the construction while applicability with timber remains insufficiently explored (Zhang et al., 2026). Therefore, the aim of this study is to investigate how circular economy strategies can be converged for sustainable timber usage in the Sri Lankan construction industry. In order to achieve this aim, the research objectives were defined as (1) to identify the key circular economy strategies that support sustainable timber utilisation in the construction sector, and (2) to examine the applicability of these strategies within the Sri Lankan construction context to enhance sustainable timber governance and resource efficiency.

2. LITERATURE REVIEW

2.1 CIRCULAR ECONOMY AND ITS APPLICATION IN CONSTRUCTION

Circular economy (CE) has emerged as a response to the limitations of traditional linear economic systems characterised by the take make dispose model (Cancela et al., 2026), aiming to minimise resource input and waste output while extending the lifecycle of materials through strategies such as reduction, reuse, and recycling (Kirchherr et al., 2017). It is increasingly conceptualised as a regenerative and systemic approach that integrates environmental sustainability with economic development, supported by practices that slow, close, and narrow material loops (Kirchherr et al., 2023). Achieving circular economy objectives requires coordinated industry efforts and supportive policy frameworks (Merli et al., 2018). Within the construction sector, which is highly resource intensive and generates significant construction and demolition waste, circular economy principles are particularly relevant (Benachio et al., 2020), promoting lifecycle thinking, efficient material utilisation, and design for reuse and recovery (World Green Building Council, 2023). However, despite its potential, the adoption of circular construction remains limited due to barriers such as weak regulatory frameworks, low awareness, and insufficient infrastructure (Bilal et al., 2020), highlighting the need for stronger policy support, stakeholder collaboration, and institutional incentives to enable the transition towards circular construction systems (Ghufran et al., 2022)

2.2 CIRCULAR ECONOMY STRATEGIES

Circular economy strategies provide practical mechanisms for implementing CE principles across industrial systems (Das et al., 2026). These strategies focus on extending the lifecycle of materials, improving resource efficiency, and minimising waste generation within production and consumption processes (Cancela et al., 2026). One important strategy is design for disassembly, which allows building components to be dismantled and reused without significant damage, thereby facilitating material recovery at the end of a building's lifecycle (Rahla et al., 2021). Similarly, modular and prefabricated construction techniques support circular construction by improving material efficiency and enabling easier reuse of building components (Munaro et al., 2020). Another key strategy involves the reuse and recycling of construction materials, which reduces the demand for virgin resources while minimising waste generation (Amudjie et al., 2023; Ibáñez-Forés et al., 2023). Digital technologies also play a significant role in enabling circular construction practices. For example, Building

Information Modelling (BIM) can support lifecycle management of building materials and facilitate informed decision-making regarding material reuse and recycling (Chen et al., 2022). In addition, materials passports and digital traceability systems provide important information regarding the properties and reuse potential of construction materials, thereby improving transparency and supporting circular material flows (Rahla et al., 2021; Schroeder et al., 2018). Public sector policies, such as circular public procurement, can further promote circular construction by encouraging the use of sustainable materials and circular design approaches in public infrastructure projects (Ogunmakinde et al., 2022; Schroeder et al., 2018).

2.3 SUSTAINABLE TIMBER USAGE IN CONSTRUCTION

Timber has long been recognised as one of the most sustainable construction materials due to its renewable nature and environmental performance. Responsibly sourced timber provides several environmental benefits including carbon sequestration, low embodied energy, and lower greenhouse gas emissions compared to conventional construction materials such as steel and concrete (Koca, 2018; Ramage et al., 2017). Timber also offers several functional advantages including high strength to weight ratio, thermal insulation properties, and suitability for prefabricated construction systems (Ramage et al., 2017). These characteristics make timber an attractive material for sustainable construction practices. In the Sri Lankan context, timber has historically been used extensively in residential construction, particularly for roofing structures, joinery, and interior finishes (Sudeshika et al., 2019). However, the availability and utilisation of timber resources have been influenced by regulatory restrictions and supply chain limitations. Government policies aimed at protecting natural forests have imposed restrictions on timber harvesting, which has reduced domestic timber supply (Ruwanpathirana, 2012). In addition, challenges such as inconsistent timber quality, fragmented supply chains, and lack of standardised grading systems have limited the efficient use of timber in construction projects. These challenges highlight the need for improved resource management approaches that can enhance sustainable timber utilisation.

2.4 USE OF CIRCULAR ECONOMY IN SUSTAINABLE TIMBER USAGE IN CONSTRUCTION

Circular economy strategies provide significant opportunities to enhance sustainable timber utilisation in the construction sector. Due to its renewable and biodegradable nature, timber is particularly well suited for circular resource cycles when appropriate management strategies are implemented (Benachio et al., 2020). Several circular economy strategies can be applied to optimise timber utilisation. For example, design for disassembly allows timber components to be dismantled and reused in new construction projects, thereby extending the lifecycle of timber resources (Thormark, 2007; Rahla et al., 2021). Lifecycle assessment (LCA) is another important approach for evaluating the environmental performance of construction materials. LCA enables designers to compare the environmental impacts of different materials and select options that minimise environmental burdens throughout the building lifecycle (Chen et al., 2022). Furthermore, , such as material passports, can record information related to timber origin, species, and treatment processes. These systems improve transparency and facilitate the reuse of timber components by providing reliable information regarding material properties (Rahla et al., 2021; Timm et al., 2023).

2.5 NEED TO CONVERGE CIRCULAR ECONOMY STRATEGIES FOR SUSTAINABLE TIMBER USAGE IN SRI LANKA

Despite the potential benefits of circular economy strategies, their implementation within the Sri Lankan construction industry remains limited. The presumption that the use of timber as a construction material exerts pressure on forest cover leads to stringent legislation that focuses solely on forest conservation but does not consider timber as a sustainable construction material (Wikramanayake et al., 2021; Buliga & Nichiforel, 2019). As a result, opportunities to enhance timber sustainability through circular strategies remain underexplored. Several barriers hinder the adoption of circular timber practices in Sri Lanka. These include fragmented legislation, limited technical infrastructure for material recovery, lack of awareness among industry stakeholders, and negative perceptions regarding the use of reclaimed timber (Munaro et al., 2020; Rahla et al., 2021). In addition, the absence of integrated policy frameworks that promote circular construction practices further restricts the adoption of circular economy strategies. Therefore, there is a need to systematically examine how circular economy strategies can be converged to support sustainable timber utilisation within the Sri Lankan construction industry. Understanding these strategies and their practical applications can contribute to improved resource efficiency, reduced environmental impacts, and more sustainable timber governance in the construction sector.

3. METHODOLOGY

This study adopted a qualitative research approach to investigate circular economy strategies that can support sustainable timber utilisation in the Sri Lankan construction industry. Qualitative research methods are particularly suitable for exploratory investigations that seek to understand complex industry practices, stakeholder perspectives, and emerging strategies within a specific context (Creswell & Creswell, 2018; Leavy, 2022). Since the objective of the research was to explore how circular economy strategies can be applied to timber usage within the construction sector, a qualitative approach enabled the collection of in-depth insights from industry experts with relevant knowledge and experience. Data were collected through semi structured interviews conducted with twelve experts representing sectors related to timber utilisation, construction practices, and timber supply chain,. Expert interviews are widely used in qualitative research to obtain detailed insights from individuals with specialised professional knowledge (Eppich et al., 2019; Gill et al., 2008). Engaging experts from multiple sectors enabled the study to capture diverse perspectives on circular economy strategies relevant to sustainable timber usage in the construction industry. A purposive sampling strategy was used to select the interview participants. Purposive sampling enables researchers to deliberately select participants who possess relevant expertise and knowledge related to the research topic (Etikan et al., 2016; Campbell et al., 2020). Data saturation was achieved at the 10th Expert, thus two more interviews were conducted. The selected experts had substantial professional experience in construction, timber utilisation, environmental management, or policy related to forest resources and the built environment as depicted in Table1.

Table 1. Expert profile

Expert Code	Designation / Role	Sector	Experience	Area of Expertise
E1	Director / Consultant	Construction sector	33	Contract Administration, Timber in Construction & CE
E2	Director	Regulatory body for timber	25	Timber in Construction, Regulation and supply chain
E3	Managing Director / Consultant	Construction sector	33	Contract Administration, Timber in Construction & CE
E4	Conservator of forest	Regulatory body for forest resources	19	Timber Legislation, CE & Sustainable Forest Management, Supply chain
E5	Engineer	Construction supplier	17	Timber in Construction, Timber Trade & Certification
E6	Charted Civil Engineer / Professor	Non-state university/ Construction sector	28	Circular Economy / Life cycle Assessment & CE
E7	Chartered QS / Professor	State university/ Construction sector	29	CE
E8	Professor	Non-state university/Construction sector	27	Timber in Construction & CE
E9	Researcher	State university/Construction sector	5	CE
E10	Academic / Lawyer	State university/Construction sector	25	Policy Implementation Supply chain and CE
E11	Chartered QS / Lawyer	Construction sector	25	CE/ Regulation and Trade
E12	Director	Construction sector/timber treatment	25	Timber Trade & Certification & CE

Participants were purposively selected based on professional experience, involvement in decision-making related to timber use or construction practices, and familiarity with sustainability or circular economy initiatives, ensuring the inclusion of individuals with adequate technical and contextual expertise to provide informed insights relevant to the Sri Lankan construction industry. The interview data were analysed using manual qualitative content analysis, which enables the systematic identification of patterns, themes, and relationships within qualitative data (Amudjie et al., 2023). Responses were coded and categorised to derive key circular economy strategies for sustainable timber utilisation, with the resulting themes forming the basis for identifying relevant strategies and examining their applicability within the Sri Lankan construction context.

4. FINDINGS AND ANALYSIS

4.1 CIRCULAR STRATEGIES THAT CAN BE USED FOR SUSTAINABLE TIMBER USAGE IN THE SRI LANKAN CONSTRUCTION INDUSTRY

The expert interviews were analysed using qualitative content analysis to identify circular economy strategies that can support sustainable timber utilisation in the Sri Lankan construction industry. Through the analysis of the interview responses, a total of thirteen circular economy strategies were initially identified as shown in below Table 2.

Table 2- Circular economy strategies for sustainable timber usage in Sri Lankan construction industry

Code	CE Strategy	Usage	Experts Support
S1	Use of Reclaimed Timber	• Reuse and Recycle • Extend the life in use as timber is a durable material • Minimise the resource extraction	E1,E2,E3,E4,E5,E6,E7,E8,E9,E10,E11,E12
S2	Design for Disassembly	• Joints are one of the most important aspects in timber • Allowed the convenience of disassembly • Improve the recovery efficiency	E1,E2,E3,E4,E5,E6,E7,E8,E9,E10,E11,E12
S3	Prefabricated Construction	• Modified from Modular and Prefabricated Construction • Improve the material efficiency	E1,E2,E3,E4,E5,E6,E7,E8,E9,E10,E11,E12
S4	Lifecycle Assessment (LCA) Based Design	• Encourage the use of timber due to its sustainability properties • Encourage the use of it in CE modes.	E1,E2,E3,E4,E5,E6,E7,E8,E9,E10,E11,E12
S5	Materials Passports and Digital Traceability	• Important to identify the place of growth, species, maturity • Can create a lasting record for second hand use.	E1,E2,E3,E4,E5,E6,E7,E8,E9,E10,E11,E12
S6	Industrial Symbiosis	• Important for forward and backward linkage between industries	E1,E2,E3,E4,E5,E6,E7,E8,E9,E10,E11,E12
S7	Modular Thinking		
	S7.1- Dimension modules	• Improve the material efficiency • Increase the opportunities of reuse	E1,E2,E3,E4,E5,E6,E7,E8,E9,E10,E11,E12
	S7.2 - Time modules	• Encourage the use of fast growing medium dense timber in the element require regular modifications.	E3, E5, E6, E7, E9, E11, E12
S8	Circular Public Procurement	• Integration of CE provision to public procurement guidelines	E1,E2,E3,E4,E5,E6,E7,E8,E9,E10,E11,E12
S9	Stakeholder Education and Awareness	• Deal with lack of knowledge in timber species and its suitability for different uses • Improve the knowledge in joinery • Avoid social myths resisting the use of reclaimed material.	E1,E2,E3,E4,E5,E6,E7,E8,E9,E10,E11,E12
S10	Commercial plantation for regeneration	• Regeneration is an important aspect of circular use	E1, E2, E4, E5, E6, E7, E9, E10, E11, E12
S11	Preservation and Treatment for Prolonged Use	• Help to prolong in use as timber is susceptible to insect attacks.	E1, E2, E3, E5, E7, E8, E10, E12
S12	Encourage Engineered Timber	• Help to negate defects and challenges inherent with timber.	E1, E3, E5, E8, E12

The findings indicate that the majority of the strategies received strong support from the interviewed experts, particularly those related to reuse, design approaches, and supply chain transparency. Strategies such as reclaimed timber use, design for disassembly, prefabricated construction, lifecycle assessment-based design, and circular public procurement received support from all interviewed experts, highlighting their perceived importance for improving sustainable timber utilisation within the Sri Lankan construction sector. In contrast, certain strategies such as modular time-based design, preservation and treatment practices, and engineered timber promotion received moderate levels of expert support, indicating emerging but still developing practices within the industry. Overall, the identified strategies demonstrate that circular economy principles can be applied across multiple stages of the timber lifecycle, from resource regeneration and material production to building design and construction practices.

4.2 APPLICATION OF EACH CIRCULAR STRATEGY FOR SUSTAINABLE TIMBER USAGE IN THE SRI LANKAN CONSTRUCTION INDUSTRY

The expert interviews provided valuable insights into how the identified circular economy strategies can be practically applied to enhance sustainable timber utilisation within the Sri Lankan construction industry. The experts highlighted that the implementation of these strategies requires improvements in design practices, supply chain management, resource regeneration, and industry awareness. The application of each strategy within the Sri Lankan context is discussed below.

The use of reclaimed timber was also strongly emphasised as a practical strategy for extending the service life of timber materials as indicated in Table 2. Initially described as the use of recycled and reused materials, the strategy was refined as use of reclaimed timber following the suggestion of E3. Experts highlighted that reclaiming timber from existing structures can significantly reduce resource extraction while allowing sufficient time for forest regeneration. As explained by E6, *"Timber comes from nature and goes back to nature therefore not a significant cause in terms of waste and its sequestration carbon performance can be further enhanced when prolonged in use through reclaiming that will also allow adequate time for regeneration while minimising the resource extraction."* Similarly, E9 highlighted the importance of reducing dependence on imported materials, stating *"Sri Lankan construction industry depends heavily on the imported material; it is important to seek more of local substitutes where timber is a definite option and use of reclaimed timber will further enhance the ability of using locally sourced material."* All experts agreed that reclaiming timber can significantly improve resource efficiency while reducing environmental impacts.

Design for Disassembly (DfD) emerged as a key design-oriented strategy for enabling circular timber utilisation, with experts emphasising the importance of joinery systems in facilitating material recovery and reuse. Traditional joinery was particularly valued, as highlighted by E8, "Joints have to be designed for disassembly," and E1, who noted that modern methods such as "nailing and gluing hinder the ability of disassembly," unlike traditional interlocking systems. Overall, experts agreed that incorporating disassembly considerations at the design stage enhances reuse, recycling, and recovery of timber. In addition, prefabricated construction was strongly supported as a strategy to improve efficiency and reduce material waste, with E6 stating that "production and material efficiency can immensely improve through offsite factory production," while E1 pointed to successful implementation in contexts such as Maldives. Based on expert feedback, the strategy was refined to focus specifically on prefabrication, highlighting its potential to enhance construction efficiency while minimising material losses. The interviews also highlighted the importance of modular thinking in enabling circular timber utilisation. While eco-design was initially identified as a potential strategy, many experts indicated that eco-design considerations are already embedded within several circular construction practices. Therefore, the concept was refined as modular thinking, which focuses on designing building components using standardised dimensions that facilitate reuse and adaptability. As explained by E3, *"Timber is considered one of the most environmentally friendly materials, and its increased use in construction contributes significantly to ecological sustainability."* Similarly, E9 emphasised the reuse potential associated with modular design, stating *"Modular construction will give a better opportunity of reusing especially when it comes to timber."* Several experts also emphasised the importance of considering time-based modularity when selecting timber species. In particular, E11 highlighted that *"Medium dense timber like rubberwood shall contribute with less embodied carbon compared to hardwoods because it grows faster and is easier to process. Using low and medium-density timber is therefore recommended, especially for elements like interior works that often require modifications."* This perspective suggests that matching timber characteristics with the anticipated lifespan of building components can further enhance circular material utilisation.

Lifecycle assessment (LCA) was widely recognised as a strategy to promote timber use, with experts highlighting its favourable environmental performance due to low embodied carbon and high sequestration capacity. As noted by E2, "*Timber is highly sustainable material with lower embodied carbon, higher strength to weight ratio and higher sequestration carbon, therefore LCA will encourage the use of timber*." Experts also emphasised that LCA can encourage the use of reclaimed timber (E6), and could be further strengthened through policy integration, with E1 stating, "if LCA combined with carbon taxation or concessions, it will definitely boost the use of timber and its circular use." Material passports were also strongly supported due to variability in timber properties, with E3 explaining, "*There is a significant variance in properties among the different species while there are also difference in properties of the same species based on the place of origin,*" and further noting that "*A material passport can certainly assist in identifying the suitability of the log or sawn timber member for specific applications, which contributes to a longer lifespan in use.*" Similarly, E2 highlighted their importance by stating, "*Laypeople in general and experts when it comes to certain species often struggle to identify sawn timber species by sight alone. The material passport in this regard can provide immense benefits*." Industrial symbiosis was identified as a key strategy to utilise timber residues across industries, with E5 noting, "*In our factory, around 80% of sawdust is wasted despite its potential for use in other sectors like particle board production and agriculture etc,"* and E11 emphasising that "*collaboration between the rubber and construction industries could mutually benefit both sectors and enhance their carbon performance.*" Circular public procurement was recognised as a critical policy driver, with E3 suggesting "*a regulation required to insist on certain minimum percentage of reclaimed content*," and E6 highlighting that "*public procurement guidelines can include mandatory LCA requirement for certain type of projects including public sector projects,"* thereby supporting sustainable timber utilisation.

Stakeholder education and awareness were also identified as essential enabling factors for implementing circular timber strategies. Experts emphasised the need to improve knowledge among designers, contractors, and clients regarding timber properties and reuse practices. As noted by E1, *"It is necessary to educate and improve the awareness* *of all the stake holders across different strata."* Similarly, E11 highlighted that *"Dislike of people of using reclaimed material, sometimes backed by customary myths, hindered the circular use of timber. Therefore, an effective social awareness campaign is required."* Digital traceability platforms were also identified as important tools for improving supply chain transparency and material tracking. Experts highlighted that digital systems could integrate material passports and documentation processes throughout the supply chain. As explained by E5, *"A streamlined digital documentation system with a material passport that accumulates information throughout the supply chain would benefit both the primary and secondary use of timber."* E7 also highlighted the role of BIM platforms in improving supply chain collaboration, stating, *"Using platforms like BIM allows early detailing and better supply chain collaboration, which is key to efficiently using timber in construction."* The regeneration of timber resources through plantation forestry was also emphasised as an essential strategy in the Sri Lankan context. Experts highlighted that sustainable timber utilisation requires continuous regeneration of forest resources. As noted by E4, *"forest conservation department encourage the private sector investments manmade forest plantation and commercial tree plantations."* However, experts also noted several challenges associated with plantation forestry. For example, E2 stated that *"Commercial timber plantations are vital, but limited land is a major challenge."* Experts also highlighted the importance of preservation and treatment in extending the lifespan of timber materials. As explained by E3, *"There is a huge stock of old building being unattended without been maintained. Old buildings are material banks."* Proper preservation techniques can therefore facilitate the reclamation of timber from existing buildings. E12 emphasised that *"Timber is a sustainable material but consume a substantial time for regeneration. Therefore, it is important to improve the durability and prolong the use to keep up with the regeneration pace."* E12 further highlighted the need to address environmental impacts associated with preservation methods. Finally, experts also emphasised the potential of engineered timber technologies in overcoming structural limitations associated with natural timber. As noted by E8, *"Although timber is highly sustainable material it comes with lot of inherent challenges as it prone to defects. Engineered timber can help address these issues and support greater circular use."* Experts also highlighted that engineered timber technologies remain relatively underdeveloped in Sri Lanka, indicating opportunities for technological advancement within the sector. Overall, the findings demonstrate that integrating circular economy strategies across design, material utilisation, supply chains, and resource regeneration can significantly improve sustainable timber utilisation within the Sri Lankan construction industry.

5. DISCUSSION

The findings of this study demonstrate strong alignment with existing literature on circular economy implementation in the built environment while also reflecting several contextual nuances specific to the Sri Lankan construction sector. The identified strategies such as design for disassembly, prefabricated construction, modular thinking, and the use of reclaimed materials correspond closely with circular construction strategies widely discussed in previous studies (Timm et al., 2023). Although Product as a Service (PaaS) was identified in the literature (Foster, 2020; Massari & Giannoccaro, 2023; Anastasiades et al., 2022), it was excluded from the final list of strategies, as experts highlighted its limited applicability to construction, being more suitable for furniture and temporary interior elements rather than structural timber applications. These strategies emphasise extending material lifecycles, improving resource efficiency, and enabling reuse through design and production innovations. Similarly, the emphasis on lifecycle assessment and material traceability reflects the increasing importance of lifecycle thinking and digital information systems in supporting circular material flows within construction supply chains (Chen et al., 2022; Schroeder et al., 2018). The findings also reinforce prior research highlighting the potential of timber as a sustainable construction material due to its renewable nature and favourable environmental performance (Ramage et al., 2017; Koca, 2018). However, the results indicate that the effective implementation of circular timber strategies requires additional enabling conditions within the Sri Lankan context. Strategies such as stakeholder education, circular public procurement, and plantation regeneration highlight the importance of institutional support, industry awareness, and resource governance in facilitating circular timber utilisation. These findings therefore suggest that while global circular construction strategies are applicable within Sri Lanka, their successful implementation depends on addressing local supply chain constraints, policy mechanisms, and industry knowledge gaps.

6. CONCLUSIONS

This study examined how circular economy strategies can be integrated to support sustainable timber usage in the Sri Lankan construction industry. The findings indicate that improving timber sustainability requires the integration of circular practices across design, material utilisation, supply chains, and resource regeneration. The convergence of these strategies can enhance timber lifecycle performance, improve resource efficiency, and reduce pressure on virgin timber resources within construction activities. The study highlights that advancing circular timber utilisation in Sri Lanka requires both improved industry practices and supportive institutional mechanisms. Circular design approaches that facilitate reuse and adaptability, together with improved material recovery and traceability practices, can strengthen the efficiency of timber utilisation within construction projects.

This study contributes to research by contextualising circular economy strategies for sustainable timber utilisation within the Sri Lankan construction industry, an area that has received limited academic attention. The study advances existing knowledge by identifying circular strategies for timber use and demonstrating how circular economy concepts can be applied within a developing construction context. The interview findings were triangulated with existing literature to strengthen the credibility, interpretation, and contextual relevance of the findings.. From an industry perspective, the findings provide practical guidance in improving timber utilisation practices by integrating circular approaches into design, material management, and supply chains. The identified strategies support improved resource efficiency, promote reclaimed timber utilisation, emphasise commercial plantations and encourage more sustainable timber practices within the construction sector. Future studies may examine the environmental and economic performance of different timber species. This study is limited to qualitative insights derived from 12 expert interviews within the Sri Lankan construction industry. To mitigate the limitations of relying solely on expert perspectives in the Sri Lankan construction industry, data triangulation was employed by integrating literature findings with expert feedback and validation.

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