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ASSESSING THE ECONOMIC AND ENVIRONMENTAL ADVANTAGES OF CIRCULAR ECONOMY PRACTICES IN CIVIL CONSTRUCTION

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Abstract. The construction industry plays an important part in economic growth but notably contributes to environmental deterioration owing to excessive resource use and waste generation. The implementation of circular economy (CE) principles provides a revolutionary strategy for reducing these unfavourable consequences by encouraging resource efficiency, material reuse, and waste reduction. The article assesses the economic and environmental benefits of principles of CE in civil construction, with a specific emphasis on their use in Sri Lanka. The research contains an analytical examination of current trends, an assessment of economic implications, and an evaluation of environmental sustainability improvements provided by CE adoption. It incorporates global and local case studies to find best practices and obstacles in circular economy implementation. The study technique comprises statistical analysis, including Pearson correlation analysis, to explore links between CE methods such as material recycling, waste management, and energy efficiency. The results demonstrate that CE principles greatly cut operating costs, boost energy efficiency, and minimize carbon footprints. These observations emphasize the significance of concerted efforts among policymakers, industry stakeholders, and regulatory agencies to promote the adoption of sustainable construction practices. The article continues by underlining the significance of organized legislative frameworks and technical advancements to assist the circular transition within the construction industry.

Keywords: *Circular economy, construction industry, economic benefits, environmental sustainability, green construction, Sri Lanka.*

INTRODUCTION

The construction industry plays a crucial role in economic growth, contributing considerably to infrastructure development, urbanization, and job formation. However, it also remains one of the greatest users of natural resources and a key contributor to environmental deterioration (Fei et al., 2021; Sepehrdoust et al., 2022). The industry is responsible for around 30 % of worldwide resource extraction and creates about 40 % of urban trash yearly, compounding concerns such as pollution, deforestation, and carbon emissions (Liang et al., 2020; Kaja & Goyal, 2023). These environmental and economic concerns underline the urgency of shifting from the current linear economic (LE) paradigm of "take, make, dispose" to a more sustainable circular economy framework (Weerakoon et al., 2023).

The circular economy (CE) model emphasizes resource efficiency via waste reduction, material reuse, and recycling, presenting a possible avenue to minimize the construction sector's negative environmental and economic consequences (Ghisellini et al., 2018). By incorporating CE principles, building operations may maximize material utilization, minimize energy consumption, and lessen waste output. For instance, employing recycled building materials may greatly lower the demand for virgin resources while minimizing the environmental footprint associated with material extraction and processing (Ginga et al., 2020; Marek & Krejza, 2024; Lonergan, 2024).

The economic benefits of CE practices extend beyond cost reductions and resource efficiency. Implementing CE principles in construction may boost job creation in recycling sectors, increase innovation in sustainable building materials, and attract green investments (Al-Nuaimi et al., 2019; Shang et al., 2021). Additionally, decreasing construction waste may minimize disposal costs and relieve the financial strain associated with landfill management. The European Union (EU) and other developed nations have already created legal frameworks that incentivize CE use in construction, indicating its feasibility as a long-term sustainable approach (Mhatre et al., 2021a; Hartley et al., 2023; HaitherAli & Anjali 2023).

Despite these potential advantages, substantial barriers limit the broad use of CE principles in construction. Challenges such as lack of knowledge, high initial investment costs, regulatory limits, and opposition to change within the sector offer challenges to implementation (Joensuu et al., 2020; Guerra & Leite, 2021). Addressing these barriers needs joint efforts among policymakers, industry stakeholders, and academics to provide practical solutions and policy interventions that support CE adoption.

This study intends to analyse the economic and environmental advantages of using CE principles in the civil construction industry. It tries to overcome the information gap by reviewing real-world building projects and studying the association between CE practices and sustainable development results. The research applies quantitative approaches, including correlation analysis, to quantify the influence of circular economy policies on cost efficiency, resource consumption, and environmental sustainability. By giving empirical insights, this study will add to the continuing conversation on sustainable building practices and give suggestions for industry stakeholders and policymakers to promote a transition toward a CE in the construction sector.

1. LITERATURE REVIEW

The construction industry is a key contributor to global growth in economies but also one of the most resource-intensive industries, accounting for a considerable proportion of raw material consumption, energy usage, and trash creation (Fei et al., 2021; Sepehrdoust et al., 2022). Given these issues, the circular economy (CE) has arisen as a transformational concept aimed at decreasing resource depletion and boosting sustainability in civil construction. The idea of CE is anchored on decreasing waste via the reuse, recycling, and regeneration of materials, hence producing closed-loop material cycles that enhance resource efficiency and decrease environmental effects (Ghisellini et al., 2017). The old linear economic paradigm in building, defined by a "take-make-dispose" pattern, has led to serious environmental deterioration, including high carbon emissions and excessive waste build-up. Studies estimate that the building industry alone contributes over 30 % of global greenhouse gas (GHG) emissions and accounts for nearly 40 % of total urban trash yearly, underlining the need for a transition toward sustainable construction methods (Kaja & Goyal, 2023).

1.1. Economic Benefits of Circular Economy in Construction

One of the major benefits of applying CE principles in construction is cost efficiency, which stems from greater resource usage and waste reduction. By using recycled resources such as recovered wood, crushed concrete aggregates, and recycled steel, construction enterprises may considerably cut material procurement costs while lowering the environmental imprint of extraction and processing (Miraldo et al., 2021). The economic advantages extend beyond raw material savings since CE techniques also cut garbage disposal costs and boost operating efficiency. For instance, modular building methods and prefabrication can optimize resource consumption by eliminating offcuts and construction waste, which further leads to budgetary savings (Moschen-Schimek et al., 2023).

Beyond cost reductions, CE increases economic resilience by minimizing dependence on virgin raw materials, which are prone to price swings and supply chain interruptions. Studies have demonstrated that incorporating secondary materials into the supply chain helps stabilize prices and guarantee more predictable construction budgets (Mojica et al., 2025). Additionally, the adoption of CE techniques fosters innovation and new economic prospects in sectors such as deconstruction services, material recovery, and recycling technologies. The rise of these markets not only adds to the financial stability of construction businesses but also provides employment in adjacent sectors, such as waste processing and green technology development (Ghufran et al., 2022).

The economic effect of CE adoption is notably visible in the creation of green building certifications such as Leadership in Energy and Environmental Design (LEED) and the Building Research Establishment Environmental Assessment Method (BREEAM) (Akinwale, 2024). These certification schemes promote sustainable building techniques and give financial incentives to construction businesses that apply CE principles. Research reveals that green-certified buildings frequently have greater property values, attract premium rental rates, and enjoy reduced vacancy rates owing to increased demand from environmentally concerned tenants and investors (Gil-Ozoudeh et al., 2024). This illustrates that CE principles not only help with cost savings but also give a competitive edge in the building industry.

1.2. Environmental Advantages of Circular Economy in Construction

The environmental advantages of CE practices in construction are also enormous, notably in terms of decreasing waste and cutting GHG emissions. The usual linear model of construction results in large volumes of construction and demolition waste (CDW), most of which is transferred to landfills, further worsening environmental deterioration (Ginga et al., 2020). CE principles, on the other hand, promote material reuse and recycling, eliminating the need for fresh raw material extraction and limiting the environmental effects associated with mining, forestry, and manufacturing. Research demonstrates that recycling CDW into secondary raw materials may minimize the carbon footprint of building operations by up to 50 % (Minunno et al., 2018).

In addition to waste reduction, CE measures help with water conservation in construction. Many typical building processes demand enormous volumes of water, not only for construction operations but also for material manufacturing, such as concrete mixing and cement processing. (Mbavarira & Grimm, 2021) By employing circular techniques, including wastewater reuse systems and rainfall collecting, building projects may dramatically decrease their freshwater use and increase overall environmental sustainability (Ogunmakinde et al., 2021). This is especially crucial in countries suffering water shortage, where sustainable building approaches may reduce the demand for local water supplies.

Furthermore, the CE model fosters energy efficiency via innovative design and construction approaches. Building Information Modeling (BIM) has been acknowledged as a major technology in promoting CE practices by providing exact material monitoring, effective construction planning, and improved resource utilization (AlJaber et al., 2023). BIM and other digital platforms enable the identification of reused materials from demolition sites, thereby increasing circularity in building and lowering the embodied energy associated with new material manufacture.

Another key environmental advantage of CE use in construction is biodiversity protection. By reducing resource exploitation, CE techniques help safeguard natural environments that might otherwise be damaged by activities such as mining and deforestation (United Nations Industrial Development Organization, 2022). Additionally, the incorporation of biophilic design and green infrastructure in CE-oriented building projects supports urban biodiversity by adding components like green roofs, living walls, and permeable surfaces that sustain local ecosystems (Mhatre et al., 2021b). These elements not only increase environmental quality but also contribute to greater urban resilience against climate change.

The application of circular economy principles in civil construction brings considerable economic and environmental benefits. By increasing resource efficiency, decreasing waste, and encouraging material reuse, these methods contribute to a more sustainable and cost-effective construction sector. Table 1 outlines the important environmental and economic advantages discovered in the literature, emphasizing their influence on sustainability and industrial development.

Table 1. Environmental and Economic Benefits of Circular Economy in Construction (developed by the authors)

Category	Factor	Description
Environmental benefits	Reduction in greenhouse gas emissions	Lower carbon footprint by reducing raw material extraction and energy use
	Waste minimization and recycling	Decreased landfill waste through material recovery and reuse
	Resource conservation (water and raw materials)	Less reliance on freshwater sources and reduction in material extraction
	Biodiversity and land conservation	Lower demand for new construction materials helps preserve ecosystems
	Energy efficiency improvements	Improved efficiency through prefabrication and recycled material integration
Economic benefits	Cost savings in material procurement	Lower costs by reusing and recycling building materials
	Job creation in recycling and green building	New employment opportunities in material recovery, recycling, and green design
	Stabilization of supply chains	Reduced dependency on volatile raw material markets through material reuse
	Reduction in waste management costs	Lower expenses associated with landfill use and disposal
	Increased market value for sustainable projects	Higher real estate value and investor interest in green buildings

1.3. Challenges and Future Directions

Despite the compelling advantages of CE in construction, broad adoption is limited by various hurdles. Regulatory constraints, lack of standardization, and insufficient knowledge among industry stakeholders are some of the key impediments to CE adoption (AlJaber et al., 2023). Many construction businesses continue to operate under conventional business models that favour short-term profitability over long-term sustainability, making it difficult to change toward circular practices (Thirumal et al., 2024). Additionally, worries surrounding the structural integrity and performance of recycled materials generate uncertainty among engineers and architects, further delaying the move to CE-based construction. To solve these problems, governments must develop clear legislative frameworks that incentivise CE use in the building sector. Governments might implement financial incentives such as tax credits, subsidies, and grants to stimulate the use of recycled materials and sustainable building processes (Alotaibi et al., 2024). Moreover, incorporating digital technologies such as blockchain for material monitoring and certification may boost transparency and generate confidence in circular building methods.

Future studies should concentrate on measuring the long-term economic and environmental implications of CE in construction via large-scale empirical investigations. Additionally, cross-industry coordination between construction businesses, waste management organizations, and regulators is vital for designing comprehensive plans that promote circularity throughout the whole construction value chain.

2. METHODOLOGY

The methodology of this study follows a systematic approach to examine the environmental and economic advantages of CE principles in construction. The study adopts a quantitative research method, concentrating on the gathering and analysis of numerical data to assess the effect of CE policies on building projects. Data is acquired from industry specialists, including project managers, architects, engineers, and sustainability consultants, using a structured questionnaire. The survey aims to collect critical factors such as material recycling and reuse rates, waste management methods, energy efficiency measures, water conservation approaches, and cost savings gained via circular activities.

Following data gathering, pre-processing procedures are employed to assure accuracy and consistency. This comprises data cleaning to remove incomplete or erroneous replies, outlier identification to reduce extreme values that might mislead findings, and normalization to normalize variables for meaningful comparison. The research then employs Pearson correlation analysis to analyse the association between circular economy practices and building project results. The Pearson correlation coefficient (r) quantifies the degree and direction of correlations between variables using a statistical formula that analyses how closely changes in one variable correspond to changes in another. A significance level of $p < 0.05$ is employed to establish the statistical validity of the relationships.

$$r = \frac{\Sigma(x - x_i)(y - y_i)}{\sqrt{\Sigma(x - x_i)^2 \Sigma(y - y_i)^2}}, \tag{1}$$

where x_i and y_i represent the individual data points of variables x and y and are the dependent variables.

To analyse the effect of circular economy methods, essential assessment indicators are applied, including energy savings, cost efficiency, waste reduction, and water conservation (see Table 2). These metrics help quantify the advantages of implementing sustainable building practices and identify the most effective approaches for enhancing environmental and economic performance. The research also examines ethical considerations by guaranteeing that participant replies stay secret and anonymous. Informed permission is sought from all participants, and they are given the ability to withdraw at any time.

By merging statistical analysis with real-world data from building projects, this study intends to give significant insights into the benefits of circular economy concepts in the civil construction industry. The results will assist stakeholders in establishing ways to improve resource efficiency, decrease waste, and increase sustainability in building operations. The systematic process enables a thorough and accurate evaluation of CE advantages, leading to informed decision-making in the sector.

Table 2. Survey Data Description Table (developed by the authors)

Variable Name	Definition	Survey Question	Response type
Water conservation	Practices related to reducing water usage in construction	How frequently do you use water-efficient methods in construction?	Likert Scale (1–5)
Material recycling	Use of recycled materials to minimize raw material consumption	What percentage of materials used in your projects are recycled?	Percentage
Energy efficiency	Measures to enhance energy efficiency and reduce energy waste	Which energy-saving technologies have been implemented in your projects?	Multiple choice
Waste management	Strategies to reduce and manage construction waste effectively	What waste management practices are adopted in your construction projects?	Multiple choice
Sustainable material usage	Use of sustainable or eco-friendly materials in construction	How often do you choose sustainable materials over conventional materials?	Likert Scale (1–5)
Project cost reduction	Reduction in project costs due to circular economy practices	What percentage of cost savings has been achieved through circular economy practices?	Percentage
Carbon footprint reduction	Reduction in carbon emissions resulting from sustainable construction practices	How much reduction in carbon emissions has your project achieved?	Percentage

3. RESULTS AND DISCUSSION

3.1. Preliminary Results

The results of this research illustrate the enormous economic and environmental benefits associated with implementing circular economy principles in civil construction. The study approach, based on descriptive statistics and Pearson correlation analysis, gives substantial insights into the link between sustainable construction practices and project results. The investigation demonstrates that CE concepts, notably material recycling, energy-efficient technologies, and waste management, have a favourable influence on cost savings and environmental performance.

The results of the survey showed a varied spectrum of construction projects, with 33.3 % working on residential projects, 25.5 % on infrastructure projects, 21.6 % on commercial projects, 17.6 % on industrial projects, and just 2.0 % (see Fig. 1) on rehabilitation projects. These projects show the relevance of sustainable methods in housing, infrastructure, and commercial sectors. The majority of responders are working on household and infrastructure projects, underlining the need for waste reduction, energy efficiency, and material reuse. However, the low percentage of rehabilitation projects may imply an opportunity for sustainable approaches in adaptive reuse and retrofitting.

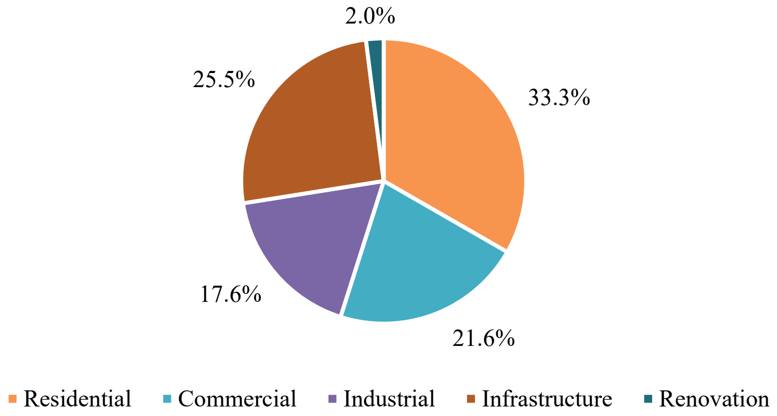

Fig. 1. Type of projects where responders currently work (developed by the author based on survey results).

The results highlight the need for enhanced integration of sustainability in building projects since survey answers suggest mixed views toward sustainability goals (see Fig. 2).

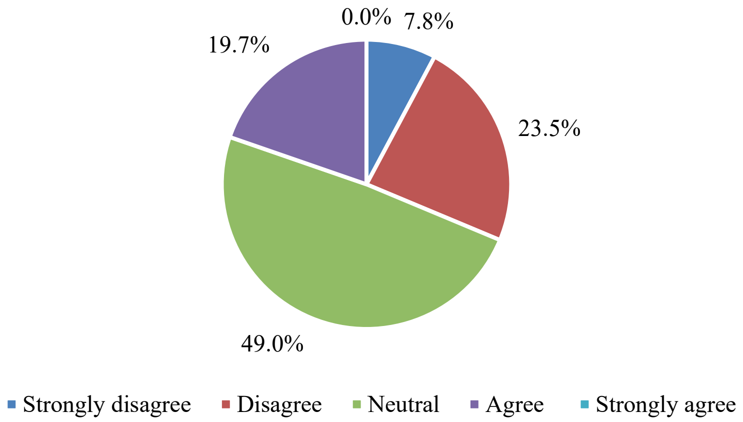

Fig. 2. Responders' perception of sustainability achievement as their main goal in respective projects (developed by the authors based on survey results).

Nearly half (49.0 %) of respondents were ambivalent about prioritizing sustainability, showing a lack of clarity or emphasis on environmental objectives. Additionally, a large number (31.3 %) disagreed, underlining inadequate commitment to sustainability in project development. While 19.7 % identified sustainability as a significant priority, no respondents strongly agreed, showing a gap in complete commitment. These findings underline the importance of more advocacy, training, and policy enforcement to incorporate sustainability into building processes, especially in locations or sectors where it remains undeveloped.

Survey findings highlight significant areas of sustainability success (see Fig. 3), with carbon footprint reduction (60.8 %) being the most accomplished aim, suggesting growing regulatory pressure and green technology uptake. Energy efficiency gains (56.9 %) and material efficiency (54.9 %) also reflect the rising adoption of sustainable methods, contributing to waste reduction and the circular economy.

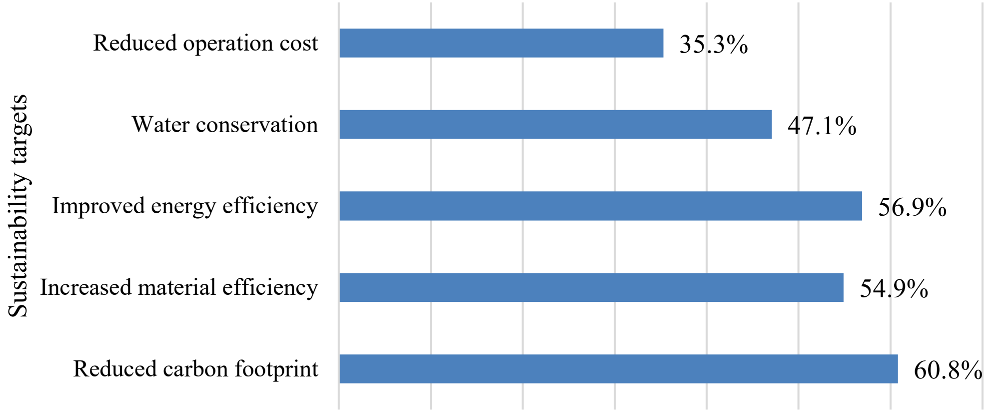

Fig. 3. Key sustainability goals achieved in respondents' projects (developed by the author based on survey results).

Water conservation was accomplished in 47.1 % of projects, underlining the need for additional breakthroughs via new methods. However, just 35.3 % of respondents mentioned decreased operational expenses as an effect, demonstrating that economic gains are not necessarily the major motivation for sustainability initiatives. This refers to a possible knowledge gap about the long-term financial benefits of sustainable building.

Overall, the findings reveal that while considerable progress has been accomplished in attaining key sustainability objectives, such as lowering carbon footprints and boosting energy and material efficiency, there is an opportunity for improvement in areas like water conservation and cost optimization. These findings underscore the need for a more holistic approach to sustainability in building, where environmental, economic, and social goals are equally recognized.

3.2. Pearson Correlation Analysis

The descriptive data in Table 3 give insights into the heterogeneity of sustainability-focused activities across projects. Material recycling (mean = 21.00; range = 80) and waste reuse (mean = 20.10; range = 90) display large disparities in adoption, as evidenced by their high standard deviations. Energy reduction (mean = 20.78; range = 68) and water reuse (mean = 20.94; range = 80) similarly exhibit various implementation levels, underlining the need for uniformity. Green building certification (mean = 1.73) suggests a low certification rate, whereas financial metrics such as project cost increase (mean = 1.57) and operations cost increase (mean = 1.65) imply that sustainability activities did not considerably boost expenses. This contradicts the idea that eco-friendly measures are inevitably costly.

The descriptive statistics indicate the variable implementation of sustainability measures among projects, with large variances in material recycling, waste reuse, energy reduction, and water conservation. These results underline the need for standardized sustainability approaches to eliminate inequities and increase environmental outcomes in construction projects.

Table 3. Descriptive Statistics (developed by the authors based on SPSS analysis)

Descriptive statistics										
	N	**Range**	**Minimum**	**Maximum**	**Mean**		**Std. deviation**	**Variance**	**Skewness**	
	N	**Stat**	**Stat**	**Stat**	**Stat**	***r***	**Stat**	**Stat**	**Stat**	**Std. Error**
Material recycling	51	80.00	.00	80.00	21.00	2.78	19.891	395.6	1.445	0.333
Waste management	51	1.00	1.00	2.00	1.098	0.04	0.300	0.090	2.786	0.333
Waste reuse	51	90.00	0.00	90.00	20.09	2.77	19.828	393.1	1.686	0.333
EE technologies	51	1.00	1.00	2.00	1.156	0.05	0.367	0.135	1.945	0.333
Energy reduction	51	68.00	2.00	70.00	20.78	2.26	16.16	261.41	1.228	0.333
Water Reuse	51	80.00	0.00	80.00	20.94	2.45	17.512	306.6	1.542	0.333
Green building certified	51	1.00	1.00	2.00	1.725	0.06	0.45	0.203	−1.04	0.333
Project cost increased	51	1.00	1.00	2.00	1.568	0.07	0.500	0.250	−0.28	0.333
Operational cost increased	51	1.00	1.00	2.00	1.647	0.06	0.482	0.233	−0.63	0.333
Financial saving EE	51	1.00	1.00	2.00	1.098	0.04	0.300	0.090	2.786	0.333
Cluster number of cases	51	1	1	2	1.22	0.05	0.415	0.173	1.425	0.333
Valid *N* (listwise)	51									

The correlation study highlights critical relationships among sustainable construction strategies. Material recycling highly correlates with energy savings ($r = 0.745$; $p < 0.01$) and water reuse ($r = 0.790$; $p < 0.01$), proving its function in decreasing environmental impact and boosting resource efficiency. It also demonstrates a positive link with waste reuse ($r = 0.615$; $p < 0.01$), validating the ideas of a circular economy. Waste management techniques reveal complicated relationships, with a slight negative association with waste reuse ($r = -0.260$; $p = 0.065$) but a moderate positive link with energy-efficient technology ($r = 0.402$; $p < 0.01$), suggesting alignment with advanced sustainability solutions. Waste reuse also correlates substantially with energy reduction ($r = 0.752$; $p < 0.01$) and water reuse ($r = 0.782$; $p < 0.01$), further confirming the advantages of resource-saving techniques. Energy-efficient technologies exhibit a moderate positive association with waste management ($r = 0.402$; $p < 0.01$) but weaker linkages with material recycling and waste reuse, showing that energy efficiency measures may occasionally work independently of waste reduction programs. Additionally, energy reduction and water reuse demonstrate a substantial association ($r = 0.879$; $p < 0.01$), underlining their dependency on sustainability-focused initiatives. The correlation analysis gives a thorough picture of how multiple sustainability programs align and interact, stressing both synergies and opportunities for improvement. Strong connections between material recycling, waste reuse, energy reduction, and water reuse underline the advantages of an integrated sustainability strategy, where many initiatives work together to yield considerable environmental and operational benefits. In contrast, weaker links between waste management and green building certification show the need for deeper integration with larger sustainability objectives to boost their efficacy in construction projects.

Beyond correlation analysis, the study analyses the practical influence of CE initiatives on energy efficiency. CE concepts, which stress resource efficiency, waste reduction, and material reuse, play a significant role in encouraging sustainable construction techniques. A scatter plot study further highlights these linkages, notably the connection between material recycling, energy-efficient technology, and water reuse in lowering total energy use. Figure 4 demonstrates a substantial positive association ($r = 0.75$) between the amount of recycled materials utilized in construction and consequent energy savings. This study accords with CE ideas, supporting the relevance of recycling and reuse in lowering resource use and energy demand in construction projects.

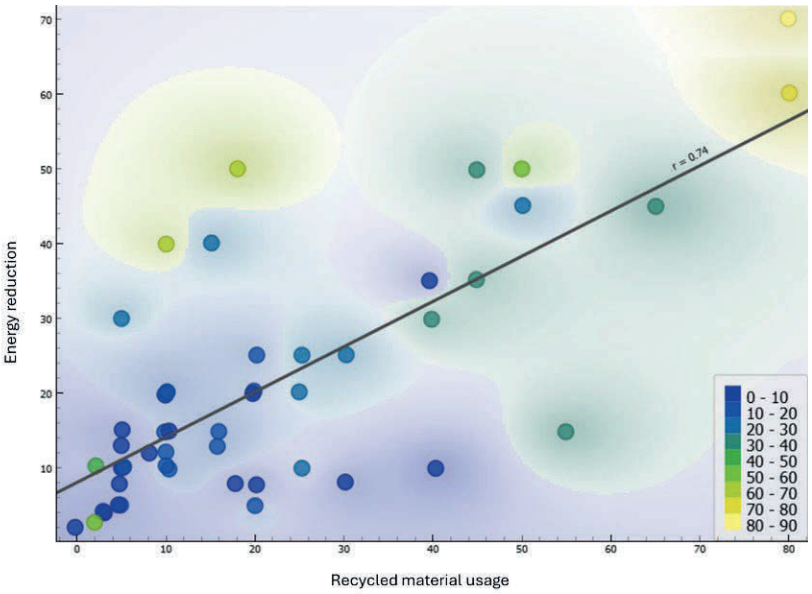

Fig. 4. Impact of material recycling on energy reduction in construction (developed by the author based on survey results).

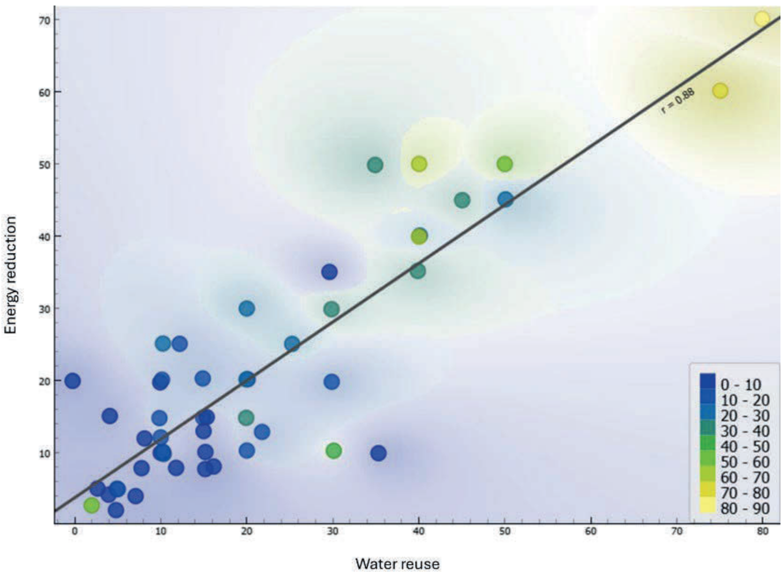

Fig. 5. Impact on energy reduction by waste reuse in construction (developed by the author based on survey results).

Several factors contribute to the positive relationship between recycled materials and energy savings in building projects. Firstly, recycled materials use less energy for processing and manufacture compared to virgin materials, lowering total energy usage. Secondly, they have lesser embodied energy, decreasing the overall energy effect during their life cycle. Thirdly, CE principles promote efficient resource use, waste minimization, and optimized material choices, leading to lower energy usage throughout the construction process. Figure 5 illustrates the strong positive correlation between waste reduction percentage and energy savings in building projects. As waste reduction increases, energy consumption decreases, reinforcing circular economy principles that emphasize waste minimization and resource efficiency to enhance sustainability in construction.

The favourable relationship between waste reduction and energy savings in construction projects is impacted by numerous variables. Optimizing material selection minimizes energy consumption during construction while reducing waste lowers the energy required for disposal and recycling. Additionally, CE techniques encourage the reuse and recycling of materials, minimizing the need for new resources and their accompanying energy usage. Figure 6 illustrates a substantial positive connection ($r = 0.88$) between water reuse and energy savings, demonstrating that higher water reuse leads to larger energy reductions. This coincides with circular economy ideas, which stress limiting water usage and increasing resource efficiency to increase sustainability in building projects.

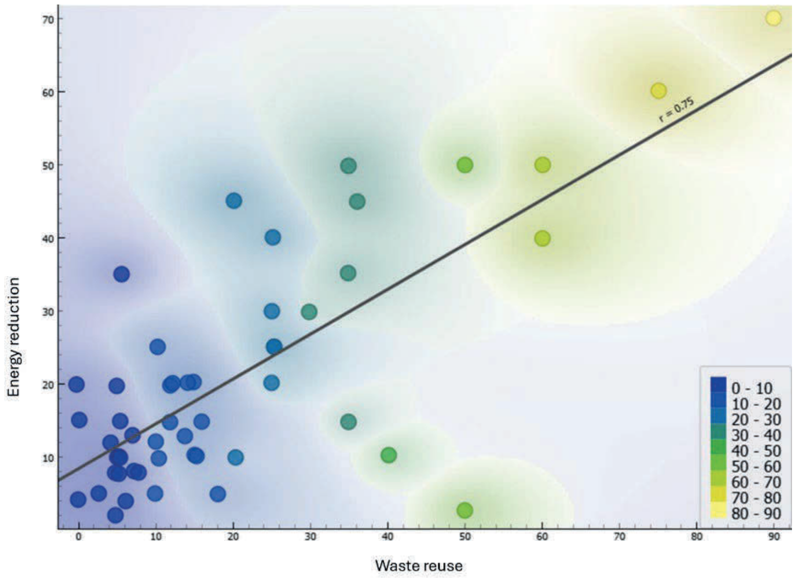

Fig. 6. Impact on energy reduction by water reuse (developed by the author based on survey results).

Several factors possibly contribute to this beneficial correlation. Firstly, water reuse decreases the necessity for potable water, which typically requires large energy for treatment and distribution. Secondly, water reuse may minimize the energy required for wastewater treatment and disposal. Thirdly, CE models usually advocate the use of rainwater gathering and greywater recycling, which may further cut water consumption and concomitant energy demand.

3.3. Environmental and Economic Benefits of CE

The correlation analysis undertaken in this research indicates considerable environmental and economic advantages associated with using circular economy concepts in building projects. One of the main results is the positive association between material recycling and energy reduction initiatives, demonstrating that recycling building materials not only saves waste but also aids in decreasing the energy footprint of projects. This underlines the environmental value of resource-efficient operations, since reusing and recycling materials decrease the need for virgin material creation, hence cutting carbon emissions and saving natural resources. Additionally, the research indicates the benefit of implementing energy-efficient technology, which shows a substantial correlation with lower operating costs and greater energy savings. This study illustrates the economic sustainability of circular economy projects, since investments in such technology may produce large cost savings throughout the lifespan of a project. Similarly, methods like water reuse and green construction certifications are connected with greater resource efficiency, further stressing the combined advantages of environmental preservation and financial savings. From an economic aspect, the incorporation of circular economy concepts helps long-term financial sustainability by maximizing material utilization and operating efficiency. The decrease in project costs via effective waste management and energy-saving activities illustrates the potential for circular practices to boost profitability while developing environmental stewardship. Overall, the correlation findings show that implementing circular economy strategies not only tackles significant environmental concerns but also gives substantial economic advantages, making them a crucial component of sustainable building.

The analysis presented in this study has proved the enormous environmental and economic advantages of applying circular economy concepts in the construction sector. The examination of numerous circular economy initiatives, including material reuse, waste reduction, and water reuse, has demonstrated considerable positive connections with energy reduction. The results demonstrate that by introducing circular economy techniques into building projects, it is feasible to achieve large savings in energy use, resource usage, and waste creation. These benefits not only contribute to environmental sustainability but also provide major economic advantages, such as cost reductions and enhanced income prospects. To fully utilize the promise of a circular economy in building, a multi-faceted strategy is essential. This involves regulatory support, industry cooperation, technical improvements, and improved awareness and education. By developing a circular economy attitude and embracing creative solutions, the construction sector can play a significant role in reducing climate change and supporting sustainable development.

CONCLUSIONS

In conclusion, this research illustrates the economic and environmental advantages of implementing CE concepts in the construction industry. The results suggest that shifting from a linear to a circular construction approach may lead to considerable cost savings, increased resource efficiency, and decreased environmental impact. By applying measures such as material recycling, waste reduction, and energy-efficient building designs, the industry may lessen its dependence on virgin resources, minimize greenhouse gas emissions, and contribute to long-term sustainability. The article also underlines the relevance of government policy, business partnerships, and technical improvements in supporting CE adoption. Regulatory frameworks that support sustainable construction methods, along with incentives for enterprises that favour circular strategies, may hasten this transformation. Additionally, digital technologies such as Building Information Modeling (BIM) and material passports may promote resource monitoring and material reuse, supporting a more resilient and eco-friendly construction sector.

Despite the clear advantages, the report admits some difficulties, including high initial investment costs, resistance to change within the business, and gaps in stakeholder understanding. Addressing these impediments needs a holistic strategy incorporating education, financial assistance systems, and a change in corporate strategies toward long-term sustainability objectives. By promoting a culture of innovation and cooperation among politicians, construction enterprises, and research institutes, the CE may become an inherent component of contemporary building processes.

Ultimately, this study adds to the expanding debate on sustainable development in the construction industry, especially in the context of Sri Lanka. The insights derived from global case studies, coupled with the analysis of local industry trends, provide a comprehensive understanding of how circular economy practices can enhance both economic viability and environmental stewardship. Moving forward, further research is necessary to explore advanced CE models, assess their long-term economic implications, and develop tailored strategies for widespread implementation in diverse construction environments.

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