

ANALYSIS OF BARRIERS TOWARDS IMPLEMENTING CIRCULAR ECONOMY IN SRI LANKAN BUILT ENVIRONMENT

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ABSTRACT

All over the world, environmental pollution has become a major environmental issue at present. As the construction industry extracts a high amount of natural resources compared to any other industry, it can be known as one of the significant causes of environmental pollution. In order to protect the environment from harmful human activities, there is a massive demand towards sustainable construction practices. Circular Economy (CE) concept has been identified as a way forward to sustainable construction practices. It has been identified that implementing CE in the construction industry has many barriers, enablers and drivers. Hence, this study aims to qualitatively analyse the relevance of the barriers identified through a literature survey in the global context towards circular economy implementation of the Sri Lankan context. Semi-structured interviews were carried out among industry experts and academics who have experience and knowledge of the CE concept. The findings of this study indicate that the practical implementation of CE in Sri Lankan built environment has many barriers as it is still in an early stage. This study concludes that the construction industry stakeholders should be aware of these concepts, and primarily the authorities should focus more on this concept to move forward with a sustainable construction industry and protect the environment.

Keywords: Barriers; Circular Economy; Construction Industry; Implementation; Sri Lanka.

1. INTRODUCTION

Environmental pollution is one of the substantial global problems that attracts both developed and developing countries because of its long-term effects (Kampa & Castanas, 2008). It can be identified as a result of humankind's unfavourable activities directly or indirectly towards the environment (Rai, 2016), such as rapid increment of waste production, malicious use of natural resources, urbanisation, and technical and industrial evolution (Kampa & Castanas, 2008). Investing on constructing of new residential, office, factory, school, hospital and infrastructure in order to support urbanisation and social changes has become urgent needs of the society (Vaduva-Şahhanoğlu et al., 2016). Therefore, the construction industry can be considered as one of the significant contributors to uplifting the three-dimensional aspects of a developed

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or developing country (Rajabi et al., 2022). Even though this industry significantly elevates a country's social and economic well-being, it consumes considerable natural resources (Omole & Ndambuki, 2014), specifically fresh water, wood, sand and limestone. One of the major reasons towards this is that the construction industry mainly focuses on "take, make, consume and dispose of", the linear chain of supplying materials (Ellen Macarthur Foundation [EMF], 2015). In order to reduce these environmental effects through this linear method, the current trend in the construction industry is to replace reclaimed materials with alternative sources for construction materials (Behera et al., 2014). Hence, sustainable construction practices have rapidly increased worldwide recently (Lima et al., 2021).

In comparison to the linear chain of supplying materials, another prominent concept in recent years is the Circular Economy (CE), which is centred on better management of resources (Pomponi & Moncaster, 2017). Further, according to Nodehi and Taghvaei (2022), CE has become a trend in modern society, especially in construction waste management. Despite the development of Sri Lanka's building sector happened recently, the country is increasingly suffering from environmental challenges caused by unsustainable construction methods (Athapaththu et al., 2016). Further, Athapaththu et al. (2016), stated that unsustainable practices in the Sri Lankan construction industry are now being acknowledged. However, according to Wijewansa et al. (2021), in fulfilment of international sustainable construction (SC) criteria, Sri Lanka remains to be a long way to go. Even though the application of the CE concept in Sri Lanka has been addressed by various scholars (Bekchanov & Mirzabaev, 2018), it is still regarded as a novel concept due to the industry's poor adaptability (Liyanage et al., 2019).

2. LITERATURE REVIEW

In any country, the construction industry is known as one of the most crucial indicators towards the economic development of the country (Alaloul et al., 2021; Makoye et al., 2022), as it makes a significant influence towards the increment of employment (Al-Bayati et al., 2019; Strout, 1958) and regional development (Nodehi & Taghvaei, 2022). Over the past decade, it has become increasingly clear that the rate of production and consumption and technological progress has led to severe environmental and social problems in the world, threatening the sustainability and continuous growth of societies (Bamgbade et al., 2022). The current Linear Economy model has produced approximately 25% of solid waste in the construction industry and extracted more than 30% of the world's natural resources (Benachio et al., 2020). With the increase in the demand for construction materials, the shortage of materials and the growing concern for the environment, the efficient construction of resources has been the subject of intense debate worldwide in, particular after the development of the concept of the CE at various levels of government, industry and academia in recent years (Hossain et al., 2020). According to EMF (2015), CE can be identified as "an industrial economy that is restorative or regenerative by intention and design". Furthermore, the fundamental aims of CE in the construction sector CE are to preserve the value of constructions and their associated parts while minimising construction and demolition waste to the greatest extent possible (Torgautov et al., 2021). On the other hand, Tseng et al. (2020) have identified that the CE has a broader economic advantage than initial material costs savings or resource optimisation to reduce waste, recycling, reuse or re-manufacturing, as all resources can produce multiplier effects, resulting in higher value generation

based on CE principles of maximisation. However, according to Adams et al. (2017) and Ghisellini et al. (2018) implementation of CE in the construction industry has hindered due to various barriers and challenges.

In developing countries, generally, along with a high growth rate, ecological degradation growth is also considered in a high range (Lee et al., 2020), Sri Lanka's construction industry has grown considerably over the past decade. At the same time, as a developing country, Sri Lanka is suffering more and more environmental problems due to unsustainable construction practices (Athapaththu et al., 2016). Researchers like Athapaththu et al. (2016), Liyanage et al. (2019) and Wijewansa et al. (2021), have established strategies that have affected the Sri Lankan construction industry to take into account CE as a sustainable construction industry strategy, such as selecting materials to promote sustainable, environmentally friendly, green materials, acquiring supplies from certified green vendors, planning for the site of use, calculating quantities before ordering materials, and implementing CE. Governments and businesses all around the world have put the adoption of CE on the agenda to address significant environmental problems since it benefits the construction industry (Roy et al., 2022). Nevertheless, significant barriers hinder the construction sector's circular supply and materials recovery (Torres-Guevara et al., 2021). Table 1 elaborates the barriers towards implementing CE in the construction industry.

Table 1 - Barriers towards CE implementation in construction the construction industry

Barriers	Sources												
	A	B	C	D	E	F	G	H	I	J	K	L	
No guarantee on economic benefits	✓		✓									✓	
Lack of understanding/ awareness/information /technology		✓	✓		✓	✓	✓	✓	✓				✓
Lack of policy and regulations		✓	✓		✓	✓		✓		✓			
Limited stakeholder collaboration				✓		✓							✓
Lack of supportive infrastructure and market to facilitate reuse/recover	✓		✓		✓		✓			✓			✓
Economical/Financing related barriers				✓		✓				✓			✓
Lack of standardised practices		✓	✓		✓			✓				✓	

Source: [A] Yu et al. (2021); [B] Grafström & Aasma, (2021); [C] Ogunmakinde et al., (2021); [D] Charef & Emmitt, (2021); [E] Mahpour, (2018); [F] Cantú et al., (2021); [G] Al Hosni et al., (2020); [H] De Jesus & Mendonça, (2018); [I] Acharya et al., (2018); [J] Sarja et al., (2021); [K] Wijewansa et al., (2021); [L] Al-Raqeb et al., (2023)

The barriers to adopting the Circular Economy concept in the construction sector are shown in Table 1. These are, lack of a proper understanding, lack of awareness and information about the CE concepts, and lack of technology to implement CE concept. Moreover, it can be identified that the second most common barrier towards CE implementation is lack of policy and regulations. The next section outlines the methods

used in this research work to determine the significance of the aforementioned barriers to the Sri Lankan building sector.

3. METHODOLOGY

The circular concept has been discussed in a worldwide context in principle during the last few years. According to Liyanage al. (2019), CE adaptability in the Sri Lankan construction industry is poor. This has led to a limited number of industry practitioners who possess adequate knowledge of the CE. Hence, the necessity to have in-depth discussions with those experts demanded a qualitative research approach for this study. According to Ritche et al., (2013) qualitative research represents a specific set of people's views, experiences, beliefs, and attitudes and is ideal for research on emerging conceptions through in-depth investigations .

15 semi-structured interviews with experts from academic and industry practitioners were conducted. The number of interviews was limited to 15 due to data saturation. By the 12th interview, the collected data got saturated and in order to confirm the saturation 3 more interviews were carried out. In qualitative research, “saturation” is the point at which incoming data does not provide any new facts, which is accepted as a benchmark for defining sample size (Guest et al., 2006; Guest & MacQueen, 2008). To guarantee that the experts chosen for the interviews have enough expertise and experience with CE in the Sri Lankan construction industry, purposive sampling was employed. According to Bernard (2017), purposive sampling is when a researcher decides what information is needed to know and then find people who can and are capable to supply it due to their knowledge or experience. The profile of each respondent is given in Table 2. The collected data was analysed through content analysis.

Table 2 - Respondent's profile

Respondent No	Designation	Experience with green buildings	Total years of experience
R 01	Deputy General Manager	10	25
R 02	Quantity Surveyor/Academia	10	24
R 03	Environmental Engineer	8	15
R 04	Project Manager	15	48
R 05	Managing Director	12	28
R 06	Senior Lecturer/Green AP	4	8
R 07	Senior Professor	13	30
R 08	ASHRAE Distinguished Lecturer/Director	12	46
R 09	Senior Professor	18	18
R10	Energy Efficiency Specialist	6	8
R11	Senior Energy Consultant	20	30
R12	Architect	10	15
R13	Quantity Surveyor	10	15
R14	Site Engineer	8	12
R15	Project Coordinator/Green AP	5	7

4. RESEARCH FINDINGS ON THE BARRIERS TOWARDS CE IMPLEMENTATION

The level of implementation of the Circular Economy in Sri Lanka is inadequate due to several barriers. The barriers identified using existing literature (Refer to Table 1) are further analysed using primary data in this section to explore the relevance of such barriers in the Sri Lankan construction industry context.

4.1 NO GUARANTEE OF ECONOMIC BENEFITS

Construction Industry is a profit-making industry. Stakeholders will only take over the risk of implementing a new concept if they know the benefits, they can gain from it. According to the perspective of R07, R10, and R11, there should be a proper guideline for the investors and the clients to refer to the benefits of their investment. Further, they suggested that this guideline quantifies the economic benefits using different parameters at different construction project phases. Respondents stressed that the first step of implementing the CE concept is ensuring that investors clearly understand the economic benefits of investment because implementing this concept is possible with the investor's consent.

On the other hand, R07 argues that industry practitioners should fulfil their corporate social responsibility towards the development of social, economic and environmental factors. Hence, through research and development, the stakeholders can identify the actual economic benefit of this concept and introduce it to the industry. Confirming this fact, R09 stated that *"Sri Lankan construction industry practitioners should consider collaborating with academia for further developments of the industry like this"*.

4.2 LACK OF UNDERSTANDING/AWARENESS/INFORMATION

In general, employers working at the site level in construction companies are unaware of concepts like sustainability and circular economy. In particular, the site-level employees of small and medium-sized contract companies face these scenarios for various reasons. R01, R02 and R03 highlighted that in Sri Lanka, lacking knowledge regarding these kinds of relatively new concepts has caused many problems during the design and post-contract stages. Further, they stated, *construction stakeholders do not bother to learn new concepts but practice the same old conventional methods and make profits out of it, which will be harmful to the environment in the long term*. R14 and R15 emphasised that as the CE concept has to be implemented from the design stage, awareness about this concept among all the stakeholders is crucial in the long do.

As stressed by the respondents, **the relevant parties and authorities should take the necessary actions to mitigate this barrier as it has led to negative environmental impacts due to the unsustainable construction activities by many parties**. Sri Lanka is a country blessed with many natural resources. However, with the population increase and the development of the construction industry, natural resources have become scarce. Due to the complete extraction of natural resources, the country is also facing natural hazards. Even though the situation is considerable, the attention towards these problems from the authorities needs to be improved.

4.3 LACK OF POLICY AND REGULATION

Even though many respondents agreed that lack of policy and regulation is a barrier to CE implementation, R02 and R15 brought up a counter-argument that implementing CE at a policy level will increase the improper activities in the industry as well as at the policy-making level in the country; hence they believe this change should happen along with the change of people's thinking pattern but not through rules and regulations. The respondents who agreed with a policy-level change stated, as Sri Lanka is a developing country, without policy Sri Lanka will go nowhere. Contradictory to this fact, R01 stated, with 25 years of experience, that it is doubtful, even with Policies, whether Sri Lanka will move forward with a concept like this as Sri Lanka's situation is getting worse daily with more corruption in every sector.

Political influence for policy implementation – In Sri Lanka, even though there are different existing policies towards environmental protection and sustainability related to the construction industry, implementing these policies is deplorable. Respondents highlighted that Sri Lanka does not have a proper system to implement the policies. Further, they highlighted that corruption takes place at various levels by the officers might be the main reason for this. While more than two-thirds of the participants agreed with this fact, they also highlighted that only a policy would not change Sri Lanka.

4.4 LACK OF SUPPORTIVE INFRASTRUCTURE TO FACILITATE REUSE/RECOVER

Most respondents agreed that Sri Lanka needs a supportive infrastructure to facilitate reuse/recovery. The main reason respondents mentioned, How the second-hand market can give an assurance about their goods? When some sellers price second-hand products higher than the price of purchasing or manufacturing them from scratch, it reduces the demand for second-hand markets. Also, some shop owners keep products longer without selling them, making them look antique and trying to sell them for a higher price than it costs. On the other hand, a few respondents stated that a part of the Sri Lankan community does not tend to reuse due to their different beliefs.

4.5 LIMITED STAKEHOLDER COLLABORATION

Construction projects are unique and complex. To implement the circular economy concept, construction projects should welcome strong stakeholder collaboration, even though it might lead to a more complex scenario, which on the other hand, will make the project harder to manage. R07 highlighted that *"making a construction project more complex might end up with huge losses"*, whilst R08 stated that *"making a construction project complex will not be an issue as long as best practices like RIBA plan of work implemented at project level"*. Moreover, respondents mentioned that stakeholder collaboration could have both positive and negative impacts on the project completion, and the interest of the stakeholders might not be the same; in that case, even with the stakeholder collaboration, the project might not be able to be implemented CE up to the expected level.

4.6 LACK OF STANDARDISED PRACTICES

This was identified as one of the major reasons for failing to implement CE in Sri Lanka adequately. The authorities should guide the stakeholders in the construction industry

with proper practices. Few respondents stated that what does it have to do towards implementation of CE was a common question from their experience in the industry. Towards lack of standardised practices, the participants were given mainly two reasons;

Not spending adequate time in the design stage of a project – It has been observed that most of the construction projects in Sri Lanka spend minimal time during the design stage. Hence, the changes during the post-contract stage due to lack of planning and designing are vital in the construction industry. There should be proper planning for obtaining and selecting materials for the CE implementation.

Lack of skilled labour – In the Sri Lankan construction industry, most labourers have no qualifications to work even as labour. Thus, they have been working in the industry for decades as it is their family occupation. Without proper education, understanding the skills which are needed for CE concept implementation will not be able to obtain from them.

Barriers towards Circular Economy implementation in Sri Lanka are mostly common to the barriers which were identified in the worldwide context. And it was recognised that there are other barriers are linked with the main barriers which are more specific to the Sri Lankan context as it is a developing country. Among these barriers, the most highlighted barrier by the participants was “Lack of Policy and Regulation” in Sri Lanka. As the sub-barriers related to this barrier; political influence, fraud activities and corruption in government were identified.

5. SUGGESTIONS TO OVERCOME THE BARRIERS TOWARDS CE IMPLEMENTATION

To overcome the barriers to implementing CE in the Sri Lankan construction industry, industry and academic experts in CE have suggested different solutions. The participants of the interview were given more suggestions as mentioned in Figure 1 to overcome the barriers towards CE implementation.

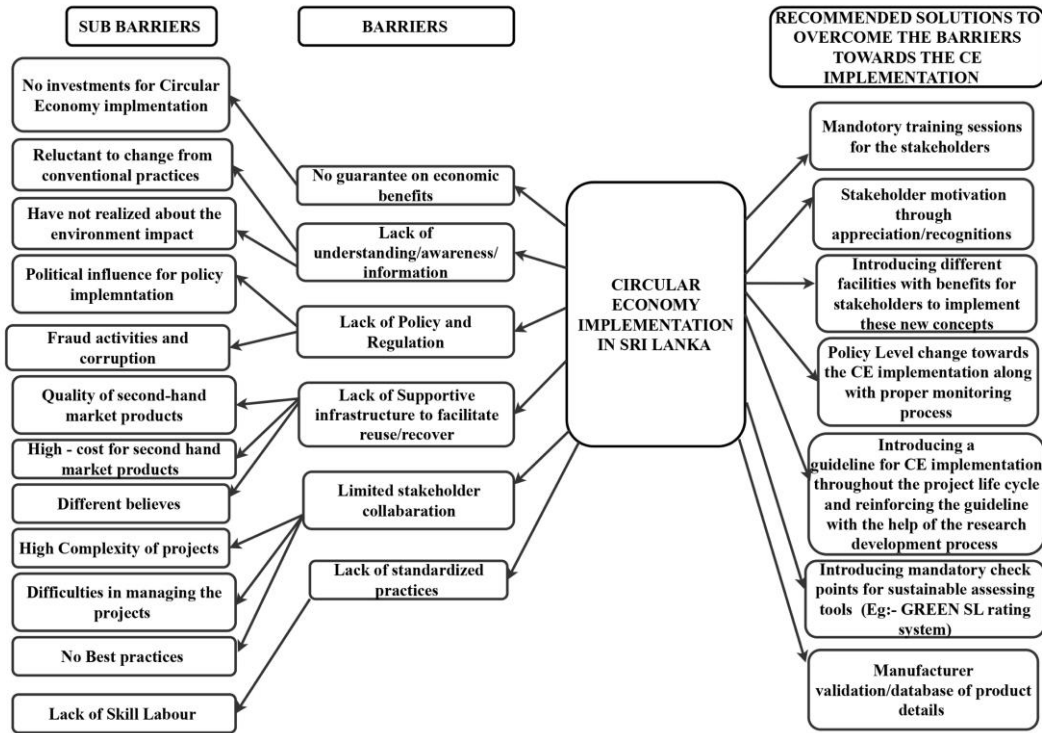


Figure 1 - Circular Economy Implementation in Sri Lanka

Mandatory training sessions for construction stakeholders - To make construction stakeholders aware, brainstorming sessions and compulsory training sessions should be implemented at the authority level. Introducing a minimum qualification level for construction workers was also suggested as a part of this recommendation.

Stakeholder motivation through appreciation/recognition – Government authorities related to the construction industry and environmental protection can introduce special benefits schemes for the construction stakeholders as appreciation for working towards sustainable development. Furthermore, respondents indicated that Sri Lanka could attract more investors from different sectors to invest in Sri Lanka.

Introducing different facilities with benefits for stakeholders to implement these new concepts – It was suggested by the interviewees that the government should play a vital role towards implementing this concept as it has numerous benefits towards the country's development. The suggested facilities by the respondents that the government can provide for the betterment of this implementation are; loan facilities with interest-free and tax exclusions.

Policy Level change towards the CE implementation along with proper monitoring process - The industry experts suggested that a policy level change should adhere in Sri Lanka as it is still a developing country and the knowledge and the consequences of environmental pollution have not been understood by the general public and even by some governing parties. Therefore, improper activities for example, issuing permission to cut trees, are still happening in Sri Lanka. A proper monitoring process should also be introduced to the stakeholders to mitigate improper activities.

Introducing a guideline for CE implementation throughout the project life cycle and reinforcing the guideline with the help of the research development process - It was recommended to introduce a guideline for the Circular Economy implementation with the collaborative inputs of experts in academia and industry. This guideline may include standard practices to implement CE in the construction industry.

Introducing mandatory checkpoints for sustainable assessing tools (e.g., GREEN SL rating system) – As there is a trend of obtaining GREEN SL rating system in Sri Lanka aiming different marketing perspectives, respondents suggested introducing mandatory checkpoints within the GREEN SL system as it can value the rating system as well and it will help for the CE implementation also.

Manufacturer validation/database of product details - To motivate the reuse principle in the Circular Economy concept, respondents suggest; manufacturer validation about the quality, life cycle, and carbon emission from the product.

6. CONCLUSIONS AND RECOMMENDATIONS

As a developing country, Sri Lanka's construction industry continues to improve to meet citizens' needs and develop the country's infrastructure. As the construction industry develops, the construction industry consumes a large number of natural resources, and environmental degradation also occurs. CE has been identified as a solution to the sustainable construction industry. Implementing the CE concept in the Sri Lankan construction industry has faced numerous barriers. As a conclusion while Sri Lanka's construction industry focuses on developing facilities, stakeholders should pay attention to minimising environmental pollution. Implementing the CE concept will benefit the stakeholders and protect the environment. The Sri Lankan government should facilitate towards these concepts as it has social and economic benefits for the nation.

Based on the findings of this paper, further studies can be adopted on; formalised pathway of achieving the circularity within a construction project indicating the cost-benefits through implementation this concept.

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