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IMPORTANCE OF A VALUE ASSESSMENT TOOL IN REGENERATING A CIRCULAR BUILT ENVIRONMENT IN SRI LANKA

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ABSTRACT

Attribute to the rapid expansion of the built environment, excessive resource consumption and waste generation aligned with the corresponding linear economy practices have impacted the preservation of the ecosphere. In addressing the shortcomings of the linear economy, the circular economy concept was introduced by prioritising the circular value streams of the resources which minimises resource extraction and waste generation. However, environmental concerns are often disregarded in construction processes where the priority is given to the cost and economic return of construction applications. Simultaneously, the absence of a proper methodology in assessing the economic aspects of circular economy principles is apparent in the built environment sector. Therefore, this study aimed to assess the importance of a proper value assessment tool in shifting to a circular built environment in Sri Lanka. Instigating from a literature survey, the existing knowledge on the study area was synthesised. A qualitative approach was followed in the empirical study where semi-structured interviews were conducted with ten experts in the field of circular economy in Sri Lanka. The manual content analysis technique was followed in analysing the collected qualitative data. The findings revealed that the extremely low maturity of circular economy practices in the Sri Lankan construction sector is mainly caused by the absence of a proper value assessment tool. Therefore, the introduction of a proper value assessment tool is important for circular built environment experts to encourage the fellow construction community towards the transition to a circular built environment in Sri Lanka.

Keywords: *Built Environment; Circular Economy; Value Assessment Tool.*

1. INTRODUCTION

The contradictory relationship between the development of the built environment and the preservation of the ecosystems has resulted in numerous negative consequences which complicate the entire process of environmental conservation (Bao, et al., 2019). The existing linear economy practices of extracting, producing, using and disposing of natural resources are considered to be the key reason which stimulates the ecological degradation and therefore, the circular economy concept was introduced to encourage the practices of extracting, producing, using and reusing (Sariatli F., 2017). Simultaneously, the

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principles of the circular economy concept intend to reduce the excessive material consumption and waste generation resulting from the built environment creations by effectively delivering the resources in circular value streams (Hossain, et al., 2020). Thus, a circular economy directly contributes to several philosophies primarily including the concept of sustainable development and the twelfth goal of the 17 Sustainable Development Goals introduced in the United Nation's 2030 Agenda for Sustainable Development, i.e. "responsible consumption and production" (Rodriguez-Anton, et al., 2019).

In addition to environmental sustainability, a circular economy contributes to social and economic sustainability through its peculiar applications in the construction industry (Wijewansha, et al., 2020). However, the absence of a proper methodology in assessing the economic sustainability provided by the circular economy principles is evident all over the globe (Saidani, et al., 2017). Specifically, due to the financial uncertainties, circular economy applications are often disregarded since the cost and economic return are generally given priority when making decisions in construction projects (Adams, et al., 2017). Thus, Hossain, et al. (2020) affirm that a special concern is required in addressing the lack of robust criticisms on the establishment of proper methodologies in assessing the economic value of circular economy practices. Simultaneously, Gorecki, et al. (2019) highlight that the establishment of structured methodologies in assessing the value for money related to circular economy applications can ensure a successful transition to a circular built environment.

Followingly, the role of a value assessment tool in economically assessing the circular economy applications in the construction industry directed this study for further exploration. Accordingly, this study aims to investigate why a value assessment tool is important in regenerating a circular built environment in Sri Lanka.

2. LITERATURE REVIEW

2.1 CIRCULAR ECONOMY AND THE BUILT ENVIRONMENT

Rapid industrial development and the corresponding urbanisation have stimulated the advancement of the construction sector while negatively influencing the conservation of the ecosphere (Govindan and Hasanagic, 2018). Relatively, the construction industry is identified as a major contributor to resource exploitation, waste generation, and toxic emissions due to its linear economic patterns (Gorecki, et al., 2019). The construction sector is accountable for more than 30% of the natural resource extraction while accounting for 25% of the global waste generation (Benachio, et al., 2020). By the early 20th century, the construction sector was accentuated as the most unsustainable industry in the globe (Núñez-Cacho, et al., 2018). Consequently, by the 21st century, the need for new concepts and strategies to lessen the impact of the linear built environment on the eco-sphere became alarmingly apparent (Osobajo, et al., 2020).

Accordingly, the concept of circular economy was introduced as a measure to replace the linear economic pattern with the circular economic strategies of extracting, producing, consuming and reusing products (Lieder and Rashid, 2016). The open-loop linear model which results in a higher degree of waste production while releasing toxic emissions can be replaced by the closed-loop circular economy model (Sauve, et al., 2016). According to Ellen MacArthur Foundation (2022), the circular economy concept is developed on the basis of the three principles of eliminating waste and pollution, circulating products and

materials and regenerating nature. Therefore, industry specialists recognised the circular economy concept as a driver to sustainable development. (Anastasiades, et al., 2020).

Simultaneously, Pomponi and Moncaster (2017) declare that a circular built environment can create a link between environmental and economic prosperity and Heshmati (2017) pinpoints that economic growth can be stimulated by the effective use of circular economy principles. According to Ellen MacArthur Foundation (2020), the circular economy concept can provide the economic benefits of cost reduction, revenue increments, and risk reduction. Thus, Finch, et al. (2021) identify the circular economy as a concept that eradicates the inverse relationship between economic development and ecological preservation. Importantly, Gorecki, et al. (2019) state that circular economic strategies are gaining popularity among construction industries of many nations due to their potential in ensuring sustainable development by preserving the environment for future generations.

2.2 CIRCULAR ECONOMY APPLICATIONS IN THE SRI LANKAN CONSTRUCTION INDUSTRY

The developing economies with a higher growth rate also have a higher rate of ecological degradation (Lee, et al., 2020). Siew (2019) reports that the construction material footprint of developing countries is rapidly increasing. Being one of the developing nations, Sri Lanka is also encountering critical environmental issues due to the continual development of the built environment sector (Abeydeera, et al., 2019; Kumanayake and Luo, 2018). More specifically, Bekchanov and Mirzabaev (2018) report that environmental pollution is high in urbanised areas e.g. Kandy and Colombo. Thus, ecological preservation concerning the built environment sector has become a key consideration in Sri Lanka (Wijewansha, et al., 2020).

According to Fort and Cerny (2020), most of the developed nations are successfully adhering to a circular economy, however, Yadav, et al. (2020) report that many developing nations e.g. Sri Lanka and India sustain a lower rate of success. Besides, Wijewansha, et al. (2020) assert that the acknowledgment of circularity principles in the Sri Lankan construction industry is currently at a primitive phase. It can be justified since many challenges e.g. lack of financial resources and public awareness hinder the successful implementation of a circular built environment in many developing and underdeveloped nations (Joshi, et al., 2018).

2.3 BARRIERS AND ENABLERS FOR CIRCULAR ECONOMY APPLICATIONS

Even though a circular built environment offers many benefits, shifting to a circular economy from a linear economy is still at a slower pace due to numerous challenges (Saidani, et al., 2017; Eberhardt, et al., 2020). Explicitly, the complexity of the processes in the construction industry has confronted adopting circularity principles for the built environment sector (Mhatre, et al., 2021). Besides, Hopkinson, et al. (2018) argue that moving towards a circular economy may cause conflicts within firms as the transition will affect the usual method of business operations. Thus, it is essential to comprehensively recognise the barriers related to legal, social, technological, and financial aspects concerning the transition to a circular economy (Gorecki, et al., 2019). Accordingly, Table 1 presents an assessment of the barriers that hinder the transition to a circular economy focusing on several contexts around the globe.

Table 1: Barriers to the transition to a circular economy

Barriers to a circular economy	China	India	Sri Lanka	Taiwan	South Korea	Oman	Australia	New Zealand	UK	Spain	Netherlands	Italy	Ghana	Nigeria	Argentina	U.S.A	Canada	Mexico
Lack of knowledge and awareness	[1]	[2]	[3]	[5]	[6]	[7]		[9]	[10]		[12]	[13]	[14]	[15]	[16]	[6]	[17]	[18]
Lack of industry communication and interest	[1]	[2]	[3]	[5]	[6]	[7]		[9]		[11]			[14]	[15]		[6]	[17]	[18]
Lack of support from the government	[1]	[2]		[5]		[7]	[8]			[11]	[12]	[13]		[15]			[17]	[18]
Lack of supportive legislation	[1]	[2]	[3]			[7]	[8]		[10]		[12]	[13]		[15]			[17]	[18]
Lack of financial incentives			[4]	[5]	[6]			[9]		[11]			[14]	[15]	[16]	[6]	[17]	[18]
Ambiguities regard to financial return and value assurance issues	[1]	[2]		[5]	[6]	[7]	[8]		[10]		[12]	[13]			[16]	[6]		
Higher implementation costs	[1]		[4]			[7]	[8]	[9]			[12]			[15]			[17]	[18]
Lack of an assessment tool to evaluate financial benefits		[2]					[8]		[10]		[12]			[15]				[18]
Technological boundaries	[1]	[2]	[4]			[7]	[8]		[10]	[11]	[12]			[15]	[16]			[18]
Quality assurance issues			[4]			[7]	[8]		[10]					[15]			[17]	

[1] (Zhang, et al., 2019) [2] (Gupta, 2019) [3] (Wijewansha, et al., 2020)
[4] (Bekchanov and Mirzabaev, 2018) [5] (Chang and Hsieh, 2019) [6] (El Asmar, et al., 2018)
[7] (Al Hosni, et al., 2020) [8] (Halog, et al., 2021) [9] (Low, et al., 2020)
[10] (Adams, et al., 2017) [11] (Ormazabal, et al., 2018) [12] (Springvloed, 2021)
[13] (Mura, et al., 2020) [14] (Virtanen and Kojo-Sakyi, 2018) [15] (Ogunmakinde, 2019)
[16] (Becerra, et al., 2020) [17] (Cantu, et al., 2021) [18] (Kellam, et al., 2020)

According to Table 1, it is evident that regardless of the context, the challenges are almost similar for a circular economy. Lack of community knowledge and awareness, lack of governmental support, technological boundaries, and ambiguities regard to financial return and value assurance issues are a few of the major barriers which need to be properly addressed to ensure a successful transition to a circular economy. On the other hand, the key enablers which influence a successful transition to a circular economy are presented in Table 2.

Table 2: Enablers for the transition to a circular economy

Enablers for a circular economy	Source (Reference Numbers are mentioned according to the list of authors in Table 1)
Strategies to increase community awareness and knowledge	[3], [4], [6], [8], [9], [10], [17]
Increased governmental support	[2], [4], [7], [13], [17]
Introduction of supportive legislation and industry standards	[2], [3], [8], [13], [15], [16], [17]
Increased industry collaboration	[4], [7], [17]
Introducing a tool for value assurance	[10], [12], [16]
Introducing financial incentives	[4], [5], [6], [9], [12], [17]
Innovations in technologies	[1], [8], [10], [16], [12]
Market development for secondary materials	[8], [9], [12], [15], [17]

Table 1 showed that the lack of knowledge and awareness of the circular economy principles is the most quoted barrier and Table 2 evidenced that the implementation of strategies to increase the community awareness and knowledge is one of the most quoted enablers of the transition to a circular built environment. Simultaneously, Agyemang, et al. (2019) state that community awareness and knowledge of the circular economy concept are negatively affected by the financial uncertainty of circular economy principles since it can be a cause that reduces the interest of the people in studying and experimenting with circular economy applications. Besides, due to the competitive nature of the construction sector, organisations are more inclined only toward the strategies which clearly offer a competitive advantage while ensuring a premeasured economic success and this negatively affects the rise of the circular economy concept (Gorecki, et al., 2019). El Asmar, et al. (2018) argue that the financial benefits are uncertain related to a circular built environment, and it drastically complicates the decision-making process of the project stakeholders. Thus, a tool for measuring the economic benefits of a circular economy is important in addressing the low community interest and awareness of circular economy principles which is a barrier that primarily hinders the rise of a circular built environment (Adams, et al., 2017; Benachio, et al., 2020). Therefore, in empowering an effective transition to the circular built environment, proper strategies and tools must be established to measure the value of the operations in terms of economic aspects (Gorecki, et al., 2019; Adams, et al., 2017).

2.4 THE NEED FOR A VALUE ASSESSMENT TOOL IN SHIFTING TOWARDS A CIRCULAR BUILT ENVIRONMENT

Economic value addition is a major project aim of many stakeholders and in adding economic value to a project, the aspects of time, cost, quality, project performance and project safety are considered (Witjaksana, et al., 2019). Among these aspects, Ibironke and Elamah (2011) pinpoint that the assessment of time, cost and quality is rather important during the design stage in increasing the total project value. At the same time, the introduction of a method for value assessment will be an incentive for the implementation of the circular economy concept as it will assist in identifying the economic gain in the dimensions of time, cost and quality from transferring to a circular economy (Heshmati, 2017). Accordingly, the absence of a tool complicates the process of measuring the overall economic benefit of shifting to a circular built environment (Núñez-Cacho, et al., 2018). Kirchherr, et al. (2018) argue that circular economy initiatives are comparatively expensive, and it further stresses the need for incentives.

However, according to Saidani, et al. (2017), various tools are introduced to evaluate the performance of circular models concerning environmental, organisational, and social performance. As reported by Sassanelli, et al. (2019), there are many tools and approaches e.g. Life Cycle Assessment (LCA), Life Cycle Inventory (LCI), Life Cycle Impact Assessment (LCIA), Multi-Criteria Decision Analysis (MCDA), Design for X, Input-Output (I-O) and Material Flow Analysis (MFA). Among these tools, LCA, I-O, and MFA can be considered the widely applied circularity assessment tools (Corona, et al., 2019). Nonetheless, most of the approaches are focused on environmental assessment, and the absence of a proper tool for the assessment of economic dimensions such as time, cost, and quality is a major barrier to the implementation of the concept (Saidani, et al., 2017).

Sanchez and Haas (2018) mention that linear applications will be continued by the industry community as the economic aspects are much clear in linear business models and it eases the overall project planning and decision-making process. Thus, Velte, et al. (2018) argue that value-focused approaches are essential concerning a rapid transition to a circular economy, and Saidani, et al. (2017) affirm that these approaches will positively inspire the community in moving from a linear economy to a more sustainable circular economy.

3. METHOD

This study addresses the following exploratory question "why a value assessment tool is important in regenerating a circular built environment in Sri Lanka". The exploratory nature of this study directs a qualitative approach while centralising around the views, opinions, and experiences of the construction industry professionals related to the establishment of circular economic principles in the construction industry (Ward, et al., 2018). Besides, interviews were selected as the data collection tool since the interview approach assists in acquiring comprehensive findings for exploratory studies (Jain, 2021). Accordingly, an expert interview survey was conducted where 10 experts in the field of the circular built environment were selected using the non-probability purposive sampling method. The consideration was given to selecting the professionals in both construction consulting and contracting firms as well as academia experts in the field of the circular built environment. The profiles of the respondents are presented in Table 3.

Table 3: Profiles of the respondents

Respondent	Discipline	Years of Industry Experience	Field of Expertise
R1	Chartered professional engineer, chartered quantity surveyor	30 years	Consultancy
R2	Chartered civil engineer	10 years	Consultancy
R3	Quantity surveyor	7 years	Consultancy
R4	Chartered architect	6 years	Consultancy
R5	Chartered architect	5 years	Consultancy
R6	Project manager	30 years	Contracting
R7	Chartered quantity surveyor	15 years	Contracting
R8	Senior lecturer	20 years	Academia
R9	Senior lecturer	17 years	Academia
R10	Senior lecturer	18 years	Academia

To fulfil the requirement of the context-specific findings for this study, the data were collected limited to the Sri Lankan context. Besides, ten semi-structured expert interviews were conducted until the saturation of data since the point of data saturation indicates the optimum sample size of an interview survey (Tran, et al., 2017). Ultimately, the collected data was analysed through the content analysis method as content analysis provides a comprehensive perception of the findings of the study (Erlingsson and Brysiewicz, 2017).

4. RESULTS

4.1 SIGNIFICANCE OF THE CIRCULAR ECONOMY CONCEPT IN THE SRI LANKAN CONTEXT

As acknowledged by all the respondents, the circular economy concept is significant to the construction sector since it minimises the negative impacts caused by the existing linear economy practices. When rationalising the importance of the circular economy concept, several benefits were mentioned by the respondents which are mentioned in Table 4.

Table 4: Benefits of a circular economy according to the respondents

Benefits mentioned by the respondents	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10
Minimising material consumption and waste generation		✓	✓	✓	✓	✓	✓	✓	✓	✓
Minimising energy waste		✓	✓	✓	✓					✓
Reducing Pollution					✓	✓				
Extending the life cycle of the products and buildings	✓						✓			✓
Regenerating Systems						✓				✓
Giving more attention to the physical limit of materials									✓	

In the respondents' opinion, the implementation of circular economy principles is fundamentally required in neutralising the impact of the construction industry mechanisms such as excessive resource utilisation and waste generation. As mentioned by R7, a circular economy has a "*significant impact on construction, especially future construction and sustainability of material and resources*".

4.2 ABSENCE OF A VALUE ASSESSMENT TOOL AS A BARRIER TO A CIRCULAR ECONOMY IN THE BUILT ENVIRONMENT

According to empirical findings, the shortage of a value assessment tool for circular economy applications was distinguished as a major barrier to the transition to a circular built environment. According to R1, *"return and financial value"* are dominant factors for the construction community in considering and experimenting with new concepts. Besides, R8 argued for the need for a well-developed circularity value assessment tool that aligns with the complexity of the construction industry. Supportively, R2 mentioned the need for incentives in shifting to the new concept of the circular economy whereas R6 finds the value assessment tool as a major incentive. As mentioned by R2, "*there is a return which we are currently unable to quantify. We need a tool to see that and convince someone else".* Thus, as suggested by the existing literature and empirical findings, the need for a value assessment tool is apparent for the transition to a circular built environment.

4.3 THE IMPORTANCE OF A VALUE ASSESSMENT TOOL IN REGENERATING A CIRCULAR BUILT ENVIRONMENT

During the semi-structured interviews, the respondents were questioned about the importance of a circularity value assessment tool focusing on the transition to a circular built environment in Sri Lanka. The results suggested that there are several benefits provided by a value assessment tool which are broadly discussed below.

- Increased interest of the clients towards circular economy applications

As mentioned by the respondents, clients are less encouraged to adhere to circular economy applications with uncertainties in the final return. R2 stated that "*almost all the clients are so conscious towards the project budget and the ultimate return of the project*". Consequently, R5 pinpointed that the corresponding financial ambiguity of the circular economy is a considerable issue in convincing the clients since *"any client would ask how much it will cost and how much is the return or the saving"*. Simultaneously, R3 affirmed that most of the construction clients lack the broader technical knowledge of construction mechanisms where their focus is mostly directed towards the apparent economic return of the construction applications. Therefore, due to the absence of a value assessment tool, the clients are less interested in applying circular economy principles to their construction projects. Simultaneously, the respondents suggested that the introduction of a value assessment tool can increase the interest of the clients in circular economy applications.

- Increased motivation among the professionals in recommending circular economy principles

Results suggested that, due to the absence of a proper value assessment tool, circular economy experts in the construction sector are encountering difficulties in distinguishing the economic return of the circular economy applications. As argued by R2, circular

economy experts are generally questioned about the benefits of the circular economy concept in terms of the economic return which they are unable to manifest due to the unavailability of a value assessment tool. Simultaneously, R7 declared the complications encountered by the circular economy experts in convincing the designers and developers to adhere to the circular economy principles without a proper mechanism to distinguish the economic benefits of the concept. Besides, circular economy experts are more discouraged in recommending the circular economy concept and R2 pinpointed that the circular economy experts in the construction industry are *"trapped"* without a value assessment tool as they "*need a tool to quantitate the benefits and to show others*" the significance in adhering to circular economy principles. Thus, it is important to introduce a circularity value assessment tool as it will increase the motivation among professionals in promoting the circular economy principles in Sri Lanka.

- Ease in communicating the benefits of the concept

According to the respondents, the absence of a value assessment tool is a considerable issue in communicating the benefits of the circular economy concept in the construction industry. As mentioned by R3, "*it is difficult to promote the circular economy concept"* with the absence of a proper tool to distinguish the economic benefits. R6 mentioned that *"financial return or benefit of return or IRR"* are major factors that seize the attention of the construction community. Therefore, the need for a circularity value assessment tool is evident and R9 declared that a properly developed value assessment tool *"will clearly communicate the benefits of the circular economy concept".*

- Higher rate of success

It was revealed during the empirical study that benchmarking and validation issues reduce the rate of success for circular economy practices in the construction industry. As mentioned by R6, for benchmarking and validation, a value assessment tool is essential to distinguish the economic benefits of the concept. Simultaneously, R10 stated that "*the unavailability of realisable costs and time-related data"* reduces the success rate of a circular built environment which is directly caused due to the lack of a value assessment tool for circular economy applications. Specifically, R9 stated that the shortage of a value assessment tool complicates the successful transition to a circular built environment since there are no example projects that have clearly benefited from the circular economy applications from an economic perspective. Eventually, the respondents suggested that the introduction of a value assessment tool can increase the rate of success of circular economy applications in the Sri Lankan construction industry.

- High maturity of circular economy principles in Sri Lanka

Results suggested that one of the major reasons governing the extremely lower maturity of circular economy principles in the Sri Lankan construction sector is the unavailability of a value assessment tool to measure the economic benefits of the concept. R10 stated that due to the unavailability of a proper value assessment tool *"the benefit of true circularity is not completely realised at the industry"* which is the root cause behind the low maturity of circular economy principles in the Sri Lankan construction sector. More specifically, R2, R3 and R5 affirmed that unless there is a properly developed value assessment tool to distinguish the benefits of the concept, the maturity of circular economy principles will remain low among the Sri Lankan construction community. However, since the economic benefit of applying the circular economy

concept cannot be properly identified, both clients and construction professionals have been reluctant to engage in the application of the circular economy principles in the construction sector. Ultimately, the introduction of a value assessment tool can address the extremely low maturity of circular economy principles by accelerating the transition to a circular built environment and increasing the maturity of circular economy applications in the Sri Lankan construction sector.

5. CONCLUSION

The disastrous linear economic patterns of the construction sector have immensely affected the well-being of mankind and ecosystems by overconsuming natural resources and exploiting non-renewable energy sources. Even if the concept of circular economy was introduced as the ultimate solution, numerous barriers have hindered the effective transition to a circular built environment. Among these barriers, the absence of a proper value assessment tool can be perceived as a key obstruction that complicates the process of distinguishing the economic benefits of the concept. According to the study, a value assessment tool is important in increasing the interest and the motivation of the developers and industry experts on the circular economy applications while communicating the benefits of the concept to address the extremely low maturity of the circular economy principles in Sri Lanka. Hence, it is essential to have a proper value assessment tool to assess the benefits of the circular economy applications to stimulate the transition to a circular built environment for the betterment of the construction industry in Sri Lanka.

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