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MINIMISING WASTE RELATED TO MAJOR BUILDING ELEMENTS AND MATERIALS IN THE SRI LANKAN CONSTRUCTION INDUSTRY THROUGH CIRCULAR ECONOMY PRACTICES

> “Construction waste causes soil and water pollution, resulting in severe social and environmental concerns. Construction waste management systems in Sri Lanka are reactive and felt only when waste is generated. Hence, a proactive approach like Circular Economy (CE) to minimising waste generation is required.”

CE concept reverses “make, use, dispose of,” which generates a massive pile of waste in the current linear economy by creating a loop/circle as in nature [1]. Hence, a Circular Economy (CE) model would be an excellent solution to maintain the generation of construction waste [2], which is to be implemented at the earlier stages of construction projects [3].

Construction is a major buyer of resources. The individual disposal of construction materials and elements contributes highly to construction waste in Sri Lanka, e.g., timber, bricks, doors, and windows. Construction material wastage is high during construction and demolition [4]. As per the survey by [5], construction waste is generated due to activities such as discarded building materials, debris from renovations, and demolitions. Therefore, applying CE practices concerning major building materials and elements is essential to minimise waste proactively.

Although many research studies have been conducted worldwide to investigate how to adopt CE principles in building materials and elements (e.g. [6], [7]), there is a dearth of studies in the Sri Lankan context. Accordingly, this research is mounting the research problem: “How CE practices can be adopted in building materials and elements to minimise C&D waste in the Sri Lankan Construction industry?” Thus, this study aims to guide the adoption of CE practices in major building materials and elements to minimise C&D waste in Sri Lanka.

A comprehensive literature review was conducted on the CE concept and its application to main building materials and elements. Using snowball sampling, ten experts fulfilling predefined criteria were selected and interviewed to collect qualitative data. The collected data were analysed using content analysis.

Due to time constraints, this study was limited to a few building materials, elements, and CE principles for collecting data. Accordingly, concrete, wood, and steel were identified as three major materials that are commonly used in building structures in the Sri Lankan context. Altogether, 4 building elements were identified: columns and beams, roofs, walls and floors, considering them as main elements related to building envelopes. Moreover, six (6) Circular Economy practices were selected: recovered, reused, designed for disassembly, recycled, repaired, and reduced to conduct the interview.

Results show that current, material selection in Sri Lankan construction projects does not consider CE aspects. Most experts consider cost and strength when selecting concrete and steel, since these materials are mostly used for structural purposes.. On the other hand, cost, aesthetic view, and availability are the most concerning factors when selecting wood. However, experts rarely consider CE-related aspects, like reusability and recyclability, in the current material selection process.

On the other hand, in the Sri Lankan context, a very little or zero attention is given to the building's End of Life (EOL) at its design and construction stage. The study revealed the reason behind this such as, difficult to convince the clients of the benefits of EOL, considerations on the initial cost to the client, lack of law and regulations for the EOL considerations, building life span is more than a person's life span in SL, and availability of required construction materials.

When considering the current disposal options of building elements, it includes demolition and combusting, while reusing and recycling are rarely used. Thus, the study found few disposal options for the major buildings. They are, (a) use of reusable and flexible building elements, (b) have short life span buildings with flexible design, (c) design buildings based on reused and recycled materials and elements, (d) demolish with minimum waste and maximize reusability, (e) maintain after- sale service from suppliers and manufacturers, (f) return to manufacturers for recycling and reproduction.

The research found that since CE supports the circularity of materials within the country, it reduces the need for imports, which is very beneficial during situations like economic crises where imports are restricted. The study recommended reusing, recycling, downcycling, cradle-to-cradle approach, material banks, and reduction to dispose of building materials and elements towards adopting the CE concept. CE can be implemented from the design stage to the whole life cycle, preferably initial stages, as an applicable practice to the Sri Lankan construction industry leading to minimising building materials and elements.

Further, the study proposes few initiatives that must be taken by government for the implementing CE practices in major building materials and elements in Sri Lanka. They are promoting the use of recycled materials for government projects, promoting the use of reusable building elements, develop a public policy framework in the government to enforce regulations, enforce strict regulations for demolishing buildings, developing separate specialization for demolition contractors, and promote the establishment of material banks in Sri Lanka where Construction Industry Development Authority (CIDA) can be involved.

This study contributes to the body of knowledge by outlining certain CE practices that could be implemented at a building's EOL as disposal options for building materials and elements. Further, the study offers a guide to initiate the implementation of CE for building materials and elements in Sri Lanka. Further, this study would contribute to developing a sustainable nation in this wide society by proposing ways to minimize the waste generated from construction and demolition. The research findings can also be extended to other contexts matching similar settings.

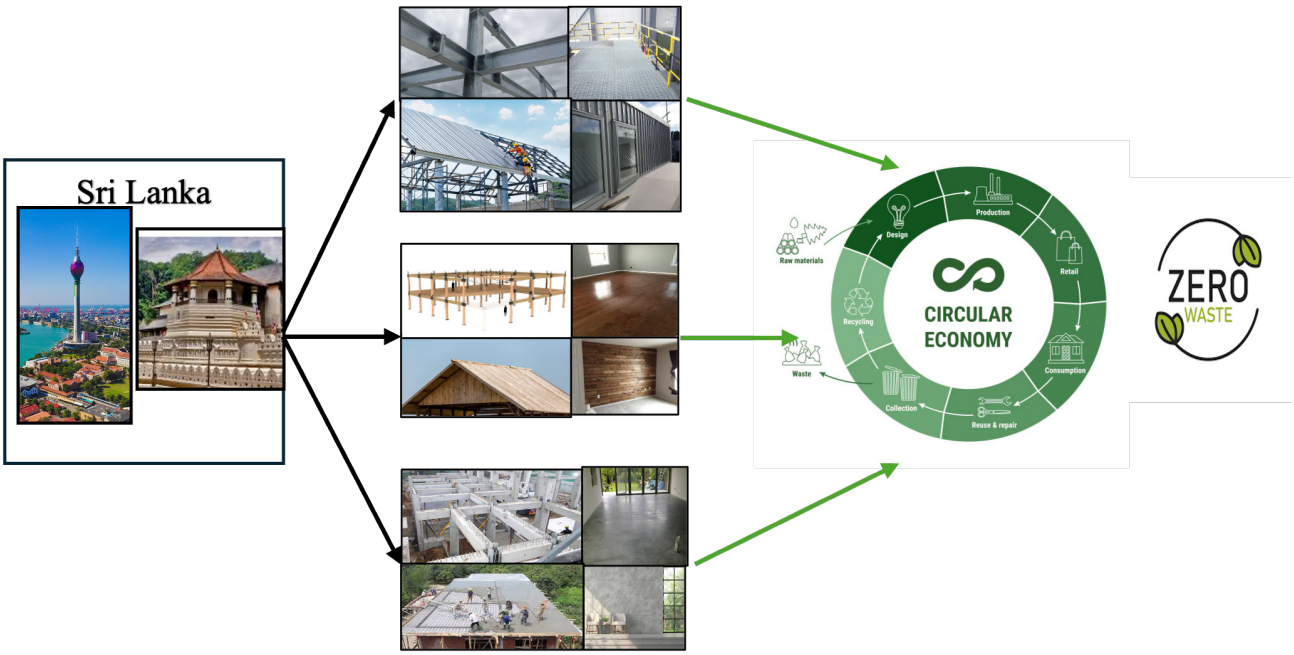

Figure 1: Graphical Abstract

References:

[1] Ellen MacArthur Foundation. (2015). Towards a circular economy:Business rationale for an accelerated transition. Retreived January 23, 2024, from https://www.ellenmacarthurfoundation.org/towards-a-circular-economy-business-rationale-for-an-accelerated-transition

[2] Mangialardo, A., & Micelli, E. (2018). Rethinking the construction industry under the circular economy: Principles and case studies. In A. Bisello, D. Vettorato, P. Laconte, & S. Costa (Eds.), Smart and sustainable planning for cities and regions: SSPCR 2017, Green Energy and Technology (pp. 333- 344). Springer, Cham. https://doi.org/10.1007/978-3-319-75774-2_23

[3] Benachio, G. L. F., Freitas, M. D. C. D., & Tavares, S. F. (2020). Circular economy in the construction industry: A systematic literature review. Journal of Cleaner Production, 260(1). https://doi.org/10.1016/J.JCLEPRO.2020.121046

[4] Liyanage, K. L. A. K. T., Waidyasekara, K. G. A. S., Mallawarachchi, B. H., & Pandithawatta, T. P. W. S. I. (2019). Origins of construction and demolition waste generation in the Sri Lankan construction industry. Proceedings of the world conference on waste management, 1, (pp. 1- 8). https://doi.org/10.17501/26510251.2019.1101

[5] Arsath, A. H., Haleeth, H. M., Nifal, M.N.M., Pithurjan, I., Saeenthan, S. (2023). Construction and demolition waste in Sri Lanka. Department of Civil Engineering, University of Jaffna.

[6] Mohammadiziazi, R., & Bilec, M.M. (2023). Quantifying and spatializing building material stock and renovation flow for circular economy. Journal of Cleaner Production, 389, 135765. https://doi.org/10.1016/j.jclepro.2022.135765

[7] Bertino, G., Kisser, J., Zeilinger, J., Langergraber, G., Fischer, T., & Österreicher, D. (2021). Fundamentals of building deconstruction as a circular economy strategy for the reuse of construction materials. Applied Science, 11, 939. https://doi.org/10.3390/app11030939

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