SUSTAINABLE FACILITIES MANAGEMENT FRAMEWORK FOR SRI LANKAN CONSTRUCTION INDUSTRY

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ABSTRACT

There are numerous definitions of sustainable development, but the most frequently cited definition comes from "Our Common Future", is the Sri Lankan construction industry moving towards a sustainable future? This can be considered a topic worth rigorous investigation. Sustainability does not impose a constraint on the construction industry, the building sector has a substantial global potential to help protect the environment, which is lacking in Sri Lanka and further, it will resolve the current energy crisis up to a certain extent facilities management specialists in Sri Lanka have realised the importance of their work in the development of sustainable structures, method of providing a solution to the aforementioned problems

The existing literature reveals a deficiency in theoretical and empirical knowledge on the use of sustainable buildings in the construction industry. Therefore, the research therefore aims to develop a framework that can be used to achieve sustainable buildings in Sri Lanka, through the facilities manager's role. As a result, four objectives were set for the research.

This study's methodology combines a literature review with an interview, and content analysis of relevant literature, through a systematic approach. Following this, a questionnaire and interview survey was conducted for data collection (purposive sampling method to be used for data collection with facilities managers who are registered members of the Institute of Facilities Management Sri Lanka - IFMSL). Further, the proposed framework will be validated and tested on an actual construction by adopting field research methodologies.

The developed framework can be used as a no prescriptive guide by facilities managers in achieving sustainable buildings in Sri Lanka. This framework improves knowledge and comprehension of what makes a sustainable building as well as the facilities manager's contribution to the creation of sustainable buildings at the

design, construction, and operation stages. Further, the study will give an understanding of the need for sustainable building, and knowledge of constituents that make a sustainable building in order to encourage the drivers and mitigate the barriers to sustainable building practice in the Sri Lankan construction industry.

Keywords: Sustainable Development (SD); Facilities Management (FM); Sustainable Building (SB); Sustainable Building Construction (SBC); Sustainability

INTRODUCTION

The construction industry consumes almost 40% of all-natural resources and generates 40% of all waste and greenhouse emissions (Tzourmakliotou, 2021). Buildings consume up to 45 per cent of all produced energy to power air conditioning and heating (Reed et al., 2011). Constructions also consume one-sixth of the world's freshwater, a quarter of all wood harvested, and two-fifths of all material and energy flows (Emmanuel, 2004). The construction industry consumes more than 40% of the world's raw materials and accounts for 40% to 50% of greenhouse gas emissions (Huang et al., 2017). The worldwide community is devoting all of its resources to addressing challenges like biodiversity loss and local community dangers to people's health and well-being as a result of these growing concerns (Bell & Cheung, 2009; Constantinescu & Platon, 2014). As a result, understanding the environmental challenges surrounding the construction industry in Sri Lanka is significant, given that the building sector is critical to the country's economic and physical progress, accounting for the fourth most important industry in the economy (Central Bank of Sri Lanka, 2017). Therefore, the building industry is a major candidate for sustainable developments (SD). Despite the built environment's rapid contribution to resource depletion, waste generation, and energy consumption (Emmanuel, 2004). Furthermore, in order to achieve SD, green building practices must be used to manage construction waste (Hamid & Kamar, 2012).

The SD movement was raised even in 21st-century development discourse. Despite the popularity, it has gathered over the years, Sri Lanka, similarly to other countries, is focusing on achieving sustainability in the construction industry (Munasinghe, 2019), but due to the activities of the construction industry and other sectors, the state of attaining sustainability needs improvements (Athapaththu & Karunasena, 2016). Further, sustainability does not impose a constraint on the construction industry but the building sector has a substantial global potential to help protect the environment,

which is lacking in Sri Lanka (Ranathungage, et al., 2018 and Kulathunga, et al., 2018).

The COVID-19 epidemic has had a devastating effect on Sri Lanka's construction sector, which has a direct bearing on the country's economy (Marwah & Ramanayake, 2021). In order to guarantee long-term growth in the local context and streamline upcoming projects with the development needs and sustainable goals, it is crucial to rebuild the sector's crumbling pillars that were caused by the COVID-19 pandemic (Hewawasam & Matsui, 2019). Further, the economic crisis has led to a material shortage in the building construction sector (Daily News, 2022), which has led to a vital fact to focus this evaluation on the use of sustainable development constituents (Ranaweera, 2010 and Munasinghe, 2009).

Despite the fact that SD has many definitions by various authors, it is clear that the Brundtland Report provided a globally accepted definition of SD. The definitions above are based on the widely cited Brundtland Report, which defines SD as meeting the needs of the current generation without jeopardising future generations' ability to meet their own needs (WCED, 1987). The Brundtland report points out the interconnecting nature of the environment, economy, and social issues and aspects. Further, Burndland's report offered an arguable definition of SD, which is a concise definition of SD offered in what is arguably the most crucial document of the second half of the century (Brooks, 1990).

In order to increase performance, sustainable construction requires adhering to best practices for material selection, sourcing, and construction methods as well as a design ethos. Decrease the environmental burden of the project, reduce waste, and be more environmentally friendly while taking environmental, socioeconomic, and cultural values into account (Matar et al., 2008.). According to (Olaniyi, 2017), it is the completion point of SD.

This has resulted in the growth of SD's environmental, economic, and social dimensions. The environmental element involves protecting natural resources, preserving ecosystems, and assessing the ecological impact of economic progress. Economic growth, resource sustenance, limiting the depletion of renewable resources, and decreasing the use of nonrenewable resources are all aspects of the economic element. The social component includes eliminating poverty, ensuring proper population growth, and

providing enough social services like medical services and general human wellbeing (Pânzaru & Dragomir, 2012 and Harris, 2003).

This has resulted in the Brundtland Report, which acknowledges that the environment is necessary for human security and basic survival (WCED, 1987). The environment should be preserved in such a way that subsequent generations can benefit from it. But no one has taken enough precautions to protect it. (Brandon & Lombardi, 2009).When it was clear that human activity was making the world's environmental situation worse, the necessity for SD became obvious. These activities include construction and technological advancement, with little or no consideration for generations ahead (Maiellaro, 2001). Environmental and economic development building sector activities have shown the involvement of buildings in the degradation of the natural environment (Mora et al., 2011). The construction industry consumes a large proportion of the world's nonrenewable resources, making it one of the least sustainable industries (Edwards, 2010). Despite its negative environmental effect, the construction industry plays an essential role in reaching SD (Gibberd, 2002). It addresses fundamental human requirements such as housing, access to services and entertainment, healthy living, and social infrastructure (Sinha et al., 2013 and Shah, 2007). According to Du Plessis (2007), the industry faces a huge problem in fulfilling the growing urbanisation and demand for suitable housing, as well as in doing so in a way that is both socially and environmentally acceptable. In order to achieve the objectives of boosting economic efficiency, safeguarding and restoring natural systems, and enhancing human well-being, it is therefore becoming a crucial issue for construction specialists in the business (Sinha et al., 2013). Public awareness of sustainable building practices has never been higher. People are starting to prefer to reside in and work in attractive, healthy, and energy-saving features buildings (Gupta et al., 2016).

As a result, attempts to achieve SD have encouraged specialists in the built environment to undertake efforts to eliminate behaviours that hurt the environment. It has heightened attention in environmentally friendly structures. Includes integrating economic, social, and environmental considerations into the phases of building planning, construction, and demolition (Kibert, 1994 +and Ibrahim et al, 2013). Du Plessis (2002), Sustainable construction is often defined as a process in which the fundamentals of SD are implemented to the construction project life cycle,

from raw material extraction to planning the building, design, and fabrication, and even dismantlement. Such definitions demonstrate that sustainable construction addresses not only the construction activities but also the design and demolition stages, with the goal of minimising environmental impact. The positive influence of sustainable building on the physical environment is pushing green construction to the forefront. As a result, the introduction of sustainable buildings as it pertains to the quality and attributes of the actual building created using sustainable construction guidelines. Green building has resulted from the processes of sustainable building design. (Sev, 2009). Sustainable buildings entail processes in which government and non-governmental organisations develop policies to support sustainable buildings (UNEP, 2009). As a result, understanding the effects of SD in the construction sector is unavoidable. SB's are environmentally friendly during the design, construction, operation, and destruction stages. Dimoudi and Tompa (2008), Insist that a building can only be fully sustainable if sustainable building practices are used throughout the entire construction process. However, the stage of operations, which is the longest in the life cycle of a building, has by far the highest environmental effect (Shah 2007). Therefore, the impact is created by energy consumption and carbon emissions, and the operating period of buildings has the most negative influence on the environment (Abigo et al., 2012).

Sustainability in the construction business is dependent on the decisions made by a variety of persons involved in the building process, such as governments, owners, managers, professionals, and so on (Abidin, 2010). Studies show that the facilities manager (FM) plays a critical role in achieving sustainability in the built environment, which includes the buildings' low environmental impact and the comfort of their occupants. (Shah, 2007 and Mohammed & Hassanain, 2010). The facilities manager, as a professional with knowledge in building management, may help in the attainment of sustainable buildings (Shah, 2007). As a response, the need for the construction sector to meet SD's requirements for creating a sustainable environment has prompted the development of SB's, which may be accomplished through the role of the facilities manager. Thus, the theoretical framework for this research investigation is established.

FM as a profession has been defined by many authors, as a practice that provides quality overall operations of buildings, encompassing a wide range

of activities ranging from tactical operational planning to regular physical repairs, cleaning, and the oversight of environmental performance issues (FMAA, 2019; EuroFM, 2014 and IFMA, 2014). The function of the FM in building management is investigated because it is the facilities managers who remain the longest with the building. Other building professionals, such as architects, project managers, structural engineers, mechanical and electrical engineers, and so on, spend a limited amount of time throughout the building's life cycle, beginning with design and ending with completion. On the contrary, the facilities manager starts his work at the design phase by offering recommendations on how to ensure a facility's sustainability all through life-cycle stages as well as the comfort of the building's occupants (Mohammed & Hassanain, 2010). As a result, the researcher thinks that FM experts in Sri Lanka have recognised the role they can play in the development of SB's to provide a solution to the difficulties described above.

The limited literature on SD and sustainable constituents used in the construction industry does not have a solid analytical and theoretical framework to support the knowledge obtained by the scholars through systematic research work in this field. Also, there is no literature on sustainable facilities manager's framework in relation to the Sri Lankan construction industry. In order to attain sustainable structures in Sri Lanka, the aim of this research is to provide a framework that can be used as a non-prescriptive guide, outlining actions that facilities managers need to take during the design, construction, and operations stages of the building life-cycle. In the design, construction, and operation phases of a building's life cycle, this study evaluates the facilities manager's function in relation to sustainable building components. Additionally, the study focuses on how facilities managers may create sustainable buildings that meet the demands of building occupants; this is an area of FM in Sri Lanka that has been overlooked in earlier research.

THE OBJECTIVE OF THE STUDY

This research aims at developing a sustainable facilities manager's framework to achieve SB's through their role in Sri Lanka. Therefore, to achieve the said aim, objectives were set as below.

1. Identify SB aspects and recognised SB standards with reference to literature.
2. Assess the role of facilities managers in SB life-cycle.

3. Evaluate the perception of facilities manager's role in relation to their competence in achieving SB's.
4. Develop and validate a sustainable facilities management framework for SB practice for facilities managers in Sri Lanka.

However, in order to achieve the above, there is a need to address the below questions:

1. What constitutes sustainable buildings?
2. What is the current facilities manager's role in achieving sustainable buildings?
3. Are facilities managers in Sri Lanka competent in their roles in achieving sustainable buildings?
4. What is the need for a sustainable facilities manager's framework for the Sri Lankan construction industry?

LITERATURE REVIEW

The Brundtland report emphasises the interconnected nature of environmental, economic, and societal factors (Burton, 1987). This approach identified that it is critical to harmonise the three aforementioned detentions in order to operationalize SD (Munasinghe 2009 and Burton, 1987). Previous studies on sustainable indicators and constitutes (Ugwu & Haupt, 2007) highlight the importance of a national strategy that is specific to each nation in achieving sustainability in the construction industry, which is mostly driven by professionals and contractors (Athapaththu & Karunasena, 2018). Therefore, this study concentrates on selected SD constituents and tools in the construction industry, with reference to previous studies.

The function of the facilities manager was also utilised in Sri Lanka's sustainable construction practices to produce structures that adhere to sustainability requirements. This research study examines the role facilities managers' play in the design, construction, and operations phases despite the fact that in Sri Lanka they are frequently not involved in a building project until the beginning of the operations stage. Studies have shown that the facilities manager's role begins at the design phase and continues through the building phase, where it is crucial. Further, it has been noted that it is particularly crucial during the operations stage since this phase of the building life cycle is the longest and most significant (Shah, 2007) in the life cycle of a building. As a result, it is clear that facilities managers have the most experience managing buildings during the design, construction, and operation stages. However, due to building users' concerns about a more

sustainable environment and the need to meet their demands for comfort and health, this research examines the facilities manager's role in the management of buildings and their related services. To accomplish the goal mentioned above, the below steps were taken for the literature review:

- Step 1-literature review and content analysis on SB's.
- Step 2-literature review and content analysis on the role of facilities managers in SB's.
- Step 3- developing a conceptual model by recognising facilities managers' attitudes about sustainable construction in Sri Lanka, as well as evaluating facilities managers' perceptions toward their intellectual ability in achieving SB's, are all discussed. This was accomplished through a literature review as well as an interview questionnaire survey.
- Step 4-improving and validating the developed sustainable FM framework in the pursuit of SB's by highly experienced facilities managers and by implementing the framework in an actual project.
- Step 5- identification of the research area: the rationale for the need for a sustainable FM framework.
- Step 6- conclusion, recommendations and feature works.

Further, there is a small amount of evidence in relation to aspects of SB's and also there is limited literature on achieving SB's through the role of facilities management. As a result, this study will present documented evidence of SB characteristics as well as how the facilities manager's role helps to achieve SB's.

METHODOLOGY

This Research discusses the research framework which consists of three stages as below:

- Stage 1- Review of pertinent writings on sustainable structures and the roles of FM in relation to sustainable structures, using content analysis of 3 documents on sustainable building constituents and 4 documents on FM roles were studied. Further, the development of a conceptual framework that shows the facilities manager's role in the design, construction and operations stages in SB's.

- Stage 2- consists of two steps: 15 facilities managers with relevant experience were interviewed, and the results of the questionnaire survey were investigated by 137 members of the Institute of Facilities Management in Sri Lanka.
- Stage 3- involves utilising the developed framework on a construction project in order to further develop and validate it.

Field Research, Archival Research and Digital Research Relevance to selected research topic and methodology having chosen mixed methods as an appropriate methodology for this research study, This section goes over appropriate research methods. According to Denscombe (2010), research methods are tools for gathering empirical data for research. Documents, interviews, observations, and questionnaires are the four main categories of tools or instruments. Documents, interviews, and questionnaires were used to collect data for this study. The exploratory design method was required for the research study, which entailed collecting qualitative data first, followed by quantitative data. The qualitative research aspect is discussed in this document. It will be discussed below:

Stage1- Literature Review, Content Analysis and Development of the Framework of the Research.

Stage1-Step1- Literature Review:

The objective of this stage is to describe the various phenomena surrounding SB achievement and the role of the facilities manager in SB's. To collect as much information on SB constituents as possible, the research will begin with a collection of qualitative data from relevant documents and literature.(SBC). The purposive sampling method was used for this stage of the research, which is usually appropriate for selecting cases that are informative to research (Neuman, 2011). In this stage archival and digital research methods were used to select to identify details of the below aspects.

- SB constitutes in the history of SD definitions
- Impact of SD on the construction industry
- Sustainable construction
- SB definitions and SB constituents
- FM role in SB and conceptual framework
- SB in the Sri Lankan context

This stage involves the selection of literature from a variety of sources which will include books, conference proceedings, websites, and databases such as Silence Direct, Elsevier, Discovery, and Ensco. It will also include a search in various journals namely. The study will start with a general review of related literature and then adopt a systematic approach to relevant literature to fulfil the aim of the study. The basis of literature selection included a keyword search for 'sustainable building'. Literature selection will also be based on the literature's relevance to the study, the currency of the paper and quality of the content on above-mentioned archival and digital research methods.

Stage 1-Step 2- Content Analysis:

The research has revealed various approaches for analysing textual data (Marshall & Rossman, 2014; Neuman, 2011). The content analysis method was used for the analysis of the selected documents as it involved evaluating text - based data from the chosen documents in order to identify the SB and FM role criteria in SB's. Rather than determining the frequency of words, the content analysis involved identifying themes. Because the SBC were described in rich text with detailed information, word frequency was deemed insufficient for analysing the content of the documents. Content analysis is a technique for identifying themes in textual data that can be accomplished with qualitative data analysis software (Bazelay & Jackson, 2013). Qualitative data analysis software has been developed to aid in the easy processing, structuring, and evaluation of large quantities of text or other data, as well as in the management of the resulting interpretations and reviews (Creswell, 2014). As a result, the QSR NVivo, a qualitative data analysis software developed by 'QSR International,' was used in this study to examine the information of the documents (Bazelay & Jackson, 2013).

Stage 2- Interviews and Questionnaire Survey.

Stage 2- Step 1-Interviews:

Interviews will be considered appropriate in gaining insights into identifying SBC in Sri Lanka in the view of facilities managers and the facilities manager's role and the barriers and drivers to their role in SB in Sri Lanka. Conducting interviews, transcribing the interviews, and analysing the interviews are steps in this stage.as in Figure 1 (Patton, 2002 and Oppenheim, 2000). The following sections describe the method of the sample chosen, the type of interview conducted and the method of data

collected in relation to the use of digital research methods. Sample of study for interviews of the research will adopt a qualitative approach and choose a nonprobability sampling method called the purposive sampling method (Neuman, 2011). Institute of Facilities Management In Sri Lanka (IFMSL) will be approached and requested by facilities managers who have been working for a reasonably long period of time in FM companies that are in Sri Lanka and that have shown an interest in the areas of sustainability in construction and are presently working on and has ongoing similar projects, was made by the researcher. Using their membership database, IFMSL selected members in the aforementioned category and after which participants will be approached via email and asked to show their interest in participating in the interviews by responding to the email by use of digital research methods. The interviews will take place at various times, and each one will be noted by the video conference software and manually recorded into Microsoft Word by the researcher. The interview questions will be based on issues identified in the literature review and document analysis to determine whether facilities managers understand the concept of SB and their roles within it. Interviews will be conducted via online interviews, fulfilling the questions which were categorised accordingly to gain answers to research objectives. Digital research methods such as "Zoom" and "WhatsApp" cloud-based video conferencing service programs will be used to conduct the interviews (Gray et al., 2020 and, Gilbert, 2002).

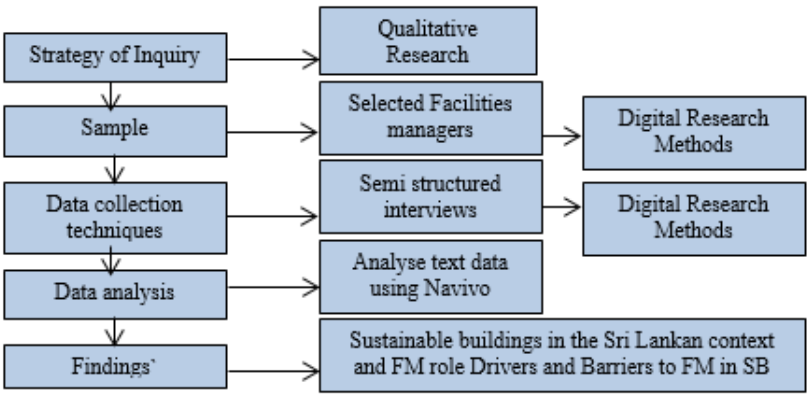

Figure 1: Research Design for Stage 2: Step 1

Source: Constructed by the Researcher

The disadvantage of being impractical in digital video conferencing will be mitigated due to the prevailing COVID-19 pandemic situation (Ranasinghe

al., 2020). Further, the selected interviewers (IFMSL members) offices based in city limits, will be a minimum disturbance in the transmission-related issues (Haththotuwa & Rupasinghe, 2021).

Stage 2-Step 2- Questionnaire Survey:

The observations of the data obtained from the interviews and documents were used to create a questionnaire which was distributed to IFMSL members who are facility managers. They are expected to be able to answer questions about what constitutes an SB in Sri Lanka, as well as recognize the current role which facilities managers play in accomplishing SB and whether they are knowledgeable in this role. Researchers create questionnaire surveys to provide a quantitative or numerical description of trends, attitudes, or opinions in a population by studying a sample of that population (Creswell, 2014). Figure 2 shows the methodological approach at this stage, which discusses the third and fourth objectives of the research study. The sections that follow describe the sample method chosen, the type of interview conducted, and the data collection technique using simple random sampling and digital research methods. As in Figure 2 The IFMSL's registered members were the target audience for the questionnaires. Email addresses taken from the IFMA Sri Lanka register will be used to contact participants, as stated above. The questionnaires were to be filled out and returned via the email address provided by the participant, along with the completed questionnaires. They had a certain amount of time to complete the questionnaires. As per Cooper and Emory (1995), the response rate for self-administered surveys is typically higher than for postal or telephone surveys. As a result, it is anticipated that a higher percentage of questionnaires will be returned via email.

The rationale to use digital research method on sample selection from IFMSL database; the registers' current state, the availability of extensive information therein, saving time in gathering participant information, such as email addresses to which questionnaires will be sent. It is convenient as the above information will be available on the web page of IFMSL.

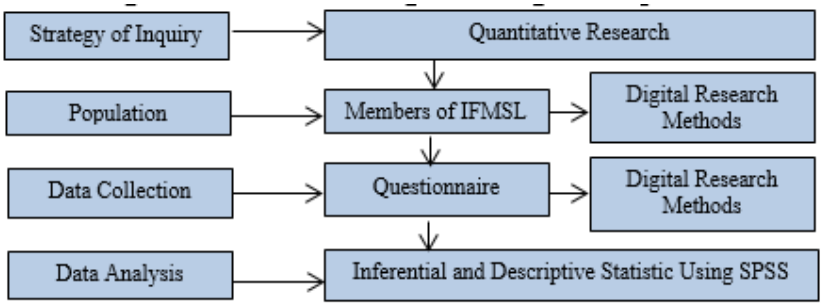

Figure 2: Research Design for Stage 2: Step 2

Source: Constructed by the Researcher

Stage 3- Development and Validation of Framework to Facilities Managers in achieving Sustainable Buildings, the Research Aimed at Developing a Framework for Facilities Managers to embed their Practice to achieving Sustainable Buildings.

Stage3- Step 1- Questionnaire Surveyor:

A framework can be validated by soliciting expert opinions and feedback (Hanson, 1999) and which could be accomplished through a qualitative or quantitative approach (Shaw, 1999). FM experts in Sri Lanka will validate the developed framework for this research by participating in a questionnaire surveyor that reflects all aspects of the research. The validation process started by identifying potential participants which involved FM experts who are viewed as qualified to help in validating the framework, by the use of purposive sampling method for data collection with twenty highly experienced facilities managers who are registered members of the IFMSL. The sample study was selected by IFMSL database as their detailed information will be available in the registers on their webpage. The participants were contacted through email initially and later the questionnaires were sent to assigned participants through email and sent back completing the questionnaires attached to their email addresses which they will receive.

Stage3-Step 2- Field Study:

The findings of the questionnaire survey will be integrated into the conceptual framework, and it will be validated further by trying to incorporate the framework on building projects from beginning to construction completion using the Field research method.

RESULTS AND DISCUSSION

The results are expected in the study as below:

- It is anticipated that Sri Lankan experts will have a sufficient understanding of SB, by the highlighted SB components.
- For the benefit of the end-user, the research will create a sustainable framework that facilities managers may use as a manual to create SB's.
- Facilities managers are also anticipated to apply the created framework in their attempts to contribute to the SD agenda in regard to the building.
- The framework created will aid FM in practically integrating with the building project team in a cooperative effort to create SB's.

CONCLUSION

The building industry has developed sustainable practices in a bid to reduce the negative impact on the environment. The studies have highlighted buildings as a major contributor to greenhouse gases, and the major consumption of scarce resources. SB's have indeed been defined in the literature as structures that use resources and energy effectively, reduce emissions of greenhouse gases and encourage occupant health by offering quality indoor air and thermal, aesthetic, and acoustic comfort. Research has also disclosed the sustainable practices employed by facility managers in their efforts to achieve SB's. Based on the anticipated findings listed above, this study seeks to present the findings' conclusions in relation to the study's objectives.

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