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THE NEED FOR REFORMING GREEN RATING SYSTEMS FOR HOSPITALS IN SRI LANKA

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ABSTRACT

The healthcare sector combines a significant environmental footprint with strict operational and safety requirements. Although green building rating systems such as LEED, and GREENSL promote sustainability, they typically assess hospitals using the same criteria as other building types. However, hospitals require specialized considerations such as infection control, biomedical waste management, specialized ventilation and continuous operations, which are insufficiently addressed in general GBRS. This creates a research gap, as general GBRS may not adequately address the unique requirements of healthcare facilities in developing countries like Sri Lanka. Therefore, this study evaluates the appropriateness of general GBRS for hospital buildings. A qualitative single case study approach was adopted focusing on Sri Lanka's only green-certified private hospital, which achieved Gold certification under the GREENSL rating. Data were collected through semi-structured interviews with three key stakeholders and on-site observations. A comparative assessment was conducted by applying the IGBC Green Healthcare Rating to the same hospital to evaluate whether it could retain its Gold certification under a healthcare-specific framework. The findings identified that strategic leadership, financial benefits, and green technology implementation supported sustainability adoption, while retrofitting aging infrastructure, operational constraints due to 24-hour healthcare services and limited government support created challenges. The comparative analysis revealed a performance gap, with the hospital scoring 68% (Gold) under GREENSL but only 60% (Silver) under IGBC criteria. Deficiencies were observed in areas such as infection control, medical waste management, specialized ventilation, acoustic design, and healing architecture. The study highlights the need for healthcare-specific green building assessment frameworks for Sri Lanka.

Keywords: *Green Buildings; Green Building Rating Systems; Healthcare facilities; Hospital Buildings; Sustainability.*

1. INTRODUCTION

The green building concept (GBC) is being developed at greater velocity due to the adverse environmental impacts of construction (Ding et al., 2018). The goal of designing

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healthy indoor environments for humans drives the construction of green buildings (Allen et al., 2015). The implementation of the green concept in hospitals while improving planning, development, services, repair and disposal mitigate health and environmental impacts (Khairunnisa et al., 2022). Implementing greenery into healthcare facilities contributes to the sustainable development aims by mitigating health, environmental, and economic drawbacks (Kalender-Smajlović & Dovjak, 2023).

Application of the green concept can be challenging. The hospitals differ from all other building categories since they need to operate 24/7 and, correspondingly require certain energy-intensive systems. For example, HVAC and lighting are continuously operating to support patient care and safety (Tomanek, 2024). Hospitals face numerous barriers to implementing environmentally sustainable practices. According to the Health Facilities Management (HFM), the American Society for Healthcare Engineering (ASHE), and the Association for the Healthcare Environment (AHE) the top barriers are conflicting priorities for investments or expenditures, insufficient staffing for projects, inadequate funding for operations and maintenance budgets, the perception of higher costs compared to traditional materials or systems, and time constraints (Dhillon & Kaur, 2015). While the concept of sustainability has been effectively used in industrial companies, there has not been adequate research done on its acceptance in the healthcare sector (Tushar et al., 2023). In Sri Lankan context, the examine on transferring hospital buildings towards GBC is significantly less (Dilrukshi et al., 2014).

With the ongoing evolution of green building rating systems (GBRS), the requirement for a healthcare-specific GBRS has also been recognized globally (Huang et al., 2022). However, Sri Lanka continues to rely on the general green building framework that treats hospitals as a traditional commercial building. This approach creates a significant gap between the theoretical application of green principles and the practical requirements of healthcare facilities (Tomanek, 2024). The existing GREENSL system lacks specialized criteria for managing complex biomedical waste streams, infection control protocols, and medical equipment energy loads that are basic needs for hospital operations (Abeysinghe et al., 2023). Furthermore, hospitals often have different energy and water requirements, safe ventilation requirements, high energy consumption, 24/7 operations, and programmatic relationships with other buildings that make pursuing strong efficiency challenging, applying general GBRS to healthcare projects (Tomanek, 2024). The basic issue is applying a general GBRS to hospitals creates a contrast between certification requirements and operational realities, resulting in missed opportunities for improved patient outcomes and operational efficiency (Golbazi & Aktas, 2020). In Sri Lanka, the examination of transferring hospital buildings towards GBC is significantly limited, and most healthcare providers neglect the psychosocial aspects of healthcare delivery (Dilrukshi et al., 2014). This gap limits the effectiveness of green initiatives in healthcare and compromises patient safety, staff well-being, and the overall sustainability goals of the healthcare sector (Tseng et al., 2020). Therefore, the aim of this study is to evaluate appropriateness of general GBRS to hospital buildings in Sri Lanka. This research is crucial in establishing a healthcare-centric GBRS, that addresses the unique challenges and priorities of healthcare facilities.

2. LITERATURE REVIEW

Green building practices will do aim to decrease ecological footprints while increasing occupant well-being and reducing operational costs (Zitars et al., 2021). These principles

are especially key in healthcare where the physical environment can directly impact patient recovery and productivity of staff (Chías & Abad, 2017). Therefore, the application of green concepts to hospital design has become an integral part of sustainable development in healthcare (Ding et al., 2018). Developments like intelligent energy control systems, green roofs, and biophilic designs have increased the utility and attractiveness of green buildings (Akpan Umoh et al., 2024).

The building sustainability was assessed globally with the establishment of the Building Research Establishment Environmental Assessment Method (BREEAM) in 1990 and the Leadership in Energy and Environmental Design (LEED) green building standard in 1998, which established quantitative metrics to assess the sustainability of buildings (Christensen et al., 2011). Developed countries such as USA and UK have highly adopted with frameworks such as LEED and BREEAM. However, there are issues in developing countries like low awareness, high initial cost, and lack of technical knowledge (Shan & Hwang, 2018). The GREENSL Rating System was localised for Sri Lanka, while meeting international requirements. However, that there is significant scope available in Sri Lanka to enhance healthcare sustainability using green buildings (Dilrukshi et al., 2014). Zitars et al. (2021) explained green hospitals will lead to environmental sustainability along with better patient outcomes, staff well-being, and operational efficiency.

2.1 ANALYSIS OF EXISTING GREEN BUILDING RATING SYSTEMS

Green Building Rating Systems (GBRSs) are optional, market-oriented criteria that evaluate and validate the level of sustainability of buildings (Marchi et al., 2021). The Building Research Establishment Environmental Assessment Method (BREEAM), the Comprehensive Assessment System for Building Environmental Efficiency (CASBEE), and Leadership in Energy and Environmental Design (LEED) are the most popular and representative green assessment techniques.

2.1.1 Building Research Establishment Environmental Assessment Method

BREEAM is the measure of best practice in environmental design and management, adopted by the U.K. government (Haapio & Viitaniemi, 2008). UK building regulation is used by the energy efficiency assessment as a basis from which to assess improved levels of performance (Awadh, 2017). It classifies aspects of credits based on building impact to the environment such as management, health and wellbeing, energy, transport, water, materials, waste, land use and ecology (Haapio & Viitaniemi, 2008). It evaluates management practices in the entire lifecycle of the building and focuses on environmental stewardship (Marchi et al., 2021).

2.1.2 Leadership in Energy and Environmental Design (LEED)

LEED was developed by the U.S. Green Building Council, is one of the most widely recognized green building certifications around the world. It assesses buildings in categories such as energy efficiency, water conservation, indoor air quality, materials selection and innovation (Marchi et al., 2021). LEED certification can be awarded at four levels, Certified, Silver, Gold, and Platinum, depending on points scored (Shan & Hwang, 2018). LEED can be applied to any type of building, whether commercial, residential or in a health care setting. However, costly certification, and the heavy process on documentation, posing hurdles for small-scale projects and in developing countries (Awadh, 2017). LEED-certified health care buildings have been reported to have lower

operational costs, enhanced quality of indoor environmental, and increased employee productivity (Golbazi & Aktas, 2020).

2.1.3 Comprehensive Assessment System for Built Environment Efficiency

CASBEE, which was developed in Japan, assesses buildings through a distinctive balance of environmental load reduction and occupant comfort. It has a new scoring system that puts buildings into four levels -C (Poor), B-, B+, and S, which stands for Excellent (Mahan & Khorramrouei, 2023). Nevertheless, CASBEE's usage is mainly confined to Japan, and its metrics need further adaptation for use in varied climatic environment. This system is suitable for applications like residential and commercial and public buildings (Mahan & Khorramrouei, 2023).

2.1.4 GREENSL

GREENSL is the indigenous Sri Lankan green building rating system, focused on meeting the unique climatic, economic and social contexts of the country (Moramudali & Manawadu, 2022). Yet, adoption is limited by lack of awareness and incentives, especially in industries like healthcare (Dilrukshi et al., 2014). This system includes requirements including energy-efficient designs suitable for tropical climates, the use of locally sourced materials, and water management strategies (Gurupatham et al., 2024). GREENSL offers some localized solutions, but does not quite fit with the daily operational needs of a hospital (Dilrukshi et al., 2014).

Although BREEAM, LEED, CASBEE, and GREENSL all promote environmental sustainability, their assessment priorities differ according to regional, climatic, and operational contexts. Most general GBRSs primarily emphasize environmental and energy performance, while comparatively less attention is given to healthcare-specific operational requirements.

2.2 General Green Building Rating Systems versus Healthcare-Specific Green Rating Systems

For hospital buildings, which have a unique building operation that goes beyond a typical building operation, there is a need for a GBRS that is more specifically designed than a typical GBRS (Marchi et al., 2021). Indian Green Building Council (IGBC) has been able to identify these unique needs and develop a GBRS specifically for healthcare facilities.

2.2.1 IGBC Green Healthcare Rating System

The unique operational requirements of a hospital include 24/7 operations, critical life-support systems, stringent hygiene protocols and mandatory energy and environmental control requirements compared to similar commercial buildings (Tomanek, 2024). In response to these issues, the IGBC healthcare Facilities rating system can be introduced as an important healthcare-specific GBRS specifically designed for healthcare facilities. This has been designed in the Asian country of India and supports the construction of hospitals in an environmentally friendly manner and the remodelling of existing hospitals to promote healthcare services that are rapidly becoming popular in India (Thapa, 2017). According to Indian Green Building Council (2020), this GBRS has been designed for both air-conditioned and non-air-conditioned healthcare facilities and covers all facilities such as sub-centres, primary health centres, community health centres, district hospitals, clinics, private hospitals and medical institutions. IGBC has been created under 6 essential elements for healthcare facilities. They are, indoor environment quality,

sanitation and hygiene, energy efficiency, water conservation, site selection and planning, Building materials and resources, and innovation design process. This rating system is different from the general GBRS because it has been designed with close attention to the comfort and safety of patients (Sonavane & Mane, 2023).

Thus, the literature suggests that green hospital concepts extend beyond environmental conservation and contribute directly to therapeutic outcomes and staff performance. This demonstrates an interrelationship between building sustainability and patient-centred care, where physical environmental quality becomes part of the healthcare delivery process itself.

2.3 GREEN HOSPITALS AND PATIENT-CENTRIC APPROACHES

Green hospitals promote environmental sustainability with the benefit of patient care, and staff wellness (Chías & Abad, 2017). These include energy efficient HVAC, biophilic designs and better air quality for a healing environment (Allen et al., 2015). Green hospitals are known to enhance recovery rates in patients to with lesser stress and better patient satisfaction (Kalender-Smajlović & Dovjak, 2023). Better indoor air quality and ergonomic designs result in fewer sick days and more productive health care workers (Dilrukshi et al., 2014). Buildings with enhanced ventilation systems have remarkably reduced respiratory issues (Golbazi & Aktas, 2020). Green hospitals also include sound-reducing strategies such as sound-absorptive materials and quieter equipment, contributing to a more soothing environment (Tomanek, 2024). Green hospitals with patient-centric designs such as, healing gardens help provide patients with a quiet space for relaxation and focusing on the psychosocial aspects (Chías & Abad, 2017). Exposure to nature supports to reduce anxiety, decrease blood pressure and increase mood and offers therapeutic benefits, alleviating stress, pain, and fostering an enhanced emotional state for patients, staff, and visitors (Kalender-Smajlović & Dovjak, 2023). Green hospitals provides positive impacts such as reduce operating costs, increase building value, and improve indoor air quality (Kumari & Kumar, 2020).

2.4 CHALLENGES AND BARRIERS TO IMPLEMENTING GREEN CONCEPTS IN HOSPITALS

In developing countries green construction has high initial costs for advanced energy systems, sustainable materials and certification fees (Golbazi & Aktas, 2020). Sepetis (2020) explained these investments generate long-term savings; however, many healthcare facilities have difficulties in justifying this upfront expenditure (Cowie et al., 2020). Financial barriers can be addressed by targeting subsidies, grants and low-interest loans to motivate more hospitals to adopt sustainable (Dhillon & Kaur, 2015). The second major barrier is operational difficulties. Continuous operation is essential to healthcare facilities; energy demand systems, including HVAC, lighting, and medical equipment, in these facilities make this point clear (Tomanek, 2024). The major issue here is that the services offered in these hospitals need to continue while old buildings are being refurbished for green compliance (Kalender-Smajlović & Dovjak, 2023).As hospital decision-makers are not familiar with the advantages of green buildings, there is initial resistance to adopt sustainable practices (Cowie et al., 2020). Furthermore, regulatory challenges do not motivate hospitals to adopt green concepts (Dhillon & Kaur, 2015). Hospitals often operate in high-pressure environments where immediate patient care takes priority over long-term sustainability (Golbazi & Aktas, 2020). These challenges

are exacerbated by the misunderstanding that green practices can disrupt clinical processes (Dhillon & Kaur, 2015).

3. METHODOLOGY

The initial step of the study was conducting a comprehensive literature review. This focused on understanding the green building concept (GBC), assessing existing Green Building Rating Systems (GBRS), and identifying the importance and relevance of green building concepts for hospital facilities. A qualitative research approach was adopted due to the limited number of green-certified hospitals in Sri Lanka. Since only one private hospital has achieved green certification, a large sample was not available for quantitative analysis. Therefore, a qualitative approach was considered more appropriate to explore the suitability of general GBRS for hospitals and to highlight the importance of establishing a healthcare-specific GBRS. This study was conducted as a single case study because only one private hospital in Sri Lanka has achieved green certification. The selected hospital is a leading private hospital in Sri Lanka and is a Gold-rated Green Hospital (GH), certified by the Green Building Council of Sri Lanka (GBCSL), which is the second-highest recognition for green compliance in the country. Three semi-structured interviews were conducted with professionals who contributed to obtaining and maintaining the hospital's green certification. The selected participants were directly involved in the hospital's green certification and operational sustainability practices, enabling the study to obtain expert and context-specific insights relevant to the research objectives. The respondents included:

- R1-Engineer & Facilities Manager (9+ years' experience): managing soft and hard services, infrastructure handling, project coordination, and sustainable management.
- R2-Engineer Executive (3+ years' experience): system maintenance, engineering resource management, and technical implementation.
- R3-Operations Manager (8+ years' experience): strategic operations planning, policy implementation, and performance monitoring.

In addition, observations were conducted to reassess the hospital's rating under a healthcare-specific GBRS and compare it with the existing general GBRS rating. To minimize observation bias, observations were conducted using predefined assessment criteria based on the IGBC Green Healthcare rating system and were verified collaboratively with the hospital's senior facilities executive to ensure consistency and accuracy. Data were analyzed using thematic analysis, where interview transcripts were coded, categorized, and organized into themes, and findings were compared with observation results.

4. DATA ANALYSIS AND RESEARCH FINDINGS

Phase I of data collection involved interviews and phase II involved observations. Table 1 represents the barriers to green concept implementation and the enablers that make it successful, in the healthcare sector.

4.1 PHASE I- INTERVIEW FINDINGS

Table 1: Interview findings

Theme	Codes	Categories
Barriers to integrating the green concept into existing hospitals	Infrastructure Obsolescence	Old and outdated building systems
		Electrical System Deficiencies
		Structural Constraints
		Technology Integration Difficulties
	Financial Constraints and Investment Burdens	High Implementation Costs
		Certification and Consultancy Fees
		Limited Government Support
	Operational Complexities	24/7 Operational Constraints
		Difficulties in balancing patient care and Sustainability
		Workflow Disruption Concerns
		Certification Process Complexity
		Difficulties in KPI Tracking and Performance Monitoring
	Human Factors and Behavioural Change Challenges	Staff and Patient Awareness Issues
		Resistance to Change
		Continuous Education Needs
Enablers to integrating the green concept into existing hospitals	Strategic Leadership	Top Management Support
		Strategic Vision and Commitment
		Brand Building and Marketing
		Green Team Formation
		Staff Training Programs
	Financial Benefits	Long-term returns of green hospitals
	Successful Green Technology Implementation	Water conservation
		Waste Management

4.1.1 Barriers to Integrating the Green Concept into Existing Hospitals

Considering the infrastructure obsolescence, R1 stated that, "*when integrate sustainable systems with existing systems, issues can be arisen. Our hospital buildings are old and systems also outdated. Because of that integrating process is difficult"*. This is proved the literature about older healthcare facilities facing unique challenges in adopting modern green technologies (Tomanek, 2024). While literature discusses retrofitting challenges, the interviews documented precise technical difficulties. In addition, system alignment problems were identified. *A*ccording to R2, *"To optimize the energy efficiency we had to install variable frequency drives (VFD) for old HVAC systems. In electrical system also using thermal cameras we had to find issues of the electrical line, leakages and fixed those problems"*. R1 noted that physical building limitations hindered rainwater harvesting, as underground lines connect directly to the main sewer.

Financial constraints are another practical challenge in implementing the GBC in the hospital sector. R1 supported this stating, the total project investment was substantial. *"We had to pay consultancy fee, altogether we had to invest more than 2 million for this whole project".* Direct certification costs also added to the financial burden. R3 stated that *"we had to invest for registration fee and instruction fee to GBCSL".* Sri Lankan evidence shows minimal government support, *"we have to expend some cost for maintain the green practices. For an example, we have to allocate money for solar panel services and sometimes invertor repairs or replacements".* R3 stated that, *" we still have not received any incentives. But government said tax will be reduced in 2026".*

Hospitals with unique characteristics face operational complexities when balancing the implementation of the green concept and meeting patient care requirements. Critical healthcare operations impose non-negotiable energy requirements. R1 stated that energy use cannot be significantly reduced because operating theatres require constant air conditioning at 16°C. Similarly, R2 stated, *"we have medical machine rooms those are needed to air conditioning 24/7"* supports Allen et al.'s (2015) theoretical frameworks about energy-intensive healthcare operations. In addition, patient safety takes precedence over sustainability goals. R1 stated that clinical priorities require maintaining air quality and HVAC in critical care units, even if it increases energy use. R3 emphasized that, *"we follow the green concept in a way that does not cause inconvenience to our patients".*

However, the interview findings revealed operational complexities extending beyond literature discussions, particularly regarding technology infrastructure gaps in developing countries. The participant explained that *"we don't have BMS system in the hospital. We manually do every function"* highlights implementation realities not adequately addressed in literature, which typically assumes basic building management system availability. Further R2 stated that, "*we have to complete upgrades without disturbing the patients was a major issue throughout the construction".* Certification is burdensome for hospitals, and KPI tracking is challenging due to complex measurements of energy, water, and waste. There are variations in factors such as staff awareness, patient behaviour, top management attitudes and training needs that can cause challenges. While Zitars et al. (2021) discusses occupant behavior in green buildings generally, healthcare-specific challenges were highlighted in this study. R3 noted that employees resist change, fearing increased workload or unclear relevance to their roles. Consequently, both new and existing staff require ongoing education on sustainability and hospital green policies.

4.1.2 Enablers to Integrating the Green Concept into Existing Hospitals

R3 identified leadership commitment was a key success factor by stating, "*the main thing is the will of top management to do this without any concern."* Further R1 explained that forward-thinking leadership approach is required to improve the morality of the workers in hospital. Also, R2 explained the brand building and marketing which received through implementing green concept. Additionally, specialized teams were established for sustainability. According to R3, *"for increase the efficiency we initiate a team called green team to support the system".* R2 explained that awareness programs were conducted, and responsibilities were assigned to staff. Respondents also highlighted the financial benefits of green hospitals. R2 reported that, "*we consider about the solar power generation is a profit for us. We have already received the return that we invested in this project, even though it is not visible".* In terms of green technology implementation, R1 emphasized water conservation and waste management initiatives. To reduce water

consumption, the hospital plans to use treated wastewater for gardens, employs dual-flush toilets, and installs water aerator taps. For waste management, medical and non-medical waste is segregated into categories such as infectious, sharp, biodegradable, glass, paper, and plastic waste. These strategies and technologies drive the hospital toward a sustainable hospital.

4.2 PHASE II- OBSERVATIONS

The observations were conducted to see the possibility of obtaining the same green certification level of GBCSL to the selected hospital, using the GBRS specifically designed for healthcare facilities by IGBC in India. The hospital's senior facilities executive was involved in the successful implementation of the observation. Their involvement in the observations improved the accuracy and reliability. The observation was faced with several significant limitations. Permission to observe the ICU and Radiology departments, identified as high energy-consuming areas—was denied due to access restrictions. Another limitation was the lack of technical equipment, which prevented the measurement of lux, indoor air quality and acoustic levels in the hospital. Although accurate measurements were not possible, the executive facilitated access to previously documented data and reports. Furthermore, the observation was limited to a single time frame, restricting the identification of seasonal and climate-related variations in sustainability factors such as energy use and daylight efficiency. The observations later confirmed by the interview respondents. The hospital under observation has achieved gold certification under the GREENSL rating system for existing building. The observations are conducted to investigate whether this hospital could regain the gold certificate through the IGBC green rating system which is a GBRS specified for hospitals.

4.2.1 Performance Comparison Between Rating Systems

The observational checklist assessment shows significant variance in hospital performance across different criteria of the two rating systems. Table 2 highlights the points achieved, based on the data obtained from the observation conducted. The total number of credits available in GREENSL ratings for hospital buildings is 100, while existing hospital buildings are evaluated under total 90 points in IGBC green healthcare system.

Table 2: Performance comparison between rating systems

Aspect	GREENSL System		IGBC Green Healthcare System		Key Observations
	Available points	***Claimed points***	***Available points***	***Claimed points***	
Site Selection & Planning	18	14	8	8	Strong performance in both systems
Indoor Environmental Quality	14	13	19	10	Significant gap in healthcare-specific criteria
Sanitisation & Hygiene	N/A	N/A	12	8	Category unique to healthcare rating

Aspect	GREENSL System		IGBC Green Healthcare System		Key Observations
	Available points	*Claimed points*	*Available points*	*Claimed points*	
Building Materials & Resources	11	7	6	4	Comparable relative performance
Energy Efficiency	28	22	23	19	Strong in both, but missed commissioning points
Water Conservation	15	7	16	8	Underperformance in both systems
Innovation	6	0	4	0	No points achieved in either system
Management	4	4	2	2	Full compliance in both systems
Social & Cultural Awareness	4	4	N/A	N/A	Category unique to GREENSL system
Total	***100***	***68***	***90***	***54***	
% of claimed points from total points	***68%***		***60%***		
Certification	***GOLD***		***SILVER***		

Table 2 provides a comparative summary of the hospital's performance in both systems. Even though under GREENSL rating hospital achieved a gold rating, under the IGBC rating system, this hospital only achieved a silver rating. Accordingly, by observing the same hospital facility undergoing certification under a general GBRS and a hospital-specific GBRS, the number of points earned under a hospital-specific GBRS is significantly lower than the point level earned under a general GBRS. This represents a difference of 8%.

A key difference between the GREENSL rating system and the IGBC green rating system is that it includes five specific healing architecture requirements under Indoor Environmental Quality aspect, that are not included in GREENSL. In addition to that, The IGBC has a separate category for sanitization and hygiene criteria, which are not included in the GREENSL system. Thus, further analysis on the variations of IGBC rating is required.

4.2.2 Analysis of Healing Architecture Requirements in Healthcare Facilities

The important aspects of healing architecture are shown in the comparative Table 3 below, and the data obtained from the observation conducted shows that the healing architecture of the hospital is at a weak level. It can also affect the recovery rate of patients.

Table 3:Analysis of Healing Architecture Requirements

Element of Healing Architecture	Available Points of IGBC	Points Claimed	GREENSL Equivalent
Day-lit Spaces	2	2	Partial coverage in general daylighting
Connectivity to Nature	2	0	Not specifically addressed
Green Open Spaces	2	1	General open space requirements
Patient-centric Healing Garden	2	0	Not addressed
Colour Psychology	3	1	Not addressed

As shown in the Table 4, the IGBC states that day-lit spaces, connectivity to nature, green open spaces, healing gardens, and colour psychology are the elements that should be present in a green hospital building to support therapeutic productivity. In contrast, the GREENSL does not provide an in-depth coverage of these factors. Although, some coverage is given to day-lit spaces and green open spaces, they are not included under any of the healing-focused criteria. More critically, connectivity to nature, patient-centric healing gardens and colour psychology are not clearly identified within the GREENSL.

4.2.3 Sanitization and Hygiene Requirements

Sanitization and Hygiene requirements criteria is a crucial gap when applying conventional green building certification standards to healthcare facilities, as infection control and medical waste management are fundamental to hospital operations and patient safety. Significant gaps in extent and coverage were observed between IGBC Green Healthcare Rating System and GREENSL Rating System when sanitation and hygiene were compared in Table 4.

Table 4:Analysis of Sanitization and Hygiene Requirements

Sanitization & Hygiene Element	IGBC Points Available	Points Achieved	GREENSL Coverage
Municipal Solid Waste Management	Required	Compliant	Covered under general waste management
Bio-medical Waste Management	Required	Compliant	Not specifically addressed
Infection Control within Spaces	5	3	Not addressed
Isolation Room	2	1	Not addressed
Sanitation Facilities	1	1	Basic coverage
Eco-friendly Cleaning Practices	2	1	Limited coverage
Organic Waste Management	2	2	General coverage

GREENSL does not cover the specific aspects of healthcare, including biomedical waste management, infections control or having separate isolation spaces for patients. This study indicates that the hygiene and sanitation provisions within healthcare settings are inadequately supported by the conventional Green Rating systems. However, the IGBC

system is a system specifically designed for the healthcare sector and provides a broader framework. As a result, it is clear that implementing a framework that integrates with medical hygiene regulations in Sri Lankan private hospitals will enable them to achieve green certification while protecting public health interests, achieving operational excellence, and ensuring patient safety. Therefore, healthcare facilities evaluated under the general green building framework are not able to assess some of their most critical operational characteristics. Therefore, this is a measure that shows a significant gap in suitability in certification. This finding directly supports Tomanek's (2024) theoretical argument about the unique hygiene requirements of healthcare facilities.

5. CONCLUSIONS

The study identified that conventional Green building rating systems such as LEED, BREEAM and GREENSL treat hospitals similarly to other building types. In contrast, healthcare-specific systems like IGBC incorporate critical medical facility requirements that recognize the unique operational demands of hospitals. Several barriers and enablers to integrating the green concept into existing hospitals were identified using a case study. The enablers include strategic leadership toward green hospital formation; financial benefits gain through the green hospitals and successful green technology implementation. Barriers include technical challenges in retrofitting antiquated infrastructure, especially when attempting to combine the advanced mechanisms with aging building designs. Operational constraints due to 24/7 service requirements created gaps between energy conservation goals and patient safety needs, while limited government financial support, combined with staff and patient behavioural change requirements, added challenges to implementation. The practical application of the IGBC Green Healthcare Rating System to the GREENSL-certified hospital, providing evidence of performance differences. The comparative analysis demonstrated a scoring difference, with the hospital achieving 68% under GREENSL versus 60% under IGBC criteria, resulting in a certification level reduction from Gold to Silver. This variance highlighted critical gaps in healthcare-specific performance areas. In indoor environmental quality, the hospital was achieved high compliance under GREENSL. However, low compliance was achieved under healthcare-specific criteria due to missing acoustic design, specialized ventilation, and infection control requirements. Most notably, the application exposed the absence of healing architecture requirements in general systems, with elements such as connectivity to nature, healing gardens, and therapeutic colour schemes receiving no recognition under GREENSL. The assessment revealed that GREENSL completely lacks sanitization and hygiene categories, resulting in average compliance when evaluated against healthcare standards for medical waste management and infection control protocols. This practical application validated the need for specialized assessment frameworks to comprehensively evaluate hospitals' unique sustainability challenges and opportunities. Further, the research demonstrated that general systems inadequately assess healthcare-specific requirements, with the 8% scoring difference and qualitative gaps providing concrete evidence of this inadequacy. This study provides empirical evidence demonstrating the inadequacy of general green building rating systems when applying to healthcare facilities in Sri Lanka. The lack of specialized technical equipment for measuring indoor environmental quality parameters limited the ability to conduct comprehensive environmental assessments required for an accurate healthcare-specific rating system application. Future research should focus on evaluating multiple healthcare facilities using healthcare-specific green building rating systems and incorporating

detailed quantitative assessments of indoor environmental quality and patient well-being outcomes. Also, policymakers and regulatory bodies need to develop healthcare-specific green building standards within the existing GREENSL framework. These standards should incorporate mandatory elements such as infection control protocols, medical waste management, healing architecture requirements, and patient-centric design criteria.

6. REFERENCES

Abeysinghe, S., De Zoysa, C. J., Siriwardana, C., Bandara, C., & Dissanayake, R. (2023). Integrating disaster resilience into green rating systems – a modification of the Sri Lankan green building rating tool. *Smart and Sustainable Built Environment*, *12*(4), 765–786. https://doi.org/10.1108/SASBE-10-2021-0182

Akpan Umoh, A., Adefemi, A., Ibewe, K. I., Etukudoh, E. A., Ilojianya, V. I., & Nwokediegwu, Z. Q. S. (2024). Green architecture and energy efficiency: A review of innovative design and construction techniques. *Engineering Science & Technology Journal*, *5*(1), 185–200. https://doi.org/10.51594/estj.v5i1.743

Allen, J. G., MacNaughton, P., Laurent, J. G. C., Flanigan, S. S., Eitland, E. S., & Spengler, J. D. (2015). Green buildings and health. *Current Environmental Health Reports*, *2*(3), 250–258. https://doi.org/10.1007/s40572-015-0063-y

Awadh, O. (2017). Sustainability and green building rating systems: LEED, BREEAM, GSAS and Estidama critical analysis. *Journal of Building Engineering*, *11*, 25–29. https://doi.org/10.1016/j.jobe.2017.03.010

Chías, P., & Abad, T. (2017). Green hospitals, green healthcare. *International Journal of Energy Production and Management*, *2*(2), 196–205. https://doi.org/10.2495/EQ-V2-N2-196-205

Christensen, P., Sayce, S., & Falkenbach, H. (2011). Assessing Assessment: Toward a more holistic rating system for sustainability performance. *18th Annual European Real Estate Society Conference*. https://eres.architexturez.net/doc/oai-eres-id-eres2011-336

Cowie, J., Nicoll, A., Dimova, E. D., Campbell, P., & Duncan, E. A. (2020). The barriers and facilitators influencing the sustainability of hospital-based interventions: a systematic review. *BMC Health Services Research*, *20*(1), 588. https://doi.org/10.1186/s12913-020-05434-9

Dhillon, V. S., & Kaur, D. (2015). Green hospital and climate change: Their interrelationship and the way forward. *Journal of Clinical and Diagnostic Research : JCDR*, *9*(12), LE01-LE05. https://doi.org/10.7860/JCDR/2015/13693.6942

Dilrukshi, H., Mallawarachchi, H., & Karunasena, G. (2014). Application of green building concept to enhance indoor environmental quality in hospital buildings in Sri Lanka. *The 3rd World Construction Symposium*, 80–88. https://ciobwcs.com/downloads/WCS2014-Proceedings.pdf

Ding, Z., Fan, Z., Tam, V. W. Y., Bian, Y., Li, S., Illankoon, I. M. C. S., & Moon, S. (2018). Green building evaluation system implementation. *Building and Environment*, *133*, 32–40. https://doi.org/10.1016/j.buildenv.2018.02.012

Golbazi, M., & Aktas, C. B. (2020). Leed certification and patient wellbeing in green healthcare facilities. *Journal of Green Building*, *15*(4), 3–18. https://doi.org/10.3992/jgb.15.4.3

Gurupatham, S. V., Jayasinghe, C., Perera, P., & Lepakshi, R. (2024). Building material selection framework for tropical climatic conditions: Eco-design-based approach. *Green Technologies and Sustainability*, *2*(3), 100103. https://doi.org/10.1016/j.grets.2024.100103

Haapio, A., & Viitaniemi, P. (2008). A critical review of building environmental assessment tools. *Environmental Impact Assessment Review*, *28*(7), 469–482. https://doi.org/10.1016/j.eiar.2008.01.002

Huang, Y., Pi, Y., Ma, K., Miao, X., Fu, S., Zhu, Z., Cheng, Y., Zhang, Z., Chen, H., Wang, H., Gu, H., Shao, Y., Duan, Y., Feng, A., Zhuo, W., & Xu, Z. (2022). Deep learning for patient-specific quality assurance: Predicting gamma passing rates for IMRT based on delivery fluence informed by log files. *Technology in Cancer Research & Treatment*, *21*. https://doi.org/10.1177/15330338221104881

IGBC. (2020). *IGBC Green Healthcare Facilities Rating System*. Indian Green Building Council.

Kalender-Smajlović, S., & Dovjak, M. (2023). Advantages of greenery in hospital environment - a literature review. *Sanitarno Inženirstvo International Journal of Sanitary Engineering Research*, *16*(1), 4–13. https://doi.org/10.2478/ijser-2023-0002

Khairunnisa, R. A., Setyonugroho, W., & Ulfa, M. (2022). Green hospital implementation in health aspects: a systematic review. *United International Journal for Research & Technology*, *3*(9), 46–58.

Kumari, S., & Kumar, R. (2020). Green hospital - A necessity and not option. *Journal of Management Research and Analysis*, *7*(2), 46–51. https://doi.org/10.18231/j.jmra.2020.010

Mahan, A., & Khorramrouei, R. (2023). CASBEE Assessment system, a technical approach to assessing the environmental sustainability of green buildings in Japan. *Journal of Renewable and New Energy*, *10*(1), 177–187. https://doi.org/10.52547/jrenew.10.1.177

Marchi, L., Antonini, E., & Politi, S. (2021). Green Building Rating Systems (GBRSs). *Encyclopedia*, *1*(4), 998–1009. https://doi.org/10.3390/encyclopedia1040076

Moramudali, W., & Manawadu, G. (2022). Adoption of green practices in hotel industry in Sri Lanka: An evaluation based on the Green SL rating system. *Conference: 15th. International Conference on Business Management; Sustainability through Going Green*.

Sepetis, A. (2020). Sustainable finance in sustainable health care system. *Open Journal of Business and Management*, *08*(01), 262–281. https://doi.org/10.4236/ojbm.2020.81016

Shan, M., & Hwang, B. (2018). Green building rating systems: Global reviews of practices and research efforts. *Sustainable Cities and Society*, *39*, 172–180. https://doi.org/10.1016/j.scs.2018.02.034

Sonavane, P. B., & Mane, A. S. A. (2023). Analysis and study of credits for IGBC green new building. *Interantional Journal of Scientific Research in Engineering and Management*, *07*(02). https://doi.org/10.55041/IJSREM17797

Thapa, D. (2017). *Rating System Pilot Version Abridged Reference Guide IGBC Green Healthcare Facilities*. https://www.academia.edu/35401446/Rating_System_Pilot_Version_Abridged_Reference_Guide_IGBC_Green_Healthcare_Facilities

Tomanek, M. (2024). Energy efficiency in hospitals –towards sustainable healthcare. *BUILDER*, *320*(3), 38–41. https://doi.org/10.5604/01.3001.0054.3461

Tseng, M.-L., Tan, P., Wu, K.-J., Lin, R., Todumrongkul, N., Juladacha, P., & Christianti, G. (2020). sustainable total resource management in thailand healthcare industry under uncertain situations. *Sustainability*, *12*(22), 9611. https://doi.org/10.3390/su12229611

Tushar, S. R., Moktadir, M. A., Kusi-Sarpong, S., & Ren, J. (2023). Driving sustainable healthcare service management in the hospital sector. *Journal of Cleaner Production*, *420*, 138310. https://doi.org/10.1016/j.jclepro.2023.138310

Zitars, J., Spadafore, B., Coulombe, S., Riemer, M., Dreyer, B. C., & Whitney, S. (2021). Understanding the psycho-environmental potential functions of a green building to promote employee health, wellbeing and productivity: A theoretical perspective. *Building and Environment*, *205*, 108268. https://doi.org/10.1016/j.buildenv.2021.108268