Kavindi, S.A.C., Ramachandra, T. and Gheethanjali, B., 2026. Enhancing green achievement: An emphasis on design features. In: Waidyasekara, K.G.A.S., Jayasena, H.S., Chandanie, H. and Tennakoon, G.A. (eds). *Proceedings of the 14th World Construction Symposium*, 10-11 July 2026, Sri Lanka. pp. 657-671. DOI: https://doi.org/10.31705/WCS.2026.49. Available from: https://ciobwcs.com/papers/

ENHANCING GREEN ACHIEVEMENT: AN EMPHASIS ON DESIGN FEATURES

S. A. Chathuni Kavindi[1], T. Ramachandra[2] and B. Gheethanjali[3]

ABSTRACT

The increasing sustainability challenges have prompted the construction industry to shift towards Green building practices globally. Despite the introduction of numerous rating systems aimed at promoting environmentally responsible construction, their adoption remains limited due to various contextual challenges. This study investigates the role of design features in enhancing Green achievement within the framework of these rating systems. A case study research method was employed through a comparative analysis of three buildings certified under the GREENSL rating system in Sri Lanka. The study aimed to identify key design strategies that enhance building performance in terms of Indoor Environment Quality (IEQ), Sustainable Sites (SS), and Energy and Atmosphere (EA). Primary data were collected through document analysis and formal discussions with Architects involved in the selected projects. The findings indicate that all three buildings prioritised natural ventilation, optimal daylight penetration, minimal water consumption, and strategies to reduce energy use and site disturbance, which significantly contributed to credits under Indoor Environment Quality, Sustainable Sites, Water Efficiency, and Energy and Atmosphere. Specific measures included the use of central atriums for passive ventilation, appropriate building orientation to reduce solar heat gain, incorporation of drought-tolerant native landscaping, and integration of renewable energy systems. The study further highlights the need to educate stakeholders on green practices and the technologies available worldwide to increase their adoption.

Keywords: *Design Features; Green Building; Green Features; Green Rating; Sri Lanka.*

1. INTRODUCTION

Accelerated urbanisation, coupled with sustained population growth, continues to exert pressure on the rapid expansion of the construction industry. The buildings and construction sector are responsible for approximately 38% of global energy-related CO_2 emissions and consumes nearly 40% of the world's raw materials (United Nations Environmental Programme [UNEP], 2022). In response, the construction industry is increasingly moving towards sustainable and green building approaches that focus on lowering environmental footprints and optimising the use of natural resources (Sachchithananthan & Thayaparan, 2024).

[1] Quantity Surveyor, Engineering Contracting Company LLC, Dubai, UAE, chathuni.kavindisa@gmail.com
[2] Professor, Department of Building Economics, University of Moratuwa, Sri Lanka, thanujar@uom.lk
[3] Lecturer, Department of Building Economics, University of Moratuwa, Sri Lanka, anjana122000@gmail.com

Green buildings focus on resource efficiency, including energy, water, and materials, while providing healthy and productive environments for occupants (Periyannan et al., 2023). To systematically measure and promote these attributes, several internationally recognised Green building rating systems have been developed, including Leadership in Energy and Environmental Design (LEED), the Building Research Establishment Environmental Assessment Method (BREEAM), and the Comprehensive Assessment System for Built Environment Efficiency (CASBEE) (Sachchithananthan et al., 2024). These initiatives have enhanced the interest of developers and building owners in Green building construction. Moreover, certifications provided by relevant regulatory bodies add value to buildings in the market and society (Doan et al., 2017). The certification frameworks provide standard criteria for evaluating sustainability performance and are often adapted or localised to reflect regional environmental conditions and regulatory contexts (Hwang et al., 2017).

However, the adoption of Green building certification and technologies is not as evident as it should have been (Chan et al., 2016). Though Ghana has introduced a Green building rating system, the certification rate remains low (Agyekum et al., 2020). The Malaysian construction industry experienced a similar situation with respect to the adoption of Green practices, with less than 5% of buildings having achieved Green certification (Masyhur et al., 2024). In Sri Lanka, only 55% of the registered buildings are recognised as Green certified buildings under the LEED certification system (United States Green Building Council [USGBC], 2026). Moreover, only 3.6% of projects registered with the Urban Development Authority (UDA) have attained certification, indicating significant gaps between policy intentions and practical implementation (Urban Development Authority [UDA], 2020).

High certification costs, limited awareness, technical complexities, and insufficient professional capacity have hindered the widespread adoption of Green certification globally (Akadiri, 2015; Zhao et al., 2022). Further, the main challenges include high costs, limited knowledge, and low awareness among stakeholders (Masyhur et al., 2024). It is reported in Sri Lanka that lack of awareness and professional knowledge regarding rating systems, lack of skilled labourers to implement Green requirements, required funds, poor planning during designs, and stakeholder management are the key barriers for green certification (Illeperuma & Abeynayake, 2022). Moreover, Mahagamage and Perera (2024) highlighted that the lack of knowledge and awareness among stakeholders about Green practices and strategies is a considerable barrier to obtaining the Green certification. The foregoing highlights that the lack of knowledge and awareness about rating systems and the requirements hindered Green adoption. To this end, the present study aims to examine the architectural design features that supported green achievements in Green Building Council of Sri Lanka (GREENSL) awarded buildings in Sri Lanka. The paper identifies the criteria under the rating system and examines the design strategies incorporated to obtain points under each criteria.

2. LITERATURE REVIEW

Initially, a document as well as an internet-based survey was carried out to examine the status of Green certification obtained by the local buildings in terms of locally used rating systems. Table 1 presents the profile of Green certified buildings in Sri Lanka.

Table 1: Green awarded buildings in Sri Lanka

Description		**Proportion**		
Year of commencement of operation	LEED	2009		
	GREENSL	2014		
	UDA	2017		
No. of certified buildings		Awarded	Registered	%
(Up to 2023)	LEED	68	116	55%
	GREENSL	54	NA	NA
	UDA BG	03	100	3%
	Total	125		
No. of certified buildings	Gold	73		58%
	Platinum	30		24%
	Silver	20		16%
	Certificate	02		2%
	Total	125		
Function of certified buildings	Commercial	53		42%
	Industrial	41		33%
	Residential	07		6%
	Educational	10		8%
	Hotel	14		11%
	Total	125		

Source: (USGBC, 2026; Green Building Counsil Sri Lanka [GBCSL], 2025)

Though three main Green rating systems are in use, only a limited number of buildings are being Green awarded since their commencement as per the certification in 2023. As seen from the table, the LEED rating system, introduced in Sri Lanka in 2009, precedes both GREENSL and the UDA Blue Green (BG) in terms of certification (Weerasinghe et al., 2022). Its early commencement is attributed to having an increased number of registered and certified buildings under the rating system. In contrast, although the UDA BG was introduced as a compulsory certification for public buildings and has registered around 100 buildings since its inception, only three buildings have completed certification (UDA, 2025). Although platinum is the highest certification level, according to the data available, most buildings under both the LEED and GREENSL ratings have been gold rated. This reflects that while platinum is an aspirational goal for sustainability, gold certification seems more practical. Building projects aiming for platinum certification typically need to meet more stringent sustainability criteria, which can involve implementing advanced technologies, materials, and design features that may come with higher upfront costs (Uğur & Leblebici, 2017). In contrast, achieving gold certification aligns better with the sustainability goals and budget constraints of many building developers and owners (Sandoval & Prakash, 2016). Gold certification still represents a significant commitment to sustainability and offers substantial environmental benefits while being more financially feasible and practical for a broader range of projects. This might be attributed to the high number of gold-rating achievements. Further, concerning the breakdown, a higher number of commercial buildings have been awarded under the GREENSL rating system, and among the certified buildings in all, three rating system 74% of the buildings have been awarded in gold.

2.1 SIGNIFICANT GREEN FEATURES: COMPARISON OF RATING SYSTEMS USED IN SRI LANKA

Although the allocation of points and credit requirements vary across rating systems, the core assessment domains: Sustainable Site Development (SS), Energy and Atmosphere Performance (EA), Water Efficiency (WE), Indoor Environmental Quality Management (IEQ), and Material Management and Waste Management remain fundamentally consistent across the rating systems. Table 2 outlines the point distribution of Green rating system of GREENSL new rating system.

Table 2: Significant criteria - GREENSL rating systems

Code	Sub-criteria	Scores
Sustainable Sites (SS) - 25		
SS1	Heat Island Reduction: Non-roof	1
SS2	Heat Island Reduction: Roof	1
SS3	Light Pollution Reduction	1
SS4	Reduced Site Disturbance	6
SS5	Development Density and Community coordination /management /involvement	2
SS6	Storm Water Design – Quantity & Quality Control	3
SS7	Site Selection	4
SS8	Reuse of Previously Developed sites and Allowance for Connectivity of Green Lands	2
SS9	Site Assessment and development	2
SS10	Alternative Transportation	3
Energy and Atmosphere (EA) -22		
EA1	On-Site Renewable Energy	1-5
EA2	Off-Site Renewable Energy	1
EA3	Optimise energy performance	1-10
EA4	Refrigerant Management	1
EA5	Greenhouse Gas Emissions Management	1
EA6	Certified Energy Auditor	1
EA7	Enhanced Commissioning	1
EA8	Measurement & Verification	1-2
Water Efficiency (WE) (14)		
WE1	Cooling tower Water Efficiency in air – conditioning system	1
WE2	Water Sub Metering	1
WE3	Water Efficient Construction	1
WE4	Indoor Water Use Reduction	1-5
WE5	Reduce Potable Water Use	1
WE6	Reduce Potable Water Use or Treat Wastewater	1
WE7	Harvested rainwater	2
WE8	Aquifer Recharge	1
WE 9	Innovative Water Transmission	1

Code	Sub-criteria	Scores
Indoor Environment Quality (IEQ) (13)		
IEQ1	Outdoor air delivering Monitoring	1
IEQ2	Increased Ventilation	1
IEQ3	Construction IAQ Management Plan	1
IEQ4	Low- Emitting Materials	3
IEQ5	Indoor Chemical & Pollutant Source Control	1
IEQ6	Lighting and Comfort Controls	2
IEQ7	Thermal comfort, design and Verification	1
IEQ8	Air Purification and Disinfection	1
IEQ9	Daylight & Views	2
Materials, Resources and Waste Management (MR & W) (14)		
MR & WM1	Local/ Regional Materials	1
MR & WM2	Rapidly Renewable materials	1
MR & WM3	Upfront Carbon Emissions	1
MR & WM4	Building Reuse	1-2
MR & WM5	Certified wood	1
MR & WM6	Green Labelled Products	1
MR & WM7	Reused and recycled Materials/products	1-2
MR & WM8	Sustainable Building Systems	1-2
MR & WM9	Construction and Demolition Waste Management	1
MR & WM10	Waste materials to construction materials	1
MR & WM11	Storage, Collection and safe disposal of hazardous wastes	1

Source: (GBCSL, 2022)

According to Table 2, the largest proportion of points is allocated to the sustainable sites' category, accounting for 25% of the total score. Within this category, "reducing site disturbance" receives the highest allocation, followed by "site selection," "alternative transportation," and "stormwater design." Although the remaining sub-criteria carry comparatively lower weightings, their achievement remains important for maximising the overall score. The next most significant category is energy and atmosphere. Within this category, "optimise energy performance" is assigned the highest number of points, followed by "on-site renewable energy." While the other sub-criteria have relatively lower point allocations, addressing them can still contribute to improving the overall rating. The remaining categories, including water efficiency, indoor environmental quality, and materials and resources/waste management, receive approximately similar weightings. These categories comprise a broader range of sub-criteria, each with a relatively smaller proportion of points. Nevertheless, collectively addressing these sub-criteria is essential for achieving a higher overall performance (GBCSL, 2022).

3. RESEARCH METHODOLOGY

This study adopted a qualitative research approach where a case study strategy was employed to explore the green features and strategies embedded within the selected Green certified buildings in Sri Lanka. Three buildings awarded under the GREENSL rating system for new buildings were selected based on accessibility, relevance, and data availability. The selection of three cases ensured sufficient diversity in Green technologies and allowed for comparative analysis within the cases. Further, comparative study is adopted to understand the impact of different features on the points achieved to identify the best techniques to be incorporated to achieve the maximum points. Moreover, different building types were selected to examine the strategies that can be implemented in each type to achieve points under the respective green certification criteria. Data collection was carried out through review of the final documents submitted to achieve the green rating under the GREENSL rating system, and semi-structured interviews. Primarily, a review was conducted into project documents, including user manuals, and supplier invoices submitted for certification purposes. Further, to validate and contextualise these findings, semi-structured interviews were conducted with Architects who were in charge of the design of the respective cases. Table 3 provides a summary profile of the selected three cases.

Table 3: Profile of selected cases

Criteria	Case A	Case B	Case C
Function	Office	Educational*	Commercial
Location	Malabe	Sabaragamuwa	Colombo
Award	Platinum	Platinum	Gold
Green certification	2020	2022	2014
Construction commencement	2018	2020	2012
Gross floor Area	21,284 m2	*	10,730m2
Number of Floors	10 floors (G+9 with one mezzanine and two basements)	**	11 floors, including 2 basements
Building Orientation	East-west oriented	***	East-west oriented linear shape
Structural Composition	Reinforce Concrete (RCC) Block wall	RCC/Block walls	RCC/Block walls
Façade Curtain	Glass and Blockwork (plastered and painted)	Green Walls,	Eastern façade -glazed with PLINKTON Low-E glass and green wall

*Note: * Exact floor area cannot be provided since the case consists of a cluster of buildings*

*** Case B is a building complex, and it consists of several medium and low-rise buildings.*

**** Since Case B is a building complex, different buildings have different orientations.*

Although Case B is part of a larger educational development comprising multiple buildings, the selected buildings within the project function as independent, standalone commercial-type facilities. Therefore, the comparison remains relevant, as the analysis focuses on building-level design strategies and green features rather than the overall campus scale. The inclusion of Case B was intended to broaden the study by incorporating a project consisting of integrated yet independently functioning buildings while maintaining comparability with Cases A and C.

4. FINDINGS AND DISCUSSION

4.1 STATUS OF GREEN ACHIEVEMENT IN THE SELECTED GREEN CERTIFIED BUILDINGS

To assess the level of Green achievement of the selected buildings in terms of main criteria, points achieved by the selected buildings were compared with allocated points for the same main criteria as per the considered rating system. Table 4 presents the points achievement of the selected cases.

Table 4: Level of green achievement

Main criteria	Allocated points	Level of significance (MS, S, LS)	Achieved points		
			Case A	Case B	Case C
Sustainable Site (SS)	25	MS	92%	92%	60%
Energy and Atmosphere (EA)	22	MS	73%	91%	73%
Water Efficiency (WE)	14	S	57%	57%	43%
Material, Resource and Waste Management (MR & WM)	14	S	64%	64%	43%
Indoor Environment Quality (IEQ)	13	S	100%	100%	100%
Innovation and Design Process (IDP)	4	LS	100%	100%	100%
Social and Cultural Awareness (SCA)	4	LS	100%	100%	100%
Management (M)	4	LS	100%	100%	100%
Marking Criteria			70-100	70-100	60-69
Overall achieved points	100		81	85	68
Overall achieved points (%)	100		81	85	68

MS – Most Significant, S – Significant, LS – Least Significant

As per the rating system, 50% of the total points are allocated to SS and EA features while another 40% is equally shared by the features of WE, IEQ and MR & WM. This allocation of points indicates the relative significance of the features within the system. In terms of the Most Significant (MS) features, the selected buildings have achieved over 70% for the EA irrespective of the rating level achieved. This indicates that developers/designers have paid more attention to the feature in achieving Green ratings. However, in terms of SS, platinum-rated buildings have scored high compared to gold rated. This could be due to the increased requirement for the given rating.

In terms of the Significant (S) features, the buildings have achieved an average level of points for WE and MR&WM, while 100% achievement is obtained for IEQ. This shows that the IEQ feature has received priority over the other two features of WE and MR&WM. However, in terms of the Less Significant (LS) features, all selected buildings have achieved 100% of the required scores. This could be due to the lower score required to achieve the features.

4.2 DESIGN FEATURES CONTRIBUTED TO THE GREEN RATING OF THE SELECTED BUILDINGS

According to the rating systems, compliance with green building requirements is achieved through the incorporation of appropriate design features. Therefore, the design features implemented in the selected green awarded buildings, for the major criteria stipulated in the green rating system, are examined and summarised in Table 5.

Table 5: Design features of selected buildings

Criteria		Design Features		
		Case A	Case B	Case C
SS1	Parking	Covered parking	Covered parking	Covered parking
SS4	Minimum Site Disturbance	Sloping land to minimise excavation and natural contours for ramps and roadways. Properly marked construction boundaries and dust control during the construction	Conservation of vegetation except building footprint, and natural vistas.	Terminalia catappa for landscaping, preservation of trees, and native drought-resistant plants
SS3/EA3	Light Pollution Reduction	Full-height glass façade. Minimum use of non- emergency lights and exterior lights	Vertical green wall, canteen bridge.	PLINKTON low-e glass, green wall. Automatic control for interior lights, energy-efficient façade lighting, and no lights directed towards the sky.
SS8	Building Design	Focus on existing trees for building roads and ramps.	Placement for panoramic views.	Open glazed façade for panoramic views
SS8	Aesthetic	Plant troughs, medium-height trees in public areas	Large garden, open landscape, pathways	Open landscape, glazed façade for a panoramic view.
SS2/ EA3	Services Installation	Service areas in the east-west direction to avoid direct sunlight. Use of CFC-free HVAC Systems.	Use of CFC-free HVAC Systems.	The roof terrace is covered with solar panels. Use of CFC-free HVAC Systems.
EA3, IEQ2	Ventilation	Large pond and cooling tower effect in atrium, high ceiling office, max window coverage with protection.	Plants, medium-height trees, triple-height lobby with cement louvres.	Windows and fixed glass on all 4 sides, wind tunnel formation. Microclimate Treatment

Criteria		Design Features		
		Case A	Case B	Case C
		Installation of a glass façade for all the occupied spaces.	Introduction of the window canopies a hybrid of vertical fins and sunshades. Internal spaces are designed to match the control of glare intake.	
EA1	Facilities	Solar power systems	Solar power systems	Solar power systems
EA3			Use of VRF system as HVAC technology and multi-V system for distribution, use specially designed heat exchangers, and inverter technology.	Use of specially designed MVAC.
EA3/ IEQ2, IEQ 9	Lighting	Building orientation avoids direct sunlight, high ceilings, sunshades, window canopies, and trees to reduce glare.	Max window coverage with protection, contoured building orientation. Lighting system controllability for all shared multi-occupant spaces, and individual controls for fully partitioned areas. Introduce switches in possible areas.	Windows on all 4 sides, east-west oriented linear shape, and internal design to control glare.
EA3	Optimise Energy Performance	Whole Building Energy Simulation, Comply with the final version of the Code of Practice on Energy Efficient Buildings.	Whole Building Energy Simulation. Comply with the final version of the Code of Practice on Energy Efficient Buildings, Placement of rainwater harvesting tanks in upper areas	all non-emergency fixtures are equipped with automatic control and comply with the final version of the Code of Practice on Energy Efficient Buildings.
IEQ5	Indoor Chemical & Pollutant Source Control	Use of an automatic sensor doors, All the chemicals and materials are stored separately.	All the chemicals and materials are stored in a separate storeroom	All the chemicals and materials are stored in a separate storeroom

Criteria		Design Features		
		Case A	Case B	Case C
IEQ1	Outdoor air delivering Monitoring	The design occupant density is 10 people per 100m^2. Provision of CO_2 monitoring	The design occupant density is 10 people per 100m2. Provision of CO2 monitoring	Provision of CO_2 monitoring
WE3	Water Efficiency	Use of water-efficient fixtures, fittings, and appliances. Use condensate water for irrigation. Installation of water faucet with Movable Heads and Flow Aerators.	Use of water-efficient fixtures. Introduce the VRF AC system. Use condensate water for irrigation. Introduce separate water meters in buildings	Use of water-efficient fixtures, fittings, and appliances
WE7	Rainwater Harvesting System	Harvest rainwater for irrigation.	Harvest rainwater for irrigation.	Harvest rainwater for irrigation.
MR & WM9/ MR & WM11	Recycling construction waste	Recycle the construction waste, Initiation waste management and Categorisation waste	Recycle the construction waste, Initiation waste management and Categorisation waste	Allocate a separate place to store waste, and remove the disposal waste every week.
MR & WM1	Local/ Regional Materials	Purchasing locally manufactured materials, use of composite roofing system, ceiling material, floor and wall tiles and glass façade.		Purchase materials only from suppliers and vendors who have sustainable certification, selecting sustainable maintenance and solution providers

According to Table 5, it is clear that the buildings have concentrated on the most significant (SS & EA) as well as significant (WE, IEQ & MR & WM) criteria. The identified features were validated, and further explanations were obtained from the interviewees for each case. Further, each building demonstrates a clear commitment to enhancing natural ventilation and lighting efficiency. Moreover, major significance is given to sustainable site selection. Though case C has obtained only 68% of the total points allocated for site selection, they have incorporated new design features to achieve the points.

5. DISCUSSION

The comparative analysis of the three case studies demonstrates that the achievement of green building credits under the GREENSL rating system is strongly influenced by the integration of context-responsive design strategies. The study analyses the various design features and strategies adopted in each case to achieve green certification. The findings provide valuable insights for future stakeholders, enabling them to adopt similar approaches and more effectively meet certification requirements. Each case adopted a distinct architectural approach. However, all three projects incorporated passive design principles and environmentally responsive planning to enhance sustainability performance.

Case A was conceptualised with a 10-level central atrium functioning as a "Green lung," facilitating cross-ventilation and daylight penetration through public areas of the buildings through open to sky atrium. This was complemented by open-plan lobbies and mezzanine levels to foster spatial flexibility and user customisation. Further, a solar power system is installed in these buildings to ensure the utilisation of natural resources. Case B integrates both biological and engineering elements harmoniously, emphasising a balance between active and passive design strategies. The development retained much of the site's native vegetation and adapted the building layout to the existing topography. The building orientation and positioning foster natural ventilation and internal connectivity, also aligning with both international and local sustainability codes.

In contrast, Case C has come into life with the concept of “Melting Ice Burg”. This land has two close water bodies, a sea from the west and a lake from the East. Therefore, a wind tunnel has been formed to allow the natural sea breeze path to pass through the building without an obstacle, which reduces the heat island effect. The use of low-e glazing not only maximised visual connectivity to the surroundings yet minimised solar heat gain, improving thermal comfort and energy performance.

It is necessary to understand the different design features they have incorporated to achieve points in different criteria. Accordingly, natural landscaping and passive design strategies will easily score more points in site selection criteria. As shown, Sustainable Sites (SS) consistently yielded the highest point scores in Cases A and B due to well-planned site layouts, minimal ecological disturbance, and preservation of native vegetation. In Case B, a deliberate focus on preserving existing trees during the construction phase facilitated the attainment of credits for Light Pollution Reduction (SS3). Additionally, the incorporation of expansive gardens and open landscaped areas played a significant role in satisfying the criteria for Site Assessment and Development (SS9). These landscape-driven approaches not only reinforced ecological integrity but also enhanced the aesthetic and recreational value of the built environment. Moreover, land development was executed with minimal ecological disruption across all cases. For example, in Case A, roads and structures were adjusted to avoid cutting down existing trees, and basement parking was preferred over altering the natural terrain. Furthermore, all three cases adopted key sustainable technologies and strategies, including passive solar design, green facades, native landscaping, and renewable energy systems.

In contrast, Case C, while achieving commendable outcomes, scored lower across SS, WE, and MW categories, indicating areas where design integration could have been strengthened. Further, Case C couldn’t achieve higher points in the reuse of previously developed sites and allowance for connectivity of green lands since it was built in the centre of the main city. The use of marked construction boundaries and noise and dust control is also visible in cases A and B to Reduce Site Disturbance, whereas Case C does not reveal such practice. It is recommended to use those mechanisms to gather more points while enhancing the environment's friendliness.

A comprehensive case analysis reveals that all three buildings prioritised energy efficiency through strategic orientation, controlled glare, and ventilation systems. Further, Case B has obtained higher points in energy and atmosphere criteria than the other two buildings. The use of a VRF system as HVAC technology, the use of a multi-V system for distribution instead of using large distribution ducts, and the use of optimised scroll compressors are such advanced techniques utilised by Case B. Though case C has obtained only 68% of the total points allocated for site selection, they have incorporated new design features to achieve the points. It is noticed that energy efficiency will not gain points under energy efficiency criteria, yet adds points to other criteria, including sustainable sites, water efficiency, indoor environment quality, and energy and atmosphere. Moreover, by changing the building orientation and by emphasising energy efficiency, the points for energy and atmosphere can be easily achieved.

Further, several strategic design considerations also contributed to the achievement of key sustainability credits. Specifically, Cases A and C earned points under the category of Occupant Comfort: Daylight and Views (IEQ9) by integrating features including the strategic placement of plants and medium-height trees, along with building orientations that minimise direct solar exposure. In Case A, automatic sensor doors are built, and the chemicals and materials are stored in a separate room in all cases to achieve points under indoor chemical and pollutant source control (IEQ5) criteria. Moreover, provision is given for CO_2 monitoring in all three buildings. These collectively demonstrate a deep integration of sustainability principles into architectural practice, contributing to energy efficiency, occupant comfort, and ecological preservation. These passive design interventions enhanced indoor environmental quality and visual comfort for occupants.

Moreover, under water efficiency criteria, installation of a rainwater harvesting system will provide 2 points, and incorporation of water-efficient fixtures will reduce the water consumption and add more points. Further, the scores for water efficiency are similar in all cases, and the points achievement is low compared to other criteria. Though they have installed a rainwater harvesting system, water efficient fixtures, reuse the water for irrigation, the scores are low due to insufficient achievement of scores in the main criteria. Therefore, more design features and technologies should be utilised to achieve maximum points under the water efficiency criteria.

Finally, to achieve points under the MR & WM criteria, construction waste was recycled in Case A and Case B. In addition, the waste during the operation period is managed properly by categorising and disposing of it weekly in all three buildings. In addition, to achieve points under sub-criteria MR & WM 1 (local/regional materials), locally manufactured materials are utilised in Case A and Case C. Moreover, all three buildings have obtained full marks for the least significant criteria.

An in-depth analysis of the three case studies confirms that many of the green building technologies have been adopted in Sri Lanka to varying extents. However, it is important to note the absence of several advanced technological interventions in the local context. These include but are not limited to colour-changing concrete paving, cement-stabilised earth construction, permeable surface technology, double/triple glazing smart windows, self-regulating building systems, key card access systems, advanced energy management systems, air filtration media, and smart grid technologies.

Critically, the study demonstrates that Green achievement under the GREENSL framework is heavily dependent on thoughtful architectural planning, contextual responsiveness along with technologically intensive solutions. The widespread reliance on passive design strategies indicates a pragmatic adaptation to local climatic, economic, and regulatory conditions. Nevertheless, the limited adoption of innovative technologies suggests that future improvements in green building performance will require stronger integration of advanced sustainable systems, particularly in water management, energy optimisation, and smart building operations. Overall, the findings confirm that while Sri Lanka has made notable progress in incorporating sustainable building principles, there remains significant potential to strengthen environmental performance through a balanced integration of passive design and emerging green technologies.

The collective findings underscore a broader trend in Sri Lankan green building practice including the integration of sustainable design principles is predominantly achieved through design-oriented strategies rather than through the application of high-end technological solutions. This approach not only aligns with the local context and regulatory frameworks yet illustrates a pragmatic application of sustainable principles in building design and site development. The findings summarise the strategies incorporated in each case study to achieve the green certificate.

6. CONCLUSIONS

This study critically examined the design features that contributed to significant Green achievement in GREENSL-certified buildings in Sri Lanka. Findings from the three case studies demonstrated that early-stage design interventions such as passive ventilation, optimised building orientation, preservation of existing vegetation, integration of shading devices, and façade installations are key enablers of higher Green ratings. Moreover, achieving full compliance with minor criteria, despite their lower individual weighting, together with the integration of significant design features in major areas, can result in a higher overall score. Furthermore, it is evident that alignment of design concepts with the rating system criteria from project inception leads to performance improvements and point maximisation across multiple environmental indicators.

The research affirms that technically grounded, performance-oriented design decisions, when implemented at the conceptual design stage, serve as critical determinants of Green point achievement. To advance the efficacy and integrity of green certification in Sri Lanka, the study recommends a twofold strategy: (1) the formal integration of minimum design performance standards into national rating frameworks to ensure baseline compliance with environmental objectives; and (2) targeted capacity-building initiatives for design and construction professionals to promote early-stage incorporation of verifiable sustainability metrics in project planning and execution. Further, from the study it is observed that a lack of knowledge regarding GB construction and GB technologies is one of the major barriers in Sri Lanka. Therefore, it is recommended to acknowledge society by conducting workshops and to provide the basic knowledge about the GBs from the school education to the future generation. These measures are pivotal for transitioning from policy intent to measurable environmental performance across the built environment.

7. REFERENCES

Agyekum, K., Adinyira, E., & Ampratwum, G. (2020). Factors driving the adoption of green certification of buildings in Ghana. *Smart and Sustainable Built Environment*, *9*(4), 595–613. https://doi.org/10.1108/sasbe-02-2019-0017

Akadiri, P. O. (2015). Understanding barriers affecting the selection of sustainable materials in building projects. *Journal of Building Engineering*, *4*, 86–93. https://doi.org/10.1016/J.JOBE.2015.08.006

Chan, A. P. C., Darko, A., Ameyaw, E. E., & Owusu-Manu, D. (2016). Barriers affecting the adoption of green building technologies. *Journal of Management in Engineering*, *33*(3). https://doi.org/10.1061/(asce)me.1943-5479.0000507

Doan, D. T., Ghaffarianhoseini, A., Naismith, N., Zhang, T., Ghaffarianhoseini, A., & Tookey, J. (2017). A critical comparison of green building rating systems. *Building and Environment, 123*, 243–260. https://doi.org/10.1016/j.buildenv.2017.07.007

Green Building Counsil Sri Lanka [GBCSL]. (2022). *GREENSL® Rating system for new constructions.* https://www.srilankagbc.org/wp-content/uploads/2022/08/Green-Building-Rating-System-Version-2.1-FINAL-25-02-2022-1.pdf

Green Building Counsil Sri Lanka [GBCSL]. (2025, December). *Green Rating System for Built Environment*. Green Building Council of Sri Lanka. Retrieved January 31, 2026, from https://www.srilankagbc.org/green-rating-system-for-built-environment/

Hwang, B.G., Zhu, L., & Ming, J. T. T. (2017). Factors affecting productivity in green building construction projects: The case of Singapore. *Journal of Management in Engineering*, *33*(3). https://doi.org/10.1061/(asce)me.1943-5479.0000499

Illeperuma, I.E. and Abeynayake, M.D.T.E., (2022). Drivers and barriers to implement green building practices in higher education institutes in Sri Lanka. In: Y.G. Sandanayake, S. Gunatilake, & K.G.A.S. Waidyasekara, (Eds.), *Proceedings of the 10th World Construction Symposium* (pp. 365-378). Ceylon Institute of Builders, Sri Lanka. https://doi.org/10.31705/WCS.2022.30

Mahagamage, V.C. and Perera, J.L.S.R., (2024). Barriers to adopting and implementing green practices: A Study of Small and Medium-Sized Enterprises (SMEs) in Sri Lanka. In H. Hansson, P. Wickremasinghe, S. Gayanika & T. Hettiarachchi (Eds.), *7th International Conference on Business Innovation*, (pp. 365-378). NIBM Green University, Colombo.

Masyhur, R. T., Alias, A. H., Haron, N. A., & Zulkafli, Z. (2024). A systematic review on green practices in the Malaysian construction industry: Status, challenges, key motivations, rating systems and technology evolution. *Energy and Buildings*, *320*, 114550. https://doi.org/10.1016/j.enbuild.2024.114550

Periyannan, E., Ramachandra, T., & Geekiyanage, D. (2023). Assessment of costs and benefits of green retrofit technologies: Case study of hotel buildings in Sri Lanka. *Journal of Building Engineering*, *78*, 107631. https://doi.org/10.1016/j.jobe.2023.107631

Sachchithananthan, M., & Thayaparan, M. (2024). A framework to select suitable sustainable materials for high-rise buildings in Sri Lanka. *International Journal of Construction Management*. *25*(9), 1072-1086. https://doi.org/10.1080/15623599.2024.2397285

Sachchithananthan, M., Ramachandra, T., Thayananth, M., & Rotimi, J. O. B. (2024). Benchmarking green technologies: a survey of non-domestic buildings in Sri Lanka. *Journal of Building Design and Environment*. https://doi.org/10.70401/jbde.2024.0004

Sandoval, P., & Prakash, A. (2016). The gold rush: The popularity of the gold tier in LEED certification. *Environmental Policy and Governance*, *26*(6), 543–555. https://doi.org/10.1002/eet.1724

Urban Development Authority [UDA]. (2020). *Building applications*. Retrieved January 31, 2026, from https://osu.uda.lk/Download_Documents/Building%20Application%20-%20OSU.zip

Urban Development Authority [UDA]. (2025). *Instructions and guidelines - National green building certification.* Retrieved January 31, 2026, from https://www.uda.gov.lk/attachments/green_building/2025/green_instructions_2025.pdf

Uğur, L. O., & Leblebici, N. (2017). An examination of the LEED green building certification system in terms of construction costs. *Renewable and Sustainable Energy Reviews*, *81*, 1476–1483. https://doi.org/10.1016/j.rser.2017.05.210

United Nations Environmental Programme [UNEP]. (2025). *Global status report for buildings and construction 2024/2025.* https://wedocs.unep.org/bitstreams/d0d91b5a-01c6-4be2-a390-fdd11e8b14c6/download

United States Green Building Council. (2019). *LEED V4 for building design and construction.* https://www.usgbc.org/sites/default/files/LEED%20v4%20BDC_07.25.19_current.pdf

United States Green Building Council [USGBC]. (2026, April 23). *LEED Project Directory, USGBC.* Retrieved July 2, 2026, from https://www.usgbc.org/projects?Country=%5B%22Sri%20Lanka%22%5D

Weerasinghe, S., Ramachandra, T., & Madushika, U. (2022, September 1). *Contribution of green buildings towards achieving sustainability: A perspective of LEED-certified buildings in Sri Lanka*. In *15th International Research Conference, KDU* (pp. 316-325). General Sir John Kotelawala Defence University, Sri Lanka. http://ir.kdu.ac.lk/handle/345/6468

Zhao, C., Liu, M., & Wang, K. (2022). Monetary valuation of the environmental benefits of green building: A case study of China. *Journal of Cleaner Production*, *365*, 132704. https://doi.org/10.1016/j.jclepro.2022.132704