

ADAPTATION OF GREEN BUILDING CONCEPT TO EXISTING GOVERNMENT OFFICE BUILDINGS IN SRI LANKA

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ABSTRACT

At present, the cost spent on constructing, operating, maintaining, and even demolishing buildings has reached an all-time high. When considering a building in operation, 40% to 50% of its costs are the result of energy usage within. Moreover, inefficiently and conventionally constructed buildings contribute to resource wastage in numerous ways, impacting both the environment and society adversely. The Green Building (GB) concept, which is a sustainable development initiative can be considered as a solution as it helps minimise environmental impact and effectively employs resources throughout a building's lifecycle. It guarantees numerous benefits socially, economically, and environmentally. In Sri Lanka many buildings that operate in the private sector have taken the initiative in implementing the GB concept, however, buildings operating in the government or public sector are lagging. This delay can be attributed to several factors, including insufficient funding, limited awareness, and reliance on outdated technology. Through a comprehensive literature review and empirical data from expert interviews and case studies, this research identifies key challenges hindering GB adoption in government sector office buildings in Sri Lanka. Recommendations emphasise the development of a robust framework tailored to government buildings, focusing on regulatory enhancements, stakeholder engagement, and capacity-building initiatives. Such strategies aim to overcome barriers and enhance adoption, fostering sustainability and resilience within the public sector.

Keywords: Green Building; Office Building; Public Sector; Sustainability; Sustainable Development.

1. INTRODUCTION

Buildings occupied by humans will interact with the surrounding environment by affecting stormwater runoff, energy, water consumption, transportation patterns, and indoor air quality (Adetokunbo & Emeka, 2015). Accumulated or uncontrolled actions by humans may result in unfavourable impacts and many other complications to the natural balance of the ecosystem and may result in unfavourable phenomena such as environmental pollution, global warming, destruction of ecosystems, etc. As a result, governments introduce sustainable development policies and practices to avoid such

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impact. GB concept is one such sustainable development initiative that focuses on environmental responsibility and resource efficiency by focusing on energy and water usage, resource utilisation, indoor environmental quality, and many more facets of a building.

However, it is a known fact that Sri Lankan government-owned buildings are comparatively reluctant to adopt the green building concept especially due to their cost investment, corruption involved, lack of maintenance, lack of policy and protocols, etc. Consequently, these buildings often fall short of meeting modern environmental standards and fail to leverage the long-term benefits associated with sustainable practices. This reluctance underscores the urgent need for targeted interventions and policy reforms to overcome these barriers and foster a more sustainable built environment across government office buildings in Sri Lanka. Furthermore, it was observed that there is a shortage of research and study concerning the government sector's involvement in advocating for the concept of green building. Therefore, this study aims to uncover obstacles and difficulties hindering the implementation of GB concepts in Sri Lanka's government office buildings, thus adding valuable insights to existing research.

2. LITERATURE REVIEW

2.1 INTRODUCTION

In many countries, buildings account for 70% of total power usage, highlighting the importance of energy efficiency in the built environment (U.S. Department of Energy, 2008). Research has shown that green buildings can significantly impact employee performance, increase productivity, decrease lifetime costs, and improve staff well-being (Nalewaik & Venters, 2009). Despite extensive research on the financial advantages of GB technologies, there is limited understanding of the other factors that influence their adoption (Darko et al., 2017; Miller et al., 2008). This issue is even more pronounced in government sector office buildings in Sri Lanka.

2.2 ECONOMIC, ENVIRONMENTAL, AND SOCIAL BENEFITS

Numerous studies have demonstrated a link between enhanced worker productivity and green office design elements (Vivian et al., 2003). GB practices can lead to significant cost savings through reduced energy consumption and operational efficiencies (Gan et al., 2020). Further, improved indoor environmental quality in green buildings can enhance employee productivity and well-being, contributing to higher job satisfaction and reduced absenteeism (Elnaklah et al., 2020).

2.3 BARRIERS TO GREEN BUILDING ADOPTION

The higher upfront costs of green buildings present a serious challenge (Geelani et al., 2012). The lengthy pay-back time is another barrier to sustainable building (Millicent et al., 2015). Additionally, there is a widespread misconception that GBs are expensive and challenging for middle and lower-class individuals to access (Azizi et al., 2015). A lack of knowledge and resistance to change are also significant barriers to GB projects (Djokoto et al., 2014; CEC, 2008). The shortage of skills further hampers green construction efforts, leading to potential delays in project completion (Yusof et al., 2012; Millicent et al., 2015).

2.4 GOVERNMENT POLICIES AND PUBLIC SECTOR CHALLENGES

Although Sri Lanka has several regulatory requirements to support local green growth, no specific law or policy focuses on GB construction (National Environmental Act, 1980; Ratnasiri, 2012). Many government-owned buildings in Sri Lanka are in a state of disrepair and lack innovation in multiple aspects (Pirabath, 2019). Government office buildings are commonly recognised as conventional and outdated, lacking sustainable features (Rajanathan, 2015).

2.5 BENEFITS OF GOING GREEN IN PUBLIC SECTOR OFFICE BUILDINGS

Adapting the green concept can help address these challenges. Green office buildings generally lead to better environmental performance than traditional ones (Zuo et al., 2016). Investment in green office buildings ensures long-term cost returns and benefits, as it ultimately offsets the capital invested (Eichholtz et al., 2013). Improved energy efficiency and reduction of Carbon footprint by green office buildings have been identified. Furthermore, green office buildings promote improved occupant health conditions and productivity compared to conventional ones (Singh et al., 2010). Ensuring effective indoor environmental quality is crucial, with features such as greenery, proper lighting, ventilation, and space planning enhancing a safe workplace (Colenberg et al., 2020). Several GB certification systems, including LEED and WELL Building Standard, acknowledge the significance of biophilic design (Degroff, n.d.). Effective implementation of biophilic design can enhance comfort and pleasure, boost productivity, decrease blood pressure, alleviate sick-building syndrome, promote better health, and raise employee motivation (Kellert & Calabrese, 2015; Tharim et al., 2022).

While the potential benefits of green building practices are well-documented, the challenges to their adoption, particularly in the public sector, must be addressed. Overcoming barriers such as high upfront costs, lack of knowledge, and resistance to change is crucial for the successful integration of green building technologies in Sri Lanka's public sector buildings. Continued research and policy development are needed to promote sustainable building practices and realise their full potential benefits.

3. METHODOLOGY

Data collection for this study was conducted in two phases. Phase 1 consisted of a case study analysis which was later followed up by expert interviews. For the case study, six government office buildings in the Colombo district were selected. The main purpose of this data collection was to identify the challenges and barriers to adopting the green concept in government office buildings. To achieve the research objectives, case study interviews were conducted through structured questionnaires to obtain information related to the research. Data collected from these buildings and their responses were analysed through manual content analysis.

Table 1 depicts the information of the case study participants in this research.

Table 1: Information on case studies

Case Name	Case description	Respondent name	Respondent description
B1	A building that has attempted to follow the green building concept, but latterly failed.	R1	Maintenance Officer
B2	An old building	R2	Landscape Architect
B3	A newly constructed building	R3	Facilities Manager (Trainee)
B4	A renovated building which has gained all the provisions for green features but cannot proceed due to some reasons.	R4	Senior Scientist
B5	An average-level building.	R5	Facilities Manager
B6	A green building.	R6	Maintenance in charge

As depicted in Table 1, 6 government office buildings of various conditions were subjected to study as the green building adaption and adaptability can be varied based on its structure, innovativeness, and condition. Hence the study has adopted the purposive sampling method. The study further included interviews with respondents beyond facilities management, such as a landscape architect and senior scientist. Their involvement enriched the research by providing specialised insights: the landscape architect contributed expertise in sustainable design and outdoor environment integration, while the senior scientist offered perspectives on environmental impact and technological advancements. Importantly, their inclusion did not compromise the quality of information gathered. Instead, it broadened the study's scope, allowing for a comprehensive exploration of green building practices in office settings. Furthermore, these case studies facilitated direct site visits, interactions with occupants (employees), investigations, and observations, all contributing to an understanding through practical experience. Hence, the findings were not solely relied upon by the respondents.

Two expert interviews were later conducted to validate the data generated through the case studies. Table 2 shows the summarised information of the experts involved.

Table 2: Information of experts

Respondent name	Respondent description
E1	Assistant Director – Landscape division
E2	Facilities Manager

The rationale for choosing the two specialists, a landscape architect and a facilities manager, for validation purposes is based on their complementing knowledge and viewpoints. The Assistant Director in the Landscape Division possesses specialised expertise in outdoor environments, site planning, and vegetation, which is essential for assessing the impact of external factors on building performance. Besides, his extensive tenure in government buildings and his overall understanding of the building and its

workings helped immensely. On the other hand, the facilities manager is highly knowledgeable in optimising operational efficiencies, implementing effective maintenance procedures, and addressing user requirements in the building environment. By integrating these two viewpoints, the goal is to attain a thorough validation of research findings, guaranteeing a comprehensive evaluation of both external and internal elements that impact building functionality and user experience.

The research process of this study is summarised in Figure 1.

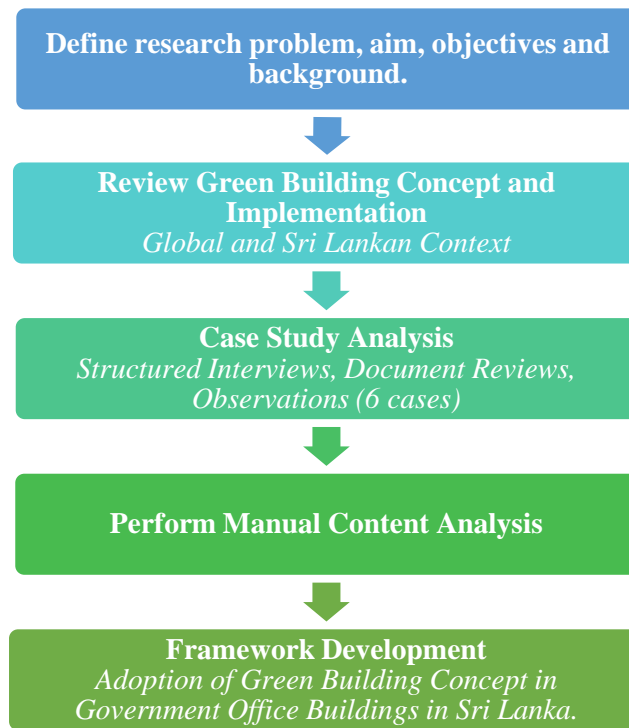


Figure 1: Research process

4. FINDINGS AND DATA ANALYSIS

4.1 FINDINGS OF CASE STUDY

4.1.1 Phase 1-Case Studies

Data collection from case studies was executed based on an interview guideline which mainly covered areas such as current practices followed, awareness of the GB concept, and feasibility of converting and maintaining a government office building. As the first step, it was crucial to establish that the interviewees were aware of the “GB concept”. Accordingly, it was evident that the interviewees had a clear idea about the concept and also found it a necessary practice.

Subsequently, it was crucial to understand the current standpoint of government office buildings in the adaptation of the GB concept. According to the results generated, it was evident that three buildings from the six that were considered under the case study had claimed to adopt the green building concept. Table 3 summarises the current practices followed.

Table 3: Current practices of green building concept in government office buildings in Sri Lanka

Case	Practice GB	Green building features within the building premises			
		Water efficiency	Energy efficiency	IEQ	Sustainable resources
B1	Yes	Rainwater harvesting	Utilising LED bulbs Solar power generation	Natural ventilation through vertical greenery	-
B2	No	-	Utilising LED bulbs	-	-
B3	No	-	Daylighting Energy efficient HVAC system, Windows	CO ₂ sensors Daylighting	Proper waste management process
B4	Yes	Zoning and metering	Daylighting Energy efficient HVAC system, Windows	Lighting controlling	Proper waste management process 3R concept
B5	No	-	Solar power generation	-	Proper waste management process
B6	Yes	Rainwater harvesting Wastewater treatment plant	Daylighting Energy efficient HVAC system, Windows Solar power generation	Noise control Visual Adequate ventilation	Proper waste management process

According to Table 3, the GB concept was not adopted by an old building, a newly constructed building, or an average-level building. Despite their non-adherence to these practices, they still incorporate some green features introduced under the criteria by LEEDs (Water efficiency, Energy efficiency, IEQ, Sustainable resources) such as utilising solar power generation and energy-efficient characteristics. Among the GB features followed by government office buildings rainwater harvest harvesting, indoor environmental controls, waste management, and energy-efficient measures can be identified.

While all interviewees agreed on the fact that GB concept could bring significant value to government office buildings in Sri Lanka, they however stated that certain barriers and concerns. Table 4 summarises the main barriers faced by government office buildings in adopting the GB concept based on both the literature review and data collection in this study.

Table 4: Barriers to follow the green building concept in government office buildings

Barriers	Respondents						Count
	R1	R2	R3	R4	R5	R6	
Financial Barriers		✓		✓	✓		3/6
Knowledge Barriers	✓	✓	✓	✓		✓	5/6
Management Inefficiency	✓			✓		✓	3/6
Lack of Facilities		✓					1/6
Social Barriers		✓	✓	✓		✓	4/6
Lack of Support	✓	✓					2/6

According to Table 4, it is evident that there are mainly six barriers that affect the implementation of the green building concept such as financial barriers, knowledge

barriers, management inefficiencies, lack of facilities, social barriers, and lack of support. Among them knowledge barriers are reportedly the highest. As per the perception of the interviewees, there is no effective knowledge transfer regarding this concept to the occupants and employees and most of the occupants are almost unaware of the GB concept. Interviewees further stated that the experts working on promoting the GB concept had failed in their task as a result. The interviewees further stated that there are issues in the project management aspects due to the building being designed by one party and built by another, employee turnover, and as a result, the current employees in charge are unaware of the building, and its workings. This has led to difficulties in implementing not only the GB concept but also other changes to the building. Another factor highlighted was that even though most buildings make provisions to adopt the GB concept they do not make any provisions afterwards to maintain and continue. Financial barriers which were recorded acted as a significant barrier that reduced the chances of organisations in making green investments.

As detailed earlier, government office buildings encounter numerous obstacles in embracing the green building concept. Nonetheless, several officials expressed the view that enhanced government engagement could significantly impact this situation. The fact that the government should conduct awareness programs and it should be done starting at the school level, institutional level, and national level was also emphasised. In addition, it was mentioned that the government and regulatory bodies should work in accordance to encourage financial convenience in green investments. In addition, the importance of proper documentation and project management practices in green project continuation was emphasised. It was further stated that to get financial relief, GB certification organisations should revise the fee charged to encourage green practitioners.

The main goal of this study is to produce strategies to adapt the GB concept to government office buildings in Sri Lanka. To accomplish this goal inquiries were made regarding the incorporation of GB elements into government office structures. Respondents were surveyed on four key aspects: water efficiency, energy efficiency, indoor environmental quality, and sustainable resource usage. Table 5 explains the applicability of the GB concept to the selected buildings as per the interviewees and literature findings.

Table 5: Applicability of GB concept to the selected buildings

GB Feature	Applicability to the selected buildings						
	B1	B2	B3	B4	B5	B6	Count
Water efficiency							
Wastewater treatment plant				✓		✓	2/6
Rainwater harvesting	✓	✓	✓	✓	✓	✓	6/6
Water-efficient fittings and fixtures	✓	✓	✓	✓	✓	✓	6/6
Energy efficiency							
Energy efficient lighting system	✓	✓	✓	✓	✓	✓	6/6
Smart HVAC systems			✓	✓		✓	3/6
Solar roof panels	✓	✓	✓	✓	✓	✓	6/6
Energy efficient windows	✓	✓	✓	✓	✓	✓	6/6
IEQ measures							
Lighting control and daylighting	✓	✓	✓	✓		✓	5/6
Blinders	✓		✓			✓	3/6

GB Feature	Applicability to the selected buildings						
	B1	B2	B3	B4	B5	B6	Count
Exhaust fans				✓		✓	2/6
CO ₂ sensors	✓		✓	✓		✓	4/6
Sustainable materials and resource usage							
3R concept	✓	✓	✓	✓	✓	✓	6/6
Waste management	✓	✓	✓	✓	✓	✓	6/6

Table 5 describes the extent to which crucial GB features can be adapted to the selected government office buildings in the study. Accordingly, only one building had adopted all the green features, while others had only a few. Therefore, opinions were sought on implementing these features in government office buildings. Responses indicated that rainwater harvesting, water-efficient fixtures, energy-efficient lighting, solar panels, energy-efficient windows, the 3R concept, and waste management could be easily adopted in government office buildings. However, wastewater treatment plants and exhaust fans were identified as challenging to implement in these buildings. Furthermore, there was limited feedback on the feasibility of smart HVAC systems and blinders. Reasons for this are mainly that government buildings are not being generous in investing in highly costly projects. Furthermore, newly constructed buildings had a supportive structure to adopt mentioned GB features due to the flexibility in construction.

However, before the introduction of a novel concept or practice in a building, it is crucial to study the level of employee/occupant awareness in successful execution and continuation. Hence the respondents were questioned about the employee’s level of awareness and support regarding the GB concept.

Table 6: Employees' awareness of the GB concept

Case Name	Employees' awareness of the GB concept
B1	
B2	
B3	✓
B4	
B5	
B6	✓

Table 6 indicates that employees in only two organisations are fully informed about the GB concept. These organisations are: B-the organisation that attempted but failed to implement the GB concept, and B6-the certified GB. Hence it is evident that there is a lack of knowledge and support when it comes to GB in government sector office buildings. The participants suggested that informing employees about new features and gaining their support should be a solution. They recommended conducting awareness programs from higher to lower positions within the organisation and involving industry experts and management in these programs.

Finally, the respondents affirmed their preference for adapting green culture to government office buildings and further stated that adaptation would help them yield the below benefits.

Table 7: Benefits of following the GB Concept

Benefits	Respondents name						Count
	R1	R2	R3	R4	R5	R6	
Energy saving	✓	✓		✓	✓		4/6
Cost saving	✓	✓	✓	✓	✓	✓	6/6
Reducing resource usage	✓			✓	✓	✓	4/6
Creating a healthy working environment		✓	✓			✓	3/6
Increasing employee productivity and organisation culture		✓	✓				2/6
Character development	✓	✓					2/6

According to Table 7, cost benefits were the most anticipated in the adaptation of the GB concept, other than that the interviewees also expected energy savings and reduced resource usage. Increased employee development and character development were the least expected benefits.

4.1.2 Phase 2- Expert Interviews

Expert interviews were conducted aiming to confirm the accuracy of the information obtained from the case study interviews. The main purpose of this is to indicate that the output of the research is more accurate and transparent. Primarily, two experts were involved in this phase, one specialised in adhering to the urban development authority guidelines mandated for constructing government buildings, as ratified by the government in 2017, while the other was a facility manager employed abroad.

Although the experts noted that the government sector is less likely to adopt the green concept, they emphasised that this is because public institutions embrace the concept first yet less concerned with keeping it up to date. On the other hand, as E2 pointed out, based on reasons such as the unavailability of long-time national policies, absence of innovation and researchers, unawareness of the GB concept in SL government leaders, negative attitude toward building concept, use of outdated technologies, corruption from top to bottom of government leaders and employees, consumption of outdated online technologies, this concept is rarely applied to government institutions. It was further stated that the GB concept is rarely adopted in old and renovated buildings due to structural inefficiencies.

The experts did note that identifying distinct barriers and drivers for GB concept adaptation may aid in GB concept adaptation successfully. Barriers to adaptation that were mentioned in Table 8.

Table 8: Barriers to adopting GB concept to existing government office buildings

Barriers	Respondent	
	E1	E2
Unavailability of national policies and standards		✓
Budget constraints	✓	✓
Technological barriers		✓
Poor government leadership and poor consultation by the responsible positions	✓	✓
Poor investment in research and development projects		✓
Unawareness and negative attitude	✓	✓
Lack of ongoing performance evaluation and management		✓

Three primary factors hindering the adoption of green practices include financial limitations, inadequate government leadership and consultation, and a lack of awareness coupled with a negative mindset. In addition issues such as the unavailability of national policies and standards, technological barriers, poor investment in research and development projects and unavailability of continuous performance evaluation and management affected the implementation of the GB concept in government office buildings.

Nevertheless, factors such as regulatory incentives and stakeholder support were noted to influence the adoption of green practices. Guidelines established by professional organisations such as the Green Building Council of Sri Lanka (GBCSL), the Urban Development Authority Sri Lanka (UDA), and the Sustainable Development Council of Sri Lanka (SDCSL) can serve as valuable references. It was said that everyone in the government, including specialists, the general public, and workers, should support the implementation of GB. It was underlined that this idea provides advantages for individuals, institutions, the nation, and society at large. In addition, it was recommended that awareness campaigns should be launched to spread the word about this idea. However, the fact that the government should initiative in this matter was emphasised.

5. DISCUSSION

Literature reviews depict a green building as one that maximises resource efficiency, including water, energy, and materials, aiming to reduce negative environmental and health impacts. It revealed obstacles such as financial, regulatory, social, knowledge, and industrial barriers-that impede the implementation of GB concepts in Sri Lanka government-owned buildings including office buildings. Furthermore, several key factors that influence the construction of GB such as regulatory incentives, stakeholder support, ecological considerations, and social responsibility were revealed. Additionally, essential elements such as water efficiency, energy efficiency, indoor environmental quality, staff training, and effective material and resource usage were identified as crucial components of the implementation process.

Just as there has been limited research conducted on the adoption of GB practices in government sector buildings, there are relatively few buildings that have obtained green building certification. As per the findings, only one building had the GB certification while the rest claimed to adopt few GB features. As factors that hindered the adaptation of old structures and condition of buildings, financial barriers, poor project management practices, knowledge barriers, and lack of managerial involvement and support were identified and this fact was later affirmed not only by the literature findings yet by the case studies and experts. Other than that the existence of corruption and fraud in the government sector too was highlighted by the experts. However, drivers that motivated the adaptation availability of various rules and regulations by leading professional bodies such as GBCSL, UDASL, and SDCSL were mentioned. Other than that drivers such as government and non-government encouragement, client's demand, contractor's support, environmental sustainability, and social responsibility were identified. Regardless of these drivers, Government office buildings have failed to adopt the GB concept and are intensively lagging especially due to the lack of finances, poor research and development in this area, and poor project management and handling practices. The interviewees and experts further affirmed that lack of action in continuous development and improvement, maintenance, and lack of authority were other key factors that hindered GB's adaptability.

Respondents largely proposed government support as the primary solution to overcoming obstacles in implementing green practices in government office buildings. Suggestions included government-led awareness programs spanning from schools to national levels, a collaboration between government bodies and regulatory agencies to facilitate financial assistance, and the presence of designated representatives involved from building construction to usage. Additionally, it was suggested that GB certification organisations should reconsider their fees to provide financial relief.

However, it is more than evident that actions to implement the GB concept should be taken at each level; individually, institutionally, and at the national level.

Figure 2 presents a summary of the findings of this research.



Figure 2: Framework for green building concept for office buildings in Sri Lanka

This framework guides government office buildings in adopting GB concepts to achieve benefits at national, organisational, and individual levels. It emphasises energy efficiency, sustainable site planning, sustainable materials, quality interior environments, and water efficiency, supported by guidelines from certification bodies such as Blue Green Sri Lanka and the GREENSL® Rating System. These practices can address energy and economic crises, conserve natural resources, and enhance work environments, boosting productivity and organisational culture. Implementation challenges include social barriers (traditional practices, negative attitudes, unawareness) and industrial barriers (lack of facilities, technological challenges, risk, and uncertainty). Overcoming these requires

government support, industry expert involvement, establishing roles such as Facilities Manager and Green Officer, and public awareness campaigns. Supporting measures include laws and legislation for GB, transparent tendering for sustainable projects, investments in research and development, and integrating sustainable development into education with practical, innovation-focused curricula.

6. CONCLUSIONS AND RECOMMENDATIONS

The background investigation revealed a lower inclination of Sri Lankan government buildings towards adopting the green concept. Hence this study aims to assess the effectiveness of implementing the GB concept in existing government office buildings, taking these findings into account. Initially, literature findings guided the identification of the implementation process for the green concept, highlighting a focus on energy-efficient lighting, daylighting, and waste management, with limited attention to water efficiency and Indoor Environmental Quality (IEQ) measures. Case study findings underscored barriers to implementing the concept in such buildings, including financial constraints, knowledge gaps, management inefficiencies, inadequate facilities, societal hindrances, and lack of support. Ultimately, the synthesis of literature review findings and analysis outcomes paved the way for the adaptation of the GB concept in existing government office buildings by identifying various barriers, drivers, and difficulties faced.

7. REFERENCES

- Abdul Tharim, A. H., Ahmad, A. C., Saarani, P. S. N., Haossain, N. Q. R., Purwanto, E., Tafridj, I. S. I., Purisari, R., & Prasetyo, T. (2022). The determinant factors of biophilic design strategies and occupants' psychological performance in office building. *Malaysian Journal of Sustainable Environment*, Special Issue, June, 87-106. doi: 10.24191/myse.v9i3.18292.
- Adetokunbo, I., & Emeka, M. (2015). Urbanization, housing, homelessness and climate change. *Journal of Design and Built Environment*, 15(2), 12. <https://doi.org/10.22452/jdbe.vol15no2.3>
- Azizi, N. Z. M., Abidin, N. Z., & Raofuddin, A. (2015). Identification of soft cost elements in green projects: Exploring experts' experience. *Procedia - Social and Behavioral Sciences*, 170(1), 18-26. <https://doi.org/10.1016/j.sbspro.2015.01.009>
- Council of the Commission for Environmental Cooperation. (2008, May 30). Green Building in North America. Retrieved from Opportunities and Challenges: <http://www3.cec.org/islandora/en/item/2335-green-building-in-north-america-opportunities-and-challenges-en.pdf>
- Colenberg, S., Jylhä, T., & Arkesteijn, M. (2020). The relationship between interior office space and employee health and well-being – a literature review. *Building Research & Information*, 49(3), 352–366. <https://doi.org/10.1080/09613218.2019.1710098>
- Darko, A., Chan, A. P. C., Ameyaw, E. E., He, B.-J., & Olanipekun, A. O. (2017). Examining issues influencing green building technologies adoption: The United States green building experts' perspectives. *Energy and Buildings*, 144, 320-332. <https://doi.org/10.1016/j.enbuild.2017.03.060>
- Elnaklah, R., Fosas, D., & Natarajan, S. (2020). Indoor environment quality and work performance in “green” office buildings in the Middle East. *Building Simulation*, 13(5), 1043-1062. <https://doi.org/10.1007/s12273-020-0695-1>
- Eichholtz, P., Kok, N., & Quigley, J. M. (2013). The economics of green building. *Review of Economics and Statistics*, 95 (1), 50–63. Retrieved from <https://EconPapers.repec.org/RePEc:gam:jsusta:v:13:y:2021:i:24:p:13863-d:703081>
- Gan, V. J. L., Lo, I. M. C., Ma, J., Tse, K. T., Cheng, J. C. P., & Chan, C. M. (2020). Simulation optimization towards energy-efficient green buildings: Current status and future trends. *Journal of Cleaner Production*, 254, 120012. <https://doi.org/10.1016/j.jclepro.2020.120012>

- Geelani, S., Geelani, S., Bhat, S., Haq, S., Mir, N., Junaid, S., & Zafar, B. (2012). Green building development for a sustainable environment with special reference to India. *International Journal of Environment and Bioenergy*, 4(2), 86-100. <https://api.semanticscholar.org/CorpusID:116287779>
- Miller, N., Spivey, J., & Florance, A. (2008). Does green pay off? *Journal of Real Estate Portfolio Management*, 14(4), 385-400. <https://doi.org/10.1080/10835547.2008.12089822>
- Millicent, A.-K., William, G.-A., & Simon, A. O. (2015). Sustainable construction implementation in Ghana: Focusing on awareness and challenges. *Civil and Environmental Research*, 7(6), 1-12. Retrieved from <https://core.ac.uk/reader/234677960>.
- Nalewaik, A., & Venters, V. (2009). Cost Benefits of Building Green. *Cost Engineering*. pp. 28–34.
- National Environmental Act. (1980). *No 47 of 1980*. Colombo: Government Publication Bureau.
- Pirabath, M.D.C., Rajini, D., Mahendrarajah, G., & Premanathan, T. (2019, December). *Space planning and management practices in government office buildings: Case studies in Sri Lanka*. Paper presented at the 10th International Conference on Sustainable Built Environment (ICSBE), Sri Lanka.
- Ratnasiri, J. (2012). Sustainable Development - Is Sri Lanka on the Right Path? *Professor A.W.Mailvaganam Memorial Oration*, (pp. 1-11). Colombo.
- Singh, A., Syal, M., Grady, S., & Korkmaz, S. (2010). Effects of green buildings on employee health and productivity. *American Journal of Public Health*, 100(9), 1665-1668. <https://doi.org/10.2105/AJPH.2009.180192>
- Vivian , L., Volker , H., & Beran , G. (2003). Linking Energy to Health and Productivity in the Built Environment Evaluating the Cost-Benefits of High Performance Building and Community Design for Sustainability, Health and Productivity. Center for Building Performance and Diagnostics, Carnegie Mellon University.
- Wanniarachchi, D. (2022, September 1). The reasons for the failure of public projects in Sri Lanka as a developing country and the state of the country after the failure, with a main focus on the Mattala airport project. Retrieved from https://www.researchgate.net/publication/363174919_The_reasons_for_the_failure_of_public_projects_in_sri_lanka_as_a_developing_country_and_the_state_of_the_country_after_the_failure_With_a_mainly_focus_on_the_mattala_airport_project
- U.S. Energy. (2008, October). *Energy efficiency trends in residential*. Retrieved from http://apps1.eere.energy.gov/buildings/publications/pdfs/corporate/bt_stateindustry.pdf
- Yusof, N., Awang, H., & Abidin, N. (2012). A foresight into green housing industry in Malaysia. *World Academy of Science, Engineering and Technology: International Journal of Environmental, Chemical, Ecological, Geological and Geophysical Engineering*, 6(2), 55-63. doi.org/10.5281/zenodo.1081413