Challenges and potential attributes of green building path based on sustainability in case of Hargeisa city, Somaliland.

Abdirisak Hassan Abdi

A Thesis Submitted to the Department of Architecture

The College of Civil Engineering and Architecture

Presented in Partial Fulfillment of the Requirement for the Degree of Master's in Environmental Architecture

Office of Graduate Studies

Adama Science and Technology University

May, 2025

Adama, Ethiopia

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DECLARATION

I hereby declare that this Master Thesis entitled "Challenges and potential attributes of green building path based on sustainability in Hargeisa, Somaliland" is my original work. That is, it has not been submitted for the award of any academic degree, diploma or certificate in any other university. All sources of materials that are used for this thesis have been duly acknowledged through citation

Name of student	Signature	Date

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I, the advisor(s) of this thesis, hereby certify that I/we have read the revised version of the thesis entitled "Challenges and potential attributes of green building path based on sustainability in Hargeisa, Somaliland" prepared under my guidance by Abdirisak Hassan submitted in partial fulfillment of the requirements for the degree of
Masters of Science in Environmental Architecture. Therefore, I recommend the submission of revised version of the thesis to the department following the applicable procedures.

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I, the advisors of the thesis entitled "Challenges and potential attributes of green building path based on sustainability in Hargeisa, Somaliland" and developed by Abdirisak Hassan Abdi, hereby certify that the recommendation and suggestions made by the board of examiners are appropriately incorporated into the final version of the thesis.

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ABSTRACT

Sustainable development aims to foster healthier living environments and enhance quality of life by balancing environmental, social, and economic considerations. While the construction industry is pivotal in advancing sustainability, it faces substantial challenges, particularly in adopting new technologies and transitioning from conventional to sustainable practices. In Hargeisa, Somaliland, many modern buildings often did not reflect local environmental and cultural contexts, with construction practices frequently influenced by foreign architectural styles and materials unsuitable for the local climate, leading to less sustainable and comfortable structures. This study assessed the challenges hindering the adoption of green building practices and identified green building rating attributes with contextual relevance to Hargeisa. A mixed-methods research design was employed, combining quantitative data from 105 survey respondents with qualitative insights from expert interviews. The findings indicated that high initial costs, a lack of awareness among clients and investors, and insufficient professional expertise were the major barriers to implementing green building principles. The study also found that many internationally recognized green building rating attributes were perceived as relevant and potentially applicable in the local context. Based on this analysis, the study recommended improving awareness and education, strengthening government support, and developing localized green building standards to facilitate sustainable construction practices in Hargeisa.

Keywords: Green Building, Sustainability, Sustainable Development, Hargeisa, Challenges

LIST OF ABBREVATIONS

Abbreviation	Meaning
ASTM	American Society for Testing and Materials
BIM	Building Information Modeling
BREEAM	Building Research Establishment Environmental Assessment Method
CO2	Carbon Dioxide
GBC	Green Building Council
GB	Green Building
GDP	Gross Domestic Product
GRIHA	Green Rating for Integrated Habitat Assessment
IEQ	Indoor Environmental Quality
LEED	Leadership in Energy and Environmental Design
LCC	Life Cycle Cost
3R	Reduce, Reuse, Recycle
BRICS	Brazil, Russia, India, China, South Africa
SDC	Sustainable Design and Construction
WE R GREEN	Waste, Energy, Resources: Green Optimization Program
6E	Energy, Efficiency, Environment, Economy, Equity, and Education

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CHAPTER ONE

INTRODUCTION

1.1. Background of the study

The concept of green building, also known as high-performance or sustainable building, has evolved over centuries, with modern sustainable construction gaining momentum due to increasing energy efficiency demands and the oil crises of the 1970s. These developments underscored the importance of environmental concerns and resource efficiency in building design and implementation, leading to a growing focus on reducing the environmental impact of construction practices(Withdraw 2024).

Green building architecture refers to the design and construction practices that prioritize environmental sustainability, resource efficiency, and the well-being of occupants. This approach integrates advanced technologies and sustainable materials to enhance energy and water efficiency while minimizing ecological impact throughout a building's life cycle (Withdraw 2024; Xi 2024). Key principles include the use of renewable energy sources, passive solar design, and smart building systems, which collectively contribute to reduced carbon emissions and operational costs (Abeywardhana 2024; Pasupuleti 2024). Furthermore, green building practices foster community resilience and improve quality of life by creating healthier urban environments that promote social equity and vibrant neighborhoods (Smith, 2024). Overall, green building architecture embodies a holistic approach to construction that aligns with sustainable development goals, addressing both environmental and social challenges in urban settings (Xi 2024; Smith 2024).

Sustainability in modern construction is crucial both globally and locally, as it addresses pressing environmental, economic, and social challenges. The construction sector is responsible for approximately 40% of global energy consumption, highlighting its significant impact on sustainability efforts (Grover, 2024). Sustainable construction practices, such as the integration of green building solutions and smart technologies, not only reduce carbon emissions and operational costs but also enhance property values and community well-being (Withdraw 2024; Moshood, Rotimi, and Shahzad 2024). Case studies, like those of eco-friendly buildings in Poland, demonstrate the successful application of sustainable principles, including the 6E concept and the 3R principle, which promote ecological efficiency and aesthetic integration with the environment (Kosakiewicz et al. 2024). However, the effective implementation of these practices is often hindered by weak regulations and a lack of awareness among stakeholders (Mishara 2024; Moshood, Rotimi, and Shahzad 2024). Thus, fostering a comprehensive understanding of sustainability in construction is essential for achieving long-term benefits for future generations (Kosakiewicz et al. 2024; Chhabra and Grover 2024).

The global need for environmentally friendly construction practices is particularly pressing in developing regions, where rapid urbanization and resource constraints exacerbate environmental degradation. Research indicates that integrating green building practices and smart technologies can significantly enhance energy efficiency and reduce operational costs, despite challenges such as financial limitations and inadequate policy frameworks (Imafidon, Enwerem, and Boye 2024).

In Nigeria, for instance, strategies focusing on capacity-building, regulatory reforms, and financial incentives have been identified as crucial for promoting sustainable construction practices (Aliu, 2024). Moreover, the construction sector in emerging economies, notably within BRICS nations, is a major contributor to carbon emissions, necessitating a shift towards low-carbon practices throughout the building lifecycle (Dalla Valle 2024). By adopting sustainable materials and innovative construction techniques, developing countries can not only mitigate environmental impacts but also foster healthier living environments, thereby aligning with global sustainability goals(Windapo and Umeokafor 2023; M. V. Kumar 2024).

In the context of Hargeisa, the construction sector is at a crucial juncture where the potential for green building practices must be explored. Despite the significant advantages of sustainable construction, the region faces unique challenges that hinder its implementation. These challenges include a lack of awareness, insufficient infrastructure, and limited access to technology and resources.

Resources show that in Somaliland, the green movement has not received considerable attention compared to the western world. Sustainable initiatives are hard to come by and challenging to execute. There is a need for construction experts to put in more effort to realize the green agenda in parallel with other western countries to advance toward sustainable growth. Creating a local construction industry that is capable and viable is the first step in starting this drive towards creating a sustainable construction industry in Somaliland. The second step is a conscious effort by the construction industry to adapt to the demand for sustainable construction in all aspects of its operation. This is only possible if all parties collaborate to implement and support this change.

1.2. Problem statement

Given that the construction team frequently needs to evaluate alternative materials and systems, green building construction can be challenging. Since green building projects have many distinctive design features that are uncommon in conventional buildings and call for deep integration, a holistic and integrated design process is used from the very beginning of the project.

In Somaliland, the theory of green building is still relatively uncommon to be practiced in the construction sector. Currently, there is no sufficient locally customized standard for green building, which results in a lack of professional dialogue, an oversimplified understanding of the issue, and, worst of all, a practical lack of implementation in practice. Somaliland green building is a highly complicated topic. Along with using architecture to convey a sense of modernity and durability, producing long-lasting buildings demands the integration of socio-cultural components and urban design.

There is a global concern about the building industry's contribution to sustainability. However, compared to the industrialized world, developing nations face considerably larger and more complicated difficulties. Low income, inadequate water supply systems, nascent sanitation systems, inadequate education and health systems, a lack of qualified human resources, financial issues, and many other issues are common in developing nations. The most fundamental human needs are so frequently not being addressed, in contrast to the developed world where in many cases these needs have even been exceeded (Baloi 2003).

Data gathered from Hargeisa Municipality shows that there are no LEED-certified green buildings in Hargeisa. The impact of green buildings is clear, despite numerous obstacles, such as a lack of awareness, outdated technology, and a lack of incentives for research and practice in this area.

The impact on the environment will only increase as urbanization and economic development in the city continue to grow, so improving the environmental performance of buildings through the use of green building concepts is crucial for stronger sustainability efforts. Additionally, for the execution of its ideas, architects, developers, contractors, residents, and government officials need to have a deeper knowledge.

Therefore, this thesis aims to fill this gap in the green building area and its application in Somaliland by assessing the building practice in Hargeisa focusing on green building principles, challenges, relevant attributes, and possible strategies for its adoption and implementation so as to mitigate climate change and achieve sustainable development. The study is expected to provide structured knowledge on the fundamental issues preventing sustainable construction adoption and find a solution accordingly. The research is believed to create awareness of green building implementation challenges and the contextual potential of the fundamental attributes in Hargeisa city.

1.3. Objective of the study

1.3.1. General objective

The general objective of this study is to assess the challenges and explore appropriate approaches for the application and implementation of green building principles in Hargeisa, Somaliland.

1.3.2. Specific objectives

1. To examine the challenges involved in implementing Green Building principles.
2. To identify the level of relevance of green building rating attributes that could potentially be adopted in Hargeisa context.
3. To develop context-based strategies to promote the practices of green building in Hargeisa context.

1.4. Research questions

1. What are the challenges to the adoption of green building practices in Hargeisa, Somaliland?
2. What green building rating attributes are potentially applicable and have contextual relevance to the construction industry in Hargeisa?
3. What context-based strategies can be developed to promote green building practices in Hargeisa?

1.5. Scope of the study

This section defines the precise boundaries and focus of the research, ensuring clarity regarding its thematic, spatial, and temporal dimensions.

1.5.1 Thematic Scope

This study focuses on the following key thematic areas within green building practices in Hargeisa:

- Challenges related to the practice of green buildings.
- Identification and evaluation of green building attributes with the potential for implementation in Hargeisa.
- Specific aspects of green building attributes, including indoor air quality, energy usage, sustainable sites, water conservation, and building materials.

1.5.2 Spatial Scope

The geographical scope of this research is confined solely to Hargeisa, Somaliland.

1.5.3 Temporal Scope

The data collection for this study was conducted from February 2025 to April 2025.

1.6. Significance of the study

1.6.1 Significance to the Researcher

This section typically articulates the personal and professional growth gained by the researcher through conducting the study, the fulfillment of academic requirements, and the development of expertise in the subject area. (Your provided text does not contain this specific point, so you may want to add a sentence or two reflecting your own personal significance here.)

1.6.2 Significance to the City Administration of Hargeisa and Policymakers

This research provides valuable recommendations aimed at enhancing the acceptance and implementation of sustainability principles in buildings within Hargeisa. By analyzing the obstacles faced in the construction sector and identifying the most appropriate green technologies for the local context, the study offers practical insights that can inform urban development strategies and reinforce the feasibility of green building concepts. It is anticipated to impact the practices of consultants in Somaliland's construction industry, thereby supporting the city's broader sustainability goals.

1.6.3 Significance to the Scientific Community

As one of the rare studies investigating the opportunities and difficulties of green building implementation specifically in Hargeisa, this research contributes important insights to the existing body of knowledge. It enhances the understanding of green building concepts, their integration, and their role in advancing sustainability in building design and construction, particularly in a context-specific manner. Furthermore, this study serves as a valuable resource for academics and industry professionals interested in the latest innovations and challenges within the field of green building.

1.7. Limitations of the research

The primary limiting the research is the absence of previous studies on green buildings, particularly within the local context, and a lack of well-documented guidelines. Additionally, since the concept of green building is still relatively novel, there were several communication challenges with municipalities and participating firms. Another difficulty was the challenge of identifying consulting firms with practical experience in green building projects

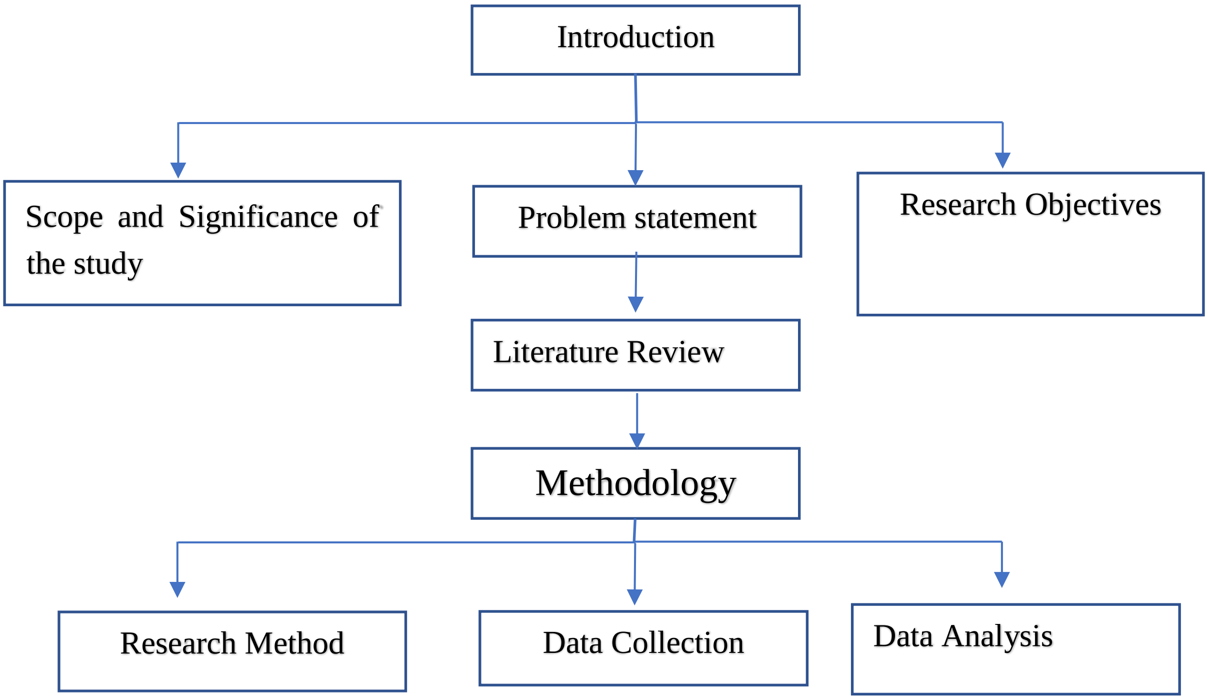
1.8. Justification for Research

- Sustainable Development: Addressing GBP can lead to sustainable urban growth, particularly in rapidly urbanizing areas like Somaliland (Hassan et al. 2024).
- Community Resilience: Initiatives like the become project emphasize the importance of sustainable housing, which could be adapted to Somaliland's context (Bellini et al. 2020).

Despite the pressing need for GBP research in Somaliland, the current focus remains insufficient, underscoring the necessity for dedicated studies to foster sustainable practices in the region.

1.9 Organization of the document

The following diagram illustrates the flow of the research:



CHAPTER TWO

LITERATURE REVIEW

The many literatures that were reviewed for this study are covered in this chapter. The literature review begins by introducing the idea of green buildings, outlining its history, and outlining its guiding principles. Second, there is a discussion of the advantages and difficulties of green construction. Green buildings, Green Building concepts, and what they consist of are the main topics of discussion. Moreover, explored are the various green building rating attributes that are being used around the world, as well as the idea of a green building rating tool

2.1 Green building

Green building represents a transformative approach to architecture that emphasizes sustainability and environmental stewardship. This concept integrates advanced design techniques and technologies to enhance resource and energy efficiency while minimizing ecological impact during construction and operation (Xi 2024; M. V. Kumar 2024). Green buildings prioritize health and comfort, focusing on reducing energy and water consumption, improving indoor air quality, and utilizing sustainable materials(Solikan, Widodo, and Atmajayani 2024; Pavate et al. 2024). The construction industry, responsible for significant environmental pollution, can mitigate its effects through green building practices, which aim to lower greenhouse gas emissions associated with traditional construction methods (John 2024; Pavate et al. 2024). Various certification systems, such as those established by the Green Building Council, evaluate buildings based on criteria like energy efficiency and environmental management, categorizing them into levels that reflect their sustainability performance (Solikan, Widodo, and Atmajayani 2024). Overall, green buildings are essential for fostering sustainable urban development and addressing climate change challenges (M. V. Kumar 2024; John 2024).

2.2 The construction of green projects

The construction of green projects is increasingly recognized as essential for sustainable development, integrating environmental considerations into building practices. Green construction emphasizes resource efficiency, waste reduction, and ecological preservation throughout the project lifecycle, as highlighted by various studies. For instance, the implementation of frameworks utilizing GRIHA parameters and BIM tools has shown significant improvements in energy and water management, promoting economic and environmental sustainability (Bharadwaj and Singh 2024). Additionally, initiatives like the "WE R GREEN" program in Indonesia have successfully reduced CO_2 emissions by 33% through effective waste management and conservation strategies (Anggraeni, 2024). Furthermore, the integration of genetic algorithms in power grid projects facilitates multi-objective optimization, balancing cost, quality, and ecological impact (Chen et al., 2024). Lastly, fostering green value co-creation among stakeholders in construction and demolition waste projects enhances resource utilization and mitigates environmental pollution (Yi et al. 2024). Collectively, these approaches underscore the transformative potential of green construction in addressing global sustainability challenges (Zhu 2024).

2.3 Green buildings benefits

Green buildings offer a multitude of benefits encompassing environmental, economic, and social dimensions. They enhance market value and occupant satisfaction through certifications like LEED and BREEAM, which are associated with superior energy efficiency, reduced operational costs, and improved indoor environmental quality, leading to higher property values and tenant preference for healthier living spaces (Gil-Ozoudeh et al., 2024). Additionally, features such as green roofs contribute to urban sustainability by mitigating heat, improving air quality, and managing rainwater, while also promoting urban agriculture and enhancing community well-being (Vourdoubas, 2024). Energy-efficient design strategies, including advanced insulation and renewable energy use, further minimize environmental impact and promote sustainability in construction (Abeywardhana, 2024). In Malaysia, the adoption of green building rating tools has been linked to improved facility management and environmental sustainability, highlighting the importance of policy support and incentives for broader implementation (Lam et al. 2024). Overall, green buildings not only foster a healthier environment but also yield long-term economic advantages, making them a vital component of sustainable development (S. Chen 2024).

2.4. Drivers of Sustainable Design and Construction

Drivers of sustainable design and construction encompass a multifaceted interplay of regulatory, economic, and innovative factors. Legal regulations and stakeholder demand are pivotal in promoting sustainability within the construction industry, as they shape decision-making processes and encourage adherence to environmental standards (Banaitis, 2024).

Additionally, the integration of innovative practices, driven by client requirements and project performance, significantly enhances sustainability outcomes (Nguyen, 2023). The adoption of green building principles, which prioritize energy efficiency and resource conservation, further exemplifies this trend, aiming to mitigate the environmental impact of construction activities (Pavate et al. 2024; Xi 2024). Moreover, the circular economy concept emphasizes the importance of maintaining materials in a continuous cycle, highlighting the need for effective waste management and product design strategies (Abdulai et al. 2024). Collectively, these drivers underscore the necessity for a comprehensive approach that balances regulatory frameworks, innovative practices, and environmental stewardship in sustainable construction.

2.5. Factors Promoting Implementation of Green Building

Factors of green building are a framework of advantages that can be categorized into economic, social, organizational, market and environmental.

2.5.1. Economic Factors

Economic factors play a pivotal role in promoting the implementation of green buildings, as evidenced by various studies. High initial costs and extended timelines are significant barriers, necessitating financial commitment from project owners and stakeholders (Mursadin, 2024). The integration of financial incentives, such as tax breaks, subsidies, and fee waivers, has been shown to encourage the adoption of green technologies, particularly in regions like India (R. Kumar et al. 2024). Additionally, the allocation of funds for green building initiatives and the economic benefits derived from energy savings further enhance the attractiveness of these projects(Kelvin, 2024;S.Chen, 2024). The collaborative interaction of economic elements, including gross domestic product and investment in technology, is crucial for fostering a conducive environment for green building adoption (Wang et al. 2024). Overall, a multifaceted economic approach, combining incentives and financial support, is essential for advancing green building practices.

2.5.2 Social factors

Social factors play a crucial role in promoting the implementation of green building practices, as evidenced by various studies. Community engagement and cultural sensitivity are essential, as designs that respect local traditions and involve community members foster social cohesion and enhance acceptance of green architecture (Iwuanyanwu et al., 2024). Additionally, socioeconomic factors, such as awareness, stakeholder engagement, and financial mechanisms, significantly influence the development of green cities and construction practices (Dzramado et al. 2024). The importance of social participation is further highlighted in the context of renovating old residential communities, where it emerges as a key factor in advancing green construction practices (Sun et al. 2023). Moreover, targeted awareness campaigns utilizing psychological theories can effectively promote green building concepts, particularly in regions with lower awareness levels (Wei 2024). Overall, integrating social dimensions into green building initiatives is vital for achieving sustainability and improving community well-being (Singh, 2024).

2.5.3 Environmental factors

Environmental factors significantly influence the implementation of green building practices, as evidenced by various studies. The collaborative interaction of technological, organizational, and environmental elements is crucial for promoting green buildings, with government policies playing a pivotal role in incentivizing or penalizing stakeholders at different development stages (Wang et al. 2024; K. Chen et al. 2024). Financial commitment, including additional funding for green initiatives and the use of sustainable materials, is essential for project owners, particularly in regions like South Kalimantan, Indonesia (Mursadin, 2024). Furthermore, the integration of local wisdom and energy-efficient designs enhances the ecological viability of construction projects (Kelvin, 2024). In developing economies, strategies such as capacity-building, regulatory frameworks, and awareness campaigns are vital for overcoming barriers to sustainable practices (Oke, 2024). Overall, a multifaceted approach that combines policy support, financial investment, and community engagement is necessary to foster the adoption of green building principles globally (Kosakiewicz et al. 2024; Aliu et al. 2024).

2.5.4. Organizational Factors

Organizational factors play a crucial role in promoting the implementation of green building practices across various contexts. Key elements include organizational capacity, culture, and structure, which significantly influence the commitment to sustainability initiatives. For instance, a supportive organizational culture that prioritizes environmental sustainability can enhance project execution and risk management in green construction (Mojumder, Singh, and Luthra 2022). Additionally, financial commitment and the allocation of resources for green projects are essential, as they directly impact the feasibility of implementing sustainable practices (Kelvin, 2024). Furthermore, the integration of stakeholder demands and legal regulations is vital, as these factors drive the adoption of sustainability criteria within the construction industry (Banaitis, 2024). However, barriers such as low prioritization of sustainability on political agendas and insufficient awareness among stakeholders can hinder progress (Laurian and Crawford 2016; Poderytė and Banaitis 2024). Thus, fostering an innovation-supportive environment and addressing financial constraints are imperative for successful green building implementation.

2.5.5. Market Factors

Market factors promoting the implementation of green buildings (GB) are multifaceted, encompassing economic incentives, policy frameworks, and stakeholder engagement. Financial incentives such as rebates, grants, and discounts on eco-friendly materials significantly influence stakeholders' decisions to adopt GB practices, as evidenced in South Africa's evolving market (Smallwood, 2024). Additionally, the potential for substantial investment estimated at $24.7 trillion by 2030 in emerging markets highlights the economic viability of green buildings, which can yield lower operational costs and higher asset values compared to traditional structures ((Sokolowski et al., 2019). Furthermore, a robust policy system is crucial, as it establishes the necessary regulatory environment that encourages innovation and adoption of green technologies (Huang, Li, and Thomas Ng 2023; Wang ,, et al. 2019). Ultimately, the interplay of these market factors is essential for fostering a sustainable construction sector that meets rising global demands while mitigating environmental impacts.

2.6. Challenges in Green Building Projects

2.6.1. Higher Costs for Green Practices and Materials

Green building projects face significant challenges, particularly concerning the higher costs associated with green practices and materials. Research indicates that the initial investment for green buildings often exceeds that of conventional structures, primarily due to the premium prices of sustainable materials and technologies (Akcay 2023). Additionally, the lack of a streamlined system for resource reuse exacerbates these costs, as architects and contractors struggle to access necessary information about available materials (Badinelli, 2016). In developing countries, such as Turkey, barriers like inadequate market demand and insufficient knowledge about green building benefits further hinder adoption, leading to a perception of higher costs without clear value (Akcay 2023). Moreover, the construction sector's historical focus on new builds rather than renovations complicates the integration of sustainable practices, despite the potential for significant resource savings through recycling and reuse (Wahlström et al. 2013). Thus, addressing these financial and informational barriers is crucial for promoting green building initiatives.

2.6.2. Risk Due to Different Contract Forms of Project Delivery

Green building projects face significant challenges related to the risks associated with various contract forms of project delivery. The inadequacy of standard contract forms in addressing the unique requirements of sustainable design and construction (SDC) is a critical issue, as highlighted in the Malaysian context where existing contracts do not sufficiently accommodate green building innovations, leading to potential legal challenges and increased risks for stakeholders (Abidin et al., 2022). Additionally, the choice of project delivery systems, such as Design-Build and Construction Manager/General Contractor, can influence risk management effectiveness, with studies indicating that these methods can enhance efficiency and reduce costs, yet they also introduce new complexities that must be managed(Tsai, Furusaka, and Kaneta 2000; Therrien, 2018). Furthermore, in developing countries like Turkey, barriers such as higher construction costs and lack of knowledge about green technologies exacerbate the risks associated with green building projects, complicating their implementation and success (Akcay 2023). Thus, the interplay between contract forms and project delivery methods significantly impacts the risk landscape in green building initiatives.

2.6.3. Long Approval Process for New Technologies

The long approval process for new technologies in green building projects presents significant challenges, particularly in developing countries. Factors such as higher construction costs, lack of knowledge about green technologies, and inadequate market demand contribute to delays in the adoption of these innovations (Akcay 2023). Additionally, the absence of an authorized green building rating system complicates the approval process, as stakeholders may lack clear guidelines for compliance (Akcay 2023). The dynamic nature of approval processes, which often involves multiple stakeholders and varying approval limits, can further exacerbate delays, as seen in other sectors (Bednar et al., 2013). Moreover, the integration of advanced materials and sustainable practices requires thorough vetting, which can prolong timelines, especially when regulatory frameworks are not well-established (Show, Lau, and Foo 2018). Thus, addressing these barriers is crucial for enhancing the efficiency of green building project approvals.

2.6.4. Unfamiliarity with Green Technologies

Unfamiliarity with green technologies presents significant challenges in green building projects, particularly in developing regions. Research indicates that a lack of awareness and education about the benefits of green buildings is a primary barrier, as seen in Malaysia, where stakeholders often lack the necessary information to adopt sustainable practices ((Esa et al.2011). Similarly, in Turkey, construction practitioners reported insufficient knowledge about green technologies and the absence of an authorized green building rating system as critical obstacles (Akcay 2023). Additionally, the unique climatic conditions in Southeast Asia necessitate specific adaptations of green technologies, yet the local application remains underexplored due to varying regional potentials (Lai et al. 2023). Effective communication and cooperation among project participants, as highlighted in the critical success factors for green building projects, are essential to overcoming these challenges and fostering a more informed approach to sustainable construction (Y. Li et al. 2019).

2.6.5. More Time Required to Implement Green Practices On-Site

Implementing green building practices on-site presents significant challenges, particularly regarding the time required for execution. Research indicates that the construction industry often struggles with integrating sustainability due to a lack of clarity in effective strategies and principles (Guevara, 2024). In Malaysia, for instance, issues such as high initial costs, inadequate public awareness, and insufficient stakeholder participation hinder timely implementation ((Kamaruzzaman, 2013). Additionally, operational and maintenance challenges during the construction phase can lead to performance deterioration, further complicating project timelines (Zakaria et al. 2024). The need for modifications in traditional project management practices is emphasized to ensure that green projects are delivered within acceptable cost and time constraints (Robichaud and Anantatmula 2011). Overall, addressing these multifaceted challenges is crucial for enhancing the efficiency and success of green building initiatives (Khodadadzadeh 2016).

2.7. Principles of Green Building Practice

2.7.1. Optimize Site Potential

Optimizing site potential in green building practice involves a multifaceted approach that integrates environmental, social, and economic considerations. Effective site development strategies, such as those outlined in the GREENSHIP rating system, emphasize the importance of microclimate management, pollution control, and water runoff management to enhance urban environments (Octarino and Wahono 2023). Additionally, energy-efficient design plays a crucial role, incorporating advanced insulation, passive solar techniques, and renewable energy sources to minimize environmental impact (Achalanka Sanduni Abeywardhana 2024). The principles of green construction advocate for the sustainable use of natural resources, ensuring that buildings are designed and maintained to reduce their ecological footprint (Djerdap usluge ad: Kladovo, Serbia and Mitrović 2024). Furthermore, implementing green site management practices, including waste management and noise control, is essential for mitigating the adverse effects of construction activities (Khoo et al. 2024). Collectively, these strategies contribute to creating healthier, more sustainable living spaces that benefit both occupants and the environment (Civil Engineering Department, Maharana Pratap Engineering College et al. 2023).

2.7.2. Optimize Energy

Optimizing energy efficiency in green building practices involves a multifaceted approach that integrates advanced technologies, innovative design techniques, and supportive policies. Building Information Modeling (BIM) and Life Cycle Cost (LCC) analysis are pivotal in enhancing energy efficiency by allowing for comprehensive evaluations of design options and energy consumption patterns (X. Li et al. 2024; Krishna 2024). Strategies such as passive design, green roofs, and the use of sustainable materials significantly reduce energy demands while improving indoor environmental quality (Aniekan Akpan Umoh et al. 2024). Furthermore, the implementation of energy policies, including tax incentives and stringent building codes, encourages the adoption of renewable energy sources and energy-efficient technologies (Shafik 2024; Master of Engineering Management, Department of Industrial Engineering, Lamar University, Texas, USA et al. 2024). Case studies, such as the Pearl River Tower and the Bullitt Center, exemplify the successful application of these principles, demonstrating substantial reductions in energy consumption and operational costs (Shafik

2024). Overall, a collaborative effort among stakeholders, supported by innovative technologies and robust policies, is essential for achieving sustainable energy efficiency in the construction industry (Master of Engineering Management, Department of Industrial Engineering, Lamar University, Texas, USA et al. 2024).

2.7.3. Protect and Conserve Water

The principles of green building practice emphasize the protection and conservation of water through various innovative strategies and technologies. Key approaches include the installation of low-flow fixtures, such as dual-flush toilets and low-flow showerheads, which significantly reduce water consumption in both residential and commercial settings (Ifechukwu Gil-Ozoudeh et al. 2023)Additionally, rainwater harvesting systems capture and store rainwater for non-potable uses, thereby decreasing reliance on municipal water supplies and mitigating stormwater runoff (Ifechukwu Gil-Ozoudeh et al. 2023). Greywater recycling further enhances water conservation by repurposing wastewater from sinks and showers for irrigation (Ifechukwu Gil-Ozoudeh et al. 2023). The integration of smart water management systems allows for real-time monitoring of water usage, identifying leaks, and optimizing consumption patterns (Ifechukwu Gil-Ozoudeh et al. 2023). Furthermore, sustainable landscaping practices, including the use of permeable paving and green roofs, contribute to effective water management by enhancing infiltration and reducing runoff (Azubuike Chukwudi Okwandu, Dorcas Oluwajuwonlo Akande, and Zamathula Queen Sikhakhane Nwokediegwu 2024; Ayuningtyas et al. 2022). Collectively, these strategies not only address water scarcity but also promote long-term environmental sustainability in building design (Krishna Pasupuleti 2024; Ayuningtyas et al. 2022).

2.7.4. Use Environmentally Preferable Products

The principles of green building practice emphasize the use of environmentally preferable products to enhance sustainability and reduce environmental impact. This approach involves selecting materials that are energy-efficient, durable, and low in maintenance, such as aluminum alloys, which offer significant benefits in terms of thermal management and longevity (Sanders and Marshall 2023). Additionally, green building design strategies focus on minimizing energy consumption and resource use during construction, particularly in high-demand structures like office buildings (H. Chen et al. 2021). By integrating these environmentally friendly materials and practices, green buildings can significantly lower their ecological footprint, promoting a healthier environment and contributing to sustainable development goals (H. Chen et al. 2021; Sanders and Marshall 2023).

2.7.5. Enhance Indoor Environmental Quality (IEQ)

Enhancing Indoor Environmental Quality (IEQ) is crucial for promoting health, comfort, and productivity in building occupants, particularly as individuals spend approximately 80-90% of their time indoors (A. M. Ali and Acharya 2023; Kraus 2018). Key factors influencing IEQ include indoor air quality, thermal comfort, lighting, acoustics, and spatial layout, which collectively contribute to occupant satisfaction and performance (Kraus 2018). In naturally ventilated buildings, especially in hot and humid climates, maintaining optimal IEQ is challenging due to external environmental influences (A. M. Ali and Acharya 2023). The integration of green building practices, such as energy-efficient design and the use of environmentally friendly materials, can significantly improve IEQ by reducing energy consumption and enhancing overall building performance (H. Chen et al. 2021). Furthermore, advanced technologies like machine learning can predict and optimize IEQ parameters, allowing for proactive management of indoor environments to mitigate health risks and improve comfort (Er-Retby et al. 2024). Thus, a comprehensive approach that incorporates these principles is essential for effective IEQ enhancement.

2.7.6. Resource Conservation and Sustainable Waste Management

Green building practices emphasize resource conservation and sustainable waste management as essential components of environmentally responsible construction. The integration of energy-saving technologies in building design significantly reduces energy and water consumption, particularly in office buildings, which are known for their high resource usage (H. Chen et al. 2021). Additionally, innovative waste management strategies, such as the production of waste blocks from inorganic materials, promote a circular economy by repurposing waste into construction materials, thereby minimizing landfill contributions (Wulandari et al. 2023). Furthermore, the maintenance phase of buildings plays a crucial role in sustainability, as it can enhance resource efficiency and reduce waste through careful planning and management (Di Sivo and Ladiana 2010). Collectively, these practices not only mitigate environmental impacts but also foster community engagement and economic opportunities, illustrating the multifaceted benefits of green building initiatives (Wulandari et al. 2023; Di Sivo and Ladiana 2010).

2.7.7. Optimize Operational and Maintenance Practices

Optimizing operational and maintenance practices in green building involves a multifaceted approach that integrates advanced technologies, sustainable materials, and strategic frameworks. Key strategies include the implementation of Energy Management Systems (EMS) to enhance energy efficiency and the adoption of predictive maintenance using IoT and AI technologies, which can significantly reduce energy consumption and carbon emissions (Yu 2024; Hauashdh et al. 2024). Additionally, frameworks that utilize GRIHA parameters and Building Information Modeling (BIM) tools can optimize resource management, including water and energy, throughout the building's lifecycle (Bharadwaj and Singh 2024). The concept of green maintenance emphasizes minimizing environmental impacts while ensuring that buildings perform as intended, which is crucial for achieving sustainability goals ((Purumal et al., 2021). Furthermore, the integration of sustainable materials during maintenance and repair processes contributes to the overall efficiency and resilience of green buildings (Yu 2024; Civil Engineering Department, Maharana Pratap Engineering College et al. 2023). Collectively, these practices not only enhance operational efficiency but also align with broader sustainability objectives, promoting a holistic approach to building management.

2.8. Green Building Councils and Rating Systems

Green Building Councils and their associated rating systems play a crucial role in promoting sustainable construction practices globally. Various systems, such as LEED, IGBC, and GRIHA, are designed to evaluate a building's environmental performance across its life cycle, addressing aspects like energy efficiency, resource conservation, and indoor air quality (Beatrice Chapi Owoicho 2024; Siddhartha and Beulah Gnana Ananthi 2024). For instance, LEED has been shown to significantly enhance sustainability in buildings, with studies indicating that certified structures often achieve higher performance scores in energy and environmental metrics (Tripathi et al. 2024; Hussain & Sheikh, 2023 and - 2023). In India, the integration of Building Information Modelling (BIM) with these rating systems has been proposed to optimize design and construction processes, thereby improving sustainability outcomes (Siddhartha and Beulah Gnana Ananthi 2024). Furthermore, comparative analyses of global systems reveal that while they prioritize environmental and social sustainability, there is a need for improved economic sustainability measures within these frameworks (Hussain & Sheikh, 2023 and - 2023). Overall, the development and implementation of tailored green building rating systems can facilitate significant advancements in sustainable construction practices, particularly in developing regions like Nigeria (Beatrice Chapi Owoicho 2024).

2.8.1. LEED Rating System

The Leadership in Energy and Environmental Design (LEED) rating system has significantly evolved since its inception in 1998, reflecting the changing perceptions and standards of sustainability in the construction sector. Initially developed by the U.S. Green Building Council, LEED has undergone multiple revisions, with each version introducing more stringent requirements and new categories to align with advancements in technology and materials (Sarkar 2023; Madson et al. 2022). Recent analyses indicate that while LEED v4 has enhanced the complexity of achieving certification, it also promotes a more integrated approach to sustainability by encouraging synergies among different credit categories (Tripathi et al. 2024). Comparative studies show that LEED consistently outperforms other rating systems like BREEAM and CASBEE in terms of certification scores, highlighting its effectiveness in promoting environmentally friendly building practices (Hussain & Sheikh, 2023 and - 2023). Furthermore, the growing body of research on LEED underscores its global influence and the increasing interest in sustainable building practices, suggesting a robust future for green building initiatives (Lei and Cui 2022).

2.8.2. LEED Credit System

A 100-point scale, along with an additional 10 bonus points, is utilized in LEED-NC and LEED-CS. The only possible results are positive, meaning points are exclusively earned by performing beneficial actions, and there is no way to lose points for performing harmful actions. The five primary categories, along with the two bonus categories, comprise the point system. Each category includes a mandatory element that must be fulfilled to achieve certification in that category. These prerequisites are designed to assist clients and enhance the credibility of the LEED certification. These requirements are simply mandatory and do not grant extra points. Subcategories can then be selected to concentrate on in order to earn more points (USGBC, 2011).

According to (USGBC, 2011), the seven categories of LEED are shortly described as follows:

- Sustainable Sites (SS): 26 points
- Water efficiency (WE): 10 points
- Energy and Atmosphere (EA): 35 points
- Materials and Resources (MR): 14 points
- Indoor Environmental Quality (IEQ): 15 points
- Innovation and Design (ID): 6 points
- Regional Priority (RP): 4 points

There are four possible levels of certification that can be achieved by exceeding the following point thresholds:

- Certified 40 - 49 points
- Silver 50 - 59 points
- Gold 60 - 79 points
- Platinum 80 + points and above

2.8.3 Challenges in Green Building Implementation

The implementation of green building practices faces several significant challenges, primarily financial barriers, lack of awareness, limited availability of sustainable materials, and regulatory issues. These obstacles hinder the transition to more sustainable construction methods, impacting both environmental goals and economic viability.

2.9. Financial Barriers

- High initial costs associated with green building materials and technologies deter investment (Aliu et al. 2024; De Beer and Kajimo-Shakantu 2023).
- Short-term financial gains are often prioritized over long-term sustainability benefits, leading to insufficient funding for green projects (Aliu et al. 2024).

2.9.1 Lack of Awareness and Expertise

- A significant gap in knowledge regarding green building technologies exists among construction professionals (Agboola et al. 2024; Akcay 2023).
- Limited training and education on sustainable practices contribute to this lack of expertise (De Beer and Kajimo-Shakantu 2023).

2.9.2 Availability of Sustainable Materials

- There is a notable scarcity of sustainable materials and technologies, which complicates the adoption of green building practices (Agboola et al. 2024; Akcay 2023).
- The absence of a robust market for green materials further exacerbates this issue (De Beer and Kajimo-Shakantu 2023)

2.9.3 Policy and Regulatory Challenges

- Ineffective regulatory frameworks and lack of government support hinder the implementation of green building practices (Poderytė and Banaitis 2024; De Beer and Kajimo-Shakantu 2023).
- Long approval processes for new technologies can delay project timelines, discouraging stakeholders from pursuing sustainable options (Agboola et al. 2024).

Conversely, while these challenges are significant, some regions are beginning to see improvements through increased awareness and policy changes aimed at promoting sustainable construction practices.

2.10 Case Studies from Other Developing Regions

The implementation of green building practices in developing regions offers valuable insights for Hargeisa, particularly in addressing similar socioeconomic challenges. Case studies from countries like Nigeria, Ghana, and Thailand illustrate effective strategies and lessons learned that can be adapted to Hargeisa's context.

2.10.0 Successful Case Studies

- Nigeria and South Africa: These countries have integrated locally sourced materials and low-cost smart systems, demonstrating that sustainable practices can thrive despite financial constraints (Imafidon, Enwerem, and Boye 2024).
- Ghana: The emphasis on educational programs and mandated green building codes has proven effective in promoting green technologies, highlighting the importance of stakeholder engagement and regulatory frameworks(Anzagira et al. 2024).
- Thailand: The development of local green building rating systems, such as TREES, showcases the significance of tailored solutions that align with national capabilities and market demands (Shen et al. 2018).

2.10.1 Key Lessons Learned

Financial Incentives: Providing financial support and incentives for green building projects can enhance adoption rates and operational savings (Verma et al. 2021).

Technical Training: Investing in training for local professionals is crucial to overcoming technical barriers and fostering innovation in green building practices (Imafidon, Enwerem, and Boye 2024).

Public-Private Partnerships: Collaborations between government and private sectors can facilitate resource sharing and knowledge transfer, essential for sustainable development (Imafidon, Enwerem, and Boye 2024).

While these examples provide a roadmap for Hargeisa, it is essential to consider local cultural and economic contexts to ensure the successful adaptation of these strategies.

2.11. Current Research Landscape

- Limited Studies: Existing literature on GBP in Africa does not adequately cover Somaliland, focusing instead on broader regional challenges (Ebekozien et al. 2024).
- Absence of Regulatory Frameworks: The lack of regulatory frameworks in Somalia hampers the adoption of GBP, as seen in the findings related to supply chain management (Factors Influencing the Adoption of Green Supply Chain Management: A Comprehensive Empirical Study on Pressures and Practices 2023).

2.12 CASE STUDY

2.12.0. The cube, Nairobi, Kenya

This case study presents a detailed analysis of The Cube, a Grade an EDGE Advanced-certified commercial building located in Nairobi, Kenya. Its sustainable architectural and operational design provides a relevant reference for green building practices in Hargeisa, which shares a similar semi-arid climate and development context. The Cube integrates energy and water efficiency, responsible material usage, and occupant-focused design, aligning with international green building standards.

The Cube was chosen as the case study due to its successful implementation of cost-effective and environmentally responsible building strategies. Key sustainable features of the building include:

- Energy Efficiency: Use of high-performance thermal glass, external shading devices, occupancy sensors, solar photovoltaic systems, and low-energy lighting.
- Water Conservation: Installation of water-efficient showers, faucets, and dual-flush toilets to minimize consumption.
- Material Optimization: Utilization of locally available and resource-efficient materials such as concrete filler slabs and stone block masonry.

Data collected from EDGE Buildings and developer publications provided architectural and performance details, including energy savings, CO_2 reduction, and water efficiency metrics. The building achieves an annual reduction of approximately 133.78 tons of CO_2 and demonstrates over 40% improvement in energy performance compared to conventional designs.

The insights from The Cube were analyzed to assess their applicability in Hargeisa's construction sector. Due to similarities in climate conditions, resource constraints, and development needs, many of the strategies employed in The Cube can be adapted for sustainable building practices in Somaliland.

2.12.1. PROJECT OVERVIEW

- **Project:** The Cube
- **Client/Developer:** London Town Group of Companies
- **Architect:** Bowman Associates
- **Location:** Riverside Drive, Nairobi, Kenya
- **Certification:** EDGE Advanced Preliminary Certificate by Green Business Certification Inc. (GBCI)
- **Total Floor Area:** Approximately 7,235 m² (77,876 sq. ft.)
- **Completion Date:** Expected November 2022
- **Certification Date:** August 1, 2021
- **Predicted Savings:** 41% energy, 50% water, 21% less embodied energy in materials

Figure 1 Renders and 3d views

Accommodation Summary – The Cube, Nairobi

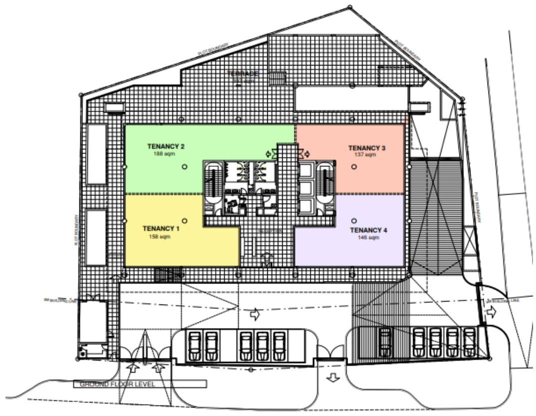
The Cube offers a total of 73,452 square feet (approx. 6,824 square meters) of let table space across seven floors. It also includes 8,633 square feet (approx. 802 square meters) of terrace space. The breakdown per floor is as follows:

Table 1 Accommodation Summary – The Cube, Nairobi

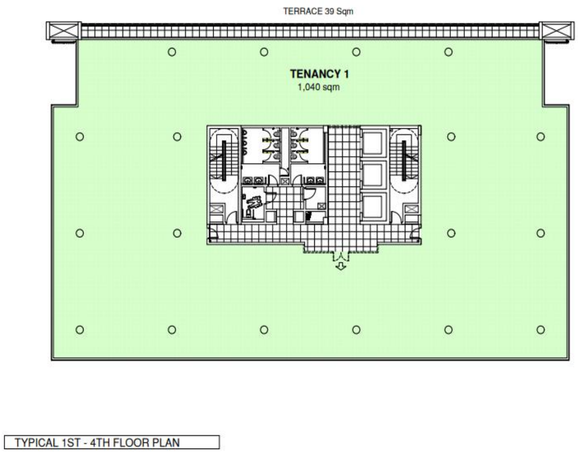
Floor	Let table Area (sq.ft)	Let table Area (sqm)	Terrace (sq.ft)	Terrace (sqm)	Availability
1st	11,700	1,087	420	39	Available
2nd	11,700	1,087	420	39	Available
3rd	11,700	1,087	420	39	Available
4th	11,700	1,087	420	39	Available
5th	9,645	896	2,303	214	Available
6th	9,645	896	420	39	Available

- **Total Let table Area:** 73,452 sq.ft (6,824 sqm)
- **Total Terrace Area:** 8,633 sq.ft (802 sqm)

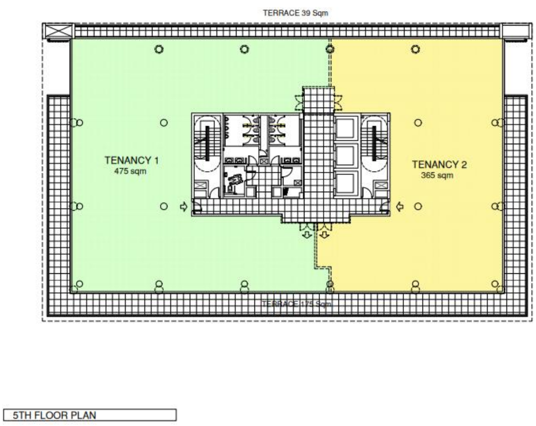
Ground Floor



Typical Floor
OPTION 1



Fifth Floor
OPTION 2



Sixth Floor
OPTION 3

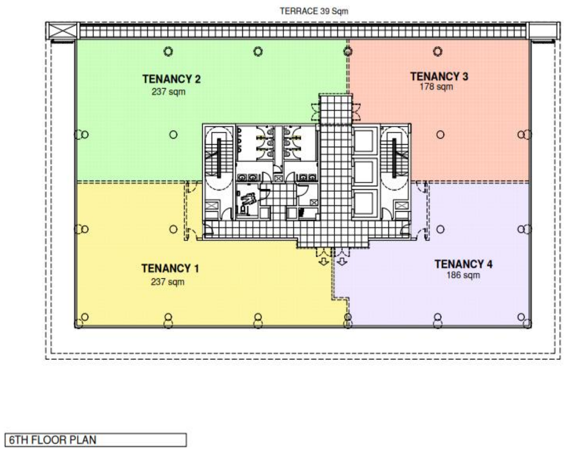


Figure 2 General layout plan or architectural rendering of The Cube.

2.12.2 Sustainable Site

The Cube is strategically located along Riverside Drive in Nairobi, offering easy access to major commercial hubs like Westland's, Lavington, and Kilimani. The site is well-served by both private and public transportation, enhancing accessibility for occupants. The building's design incorporates outdoor breakout terraces and generous balcony spaces on each floor, providing panoramic views of the Ngong Hills and Nairobi National Park. These features not only enhance the aesthetic appeal but also contribute to the building's environmental performance by promoting natural ventilation and reducing the need for mechanical cooling systems.

Figure 3 Photograph of The Cube's exterior showcasing terraces and balconies.

4.12.3. Water Efficiency

The Cube has achieved a 50% reduction in water consumption through the implementation of ultra-efficient water fixtures. These include low-flow faucets in bathrooms and kitchens, efficient flush systems for water closets, and water-efficient urinals. Such measures significantly reduce the building's water footprint, making it a model for sustainable water

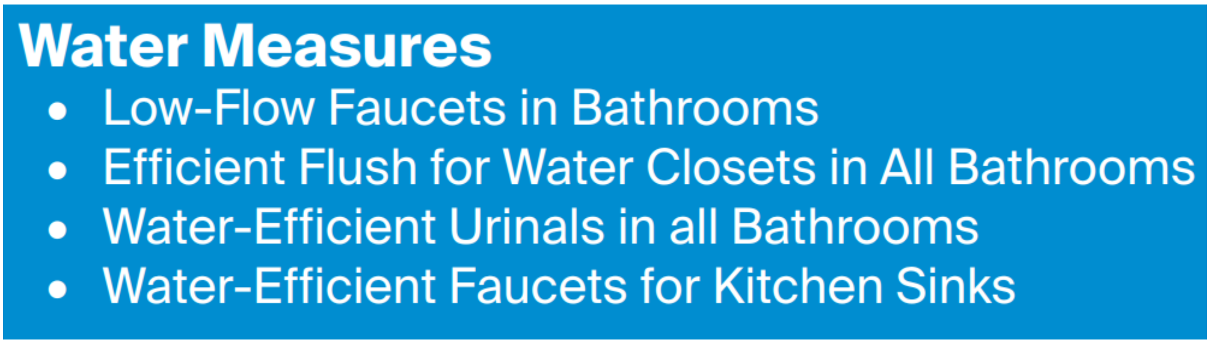


Figure 4: Image of installed water-efficient fixtures.

management in commercial buildings.

4.12.4 Energy Efficiency and Atmosphere

The building boasts a 41% reduction in energy consumption, achieved through several key strategies:

Energy Measures

- External Shading Devices
- Higher Thermal Performance Glass
- Energy-Saving Light Bulbs - Internal Spaces
- Energy-Saving Light Bulbs - External Spaces
- Occupancy Sensors in Bathrooms, Conference Rooms, and Closed Cabins
- Occupancy Sensors in Open Offices
- Solar Photovoltaics

- High Thermal Performance Glazing: Minimizes heat gain, reducing the need for air conditioning.
- LED Efficient Lighting: All lighting systems utilize energy-saving LED bulbs.
- Lighting Control Systems: Incorporation of occupancy sensors in bathrooms, conference rooms, closed cabins, and open offices ensures lights are only on when needed.
- Solar Photovoltaic System: Harnesses solar energy to supplement the building's power needs.

These features collectively contribute to the building's impressive energy performance.

Figure 5 Photograph of solar panels installed on the rooftop.

2.12.5. Material and Resources

The Cube achieved a 21% reduction in embodied energy in materials by selecting sustainable construction materials:

- **Concrete Filler Slabs:** Used for both floor and roof construction, reducing material usage.
- Stone Blocks: Machine-cut unpolished stone blocks were utilized for both external and internal walls, sourced locally to minimize transportation emissions.
- **Finished Concrete Floors:** Provides durability and reduces the need for additional finishing materials.

These material choices not only lower the building's environmental impact but also support the local economy.

2.12.6. Indoor Environmental Quality

The Cube's design emphasizes occupant comfort and well-being:

- **Natural Ventilation:** The building's orientation and window placements promote cross-ventilation, reducing reliance on mechanical ventilation systems.
- **Daylighting:** Large windows and open spaces allow ample natural light, decreasing the need for artificial lighting during the day.
- **Thermal Comfort:** The combination of high-performance glazing and natural ventilation maintains comfortable indoor temperatures.

These features contribute to a healthy and productive indoor environment for occupants.

Figure 6 Interior photograph highlighting natural lighting and ventilation.

2.12.7. Summary of Green Building Rating Attributes

Table 2 EDGE rating achievements for The Cube.

Green Building Rating Attributes	EDGE Achievements
Energy Efficiency	41% reduction
Water Efficiency	50% reduction
Embodied Energy in Materials	21% reduction

2.12.8. Summary and Relevance to Hargeisa

The Cube demonstrates scalable, affordable, and effective green building solutions for East African cities. Its EDGE-certified design serves as a valuable model for Hargeisa, where water and energy resources are constrained. The building's reliance on passive and locally adaptable strategies offers practical insights for Somaliland's sustainable urban development path.

2.13 Research Gap

Although green building practices are gaining global recognition for their potential to mitigate climate change and promote sustainable development, their adoption in developing countries remains limited. In Somaliland, particularly in Hargeisa, the concept of green buildings is still in its infancy. A lack of locally customized standards, insufficient awareness, outdated technologies, and minimal research or incentives for implementation hinder progress in this area. Furthermore, data from Hargeisa Municipality confirms that there are no LEED-certified green buildings in the city, highlighting the absence of practical examples or successful case studies to guide the adoption of green building principles.

Existing studies and theoretical frameworks on green buildings primarily focus on developed nations or regions with more advanced infrastructure and resources. These studies often fail to address the unique socio-economic, cultural, and environmental challenges faced by developing countries like Somaliland. While some literature examines the global importance of sustainable construction, limited attention has been given to the contextual barriers and opportunities specific to Somaliland. For instance, the integration of socio-cultural values into green building designs, resource constraints, and the lack of institutional frameworks are rarely explored in depth.

Moreover, while sustainability efforts in Hargeisa are critical to addressing the environmental impacts of urbanization and economic growth, there is a significant knowledge gap regarding how green building principles can be effectively applied in the local context. The absence of structured dialogue and professional engagement on green buildings further exacerbates the issue, leaving architects, developers, contractors, and policymakers without the necessary tools or knowledge to pursue sustainable construction.

This research aims to address this gap by providing a comprehensive assessment of green building practices in Hargeisa. It will explore the challenges, relevant attributes, and possible strategies for adopting and implementing green construction principles tailored to the local context. By doing so, the study seeks to contribute to the academic discourse on sustainable construction in developing nations while offering practical insights for stakeholders in Somaliland.

CHAPTER THREE:

METHODOLOGY

3.1 Introduction

This chapter described the methodology used to investigate the challenges and potential attributes of green building practices based on sustainability in Hargeisa, Somaliland. Due to the limited current adoption of green building practices in the region, the study also incorporated a comparative case study from a climatically similar country to support context-specific recommendations. The methodology covered the study area, research approach and design, population and sampling strategies, data types and sources, data collection instruments, data analysis techniques, ethical considerations, validation procedures, and methods of data presentation.

3.2 Description of the Study Area

The study was carried out in Hargeisa, the capital city of Somaliland. Geographically, Hargeisa is located in a semi-arid zone at an elevation of 1,334 meters above sea level, at latitude 9°33′47″ N and longitude 44°04′03″ E. The city spans an area of approximately 128 km² and hosts an estimated population of 2.2 million people (MNPD, 2011). Its rapid urban development and ongoing construction activities made it an appropriate setting to assess the feasibility of sustainable building practices.

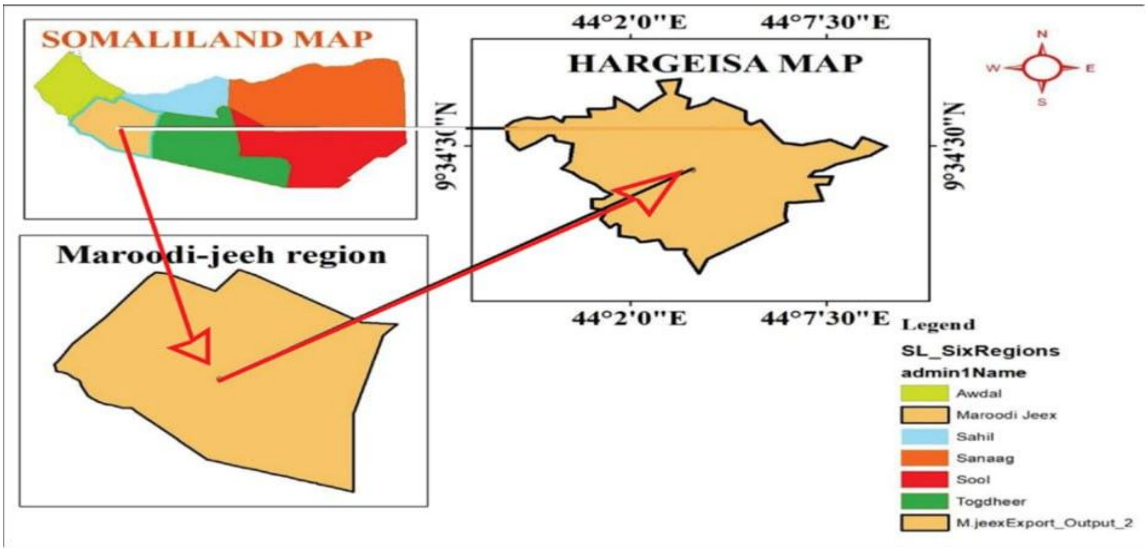


Figure 7 this figure shows the map of Hargeisa Somaliland

3.3 Research Method

A mixed-methods approach was employed, combining both quantitative and qualitative methodologies. The quantitative component utilized structured questionnaires to statistically evaluate the views of construction professionals. The qualitative component included interviews, a case study, document review, and site observations to gather in-depth contextual information. This approach enabled triangulation to enhance the credibility and depth of the findings.

3.4 Research Design

A sequential research design was applied. Initially, a case study analysis of a LEED-certified green building in a country with a climate similar to Hargeisa was conducted. This was followed by the distribution of questionnaires to construction professionals in Hargeisa and interviews with selected stakeholders. The quantitative data guided the qualitative phase and supported a more comprehensive interpretation of results.

3.5 Research Population

3.5.1 Target Population

The target population included professionals in the construction sector, including individuals from local government offices, the Ministry of Environmental and Climate Change, the Ministry of Public Works, Land and Housing, consulting offices, construction companies, and on-site practitioners. Participants were selected based on their roles and expertise in architecture, engineering, policy-making, and project management.

3.5.2 Accessible Population

The accessible population matched the target population and consisted of 110 professionals engaged in construction and urban development in Hargeisa.

Table 3 Distribution of Target Population

No.	Institution	Number of Respondents
1	Local Government	19
2	Construction Firms in Hargeisa	21
3	Construction Sites	24

4	Ministry of environmental and climate change	16
5	ministry of public work, land and housing	20
6	Consulting Offices	10
	Total	110

3.6 Sample and Sampling Procedure

Purposive sampling was applied to select respondents with relevant expertise in construction practices. According to 2022 data from the Ministry of Urban Development and Construction, there were about 91 active construction firms in Somaliland, with 28 located in Hargeisa. Participants were drawn from Level One consultancy and construction firms due to their broader experience. This sampling method ensured the inclusion of key decision-makers.

3.7 Sampling Technique

A combination of purposive and stratified random sampling techniques was used. Purposive sampling ensured the selection of experienced professionals in sustainable construction. Stratified sampling allowed for balanced representation across government bodies, consulting offices, and active construction sites.

3.8 Data Type and Source

3.8.1 Primary Data

Primary data was gathered through structured questionnaires and semi-structured interviews with professionals and decision-makers in the sector. These tools collected both numerical and descriptive insights.

3.8.2 Secondary Data

Secondary data was drawn from published literature, government documents, policy frameworks, and green building guidelines. Relevant information on the case study building, such as architectural plans and environmental data, was also reviewed.

3.9 Data Collection Method

Through site surveys, interviews, questionnaires, and the evaluation of pertinent documents, all the data required to carry out the study was acquired.

3.9.1 Questionnaires

The questionnaire included both closed and open-ended questions and consisted of four parts: demographic details, challenges to green building adoption, prioritization of sustainability attributes, and respondent suggestions. It facilitated both quantitative and qualitative data collection.

3.9.2 Interviews

Semi-structured interviews were conducted with architects, engineers, planners, and government officials to explore implementation barriers, policy gaps, and stakeholder perceptions.

3.9.3 Case Study Method

A comprehensive analysis was conducted on a LEED-certified building in in Nairobi, Kenya with comparable climate conditions.

This study employs a case study strategy to provide a thorough analysis of an exemplary green building. While the primary geographical focus of this research is Hargeisa, The Cube, located in Nairobi, Kenya, was selected and analyzed as a case study. This selection was based on its demonstration of scalable, affordable, and effective green building solutions relevant for East African cities, including those with similar climatic conditions and resource constraints like Hargeisa. The Cube's EDGE-certified design and its reliance on passive and locally adaptable strategies offer valuable insights into sustainable building practices, helping to comprehend genuine green building implementation, its constraints, and contextual opportunities, as well as to suggest suitable solutions relevant to the Hargeisa setting.

The study offered practical design references and adaptable policy strategies.

3.9.4 Site Survey

Field observations were conducted at selected construction sites in Hargeisa to examine building practices, material usage, waste handling, and energy efficiency.

3.11 Data Analysis Method

3.10.1 Descriptive Statistics

Quantitative data was analyzed using descriptive statistics such as frequencies, percentages, means, and standard deviations to assess stakeholder perspectives.

3.10.2 Content Analysis

Content analysis was used to evaluate qualitative data from interviews and open-ended responses. Data was coded, categorized, and interpreted to identify major themes and suggested interventions.

3.11 Data Analysis Tools

The collected data was processed using Microsoft Excel, and Google Forms. Descriptive and regression analyses were conducted, and findings were displayed using graphs, tables, and charts.

3.12 Ethical Considerations

Ethical standards were strictly followed throughout the study. Participants gave informed consent, and their anonymity and confidentiality were respected. Participation was entirely voluntary, and no personally identifiable data was collected.

3.15 Validation Process

To ensure accuracy, the questionnaire was pilot-tested, and feedback was sought from academic and professional experts. Validation continued throughout data collection and analysis to confirm alignment with research objectives.

3.14 Presentation Techniques

Findings were presented using visual aids such as bar graphs, pie charts, tables, and architectural diagrams. These tools enhanced the clarity and accessibility of results, particularly in illustrating sustainable construction practices for Hargeisa.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 INTRODUCTION

This study seeks to explore Challenges to the implementation of green building principles and theories, and Green building rating attributes that could be potentially adopted for the Somaliland building industry, specifically in Hargeisa. Along with these two main goals, the study looked into whether respondents' responses varied statistically significantly according to their major occupation and years of experience. A thorough examination of the data gathered and the outcomes is presented in this chapter.

Demographics of survey respondents, an analysis of the research questions, and a summary are all included in the discussion.

4.2. DEMOGRAPHIC PROFILE OF SURVEY RESPONDENTS

The response rate for the 110 target sample in this study was 105 (95.4%). This study's sample and response rate were determined statistically reasonable.

Responses to Section I survey items were explored using descriptive statistics. The survey respondents were profiled using three demographic factors, including years of experience, primary occupation and gender. Figures 7, 8 and 9 show the results of the demographic distribution of replies according to "years of experience" and "primary occupation," and also "gender," respectively.

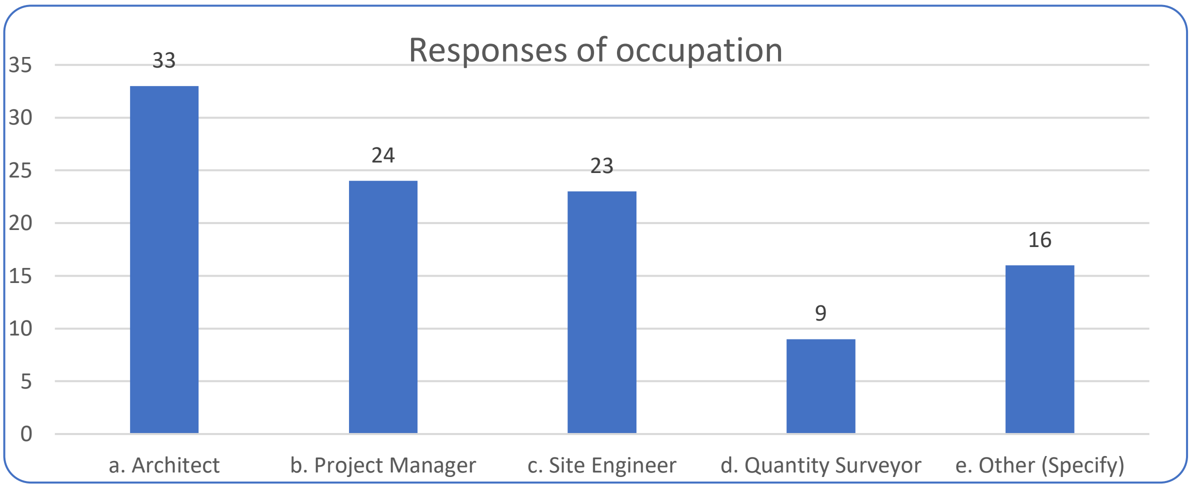


Figure 8 Demographic distribution of responses - _primary occupation

The survey comprised 105 respondents, exhibiting a range of professional roles within the construction industry. The occupational distribution was as follows: Architectural Designers represented the largest segment, comprising 31.4% of the respondents (n=33), followed by Project Managers (22.9%, n=24) and Site Engineers (21.9%, n=23). Quantity Surveyors constituted 8.6% of the sample (n=9). A further 15.2% (n=16) of respondents indicated occupations classified as "Other," encompassing roles beyond those specifically listed.

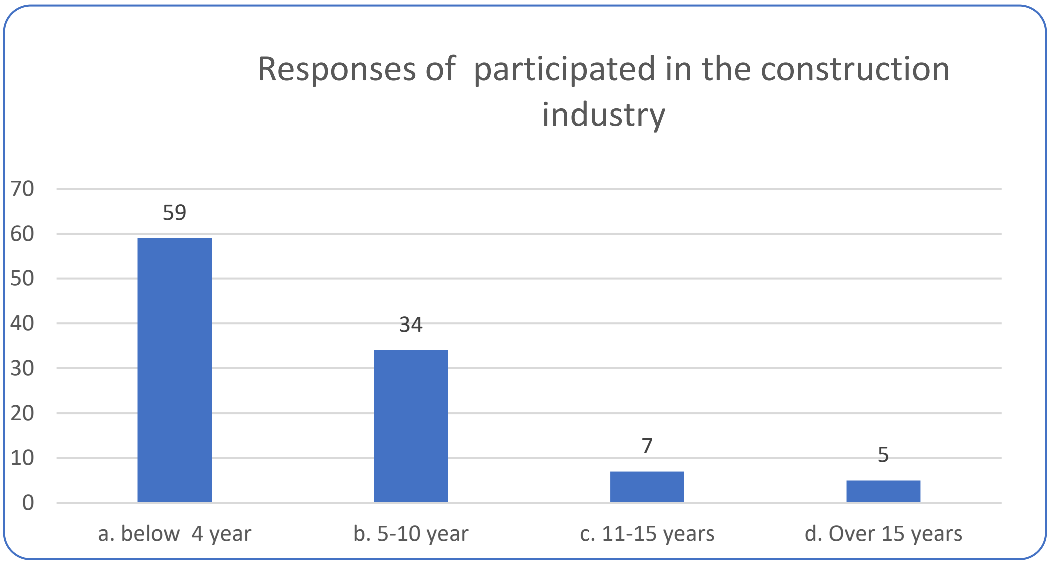


Figure 9 Demographic distribution of responses - years of experience‘

Respondents also demonstrated a range of experience levels within the construction industry. A substantial portion, 56.2% (n=59), reported having less than 4 years of professional experience. Approximately one-third of the respondents, 32.4% (n=34), possessed between 5 and 10 years of experience. Smaller proportions reported between 11 and 15 years of experience (6.7%, n=7) and over 15 years of experience (4.8%, n=5).

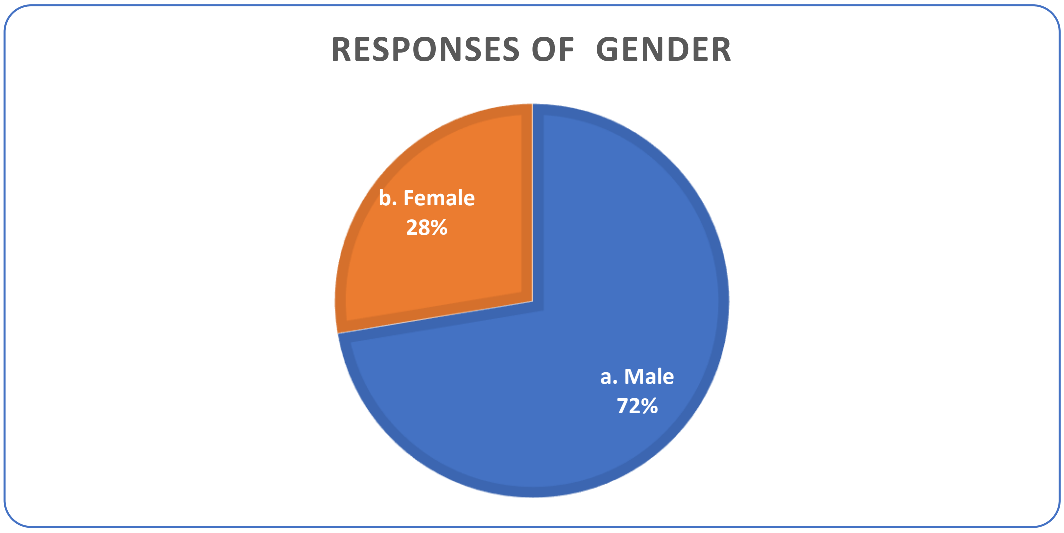


Figure 10 Demographic distribution of responses - gender'

The gender distribution of the survey participants was skewed towards male representation. Specifically, 72.4% (n=76) of the respondents identified as male, while 27.6% (n=29) identified as female.

4.3. ANALYSIS OF RESEARCH QUESTIONS

4.3. ANALYSIS OF RESEARCH QUESTIONS

The data analysis procedure for this study was made more rigorous by independently examining each research question.

Research Question 1: What are the challenges to the adoption of green building practices in Hargeisa?

To determine the data's central tendency (mean rating), descriptive statistics were utilized. Following that, a hierarchical ranking of the challenges to the adoption of green building was created. In general, 21 challenges to the adoption of green construction methods were found in the literature, and the opinions of building professionals in Hargeisa were evaluated.

Table 4 Challenges to the Adoption of Green Building

Challenges	**References**
Corruption, culture, attitude, and lifestyle	Balasubramanian (2012), Carbon Trust (2005), Deringer et al. (2004), IPCC (2007)
Loss of culture as a result of the introduction of creative approaches	Balasubramanian (2012), IPCC (2007)
Experience and non-suitability of Western methods	Balasubramanian (2012), Deringer et al. (2004)
Inadequate expertise in the industry	Hankinson and Breytenbach (2012), Jacobs (2011), International Labour Office (ILO) (2011), Choi (2009)
Insufficient knowledge concerning green buildings	Hankinson and Breytenbach (2012), Choi (2009)
Lack of training and experience	Jacobs (2011), ILO (2011)
Changes in skill requirement for green buildings	Choi (2009), ILO (2011)
Higher up-front costs for green building	Isaksson and Linderoth (2018), Agyekum et al. (2020), Deringer et al. (2004)

Risk of investment and higher final cost	Chan et al. (2018), Kibert (2016)
Lack of internalization of environmental, health and other external costs	Deringer et al. (2004), Carbon Trust (2005)
Lack of incentives	Peterson (2007), Kibert (2016)
Lack of access to financing	Agyekum et al. (2020), Isaksson and Linderoth (2018)
Inadequate enforcement of standards	Windapo et al. (2013), Jacobs (2011)
Lack of detailed guiding principles, tools, and experts	Durmus-Pedini and Ashuri (2010), Hakkinen and Belloni (2011)
Lack of governance leadership/interest	Jacobs (2011)
Lack of green products and material testing/certification	Hakkinen and Belloni (2011), Windapo et al. (2013)
Lack of awareness among consumers, managers, companies, politicians	Hoffman and Cruywagen (2013), Cowie (2014), Carbon Trust (2005), Yao et al. (2005)
Insufficient information about green building possibilities, techniques, and potential	Yao et al. (2005), Carbon Trust (2005)
Lack of comprehensive cost-benefit analysis of green building	Windapo et al. (2013), Jacobs (2011), Durmus-Pedini and Ashuri (2010)

Inadequate knowledge of the most recent green building supplies and materials	Hoffman and Cowie (2014), Cruywagen (2013)
A lack of understanding among lawmakers, building managers, and construction firms	Cowie (2014), Carbon Trust (2005), and Yao et al. (2005)

This research question was addressed using descriptive statistics. Data from the second section of the survey were used for the analysis. The survey items' challenges were classified into one of the following categories: Data and motivation management system, Regulatory and steering considerations, inadequate skilled experts, Behavioral barriers, and Cost of green building. The intensity of each challenge and its related category were then determined and ranked using the following formula:

$$\text{Mean Rating} = \frac{\sum(W \cdot F_i)}{n}$$

Where:

- W = scale value of the response (1 to 5)
- Fi= frequency of response
- n = total number of respondents
- i = response scale value

- 1 = minor extent, 2 = near minor extent, 3 = some extent, 4 = near major extent, 5 = major extent

Interpretation of Mean Score:

- < 2.5 = Less challenging
- 2.5–3.0 = Moderate
- 3.0–4.0 = moderately high
- 4.0 = High

4.3.1 Descriptive Statistics of Category 1: Data and Motivation Management System

Table 5 Data and Motivation Management System

Challenges in Category 1	Mean Score
Insufficient data about the advantages of green buildings	3.63
General lack of awareness of the present green building materials	3.67
Inadequate local study data on green practices	3.82
Lack of motivational strategies to enhance initiatives on green projects	3.45
Lack of information and awareness among investors about the concept of green construction	4.02
Clients are not interested to invest their money on green building projects	3.94

Average Mean Score: 3.75

This primary factor had the highest mean score explained by six variables, which were as follows: insufficient data on the advantages of green buildings (3.63); general lack of awareness of the present green building materials (3.67); inadequate local study data on green practices (3.82); lack of motivational strategies to enhance initiatives on green projects (3.45); lack of information and awareness among investors about the concept of green construction (4.02); and clients are not interested to invest their money on green building projects (3.94).

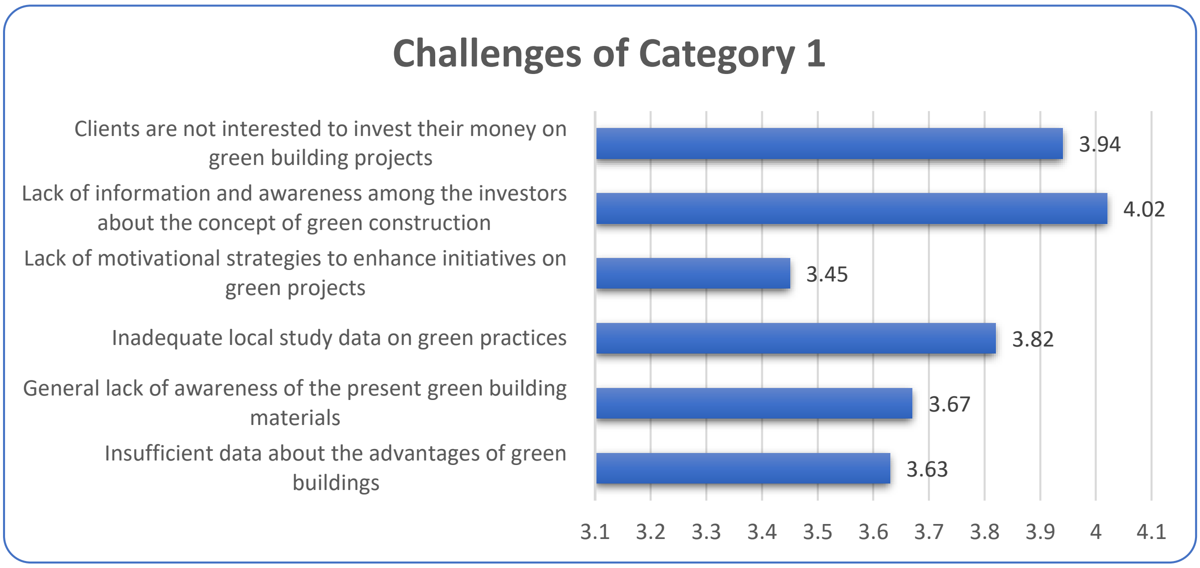
Among these, the lack of information and awareness among investors about the concept of green construction received the highest mean score in the 'Data and Motivation Management System' category. This suggests that stakeholders in Hargeisa do not have sufficient information to be persuaded that investing in green projects is a worthwhile decision. Conversely, insufficient data on the advantages of green buildings was rated the least challenging in this category.

The first four challenges in this category relate to the shortage of data, while the last two relate to motivational systems. Since access to the relevant information is crucial for the implementation of green projects, the absence of a robust green building data management system in Hargeisa hampers adoption efforts.

This supports the findings by Chan et al. (2018), who emphasized that barriers to the adoption of green building technologies include a lack of knowledge and information asymmetry regarding their benefits. It also aligns with Kibert (2016) and LaBadie (2010), who highlighted that the lack of research, cost-benefit awareness, and information sharing significantly impede uptake.

As is the case in many developing cities, Hargeisa's building sector also lacks robust incentive structures to encourage green adoption. The lack of motivation to advance the green building movement is perhaps a reflection of Hargeisa's slow adoption and limited implementation of sustainable practices, as well as developers' and clients' unwillingness to absorb the additional costs of green initiatives.

Therefore, it is crucial to change stakeholders' attitudes toward adopting green construction by offering both economic and non-economic incentives—such as tax credits, awards, and technical support. According to Peterson (2007), incentives can inspire, encourage, and stimulate both individuals and project teams to achieve exceptional results, supporting the findings of this study.



Summary of Findings – Category 1

Figure 11 Distribution of responses - Data and motivation management system

The results suggest that information scarcity and lack of motivation are central obstacles to green building adoption in Hargeisa. The construction sector requires robust support mechanisms—such as comprehensive awareness campaigns, locally relevant data generation, and well-designed incentive structures—to facilitate a sustainable transition. Without addressing these foundational issues, widespread implementation of green building practices will remain elusive.

4.3.2 Descriptive Statistic of Category 2: Regulatory and steering factors

Regulatory and steering factors present a significant barrier to the implementation of green building practices in Hargeisa. As detailed in Table 2, four challenges were examined under this category, with an average mean score of 3.29, indicating a moderately high challenge level overall.

Table 6 Regulatory and steering factors

Challenges in Category 2	**Mean score**
Inconsistent standards and insufficient regulations	3.67
Lack of green material testing/certification	3.4
Difficult to understand requirements/documentation processes	2.93
Certification for green buildings is too costly and time intensive	3.16

Average Mean score = 3.29

The most critical challenge under this category is inconsistent standards and insufficient regulations (mean = 3.67), highlighting the fragmented nature of Hargeisa's green building policy framework. This is followed by the lack of green material testing and certification (mean = 3.40), which erodes confidence in material quality and hinders implementation. The costly and time-consuming certification process (mean = 3.16) also discourages many developers. Although difficulty in understanding regulatory documentation received the lowest score (mean = 2.93), it still represents a notable barrier for stakeholders unfamiliar with green requirements. These findings are in line with studies by Labadie (2010) and Choi (2009), who emphasized that the absence of regulatory ownership and clear legislative guidance significantly deters the adoption of sustainable building practices.

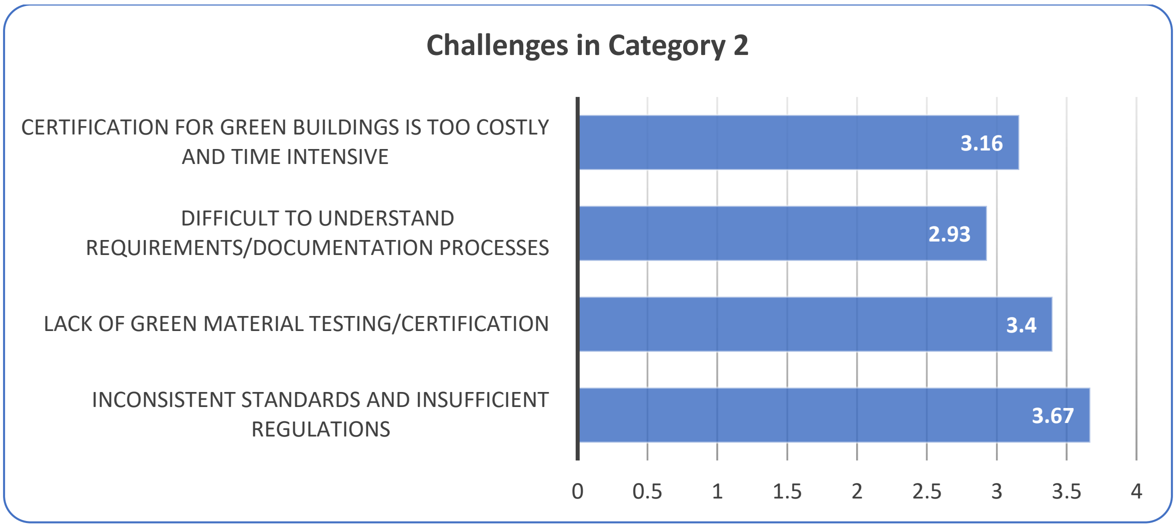


Figure 12 Distribution of responses - Regulatory and steering factors

4.3.3 Descriptive Statistic of Category 3: Inadequate skilled professionals

The effective implementation of green building in Hargeisa is hindered by a lack of adequately trained and experienced professionals. This category includes five variables related to skills and human resource capacity in the construction sector, as presented in Table 3.

Table 7 Inadequate skilled professionals

Challenges in Category 3	**Mean score**
Inadequate expertise and manpower with suitable experience	3.92
Lack of experienced green building practitioners	3.49
Lack of Green Star accredited professionals	3.57
Insufficient education in the construction industry	3.08
Lack of training and support relative to green issues	3.7

Average Mean score = 3.55

Among these, the most critical challenge is inadequate expertise and manpower with suitable experience (mean = 3.92), indicating a significant shortage of professionals who possess the technical competencies required for green building practices. This is closely followed by lack of training and support related to green issues (mean = 3.70) and lack of Green Star-accredited professionals (mean = 3.57). These figures reflect the gap in both formal accreditation and on-the-job exposure necessary for sustainable construction.

Insufficient education within the construction industry received the lowest score in this category (mean = 3.08), yet it still reflects a noteworthy barrier to capacity development. Together, these findings highlight the critical shortage of knowledge, skills, and professional certifications necessary for advancing green initiatives in Hargeisa.

These results are consistent with the findings of Jones and Mandy (2016), who emphasized that the availability of qualified green building professionals is a key enabler for sustainable development. The situation in Hargeisa mirrors challenges reported in other developing contexts—such as Ethiopia—where the limited pool of trained personnel is considered a major constraint to adoption.

Further, the findings support Chan et al. (2018), who observed that the construction industry's limited awareness and understanding of green technologies is a widespread issue. Similarly, Balasubramanian (2012) noted that the shortage of qualified personnel critically hinders green building progress. Wang et al. (2018) also argue that the capabilities of the project team significantly affect the implementation of green practices, stressing the importance of coordinated effort among designers, engineers, and contractors.

In light of the global push for greener construction methods, the need for comprehensive education, targeted training programs, and capacity-building initiatives has become more urgent. Ensuring that professionals in Hargeisa acquire both technical knowledge and hands-on skills is essential for the city to transition toward sustainable building practices.

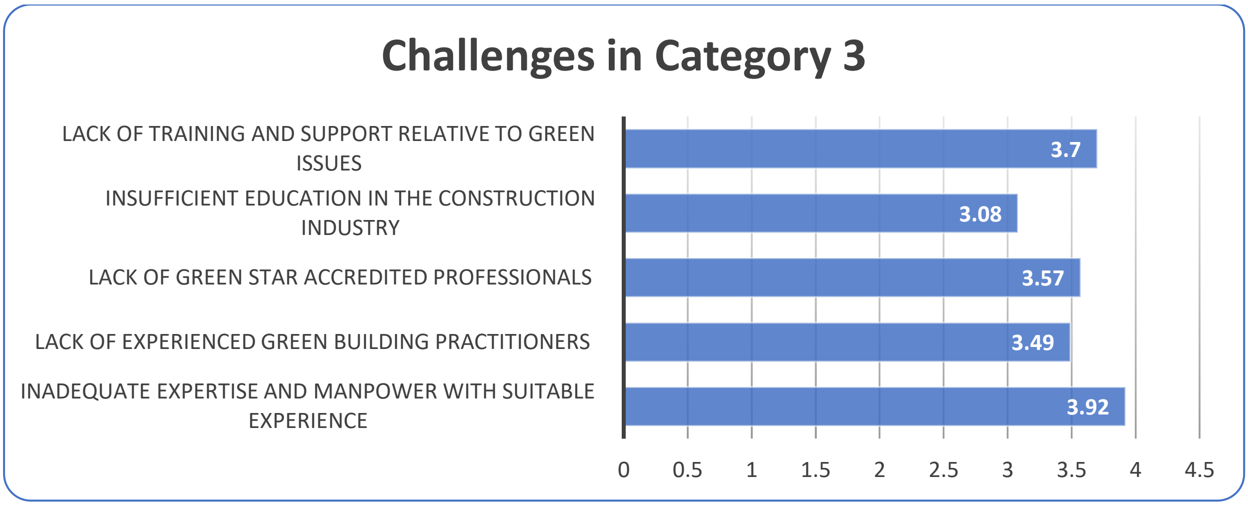


Figure 13 Distribution of responses - Inadequate skilled professionals

4.3.4 Descriptive Statistic of Category 4: Behavioral barriers

Behavioral barriers refer to the attitudes, perceptions, and cultural tendencies among individuals and organizations that hinder the adoption of environmentally sustainable practices. As shown in Table 4, this category includes four main challenges that influence the acceptance and integration of green building concepts in Hargeisa.

Table 8 Behavioral barriers

Challenges in Category 4	**Mean score**
Attitude of professionals towards green initiative	3.56
Resistance-to-change culture	3.03
Non-suitability of western techniques	2.87
Lack of demand for innovative building solution	3.34

Average mean score = 2.88

Among the factors identified, the most significant is the attitude of professionals toward green initiatives (mean = 3.56), indicating a moderate but notable resistance or indifference among professionals toward adopting sustainable practices. This is followed by the lack of demand for innovative building solutions (mean = 3.34), which points to limited market interest or client-driven pressure for greener alternatives.

The resistance-to-change culture (mean = 3.03) reflects a general conservatism within the construction sector, and the non-suitability of western techniques (mean = 2.87) was perceived as the least impactful but still relevant—suggesting that localized and context-appropriate green solutions are necessary.

These findings support the assertions of Djokoto et al. (2014) and Labadie (2010), who noted that the construction industry often resists innovation, particularly when it comes to adopting environmentally friendly technologies and practices. This conservatism has slowed the evolution of construction methods in many developing contexts, including Hargeisa. Labadie (2010) further suggests that the lack of political support and confidence in new technologies may contribute to the persistence of outdated practices.

The relatively low demand for innovation and skepticism towards foreign green approaches highlight the importance of cultural adaptation and market sensitization. For successful green building adoption, it is essential to foster a positive professional mindset, raise awareness about local benefits, and build public and private sector interest in innovative, sustainable solutions tailored to the local context.

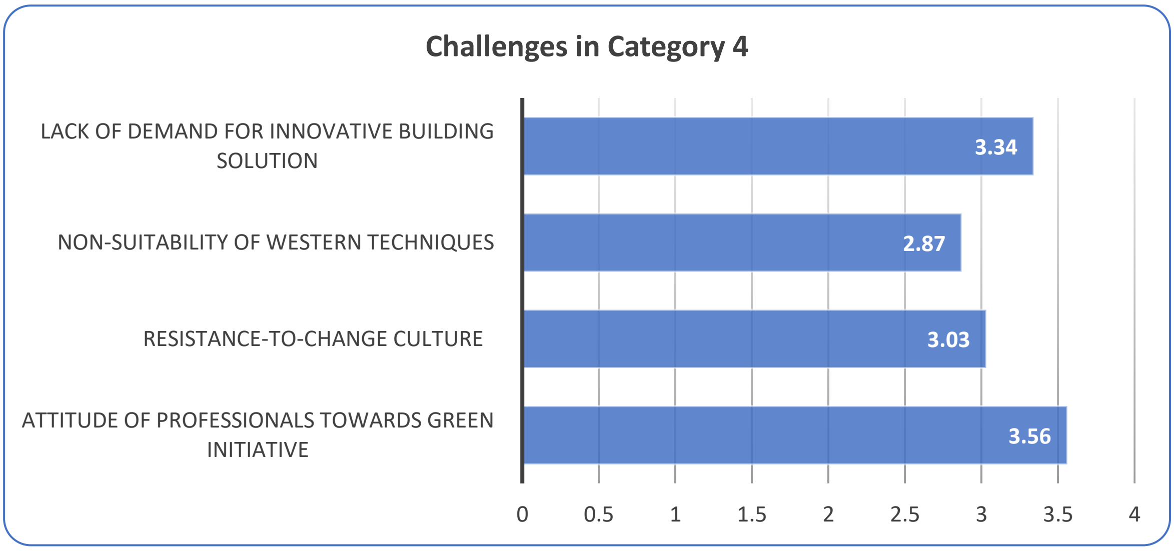


Figure 14 Distribution of responses - Behavioral barriers

4.3.5. Descriptive Statistic of Category 5: Cost of green building

The cost of green building is a significant barrier to its adoption, especially in developing regions like Hargeisa. As outlined in Table 7, this category is defined by two main challenges: the higher upfront costs associated with constructing green buildings and the increased cost of green technologies and materials.

Table 9 Cost of green building

Challenges in Category 5	**Mean score**
Higher up-front costs for green building	4.21
Higher cost of green technologies and materials	3.98

Average mean score = 4.09

The cost of green building is a major barrier, with the highest average mean score among all categories (4.09). The most critical issue is the higher upfront cost of green buildings (mean = 4.21), followed by the high cost of green technologies and materials (mean = 3.98). These challenges discourage investment, especially in resource-limited contexts like Hargeisa.

Studies by Cruywagen (2013) and Hankinson & Breytenbach (2012) support these findings, highlighting cost uncertainty and lack of awareness as key obstacles. Factors such as unfamiliar methods, limited expertise, and certification expenses further elevate costs. Addressing this barrier will require cost reduction strategies, financial incentives, and better industry support.

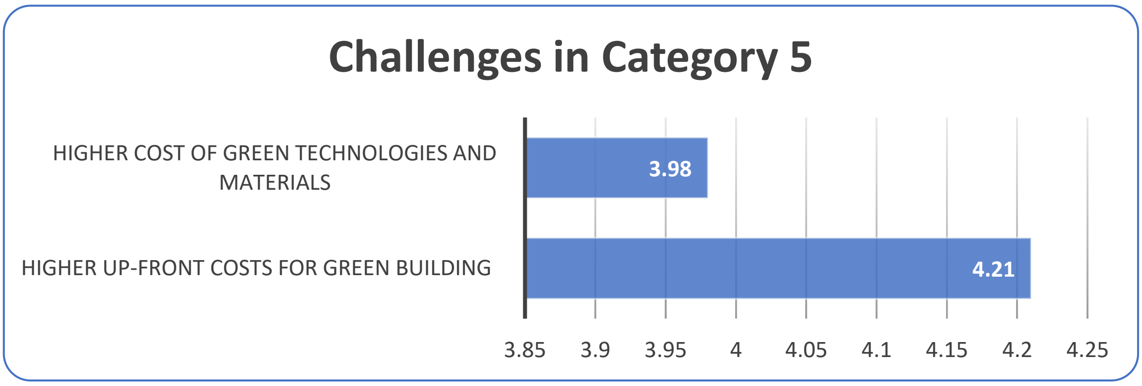


Figure 15 Distribution of responses - Cost of green building

Comparative Ranking of the challenges in implementation of green building principles in order of level of difficulty

Table 10 Comparative Ranking of the challenges

Challenges of Green Building Practice	Mean Score	Rank
Higher up-front costs for green building	4.21	1
Customers are unwilling to pay for green building projects	4.02	2
Higher cost of green technologies and materials	3.98	3
Investors' lack of awareness to easily be persuaded to invest in green projects	3.94	4
Lack of trained/educated green building experts	3.92	5
Lack of professionals and workers with suitable green experience	3.92	6
Lack of relevant local green building research data	3.82	7
Inconsistent standards and insufficient regulations	3.67	8
Lack of green material testing/certification	3.40	9
Inadequate data regarding the advantages of green buildings	3.63	10
Lack of information relative to current green building materials	3.63	11

Lack of training and support relative to green issues	3.70	12
Lack of Green Star accredited professionals	3.57	13
Attitude of professionals towards green initiative	3.56	14
Lack of motivators to encourage green building movement	3.45	15
Certification for green buildings is too costly and time intensive	3.16	16
Lack of demand for creative building solutions	3.34	17
Education within the construction industry is not sufficient to a consensus	3.08	18
Resistance-to-change culture	3.03	19
Difficult to understand requirements/documentation processes	2.93	20
Non-suitability of western approaches	2.87	21

According to responses on a scale of 1 (small) to 5 (major), with a mean score ranging between 1.00 and 5.00, Table 8 displays the respondents' level of agreement regarding the 21 challenges limiting the adoption of green building practices in the construction industry of Hargeisa, Somaliland.

Higher up-front costs for green buildings was ranked first, with a mean score of 4.21, making it the most significant challenge identified. This was followed by customers' unwillingness to pay for green building projects, ranked second with a mean score of 4.02. The lack of awareness among investors, making them difficult to persuade to invest in green buildings, was the third highest challenge with a mean score of 3.94. Other top-ranked challenges included the lack of trained or educated green building experts (mean = 3.92) and the higher cost of green technologies and materials (mean = 3.98), which were ranked fourth and fifth, respectively.

The lack of relevant local green building research data (mean = 3.82) and lack of information on current green building materials (mean = 3.63) also appeared among the top concerns. The least critical challenges, according to respondents, were resistance to change (ranked 19th), difficulty understanding documentation and requirements (ranked 20th), and the non-suitability of western techniques (ranked 21st), with mean scores below 3.10.

These findings are supported by previous studies. The high initial cost of green buildings has been linked to increased market valuation, the elevated price of eco-friendly materials, and the complexities of operating green technologies. Wilson and Tagaza (2004) observed that professionals in other regions perceived green buildings as more expensive than traditional structures. Studies from Australia, the United States, and Singapore similarly concluded that higher construction costs contribute to the slow adoption of green practices.

In the context of Hargeisa, the current study also reveals a substantial lack of professional expertise, with most contractors' understanding of green construction remaining at a basic theoretical level. This aligns with Yusof and Awang (2012), who noted that limited practical knowledge among construction professionals hinders implementation. Another key challenge in the Hargeisa context is the lack of public and investor awareness, which leads to reluctance in adopting green building solutions. As Balaban (2013) emphasized, inadequate access to green construction information creates major barriers to investor confidence and public support.

Analysis of Comparative Ranking of Green Building Challenges

Table 11 Comparative ranking of the five categories of green building practice challenges

Comparative ranking of the five categories of green building practice challenges	Average Mean score
Data and motivation management system	3.75
Regulatory and steering factors	3.29
Inadequate skilled professionals	3.55
Behavioral barriers	3.2
Cost of green building	4.09

The comparative analysis of the five categories of green building practice challenges in Hargeisa reveals that the cost of green building was perceived as the most significant barrier, with the highest average mean score of 4.09. This suggests that stakeholders consider the high initial investment and cost of green technologies and materials as major deterrents to adopting green building practices. The data and motivation management system ranked second with a mean score of 3.75, highlighting issues like the lack of information, awareness, and motivational incentives as critical barriers. Inadequate skilled professionals followed with a mean score of 3.55, indicating that the shortage of trained personnel and limited technical expertise continues to hinder sustainable construction efforts. The regulatory and steering factors category, with a mean score of 3.29, suggests that gaps in policy, regulation, and certification processes are present but are viewed as slightly less critical than skill and data-related issues. Behavioral barriers were ranked lowest, with a mean score of 3.20, showing that while cultural attitudes and resistance to change do pose challenges, they are considered less impactful compared to financial and informational constraints.

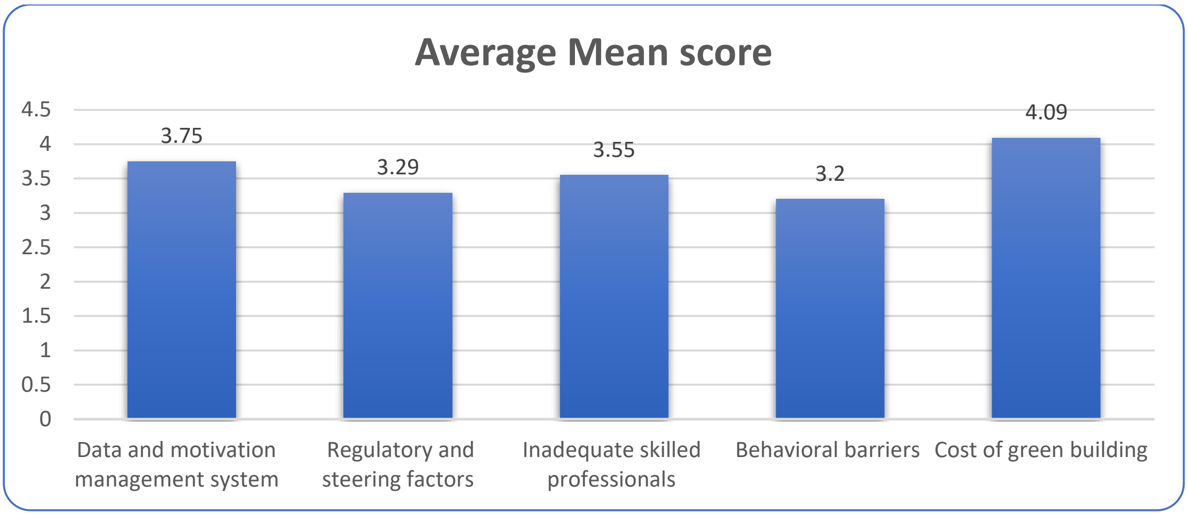


Figure 16 Comparative ranking of the five categories of green building practice challenges

Research Question 2: What green building rating attributes are potentially applicable and have contextual importance to the construction industry in Hargeisa, Somaliland?

This research question was addressed using descriptive statistical analysis of Section III of the survey, which focused on various green building rating attributes. Each item in the survey was categorized under five key rating categories: sustainable sites, water efficiency, energy and atmosphere, materials and resources, and indoor environmental quality.

Based on the findings presented in Table 9, all 25 green building rating attributes included in the survey received mean scores above the neutral point, indicating that respondents considered them important to the local construction context. This suggests that the internationally recognized green building rating criteria are contextually relevant and applicable to the construction industry in Hargeisa, Somaliland. Therefore, the study concludes that these attributes can serve as a foundational reference for developing local green building guidelines and may support future policy and planning efforts to promote sustainable construction practices in the region.

Table 12 Green Building Rating Attributes

Category	**Green Building Rating Attributes**
Sustainable Site	Prevent air and site pollution generated on by construction.
	Protect or restore the building site's natural state with regard to the environment, agriculture, plant life, and animal habitat.
	Choose a location with a higher population density for the project site.
	Build or construct as close as possible to existing utilities and transportation infrastructure.
	Provide safe bicycle storage for building users and tenants.
	Encourage people who live in buildings to drive cleaner, more fuel-efficient cars.
	Reduce the amount of parking spaces at the building's location.
	Control the amount of storm water runoff from the structure or location.
	Manage the building's or site's storm water runoff's quality.
	Use more heat-reflective roof and non-roof materials.
	Maximize open space on the building/site.
	Adopt strategies to save water usage in the building.

Water Efficiency	Treat and re-use waste water in the building.
	Collect rainwater for use in the building.
Energy Efficiency and Atmosphere	Implement approaches to minimize the building's energy use.
	Preferably use renewable energy that is generated on the building site
	Implement strategies to measure and verify energy use in the building.
Materials and Resources	Preferably re-use an existing building structure instead of constructing a new one.
	Preferably use recycled or salvaged building materials.
	Preferably use materials that are available close to the building/site.
	Preferably use building materials that are rapidly-renewable
Indoor Environmental Quality	Restrict indoor smoking.
	Provide openings for natural ventilation.
	Implement strategies to achieve maximum daylight entering the building.

4.4. Assessment of Green Building Rating Attributes

The mean rating score for the overall relevance of each green building attribute was calculated using the same formula applied in previous sections. To interpret the results, the following scale was used: a mean score below 2.5 was considered low or not important, a mean score between 2.5 and 3.0 was interpreted as moderate, scores between 3.0 and 4.0 were classified as moderately high, and scores above 4.0 were regarded as highly important.

Each green building rating attribute was assessed individually within its respective category—namely sustainable sites, water efficiency, energy and atmosphere, materials and resources, and indoor environmental quality. This breakdown allowed for a more precise analysis of the relevance and contextual importance of each attribute to the construction industry in Hargeisa, Somaliland. The findings from this assessment provide key insights into which sustainability dimensions are perceived as most applicable for local green building practices and may inform the development of tailored rating systems or guidelines for the region.

4.4.1 Descriptive Statistic of Category 1: Sustainable site

Table 13 Sustainable site

'Sustainable site' green building attributes	**Mean score**
Prevent air and site pollution generated on by construction.	4.02
Protect or restore the building site's natural state with regard to the environment, agriculture, plant life, and animal habitat.	3.76
Choose a location with a higher population density for the project site.	3.23
Build or construct as close as possible to existing utilities and transportation infrastructure.	3.33
Provide safe bicycle storage for building users and tenants.	3.29

Encourage people who live in buildings to drive cleaner, more fuel-efficient cars.	3.45
Reduce the amount of parking spaces at the building's location.	3.16
Maximize open space on the building/site.	3.6
Control the amount of storm water runoff from the structure or location.	3.5
Manage the building's or site's storm water runoff's quality.	3.67
Use more heat-reflective roof and non-roof materials.	3.7

Average mean score = 3.52

The analysis of eleven sustainable site attributes revealed varying degrees of perceived importance among respondents. The most highly rated factor was preventing air and site pollution during construction activities (Mean = 4.02), followed by protecting or restoring the natural state of the site in terms of environment, agriculture, vegetation, and habitat (Mean = 3.76), and the use of heat-reflective roof and non-roof materials (Mean = 3.70). These results underscore a strong emphasis on minimizing environmental disruption and enhancing thermal performance.

Moderately important attributes included choosing a site in a higher population density area (Mean = 3.23), building close to existing infrastructure (Mean = 3.33), providing safe bicycle storage (Mean = 3.29), and reducing on-site parking spaces (Mean = 3.16). Among the eleven attributes, none scored below 3.00, indicating that all are considered relevant to some extent in promoting sustainable site development.

Overall, the mean scores ranged from 3.16 to 4.02, with an average mean of 3.52. This suggests that the majority of sustainable site features are considered significant contributors to green building practices in Hargeisa.

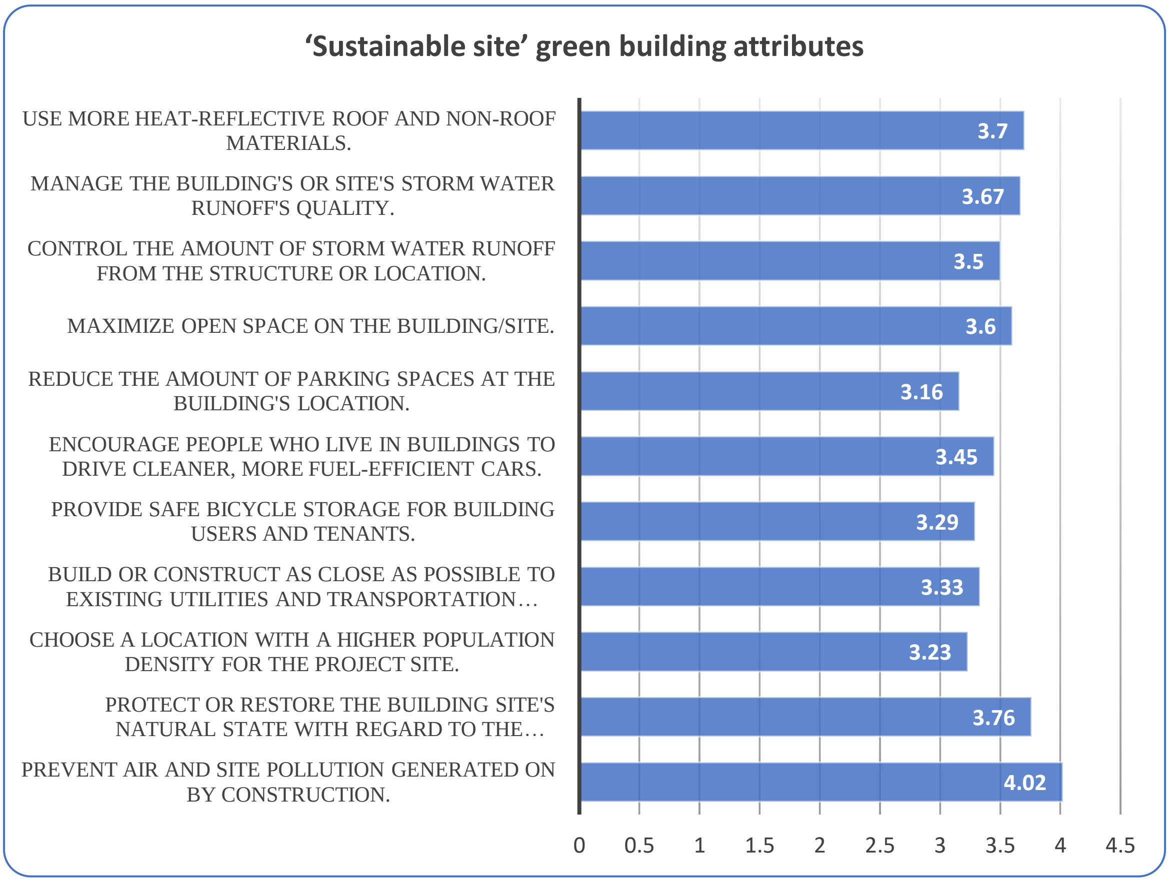


Figure 17 Distribution of the responses - Sustainable site

4.4.2. Descriptive Statistic of Category 2: Water efficiency

The water efficiency category comprises three key green building attributes: adopting strategies to reduce water consumption within the building (Mean = 4.10), collecting rainwater for internal use (Mean = 3.70), and treating and reusing wastewater generated in the building (Mean = 3.61). With an average mean score of 3.80, this category is considered to be of moderately high importance in the context of sustainable construction practices in Hargeisa.

Table 14 Water efficiency

'Water efficiency' green building attributes	**Mean score**
Adopt strategies to save water usage in the building.	4.1
Treat and re-use waste water in the building.	3.61
Collect rainwater for use in the building.	3.7

Average mean score = 3.8

Among the three attributes, the most highly rated was adopting water-saving strategies (4.10), followed by collecting rainwater (3.70) and reusing treated wastewater (3.61). These findings highlight the significance placed on efficient water resource management by stakeholders involved in building design and operations. This aligns with the conclusions drawn by Nelson (2007), who emphasized water efficiency as one of the core objectives of the green building movement.

Furthermore, (Waidyasekara et al. (2013) noted in their comparative study of green building rating systems across eleven countries that water efficiency typically accounts for 10 to 15 credits, underscoring its weight in green rating systems. Their findings also suggest that water efficiency measures are most effectively integrated during the design phase of building development, reinforcing the importance of early planning in achieving sustainable outcomes.

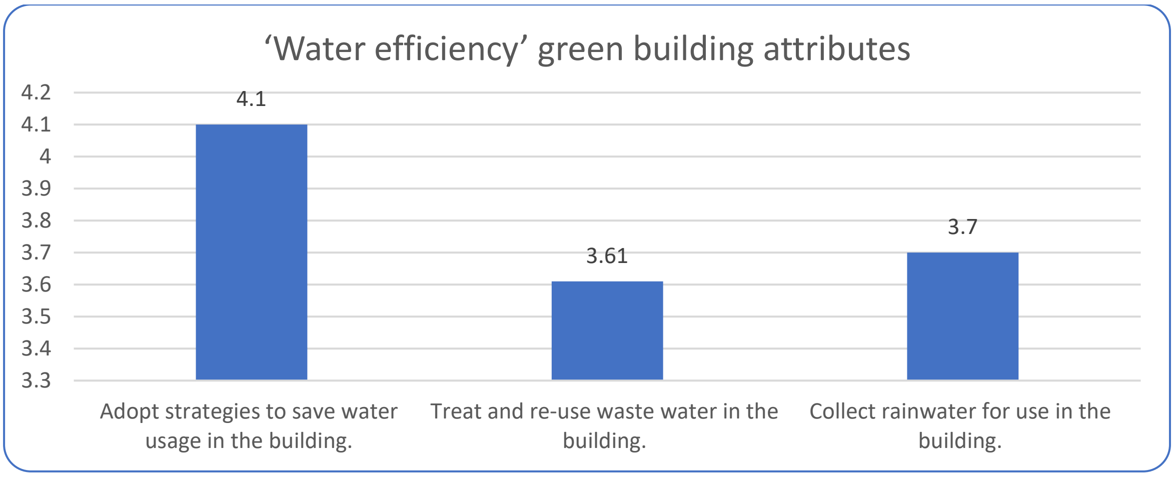


Figure 18 Distribution of responses – Water efficiency

4.4.3 Descriptive Statistic of Category 3: Energy and Atmosphere

The Energy and Atmosphere category includes three essential green building attributes: implementing strategies to minimize the building's energy consumption (Mean = 4.01), using on-site renewable energy sources such as solar and wind (Mean = 3.83), and adopting systems to measure and verify energy usage within the building (Mean = 3.68). With an average mean score of 3.84, this category reflects a relatively high level of importance placed on energy-related sustainability practices in the context of green building in Hargeisa.

Table 15 Energy efficiency and Atmosphere

'Energy and Atmosphere' green building attributes	Mean score
Implement approaches to minimize the building's energy use.	4.01
Preferably use renewable energy that is generated on the building site.	3.83
Implement strategies to measure and verify energy use in the building.	3.68

Average mean score = 3.84

Among the three attributes, minimizing energy consumption received the highest rating (4.01), followed closely by the use of renewable energy and energy performance monitoring. These findings indicate that energy efficiency is a high priority for stakeholders, and they align with global best practices in sustainable construction.

According to the Department of Energy and Climate Change (2012), energy efficiency refers to the effective use of energy to deliver services while reducing waste. By improving energy efficiency, more output can be achieved with less energy, reducing operational costs and environmental impact. Oyedepo (2012) further argues that energy-efficient production should be considered a cost-effective source of new energy, as it lowers the cost of energy supply. Moreover, scholars such as Murer et al. (2013) emphasize that energy efficiency is central to achieving sustainability goals, while Weber (2011) highlights its role in reducing building-related energy demand, especially for lighting, HVAC, and other essential services. Additionally, Zimmerman (2012) asserts that enhanced energy efficiency is one of the most effective strategies for reducing greenhouse gas (GHG) emissions.

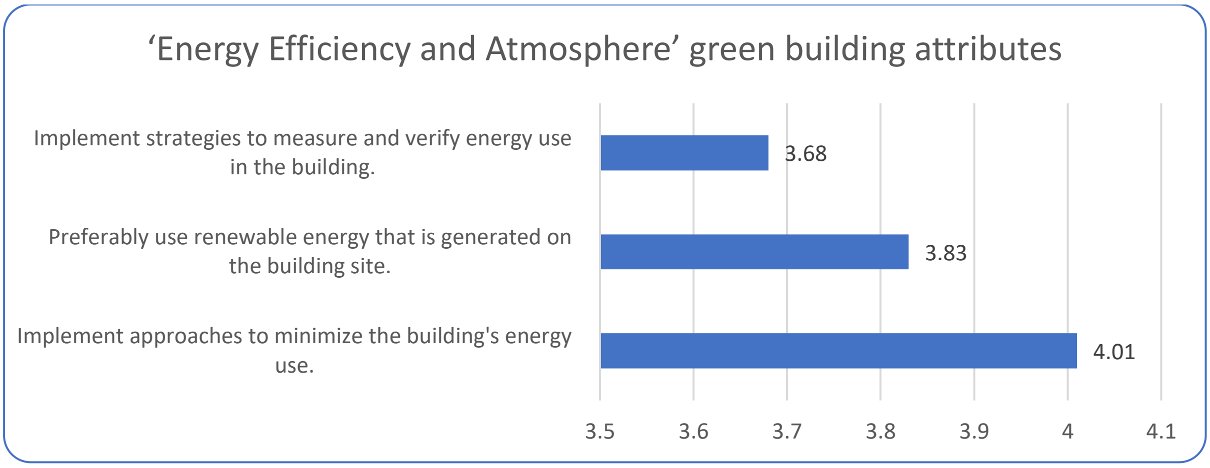


Figure 19 Distribution of responses - Energy efficiency and Atmosphere

4.4.4 Descriptive Statistic of Category 4: Materials and Resources

The Materials and Resources category comprises four key attributes that promote environmentally responsible sourcing and usage of construction inputs. These include: preferably using recycled or salvaged building materials (Mean = 3.84), reusing existing building structures instead of constructing new ones (Mean = 3.61), selecting rapidly renewable materials (Mean = 3.49), and sourcing materials locally near the building site

(Mean = 3.38). With an average mean score of 3.58, this category is considered moderately important in advancing green building practices in Hargeisa.

Table 16 Materials and Resources

'Materials and Resources' green building attributes	**Mean score**
Preferably re-use an existing building structure instead of constructing a new one.	3.61
Preferably use recycled or salvaged building materials.	3.84
Preferably use local materials that are available close to the building/site.	3.38
Preferably use building materials that are rapidly-renewable	3.49

Average mean score = 3.58

Among the four variables, the use of recycled or salvaged materials received the highest rating (3.84), suggesting that respondents recognize the sustainability benefits of minimizing raw material extraction and reducing construction waste. Reusing existing buildings also scored relatively well (3.61), reflecting an awareness of the environmental cost associated with new construction. Meanwhile, using local materials (3.38) and rapidly renewable resources (3.49) were rated slightly lower but still indicated moderate importance.

These findings are consistent with research by Komurlu, Arditi, and Gurgun (2012), who highlight that material selection plays a vital role in achieving sustainability targets when pursuing green building certification. Certification systems typically reward the use of recycled, renewable, and locally sourced materials. Asli P., Gurgun, and Ruveyda K. (2015) further emphasize that materials used in sustainable construction projects significantly influence environmental performance. They advocate for practices such as waste minimization, recycling, and resource reuse as integral components of sustainable material management. Similarly, Castro-Lacouture (2009) affirms that the strategic use of sustainable materials enhances resource efficiency and supports broader green building objectives

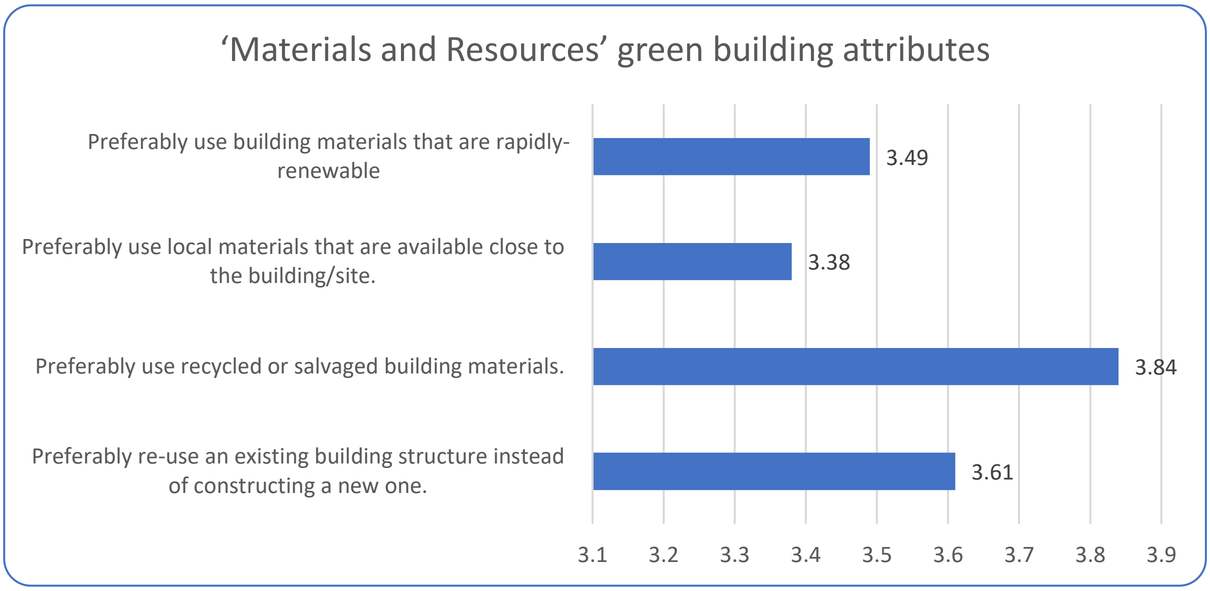


Figure 20 Distribution of responses - Materials and Resources

4.4.5 Descriptive Statistic of Category 5: Indoor Environmental Quality

The Indoor Environmental Quality (IEQ) category comprises three key attributes related to occupant health, comfort, and productivity. These include: providing openings for natural ventilation (Mean = 4.30), implementing strategies to maximize daylight penetration (Mean = 4.11), and prohibiting smoking indoors (Mean = 3.85). The average mean score for this category was 4.08, indicating a high level of importance placed on IEQ-related practices in the context of green building adoption in Hargeisa.

Table 17 Indoor environmental quality

'Indoor Environmental Quality' green building attributes	**Mean score**
Provide openings for natural ventilation.	4.3
Implement strategies to achieve maximum daylight entering the building.	4.11
Prohibit smoking indoors.	3.85

Average mean score = 4.08

Among the variables, the provision of natural ventilation openings received the highest rating (4.30), underscoring its perceived value in improving indoor air quality and thermal comfort. Closely following was the use of daylighting strategies (4.11), which not only reduces energy consumption for lighting but also contributes to the well-being of building occupants. The third variable, restricting indoor smoking, scored slightly lower (3.85) but still fell within the range of high importance.

These findings support earlier studies emphasizing the significance of IEQ in sustainable building design. According to Wargocki et al. (2002), indoor environmental quality plays a crucial role in influencing both the short-term and long-term health of occupants. Daisey et al. (2003) noted that increasing ventilation rates is a proven strategy for reducing indoor air pollution. Additionally, controlling pollutant sources both inside and outside the building further enhances indoor air quality. Research by Wargocki et al. (1999) demonstrated that increased outdoor air supply improves overall air quality and reduces the concentration of pollutants in non-industrial buildings.

Moreover, Brager and Borgeson (2010) asserted that natural ventilation, when properly designed, can significantly reduce energy consumption for cooling. Seppänen and Fisk (2002) further observed that workers in naturally ventilated environments experience fewer symptoms of building-related illnesses compared to those in mechanically conditioned spaces.

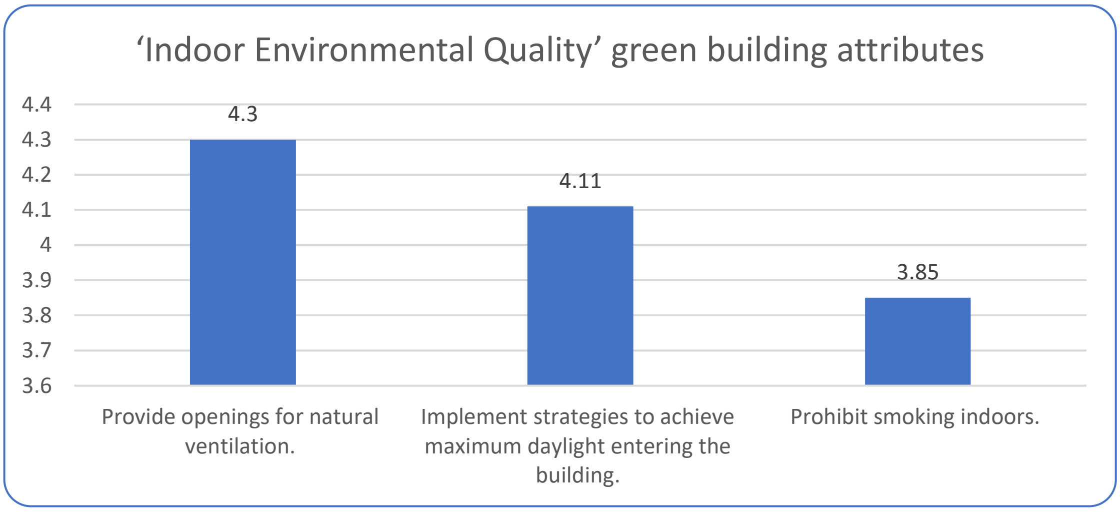


Figure 21 Distribution of responses - Indoor environmental quality

4.5 Green Building Rating Attributes – Ranked by Mean Score

Table 18 Overall ranking of the green building attributes

Green Building Rating Attribute	Mean Score	Rank
Provide openings for natural ventilation.	4.30	1
Implement strategies to achieve maximum daylight entering the building.	4.11	2
Adopt strategies to save water usage in the building.	4.10	3
Prevent air and site pollution generated on by construction.	4.02	4
Implement approaches to minimize the building's energy use.	4.01	5
Preferably use recycled or salvaged building materials.	3.84	6
Preferably use renewable energy that is generated on the building site.	3.83	7
Prohibit smoking indoors.	3.85	8
Collect rainwater for use in the building.	3.70	9
Use more heat-reflective roof and non-roof materials.	3.70	10
Implement strategies to measure and verify energy use in the building.	3.68	11

Manage the building's or site's storm water runoff's quality.	3.67	12
Protect or restore the building site's natural state with regard to the environment, agriculture, plant life, and animal habitat.	3.76	13
Treat and re-use waste water in the building.	3.61	14
Preferably re-use an existing building structure instead of constructing a new one.	3.61	15
Maximize open space on the building/site.	3.60	16
Preferably use building materials that are rapidly-renewable	3.49	17
Encourage people who live in buildings to drive cleaner, more fuel-efficient cars.	3.45	18
Preferably use local materials that are available close to the building/site.	3.38	19
Build or construct as close as possible to existing utilities and transportation infrastructure.	3.33	20
Provide safe bicycle storage for building users and tenants.	3.29	21
Choose a location with a higher population density for the project site.	3.23	22
Reduce the amount of parking spaces at the building's location.	3.16	23
Control the amount of storm water runoff from the structure or location.	3.50	24

4.5.1. Comparative analysis of the green building attributes in order of importance

Table 13 displays the comparative analysis of the green building attributes, ordered based on their mean ratings. The results revealed which green building characteristics are deemed the most important by the respondents in the context of Hargeisa's green building practices.

The category with the highest overall importance is Indoor Environmental Quality, with a mean score of 4.08, making it the most highly valued category. Within this category, providing openings for natural ventilation (4.30) and implementing strategies to achieve maximum daylight entering the building (4.11) were highly rated. These attributes highlight the significance of occupant well-being and comfort in green building design.

Following closely in importance is the Energy Efficiency and Atmosphere category, which received a mean score of 3.84. Among the attributes in this category, implementing approaches to minimize the building's energy use (4.01) was the most important factor, followed by preferably using renewable energy generated on the building site (3.83). These attributes indicate a strong emphasis on reducing energy consumption and reliance on sustainable energy sources.

The Water Efficiency category was also highly regarded, with an average mean score of 3.80. Specifically, adopting strategies to save water usage in the building (4.10) and treating and re-using waste water (3.61) were the highest-rated attributes, demonstrating a commitment to sustainable water management in building designs. However, collecting rainwater for use in the building (3.70) was ranked slightly lower.

In the Materials and Resources category, the most highly valued attribute was preferably using recycled or salvaged building materials (3.84), followed closely by preferably reusing an existing building structure (3.61). Despite this, the use of local materials (3.38) and rapidly renewable materials (3.49) were ranked lower, indicating a relatively moderate priority for these aspects in comparison to energy and water efficiency measures.

Lastly, the Sustainable Site category received an average mean score of 3.52, making it the least prioritized category. The most valued attributes in this category included managing the building's or site's storm water runoff's quality (3.67) and using heat-reflective roof and non-roof materials (3.70), which contribute to the sustainability of the site. However, attributes such as encouraging people to drive cleaner, more fuel-efficient cars (3.29) and reducing parking spaces (2.81) received the lowest scores, reflecting a more moderate approach to site-based sustainability measures.

The least significant attributes were prohibiting smoking indoors (2.47) and preferably re-using an existing building structure instead of constructing new (2.43). These attributes received the lowest rankings (24th and 25th, respectively), reflecting their minimal perceived value in the context of green building implementation in Hargeisa, particularly the latter, as Hargeisa is still undergoing urbanization and expansion.

Comparative Ranking of Green Building Attribute Categories

Table 16 shows the comparative ranking of the green building attribute categories based on their average mean scores. The results reveal the level of importance each category holds in the context of green building practices in Hargeisa.

Table 19 Comparative Ranking of Green Building Attribute Categories

Category	Average Mean Score	Rank
Indoor Environmental Quality	4.08	1
Energy Efficiency and Atmosphere	3.84	2
Water Efficiency	3.80	3
Materials and Resources	3.58	4
Sustainable Site	3.52	5

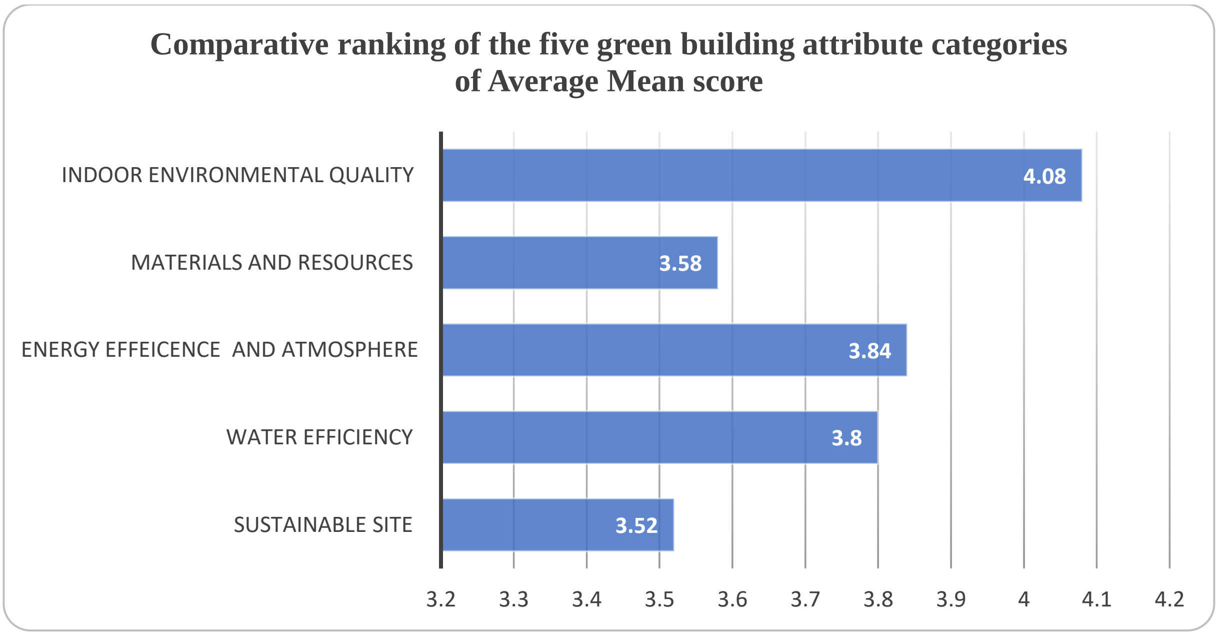


Figure 22 Comparative ranking of the five green building attribute categories

Interpretation:

- Indoor Environmental Quality (4.08) is the most highly valued category, indicating that factors such as natural ventilation and daylight are crucial for creating healthy and comfortable living and working spaces.
- Energy Efficiency and Atmosphere (3.84) follows closely, reflecting a strong emphasis on reducing energy use and promoting the use of renewable energy sources, which are key to sustainable building practices.
- Water Efficiency (3.80) is ranked third, highlighting the importance of water-saving strategies, such as rainwater collection and wastewater reuse, in sustainable buildings.
- Materials and Resources (3.58) comes next, with attributes such as using recycled materials and reusing existing building structures being prioritized, although less so compared to energy and water efficiency measures.
- Sustainable Site (3.52) ranks last, though it still holds significant value. Attributes like stormwater management and the use of heat-reflective materials are considered important, but site-specific factors like reducing parking spaces or encouraging cleaner vehicles were rated lower in importance.

Research Question 3: What are the possible solutions to overcome the challenges in sustainable construction?

To address this research objective, the content analysis method was applied to the responses from the final section of the survey, which included an open-ended question. Participants were invited to share further comments and recommendations regarding the challenges they face in sustainable construction. A total of 89 responses were received.

After performing the content analysis, responses that were unclear or irrelevant were excluded, and similar responses were grouped together. The relevant findings were categorized and presented as follows:

- A local green building council and a tailored green building rating system must be established in Hargeisa's construction industry.
- Green construction is necessary for Hargeisa, but implementation remains difficult due to its ambiguous nature.
- Green building practices are likely to increase construction costs initially.
- The idea of green building is gaining traction in Hargeisa, but full acceptance by developers and clients will take time.
- For green building to be widely embraced in Hargeisa, substantial training efforts are needed.
- There is a need for increased awareness about the benefits of green building in Hargeisa.
- Raising awareness is essential for the successful launch of green building practices in Hargeisa.
- The construction industry needs more technical training in green building practices.
- A significant barrier to green building adoption in Hargeisa is the absence of standardized practices. Environmental professionals must advocate for a coordinated effort to develop local standards, possibly drawing from international rating systems.
- Higher education institutions in Hargeisa should offer specialized courses on green construction.

4.6.1. Education and Awareness Creation

According to the survey respondents, the most effective solution to overcome the challenges in sustainable construction is through education and awareness creation. The participants emphasized that public awareness campaigns, education, and training focusing on the advantages of green buildings are crucial to accelerating the adoption of green construction in Hargeisa.

This finding aligns with Umar and Khamidi's (2012) study, which suggests that raising awareness and understanding of sustainability influences stakeholders' behaviors and promotes the success of green initiatives. While the green building concept is still in its early stages in Hargeisa, it is essential to focus on informing and educating all relevant stakeholders.

Key methods for raising awareness and educating stakeholders include:

- Organizing workshops, seminars, and forums on green building principles and technologies.
- Leveraging media coverage (TV, radio, newspapers) to promote the benefits of green construction.
- Hosting expos and exhibitions organized by the construction industry to share knowledge.
- Publications in newspapers, magazines, and other media to increase visibility of green building benefits.
- Using interactive social media platforms to engage with a broader audience about sustainable practices.
- Introducing guidelines and regulations to help the public understand green building concepts.
- Offering continuing education programs in higher education institutions focusing on green building topics.

4.6.2. Government Support

Another key solution proposed by the participants was the need for government support to promote and develop green construction practices in Hargeisa. The respondents argued that the government plays a pivotal role in encouraging stakeholders to adopt green building practices.

Various studies have highlighted the importance of government intervention in promoting sustainability in construction. To foster the growth of green building practices, the government can implement policies and mechanisms to support green construction.

Government initiatives could include:

- Legislating green building standards and enforcing energy-efficient building codes.
- Providing financial incentives for projects that follow green building practices, such as tax breaks or subsidies.
- Converting government buildings to green buildings as a model for others in the private sector.
- Offering tax incentives to encourage private developers to adopt green building standards.
- Funding research into sustainable construction methods and green building technologies.

4.6.3. Green Building Ratings

The study also found that implementing a green building rating system is crucial for guiding stakeholders toward adopting sustainable construction practices. Respondents emphasized that the establishment of a formal green building rating system could incentivize competition and provide clear guidelines for adopting green construction methods.

The introduction of such systems has been successful in many countries, where they have driven the development of sustainable buildings. A locally tailored green building rating system could help Hargeisa align its construction industry with international sustainability goals while considering local environmental and cultural contexts.

Recommendations for a green building rating system include:

- Establishing a local green building council to develop a green building rating system specific to Hargeisa.
- Adapting international rating systems to create locally relevant standards for green buildings.
- Using the rating system to foster competition among stakeholders, encouraging them to prioritize sustainable construction practices.

CHAPTER FIVE

5. CONCLUSIONS AND RECOMMENDATIONS

5.1. CONCLUSIONS

By identifying the primary challenges to adopting green building concepts into practice, evaluating the most significant green building attributes, and suggesting strategies to improve green building practice in Hargeisa, the three specific research objectives have been met.

The current investigation has identified 21 challenges. According to this study, the major barriers to putting the green building concept into practice in Hargeisa are found to be the higher upfront costs of green buildings, clients' refusal to pay for green building projects, a lack of information to persuade investors that green buildings are a smart option, a lack of qualified green building professionals, and the higher costs of green materials and technologies. This study demonstrated that the project's cost, data and motivation management, and a lack of trained personnel are the three most difficult factors that are making it hard to execute the sustainable building concept in Hargeisa. According to the findings of this study, the least challenging characteristics in green building were found to be the non-suitability of western approaches and the lack of demand for creative building solutions.

The second objective of this study was addressed by making a comparative analysis of the significance level of each of the 25 green building rating attributes according to the perspective of construction professionals in Hargeisa. The outcome showed that the factors correlated with "energy and atmosphere" ranked as having the highest potential for adoption. This indicates that among other green building components, 'energy and atmosphere' attributes are considered to be of the extreme significance by the perspective of building professionals in Hargeisa. In terms of significance, "water efficiency" came in second, and "interior environmental quality" came in third. Materials and resources were placed fourth, and sustainable sites were ranked fifth. A crucial framework for establishing green building rating criteria that is specific to the context of Hargeisa can be formulated based on this ranking of potential green building features in accordance with their assessed value.

The results of this study show that there is a significant knowledge gap regarding the benefits of green construction practices, which discouraged stakeholders from investing in green development initiatives. For this reason, spreading awareness and creating educational opportunities are crucial to promoting the adoption of green concepts. In the current study, financial concerns are the other main difficulty that has been discovered. The government should give financial support for green projects. Besides that, both the government and private sectors should work on green incentives and promoting green concepts in Hargeisa.

In summary, adopting all aspects of sustainability in accordance with the needs of the local context could improve the green movement and diminish its negative effects. Localized green building characteristics may guarantee that the structures are more adaptable to and sustainable in the local environment. It is noted in particular that the government must take action to provide new strategies and motivations for the development of green construction practices in order to advance toward sustainable development

5.2. RECOMMENDATIONS

Based on the study's findings, the following recommendations are proposed to address key challenges and promote green building practices:

- **Promoting Local Green Industry and Financial Incentives:**
  - Provide financial support and establish incentive programs for local manufacturers of environmentally friendly building materials.
  - Utilize government incentives to strengthen local manufacturers and suppliers of green materials.
  - Encourage and promote the widespread usage of locally produced green materials by the government.
  - Support local construction companies, suppliers, and manufacturers through government policies and green building certification systems to foster the adoption of green practices.
  - Ensure the public is well-informed about available incentive programs and tax exemption rules related to green investments.
- **Enhancing Awareness and Education:**
  - Launch comprehensive educational initiatives and awareness campaigns by both private and public sectors to increase understanding of green construction principles among all stakeholders.
  - Organize workshops, conferences, and campaigns to facilitate experience sharing and deepen comprehension of green building concepts.
- **Developing Professional Expertise:**
  - Encourage higher educational institutions to place a strong emphasis on sustainability by offering specialized green building courses, practical education, and relevant training.

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APPENDIX I - QUESTIONNAIRE

This questionnaire was designed by a Master's degree student at Adama science and Technology University, Environmental Architecture Program. Its objective was to collect data related to the challenges and potential attributes of green building practices based on sustainability in Hargeisa, Somaliland. All information was kept confidential and used solely for academic purposes. No personally identifiable information was collected.

Section I: General Information

Please provide information about yourself by checking the most appropriate response.

1. Which of the following best describes your primary occupation category?

   a. Architect

b. Project Manager

c. Site Engineer

d. Quantity Surveyor

e. Other (Specify) ______________.

2. How long have you directly worked or participated in the construction industry?

a. Below 4 years

b. 5–10 years

c. 11–15 years

d. Over 15 years

3. Gender

a. Male

b. Female

Section II: Challenges in Adopting Green Building Practices

The following are key challenges related to the implementation of green buildings. Please rate each challenge based on how significant you believe it is in the context of Hargeisa. (1 = Not a challenge, 5 = Major challenge)

No.	Challenge	1	2	3	4	5
1	Lack of data on benefits of green buildings					
2	Lack of cost data for greening existing buildings					
3	Limited knowledge sharing on green practices					
4	Inadequate information on local green building materials					

5	Lack of local research on green buildings					
6	Lack of incentives for adopting green buildings					
7	Difficulty in measuring/verifying green building performance					
8	Limited access to convincing information for investors					
9	Low customer willingness to invest in green buildings					
10	Weak or inconsistent standards/regulations					
11	Regulatory barriers to innovation					
12	Complexity of requirements and documentation					
13	Lack of testing/certification for green materials					
14	Green certification is costly and time-consuming					
15	Shortage of trained green building professionals					
16	Lack of accredited professionals (e.g., LEED/Green Star)					
17	Lack of skilled professionals and workers					
18	Insufficient training/support on green issues					
19	Inadequate education in the construction industry					
20	Loss of traditional methods due to new innovations					
21	Resistance to change					
22	Professional attitudes toward green initiatives					
23	Low demand for sustainable building solutions					
24	Unsuitability of Western techniques					
25	High upfront costs of green buildings					

26	High cost of green technologies/materials					

Section III: Green Building Rating Attributes

Green building involves different sustainability attributes. Please rate the importance of the following attributes in the context of Hargeisa. (1 = Not important, 5 = Very important)

No.	Category	Green Building Attribute	1	2	3	4
1	Sustainable Site	Prevent site and air pollution during construction				
2		Restore the natural condition of the site (ecosystem, habitat)				
3		Locate buildings in higher population density areas				
4		Build near public transport and utility infrastructure				
5	Water Efficiency	Reduce water consumption inside the building				
6		Treat and reuse greywater				
7	Energy & Atmosphere	Minimize energy consumption				
8	Materials & Resources	Reuse existing building structures				
9	Indoor Environmental Quality	Provide natural ventilation openings				

Section IV: Open Feedback

If you have any additional suggestions, recommendations, or concerns related to green building practices in Hargeisa, please share them below:____

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Interview Guide

1. Do you think green building practices are beneficial for Somaliland? How?
2. How do you assess the current practice of green building concepts in Hargeisa's construction sector?
3. What gaps or limitations exist in green building adoption in Hargeisa?
4. What are the main challenges to implementing green building principles in Somaliland?
5. What strategies would you recommend to improve green building practices locally?