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An Assessment of the Viability of Green Building Technologies in Construction Projects in Nairobi County, Kenya

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***Abstract*— Construction activities in Nairobi County, Kenya, are still overwhelmingly based on conventional construction methods and materials, leading to environmental degradation, high resource use, and lost opportunities for cost and energy savings. Despite green building technologies' promise to resolve these problems, adoption is narrow because green technologies are costly, awareness is poor, policies are poorly enforced, and culturally, construction is resistant to changes. The study aimed to identify the viability of green building technologies when used on construction sites in Nairobi County. The specific goals were: to analyze the impact on construction costs from the use of green construction materials; to examine the correlation between green construction practice and construction costs; to find out the combined impact from green construction practice and green construction materials; and to evaluate strategies for increased green building technologies` adoption. A descriptive research design was utilized. The study target population consisted of 150 green commercial builders, architects, engineers, project managers, quantity surveyors, contractors, and end-users from Nairobi County. Stratified and simple random sampling was applied to select 150 respondents, ensuring representativeness and reduction of selection bias. Out of the 150 questionnaires administered, 140 were returned, giving a response rate of 93.3%. This was deemed adequate for reliable statistical analysis. Questionnaires were administered through a structured schedule, and data were complemented by secondary sources. The analysis was carried out on SPSS version 29 and Microsoft Excel, where descriptive statistics described the principal indicators and inferential statistics, ANOVA and regression analysis, tested the postulated relationships. Green materials, including aluminium formwork, interlocking blocks, bamboo, recycled steel, reused timber, and straw bale construction, reduce significantly costs of use and environmental footprints, and green activities, namely energy saving measures, waste reduction, and water savings, enhance building performance, reduce carbon emissions, and improve indoor air quality. The combined use of green materials and practices yielded greater cost efficiency and sustainability benefits than their isolated application. However, adoption is hindered by high initial investment costs, inadequate technical expertise, regulatory gaps, and cultural barriers. The study concludes that green building technologies are viable for Nairobi's construction sector and, if effectively promoted, can support Kenya's sustainable development agenda. Key recommendations include the introduction of policy incentives and subsidies, industry-wide capacity-building and technical training, stronger enforcement of green building standards, and increased public awareness campaigns to foster acceptance and demand for sustainable construction. These findings provide valuable insights for policymakers, construction stakeholders, investors, and researchers working toward the mainstreaming of sustainable building practices in Kenya and comparable developing contexts.**

***Keywords*— Green building technologies, construction projects, Nairobi County, sustainable practices, viability**

I. INTRODUCTION

A. Background

The global construction industry has been through significant changes in the past couple of decades, and sustainability has become the chief driver of innovation and advancement. Green building technologies, which are building methods, materials, and systems that provide environmental stewardship and resource effectiveness over the lifecycle of a building, have been the subject of unprecedented international attention as the industry seeks to fight climate change, resource degradation, and ecological destruction. This change has been brought about by the global treaties such as the United Nations Sustainable Development Goals (SDGs) and the Paris Climate Agreement, and local environmental policies which emphasize the urgency of the need for sustainable building practices.

Kenya, a rapidly emerging nation in Eastern Africa, has unusual challenges to balance economic growth with environmental sustainability. Kenya's building construction industry has experienced unprecedented growth, contributing about 13.4% of the nation's GDP and serving as a major catalyst of infrastructure building and urbanization (Ngeny, 2022). However, the growth came about with a considerable environmental cost, with the building construction industry contributing significant resource use, carbon footprints, and

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wastages. The National Climate Change Action Plan 2018-2022 and the nation's target of achieving carbon neutrality by 2030 have created an imperative for the construction industry to practice environmentally friendly approaches, thus making green building technologies a necessity rather than an option for the nation's policy of sustainable development.

Nairobi County, the capital city and largest city of Kenya, is a microcosm of the country's construction opportunities and challenges. With a population of over 4.4 million, the county contains Eastern Africa's economic hub, which is rapidly undergoing urbanization, thereby increasing the demand for residential, institutional, and commercial buildings (Calas, 2021). Increased construction activities all over the world, including Kenya, have been followed by a parallel increase in the use and demand for raw building material. As the use of raw building material continues to rise, the volume of building wastes continues to rise accordingly, comprised of concrete and bricks of such collapsed buildings, defective woods, and unassembled elements of these materials. Methods of disposing such wastes, such as the burning of the plastic and timber wastes, have become a cause of concern. Such wastes and methods of disposing them have serious economic and environmental effects in Kenya and the whole world, as the building costs are heightened while financial funds that could have been used elsewhere are decreased. Additionally, such wastes have been highly contributing to the escalation of the carbon footprint, which has been followed by the effects of climate change, a situation which requires creativity and innovation in the construction industry of the whole world towards the manufacturing of green building material as well as the escalation of the whole building process.

Green building technologies are a wide range of innovations involving building systems which are energy-efficient, sustainable building materials, water-saving technologies, integration of renewable energy, strategies for minimizing waste, and improvement of indoor environmental quality. Green buildings are structures that have been developed to be resource efficient and environmentally friendly, incorporating environmentally friendly measures and good utilization of resources throughout the construction process. International green building certifications such as LEED (Leadership in Energy and Environmental Design) and EDGE (Excellence in Design for Greater Efficiencies) have been developed to provide frameworks for environmentally responsible construction, and these certifications are now increasingly applied within Kenya to benchmark sustainability standards in the built environment. In Nairobi, notable examples of green-certified buildings include the University of Nairobi Towers, which was designed with energy-efficient systems and received EDGE certification, The Global Trade Centre, and Two Rivers Mall, both of which have incorporated sustainable design features to enhance energy and water efficiency. These examples demonstrate that green building technologies are not only viable in Kenya but also gaining traction among developers committed to sustainable urban development.

Green construction materials used for construction are characterized by their low-level carbon footprint, environmentally-friendly characteristics, and highly cheap prices. Green building construction involves the activities used to construct planned buildings through the utilization of renewable and environmentally-friendly building raw materials. Kenya's building construction sector has adopted a whole lifecycle approach of construction planning, design, material supply, building operation, and building servicing of the constructed commodities with the goal of ensuring the building sites' inherent efficacies are optimized effectively and integrated with low-carbon technologies and renewable energy to foster the achievement of a healthy building and building construction environment. There are several green building materials which have been introduced and are being optimized by the international building construction sector, such as, reclaimed and recycled woods, fiber cements, recycled steels, recycled glasses and plastics, pallets, and bamboo. Such building materials have excellent characteristics to meet building and building construction needs in Kenya. For instance, fiber cements have excellent fire resistance and durability qualities at cheap prices, resistant to extreme weather factors, hence easily adoptable in different parts of Kenya. In green building construction, recycled steels are highly used, the recycling process involving the melting of steels through the use of furnaces before the molten metal, which gets the molten metal, thereafter, cooled as well as solidified after it gets cast into desired shape molds. Such a process helps conserve the material's atomic make-up, which ensures the material retains the same amount of durability and strength regardless of the various recycling cycles. Of special significance is the application of scrap steel in the green buildings as it contributes to saving up to 74 per cent of the energy needed to manufacture new steel, and when a tonne of steel is recycled, savings would amount up to 0.5 tonnes of coke and 1.5 tonnes of iron ore.

B. Research Problem

The global construction sector is under growing pressure to implement sustainable practices given the escalating environmental issues as well as a need for curbing carbon emissions. Kenya's construction sector still depends on traditional building methods and building materials, leading to environmental degradation as well as inefficient use of resources. The problem under research is a limited understanding as well as a lack of awareness regarding the feasibility of green building technologies in projects within Nairobi County. Consequently, there has been a slow growth in adoption rates of sustainable constructions, hindering the sector from realizing its utmost environmental as well as economic benefits from green building technologies. Limited use of green building technologies as well as green building methods in Kenya's construction sector is a loss in potential cost reduction, energy efficiency, and environmental sustainability.

A number of studies have examined the adoption of green building technologies across the world, highlighting some of their benefits as well as hindrances in implementation. Branca et al. (2020) proved how the utilization of recycled steel in green buildings reduces energy used in making steel from raw material by up to 74%, while Abera et al. (2024) explained how different green materials such as reclaimed wood, fiber cement, as well as bamboo, contribute significantly in satisfying building standards. Javed et al. (2020) pointed out how planning, designing, procuring material, operating, as well as maintaining, must take a holistic approach for effective green building implementation. However, despite all these

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breakthroughs and these success stories, adoption of green building technologies in Nairobi County has been sporadic and limited, with various barriers such as the exorbitant initial costs, ignorance, inadequate technical expertise, regulatory gaps, and market resistance inhibiting wide-scale adoption. Technical appropriateness of green building technologies in Nairobi County relies on a number of factors such as local climatic conditions, availability of sustainable building materials, technical expertise, infrastructure capabilities, and maintenance requirements. Nairobi City's tropical highland climatic conditions provide a mixture of prospects and challenges for the use of green building technologies. Relatively stable temperatures, intense solar radiation, and the bimodal rainfall regime provide good conditions for a number of green technologies such as solar photovoltaic systems, ventilation, and rainwater harvesting.

Regulatory framework for green building technologies for Kenya has changed considerably over the past couple of years, through the formal integration of the Green Building Society of Kenya, the adoption of green building rating systems, new environmental regulations, as well as building codes. The National Construction Authority began incorporating sustainability specifications in building specifications, while the county governments, such as, Nairobi County, have begun drafting green building policies and reward programs. Enforcement and adoption of these regulations, however, are yet patchy, hence leading to confusion among the industry stakeholders and yet inhibiting the adoption of green building technologies. As such, this study attempts to contribute to the knowledge base by exploring the viability of green building technologies specifically within Nairobi County's construction sector, addressing the identified research gaps and providing evidence-based recommendations for stakeholders. However, there is no evidence that research has been carried out on the utilization of green building technologies in Nairobi County, it is for this purpose that this study is aiming to assess the viability of the green building technologies in construction projects in Nairobi County.

C. Research Objectives

The main objective of this study is to investigate viability of the use of green building technologies in construction projects in Nairobi County.

Specific Objectives

1. To analyze the effect of use of green materials on the cost of building construction projects.
2. To establish the relationship between the use of green building practices and the cost of building construction projects.
3. To examine the combined effects of green building materials and practices to the cost of building construction.

To evaluate strategies and policy-driven approaches that can effectively increase the adoption of green building technologies in Nairobi County

D. Study Significance

The implications of this study on the different stakeholders in the construction industry in Kenya were very crucial because it provided comprehensive evidence that could drive the process of sustainable development. The players in the industry, such as the developers, contractors, designers and other stakeholders were given a more insight into green building products and practices allowing them adopt informed choices concerning sustainable building technology. The architectural firms and other building firms especially were the direct benefactors of the study as it illuminated not only the monetary advantage but the other benefits of implementing green building technologies that serves as evidence-based support in the shift towards traditional methods to more eco-friendly ones.

Professionals in the industries were provided with useful fact on the cost implications, implementation procedures, and consequences of green technologies in the long run, which might end up being embraced faster and providing them with a competitive edge towards an expanding industry. The research was also of assistance to the stakeholders in looking at the viability and profitability of the Green building investments thus the research may have assisted in greater market penetration of the sustainable approaches to construction in the Nairobi County and across the country.

Policy-wise, the research gave the Kenyan administration, especially the Ministry of Housing and Urban Development, career supporting information to aid in policy formulation, incentives, and mechanisms of encouraging green building technologies. This donation aided in national sustainable development ambitions and climate change interventions measures.

Academically, the study contributed to the literature of green building technologies in the developing countries that fulfilled the gap that was noted in the Kenyan context. It gave a point of reference to future scholars and researchers that would conduct their investigations on sustainable construction in such a socio-economic set up and it was used to further conduct other research on how green building technologies fuel the growth of the construction sector. Further, the research has provided input in the world discussion about sustainable construction in emerging economies providing a framework which is of relevance to the development programs and best practices in other part of the world on how to incorporate green building technologies in developing communities.

II. LITERATURE REVIEW

A. Introduction

This chapter reviews existing literature on the use and impact of green building technologies globally and within the Kenyan context, with a focus on materials, practices, and the methodologies used by past researchers. Emphasis is placed on how data was collected and analyzed, what research designs were used, and what gaps or contradictions persist in scholarly discussions on green construction. This lays the foundation for the current study’s contribution to the ongoing academic and practical debates surrounding sustainability in the construction industry.

B. Use of Green Building Materials in Building Construction

Moradi and Sormunen (2024) defines the green building materials as those products that are minimally or naturally processed, their energy use is low and the chemical release risk is low when they are being manufactured. Construction

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comprises of the metal ore, ground minerals and aggregates extraction and exhaustion of these minerals means that they won't be available for future use. Thus, there is need to ensure that such resources are utilised efficiently or alternatives are availed to replace them to foster greater sustainability in the construction industry. Blackburne et al. (2022) argues that the process of manufacturing these materials is likely to cause pollution problems and consumption of substantial energy amounts. The products that are minimally processed or are natural may regarded to be green because low carbon is released during their manufacture and energy use is limited. In green construction, the selection of these materials with less properties that are less hazardous from the manufacturing stage to recycling point is a critical step (Agyekum et al., 2022).

Analysis of the literature used coincides well with the aim of the research which was to determine the feasibility of green building technologies in Nairobi County. The minimal processing, energy-efficient, low in the chemical emission definition of green building materials as provided by Moradi and Sormunen (2024) highlights the essential environmental argument behind the need to employ the sustainable constructions methods within the urban setting such as in the case of Nairobi. Due to the fast urbanization and rising demand of building materials, the exhaustion of natural resources like metal ores, ground minerals and aggregates is an urgent issue as the county develops rapidly. The focus on the use of alternative materials that aim at curbing the use of non-renewable resources is also eminent in Nairobi, considering that unsustainable construction activities have been known to derail carbon footprints and efficiency of resources in the past. The study contributes to the manifestation of the global sustainability agenda as well as anchors the issue of sustainability in the local Kenyan capital of Nairobi by examining how green materials are likely to be introduced in the commercial building industry in the city.

Additionally, arguments expressed by Blackburne et al. (2022) and Agyekum et al. (2022), based on the environmental risk of conventional material production, the key arguments being energy intensity and pollution, create a convincing premise to assess the environmental impact of the green building technologies as an alternative to conventional production methods. Nairobi as a city that is ever so industrialized experiences such challenge that is similar to that experienced in Manila, where the old construction techniques have led to degradation of the environment due to high emission and high levels of energy consumption. The process of identifying material low in embodied energy and with low amounts of chemical hazards helped this research in confirming its research questions that green building practice has the potential to increase its environmental performance and still be economically self-sufficient. This study was premised on the scholarly findings and attempted to empirically present how such green materials, used in the Nairobi County, could lower the cost of construction, aid in regulatory compliance, and improve the built environment sustainability, in general.

With regard to Environmental Protection Agency of USA, environmental friendly materials have to been used in green building in an efficient manner and that which minimises environmental effects. Green Building Council states that 'it's less costly to use green materials compared to conventional one (Kruege et al., 2019)'. This is supported by Australian Building Council, which adds that the cost saving attributes of the materials could be used to minimise the cost of construction, hence, allowing developers to increase the number of units via the available capital. This research study sort to determine whether the situation was the same in the construction sector of Kenya and later assess whether these green building materials are more affordable in the region and if they are likely to contribute to the sector's growth. The research further attempted to identify other ways that these materials could be used to foster the industry's growth.

Another important aspect of viability measurement was the social acceptance and awareness of various stakeholders in the Nairobi County to the use of green building technologies. Although there has been an increase in the level of environmental awareness amongst some groups in the population, especially the educated urbanites and corporate institutions of society, people are not very aware of the advantages of green building. The general knowledge of the green building technologies, their advantages, and the necessities of their functioning as well as the understanding of the end-user and building owners and tenants was insufficient, thus, creating demand for sustainable construction projects and shaping the future of a green building project.

The green building technologies in the Nairobi County have several market dynamics determined by factors such as developer preferences, interest of investors, companies demand, the availability of financing as well as competition. The development of the concept of multinational corporations, international developmental organizations and environmentally friendly investors has led to the development of an increasingly growing market segment which actively pursues green building as a solution. But the larger market is still dominated by the traditional methods of construction and the sensitivity to prices remains an important factor to most of the players in the market.

The adaptation of renovation to green building technologies existing construction practice in the Nairobi County has presented opportunities and challenges. Some of these technologies are simple to retrofit, or integrate with standard construction techniques but others demand some basic changes in design strategy, construction practice and operating routines. The ability of the local construction industry to adjust to these new demands, the presence of skilled workforce, suitable equipment, as well as effective supply chains, determines the feasibility of green building technologies, to a considerable degree.

Environmental impact study of green building technologies for the case of Nairobi County should consider local environmental conditions, resource availability, and ecological sensitivities. As a city that is found in a water-scarcity location, which is subjected to the impacts of climatic change, as well as a hub of economic activity for the region, produces a group of rare environmental challenges, which the green building technologies have to resolve. Helping the environment, reducing resource use, and addressing the consequences of climatic change at the local level are all important constituents of their general viability.

This study emanates from the realization that while green building technologies have immense potential for the solving of environmental challenges as well as improved building

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performance for the county of Nairobi, their adoption as a mass process relies on a comprehensive understanding of their viability on various fronts. Based on a comprehensive exploration of the economic, as well as the environmental, social, and the technical drivers that influence the viability of green building technologies, the study hopes to provide evidence-based information relevant to the policy design process, industry practices, as well as decision-making process intended to catalyze the adoption of sustainable construction practices for the county of Nairobi, as well as the broader sustainability agenda of Kenya. The findings of the study would benefit stakeholders within the construction sector, the policy circles, investors, as well as the academic circles involved in the quest for sustainable development for the cities of Kenya.

A compelling Kenyan case study of material efficiency and cost-effective sustainability was the Catholic University of Eastern Africa (CUEA) Learning Resource Centre, designed by Architect Musau Kimeu ("Architects |," n.d.). The project utilized locally available resources including Njiru blue stone, Mazeras paving, and Mvule timber, successfully reducing the environmental footprint and debunking the myth that green buildings must be costly. These materials not only met performance and aesthetic needs but also reflected a strong commitment to vernacular architecture and sustainability. To achieve this, green building materials outlined by the Environment Agency and Indian Concrete Institute were focused such as interlocking block system and the aluminium formwork system, which are discussed in the below sub-sections;

1) Aluminium Formwork and the Construction Industry Growth

Mandala and Nayaka (2023) defines Aluminum formwork is a structure that is used to hold and mound concrete to the required dimensions and give it support until it attains the form to support itself. It has bearers that support the face contact material directly. This material is cost saving compared to the form works made of wood in the past, which were also labour intensive because of the need for joinery via use of nails with the process of setting them up being very tedious. This was a view that was supported by the Building Council of Australia (2019), which argues that the saved costs can be used to increase the number of units by developers. These systems are widely used in buildings and apartments' construction, which are both high and low rises. Senarath and Fernando (2017) added that another advantage of these materials was that they require less labour during installation, they could be re-used as much as possible and require no use of cranes in high storey buildings. With regard to the green building council, these materials are regarded to be regarded due to a number of reasons.

According to Li et al. (2023), one of them was that they reduced natural resources' depletion. This was because they replaced the use of wood and this was vital in ensuring that cutting down of trees was reduced and this was significant to the protection of the natural environment. Kavaarpuo et al. (2024) adds that another reason was because of the fact that the forms could be re-used more than 2000 times when compared to steel. As well, they have the ability to minimise concrete wastage trough spills to a minimal amount because they do form moulds that re air-tight. The minimisation of wastes contributes significantly within the construction industry. The use of these materials do minimise the construction costs by 40% compared to the cost that is incurred when using conventional building materials (Kavaarpuo et al., 2024). This was also attributed to the fact that labour cost is minimised by 30% compared to when conventional building materials are being used. This has been supported by the Indian National Institute of Building Sciences meaning that these materials have proven to be of great value in the Indian construction industry.

Breja and Couston (2017) add that these materials reduce the time used to construct buildings because of the high construction speed that is fostered. It outlines that a structure that is constructed using these materials could be finished at the rate of 4 days per every floor. Lubis et al. (2024) clarifies that a 5 storey building that normally takes 32 weeks using conventional methods could take less than 8 weeks when the aluminium form work system is used and also producing a building that is stronger 10 times compared to a conventional building. The increased construction speed of the aforementioned material and its strengths have not been fully related to the growth of the construction industry and this leaves a gap that this study sought to fill.

The literature relating to the aluminium formwork technology was assesses in relation with the objectives of the study that looked into the feasibility of green building technologies in the construction industry in Nairobi County. The benefits of aluminium formwork listed by Mandala and Nayaka (2023) and highlighted by the international institutions, including the Building Council of Australia or Indian National Institute of Building Sciences, addresses the economic and environmental outcomes of green construction directly. The city of Nairobi in Nairobi County is enjoying a high rate of development as well as a high demand of both low-rise and high-rise commercial structures and thus the development of new cost saving technologies such as the aluminium formwork are very beneficial to it. The smaller number of skilled labor, the repetitiveness of the work which extends its life to more than 2,000 cycles as well as reduced reliance on wood-based formworks make this system financially viable and environmentally friendlier since this will save forests and construction waste materials. This is portraying a feasible channel of realization of the green construction objectives in the Kenyan context especially in meeting the local challenges which include excessive costs of labor as well as material wastage.

More so, the streamlined construction duration (as it is achieved through aluminium formwork systems, Breja and Couston, 2017; Lubis et al., 2024) gives an additional aspect of its cost-effectiveness. In a city such as Nairobi where delays in the construction time-lines are the order of the day occasioned by logistical constraints, regulatory and personal congenial climate, speed enhancing technologies that do not affect the quality of the work done on the construction project are priceless. This is echoed by the fact that the present research aimed at discovering the green technologies capable of saving the environment-still maintaining economic and modernization development of the local construction sector. Notwithstanding these interesting advantages, it is mentioned in the literature that the exact contribution of aluminium formwork to the

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overall growth of the sectors is yet to be explored fully, precisely the gap this study aims to fill by contextualizing the technology's performance and acceptance within Nairobi County's evolving construction landscape.

2) Interlocking Blocks and Construction Industry Growth

The interlocking block system are alternatives to conventional brick and mortar through the use of stabilised soil blocks that are interlocked (Mandala & Nayaka, 2023). Soil stabilization is used for additional forces or supplement to soil in order to increase its strengths and water-proof ability with the interlocks increasing its wall structural stability and reduces the cement amount that is required as mortar. Tighnavard et al. (2018) argues that the interlocking block is created by compressing soil and stabilizer mixture hydraulically in a block making machine. The produced block has grooves on all sides to foster a perfect interlock when two consecutive blocks are stacked together to create aesthetic and strong walls. These interlocks allow the building of walls without need for mortar or cement to join the blocks that are subsequent, hence, forming walls that are of same strength as those that are built using conventional materials like mortar and stones (Bonisile et al., 2019). This method is being adopted widely leading to different types of manual and motor-driven presses and industrial and mobile scale unit production that are cost-effective as well as environmentally friendly, hence, highly likely to foster the growth of the industry.

According to Muhammed et al. (2022), these materials are considered green because they do minimise negative effects as compared to application of conventional methods. The use of these blocks significantly minimised the use of energy in the construction sector and also cut down excessive emission of carbon. They significantly minimise the use of cement and mortar in construction and that meant that the production of cement is lowered (Monraview & Aramenko, 2020). The production process does involve limestone mining, which has negative impacts on the environment through the excess carbon emissions from the factories that are producing cement. These blocks give green benefits through the reduction of negative effects of transporting materials used for building, hence, reducing carbon emissions from lorries because in most of the cases, the production of the discussed blocks is done on the site. Garg et al. (2021) argues that this technology is an affordable construction strategy compared to the use of conventional building materials. It also fosters the removal of cement used in block joints and this fosters quicker construction, hence, labour cost is minimised. These materials make significant contributions to the growth of the construction industry because with saved resources, more units are produced with the same capital.

The lessons addressed in the literature reviewed on interlocking block structures directly correspond to the main objective of the study that was dealing with the feasibility study of green building technologies in the County of Nairobi. As emphasised by Mandala and Nayaka (2023) and Tighnavard et al. (2018), interlocking blocks offer a viable replacement of conventional brick-and-mortar systems using stabilized soil blocks that need minor or no mortar. It also saves a lot on cement which is a significant contributor of carbon emission in the construction sector, and is, therefore, highly applicable in the scenario of Nairobi where environmental sustainability is currently a high priority. Since the construction industry in Nairobi has been booming to cater to the population growth and urbanization, promoting the use of cost effective and environmentally friendly construction technologies like interlocking blocks has a potential to be a way of addressing the issue of environmental degradation, at the same time fulfilling the needs of infrastructure provision.

The cost-effectiveness and the possibility to produce interlocking blocks on-site, which Muhammed et al. (2022) and Garg et al. (2021) mentioned as corresponding positively to their application in Nairobi County, was also supported by the fact that high prices of materials and transportation restrictions were limiting factors of many developers working in the area. This decrease in the labor, cement and transportation requirements had a significant cost savings and increase in efficiency in the project which is important in the viability of green building technologies. Parallel to the economic value in terms of capital cost savings, the environmental value in the form of reduced emission, a lower dependency on industrial cement steamworks can be developed, thus making interlocking block systems a strategic intervention towards acquiring economic and ecological sustainability. The aim of the current research was to examine empirically the potential of the prolific adoption of such technologies in potentially changing the face of the construction sector in Nairobi County by reducing the cost of heavy construction, making it more energy-efficient, and improving on green practices, which eventually would help enhance a greener city-built environment in the county.

3) Bamboo

Ali et al. (2018) states that bamboo is a sustainable and popular material in the construction industry because of its flexibility, strengths and rapid growth. These features make it applications in different areas like flooring, framing, roofs and scaffolding. There are 2 types of bamboos and one of them is tropical bamboo, which is often preferred in construction because of its bigger size, thicker walls and superior structural properties. The second type is specific species that is valued for its robustness and significant in the construction industry. Bamboo is commonly used as a construction material in low-cost housing projects located in tropical and subtropical countries (Ali et al., 2018). This practice is especially prevalent in rural areas where bamboo grows naturally and families have experience working with it. Bamboo is a sustainable building material for homes, even in cases where houses need to be resistant to earthquakes or storms. The traditional bahareque technology was enhanced in Costa Rica and Colombia to make it earthquake resistant. After the year 2000, this technology was transferred to several other countries in Latin America, Asia and Africa gaining recognition as an innovative building technique.

Many successful examples of bamboo housing constructions can be found in various countries, where modern architectural solutions are combined with innovative bamboo methods (Garg et al., 2021). Local communities in Kenya play a crucial role in bamboo processing, allowing residents to actively participate in the construction of their homes under technical supervision (Oyier & Tumuti, 2025). This emphasizes the social sustainability aspect associated with bamboo. Ensuring the durability of bamboo housing constructions is paramount for

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the longevity of the houses, highlighting the need for technical assistance for self-builders and resident groups. With proper organization, bamboo housing has the potential to become part of the social production of housing.

The bibliography of the bamboo-based construction material falls directly in line with the theme of the study conducted to determine the feasibility of the green building technologies in Nairobi County. The innate properties of bamboo, depending on the species, include the ability to bend easily, having superior structural capabilities, and growing quickly, which makes it one of the most suitable materials used in building diverse construction projects as explained by Ali et al. (2018), such as floors, framing, roofing, and scaffoldings. These features render it particularly useful in areas such as Kenya where cost effectiveness, strength and convenience of access is important during construction. Its 100 percent structural integrity owing to the tropical bamboo makes it ideal in the city of Nairobi which is experiencing a rise in urban population together with its climatic conditions which are more conducive to the use of the tropical bamboo, and serves as a complementary material to the expensive and resource-consuming conventional materials used in the construction industry. Moreover, the property of bamboo renewability and its local accessibility is suitable to the principles of protection of the environment and efficiency of use of resources which are in the core of using green building technologies. The use of bamboo in the construction industry in Nairobi would thus greatly cut down the use of foreign materials or the use of non-renewable materials and this would also greatly cut down the level of carbon emissions and the cost of construction.

Also, the additional focus on the social sustainability feature presented by Oyier and Tumuti (2025) and Garg et al. (2021) only then solidifies the widespread applicability of Bamboo as a green building material in the Nairobi County. The participation of local people in processing of bamboos and housing infrastructures enables the locals to participate in sustainable development as well as acquire technical skills and employment. This is in line with the social economic situation faced by most informal settlements and low-income areas in Nairobi communities where affordable housing and community participation is a serious issue of concern. Through the integration of the traditional knowledge of building techniques and modern-day architectural methodologies as has been effectively done in Latin America and Asia - the potential exists to introduce climate resistant and durable housing using bamboo construction. The requirement of technical support outlined in literature reflects the existing nullities in education and awareness within Nairobi construction sector.

4) Recycled Steel

Rao et al. (2019) states that recycled steel is essentially a perpetual resource that can be reused over and again without compromising its quality or strength with the help of top construction companies. By choosing recycled steel, construction projects actively contribute to the conservation of natural resources, as it diminishes the demand for virgin steel production. This approach goes parallel with the principles of a circular economy, where materials are reused, reducing the overall strain on finite resources (Chandra-ambhorn et al., 2019). Utilizing recycled steel significantly contributes to environmental sustainability by curbing the need for raw iron ore extraction and traditional steel manufacturing processes. Producing fresh steel from iron ore is an energy-intensive process, releasing substantial carbon dioxide emissions. In contrast, recycling steel requires less energy along with producing fewer greenhouse gas emissions, making it a vital choice in efforts to reduce the construction industry's carbon footprint (Rao et al., 2023). While prioritizing sustainability, the use of recycled steel also brings economic advantages to construction projects. Recycled steel is often more cost-effective than newly manufactured steel, presenting an opportunity for builders and developers to achieve both financial savings and environmental stewardship. Additionally, as sustainable practices become more ingrained in construction norms, using recycled materials can enhance a project's marketability and reputation.

The relevance of the literature on recycled steel as a sustainable material behind construction directly sustained the aims of this study, which was to determine the viability of green building technologies in the Nairobi County. Indeed, recycled steel, as noted by Rao et al. (2019) and Chandra-ambhorn et al. (2019), is consistent with the concept of a circular economy where it can be used to respond to the present increased demand in virgin steel and limit environmentally harmful resource-use by reusing them. This is very much applicable in the neighborhood of Nairobi whereby there is ongoing construction and demand of materials is increasing. Using recycled steel in developing Nairobi buildings would mean the developers would have minimized the environmental effects of mining and manufacturing of steel especially the carbon releases that are high as a result of the production of steel by industries using raw iron ore. Through the use of recycled steel, a twofold advantage is achieved; Continuous reduction of carbon footprint within the building process and a method of preserving the naturally limited resources in Kenya, which is the main essence of developing green building technologies.

Besides, the economic advantages linked to recycled steel appeal to the financial feasibility issues that preoccupy Nairobi construction sector. According to Rao et al. (2023), it is well known that recycled steel is usually cheaper to acquire than new materials, and in this way, the developers can save costs without the building being weakened in terms of structural stability or quality. This is essential in Nairobi, where low cost is a priority issue during the construction of commercial and residential properties. Moreover, with the increasing importance that sustainability is taking in the construction industry, recycled materials do not only contribute towards the realization of environmental objectives but also help develop the marketability and image of developments. This is in line with the overall objectives of the current research, which intends to find out the green building technologies that do not only make environmental sense but also stand the economic and social viability test to be integrated in large numbers of projects in the Nairobi County.

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5) Reclaimed Wood

Reclaimed wood or lumber has a history and has been used for buildings and structures from the 18th to the early 20th century (Arbabi et al., 2024). The wood is recycled and reused to meet today's ever-growing need for sustainable, eco-friendly homes and businesses. Any wood species can be reclaimed, but some of the most common are Douglas fir, redwood, pine and oak. A rare reclaimed wood species is longleaf pine, which can take up to 500 years to mature, as opposed to the more common yellow pine, which only takes 50 years. Besides the beautifully rustic character reclaimed wood lends to any building, modern or traditional, commercial or private, its ecological benefit is clear (Shi and Wang, 2024). The environmental impact of mass forestation worldwide has heightened awareness of how using reclaimed wood can help protect our future. With green building concepts becoming widespread in the construction field, building practices and materials are being examined for their environmental impact (Krueger et al., 2019). Reusing building materials has a distinct advantage over using newly manufactured materials because these reclaimed materials avoid greenhouse gas emissions associated with new material manufacturing. In a wood-framed building, building materials reclaimed during deconstructing may include framing lumber and wood flooring.

6) Straw Bales

Straw bale construction is a natural building method that utilises straw as the primary building material (Brojan & Clouston, 2017). It typically involves tying straw into larger bundles and stacking them on top of each other in a brick-like fashion. Another common approach is to use straw bales as insulation only, and fill them into a structural frame. Building with straw bales took off in the early 20th century, with the advent of automatic baling machines (Adedeji, 2011). It gained in popularity due to the oil crisis, and has gradually been established as a compelling alternative among self-builders and eco-enthusiasts. However, with the urgency of the shift towards more sustainable solutions and significant technological innovations, straw now has the potential to become a game changer for the construction industry.

The scope to which literature on straw bale construction has been reviewed refers to its high support to the objectives of the research, which looks at viability of the green building technologies to be conducted in Nairobi County. As it is outlined by Brojan and Clouston (2017), straw bale construction takes advantage of agricultural by-products in a sustainable and low-energy, thus, being one of the most appealing options in terms of the lack of affordable and environmentally-friendly, which is deeply needed in various regions of the world, including Nairobi. Straw bale construction, when taken either as a structural stress bearing member or indeed as an insulation material in a frame construction, is flexible in its application and also in its design structure, particularly in its low- and middle-income housing sectors. Since there is a lot of agricultural practice in Kenya, and that the straw is easily available as a by-product, then using this method in Nairobi is an opportunity to utilize the available local materials and minimize the cost of construction. In addition, the lightweight embodied energy of the straw bales is in line with the sustainability concerns and reduces on the carbon footprint of building materials that is relevant towards the objectives of the environmental management of Nairobi city.

Moreover, the adaptation of straw bale construction as a solution self-implemented by its designer to a more conventional and ecologically aware solution, particularly in the light of the worldwide crises of resources, as well as of energy, can be compared with the transformation nowadays being observed in the sector of the building in Nairobi. With the rise of the population, the shortage of resources, and the necessity to implement infrastructure resistant to climate changes, the straw bale construction is one of the possible green solutions to the needs of the city. The case of straw in its properties enhances urban development through fire resistance and durability as well as insulation capacity because most of the developing technological advances have the capacity to augment its fire resistance, durability and insulation capacity. Straw bale construction may be established through the official support of the relevant policies and guided by the technical application as a strategy of sustainable building in the Nairobi County. The current research will therefore analyse the role that these underutilised technologies which have a lot of potential can play to make the construction future in the region greener, more inclusive as well as economically viable.

C. Use of Green Practices in Building Construction Projects

Green construction practices have numerous benefits such as savings of scarce resources, reduction in energy consumption and improvement of environmental quality (Fouchal et al., 2013). Buildings that are considered green offering efficient energy use have higher demand compared to that of conventional buildings. He argues that such buildings attract higher rental income and are very attractive to corporate clients trying to use the green aspect to build a good corporate image. IBEF (2019) argues that an increase in demand of finished units is one of the factors that contribute to growth of the construction industry. Based on Gao et al. (2019) argues that energy efficient buildings have a higher demand, then this would contribute to the growth of the construction industry. Shi and Wang (2024) argue that energy technology consists of the new ways employed in the use of energy by products. They further argue that products could range from electronic devices to completed buildings.

One of the most exemplary applications of passive green design strategies in Kenya is again seen in the CUEA Learning Resource Centre, where Architect Musau Kimeu applied environmentally responsive features such as sinuous double walls for thermal and acoustic insulation, rock-bed cooling systems, wind-driven chimneys for ventilation, and timber louvers for daylight control. Additionally, the building incorporates rainwater harvesting and oxidation ponds for sewage treatment, allowing the facility to operate without mechanical air-conditioning or artificial sound amplification. These features showcase not only environmental performance but also the practical viability of such green practices in Nairobi's tropical upland context.

Energy technologies main aim is to reduce the amount of energy that is used by a product and thus making the said product energy efficient (Androulaki et al., 2016). Shi and

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Wang (2024) argue that solar energy technologies can be regarded as representatives of both strategies of renewable energy and efficient energy use. They further argue that the direct use of solar energy has an essential role in reducing the harmful effects of energy production activities on the environment and thus acts as a green construction practice. According to (Fouchal et al., 2013) by adopting a passive solar house design the energy demand for heating or cooling a building can be satisfied or reduced without the addition of supporting systems such as air-conditioning systems. They further state that the following steps are taken to passively reduce the building's energy demand namely; orienting the building towards the sun's rays, maximising the volume to surface ratio of a building exposed to the sun's rays, enhancing window orientation towards the sun, using thermally heavy materials in the interior and high degree of insulation in the building envelope.

Shi and Wang, (2024) also argue that insulation is usually one of the first steps in a passive solar house design. They further argue that a passive solar house design results in major cost cuts by saving on energy needed for either heating or cooling a building. The Bureau of Energy Efficiency [BBE] (2019) states that buildings that have a passive solar house design offer cost savings of up-to 30%. They further argue that these costs savings result to such green buildings having a greater return on investment and stock value than conventional ones. An increase in the value of buildings as the one attributable to a passive solar house design contributes to the growth of the construction industry.

D. Combined Effects of Green Materials and Practices

1) Reduced carbon footprint

The use of conventional or traditional materials and methods of construction have led to increased carbon emissions in the country (Rao et al., 2023). These emissions are threat to environment because they are the largest contributors of climate change. It is also important to note that these emissions cause respiratory disorders that affects engineers or construction workers. The introduction of green materials and practices are important in reducing the carbon footprint. These materials like Bamboo, recycled steel, reclaimed wood and practices like the installation of renewable sources of energy are important because of low carbon emissions (Krueger et al., 2019). This is vital in ensuring that the carbon footprint in the construction industry is reduced. This is vital in ensuring that site workers and the neighborhood is safeguarded from health risks. As well, climate change threat is reduced due to reduced emissions in the construction industry. Existing studies have covered, this effect without explaining effects related to cost of using green materials and practices, hence creating a literature gap that this study aims to cover.

E. Improved Indoor Environment

The use of Volatile Organic Compound (VOC) and implementation of appropriate ventilation systems creates a healthier indoor air for building occupants (Broja & Clouston, 2017). These materials include ceramic tile, natural stones, low-coat paints and coatings, which are readily available in the market and being used widely in green building technologies. These VOC materials are designed to reduce emission of dangerous chemical fumes into the air, which is vital in minimising environmental pollution by players in the construction sector. It is also significant to note that the installation of these materials is minimising the emission of harmful gases and improving indoor air quality, which is very important in the reduction of health risks (Adedeji, 2011). This is vital in improving the reputation of construction contractors that have adopted the use of these materials. Existing studies have focused more on the non-financial effects of green materials and practices like the improved indoor environment foregoing the cost effects, which is a literature gap that this study will address.

This argument on the VOC materials and ventilation systems also relates directly to the subject of research by shedding the light on a serious health and environmental advantage on green building technologies. These materials contain ceramic tiles, natural stones and low-VOC, which are important in both enhancing indoor air quality, a major sustainability issue in contemporary construction. The use of such material is practical and effective in implementing a green solution in the Nairobi County which is becoming densely urbanized and a lot of the buildings have poor ventilation and indoor air pollution. The fact that they reduce the number of toxic emissions and health hazards confirms their environmental suitability and proves why their implementation in sustainable construction design should be viewed as a priority.

What is more, this section opens up a significant literature gap that the study aims to fill in the cost implication of the VOC-compliant materials usage. Although previous works lean towards the non-financial health advantages of the same, the thesis proffers to determine whether green materials in Nairobi can be advantageous to developers and contractors in terms of perceived environmental and health benefits as well as economic sense. The study examines the two aspects equally to review environmental performance and the cost feasibility of green building technologies in a more comprehensive manner. This twofold view would be essential to promoting greater uptake of these materials and practices across Kenya construction industry, a situation that is challenged in Kenya given that the issue of cost is usually high on the agenda compared to the environment objectives.

1) Increased Property Value

Green buildings are very attractive to renters and buyers and this increase their value (Arbabi et al., 2024). It is evident that due to use green practices, these buildings are installed with systems that consume low energy, hence lowering utility bills for buyers and tenants. For example, the installation of renewable sources of energy lowers the power bills of consumers compared to the use of electricity. It is also important to note that the buildings have quality indoor air that gives consumers an exceptional experienced (Fouchal et al., 2013). These buildings are also regarded to be very durable and unique differentiating them conventional or traditionally build buildings that lose their design and comfort with time (Krueger et al., 2019). Thus, investing in green buildings increase property value making exposing them to high market demand. Existing studies have not shown the cost of these green materials and practices, hence availing a literature gap that this study will try to explore.

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F. Approaches to Enhance the Use of Green Technologies in Kenya

A shift towards sustainable construction activities in Kenya needs to be a multi-factorial process that cuts across the systemic impediments that are found in the implementation of green building technologies. Although the above discussion has seen that it is possible that high material costs are the biggest drawback to this wide scale application, effective change in the construction industry requires interventions that are not necessarily economically concerned but rather regulatory policies, technological development, and human resource training. The strategies discussed in this section are the evidence-based strategies aimed at establishing enabling environment to the adoption of the green building technology due to the peculiarities of the interactions between policy implementation, industry practices, and the capacity of stakeholders. These interventions acknowledge the fact that the transformation of sustainable construction must be addressed all at the same time in a number of different areas: the establishment of standardized certification models to legalize and orient the green building practices, the promotion of new construction methodology, which would show environmental and economic benefits, and the creation of holistic training programs that would enable professionals of the industry to have the knowledge and confidence to adopt the green alternative. Through these complementary strategies, Kenya can establish the background status that the country requires to address the current obstacles and also introduce the concept of green building technologies as scalable solutions to the quickly growing urban construction industry in the country.

1) Promoting Green Building Technologies

There is need to ensure that green building certifications and standards are implemented and adhered to across the construction industry (Arbabi et al., 2024). For instance, the LEED (Leadership in Energy and Environmental Design) should be emphasized on within the sector and this will influence building design and construction practices towards sustainability. Design prioritisation will lead to integration of passive design techniques such as natural ventilation and lighting, building orientation optimization, utilisation of vertical gardens or green roofs, which will effectively minimise energy consumption and quality of indoor environment. (Shi & Wang, 2024) These use vertical gardens and green roofs will mitigate the effect of urban heat island, promote biodiversity and minimise storm water runoff.

The realization of green building certifications and standards like LEED is directly linked to the research objective of evaluating viability of green building technologies in Nairobi County. Programs such as LEED offer tools to help professionals to organize and structure sustainable construction designs, establish measurable environmental performance, energy efficiency and human health targets. Their application in Nairobi would create constructive sustainability targets hence stimulating uniformity and responsibility amongst the developers, contractors, and the designers. This is in line with the study purpose of not only testing on the effectiveness of green technologies, but also promoting systems that would strengthen their implementation in Kenya urban construction.

Moreover, the implementation of passive design interventions, including natural ventilation, the rational orientation of buildings, the vertical vehicle and green roofs are also an effective purposeful response to the possibility of certified sustainable design to minimize the environmental impact of buildings. Such solutions are particularly appropriate in the context of a fast-urbanizing community of Nairobi, where issues with energy use and heat build-up exist. Vertical gardens and green roofs serve to reverse the urban heat island effect, increase biodiversity, and control stormwater, which increase both ecological and structural resilience. The mentioning of such techniques enhances the point that standardized green certifications do not only legitimize the use of green technologies but also offer adequate solutions to the environmental problems in Nairobi and urban planning, which makes them a critical part of their feasibility.

2) Utilization of Innovative Construction Practices

There is need to popularise modular and prefabrication construction (Oyier & Tumuti, 2025). This will entail the construction of building materials off-site in environments that are controlled. This will be significant in reducing the wastage of materials, reducing on-site disturbance as well as construction timelines. In-situ concrete construction (ICFs) should also be communicated to construction stakeholders. Understanding them is vital in facilitating the transition to green building practices and materials (Muute, 2019). ICFs are insulated concrete forms, which offer structural support, insulation and can be re-used a number of times, hence reducing amount of energy consumed and material waste. This is vital in enhancing sustainability efforts within the construction sector, hence enabling stakeholders to enjoy associated benefits.

Modular and prefabrication approaches have been brought out as possible green building technologies that can have significant influence to sustainability in the construction sector. The techniques of building components off-site under a controlled environment have been seen to be of relevance to Nairobi County because there have been cases of delays in construction activities that can be attributed to poor logistics and favorable conditions in the environment. These technologies are a good fit in the role of research objective to evaluate environmentally friendly, cost-effective, and efficient construction methods since they help reduce material losses, decrease pollution at the site, and reduce project schedules. Their adoption resonates with modern green oriented practices which is central in evaluating the viability and feasibility of green building technologies in Kenyan construction scenario.

Besides, the reference to ICFs supporting the topic of focus in the study implies innovative green technologies that are able to provide structural performance and energy efficiency. ICFs will minimize the use of other insulation materials, conserve energy use during the construction activities, and have the added advantage of being reused, which directly helps achieve the objectives of the sustainable construction. However, stimulation of actionable solutions to drive the shift in favor of ICFs and prefabricated systems by encouraging the stakeholders to be aware and educated in this field is encouraged through the study. Therefore, these practices not only are in line with the sustainability agenda, but also are effective mechanisms to support the implementation and

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feasibility of green building technologies in the expanding urban space of Nairobi city.

3) Training and Education

It is important to note that for contractors to move from traditional building methods to green building methods, they need to be convinced of the importance of this transition (Lubis et al., 2024). This is the case especially for those contractors that have been in the field for long and are used only to traditional building methods. Due to their specialisation, they have high resistant to change and this can only be solved via continuous training. Therefore, it is important for to organise frequent seminars and conferences for construction stakeholders. To foster high attendance, the seminar fees need to be very affordable and good mobilisation needs to be done (Kimaru & Maitho, 2021). There is need to high competent speakers that have significant experience in green building technologies. This will ensure productive training sessions, where participants will be informed about the different green building materials and practices that are easily accessible, their benefits and how to counter any arising challenges. Ensuring that the participants are fully satisfied of the training sessions, the transition process will began to take place mentally before its being fully embraced practically.

The excerpt has a direct relevance to the topic of the research by taking into account one of the crucial obstacles towards the feasibility and general market penetration of green building technologies in Nairobi County: the unsupportive attitude towards the change by contractors. Most of the experienced construction industries are entrenched in the customs and are therefore reluctant to accept foreign practices and materials.

Furthermore, such a focus on training was consistent with one of the objectives of the study: to define the right methods of improving green technologies adoption. The advice to use knowledgeable and experienced facilitators would mean that the stakeholders will be informed on practical and actionable information, which further enhances the likelihood of application in real life setting. These training programs do not only promote the technical skill, but also psychological preparedness, which is a key to bringing permanent change. Consequently, this aspect of stakeholder education and sensitization is central in ensuring successful execution and sustainability of green building technologies in the vibrant construction industry that exists in the city of Nairobi.

G. 2.6 Theories

The study was based on two theories, which form the conceptual basis of this study to explain the adoption and viability of green building technologies in Nairobi County: the Green Industry Theory and the Lean Construction Theory. The theory of Green Industry which has been promoted by United Nations Industrial Development Organization (UNIDO) focuses on incorporating the concept of sustainability in the development of industry by engaging in green investment, sustainable behaviors, and alignment of policies. Given the context of this research, it offers a framework by which sustainable construction material use and practices can be associated with cost efficiency, environmental conservation, and responsibility of the stakeholders. The Lean Construction Theory, conversely, provides a project management angle with value creation, efficiency, waste reduction, and customer orientation as its main concerns in construction process. Its applicability to the research is that it will show how a sustainable approach and green technologies can be incorporated into the construction processes to improve the costs, resource utilization, and the overall performance of a project. The two theories are seen as complementary in that the Green Industry Theory is a policy- and sustainability-oriented justification of adopting green building practices whereas the Lean Construction Theory is a process- and efficiency-oriented approach to operationalizing the practices. This two-pronged theoretical stance is designed to make sure that the research objectives are informed by both macro-level concept of sustainability and micro-level concept of project management strategies, which also makes the analysis framework of the study stronger.

1) Green Industry Theory

The United Nations Industrial Development Organisation (UNIDO) Green Industry Theory focuses on the sustainability of industrial growth wherein all the stakeholders are answerable toward the level of their influence on the environment. It supports the introduction of green investment and policy measures in the government that will encourage the practice of environmentally responsible behaviours to reduce carbon emissions and curb the changes in climate(Lazaroiu et al., 2020). The Green Industry Theory, in this context, guides the scope of the first research objective and question that aims at examining the impact of utilizing green material on the construction cost of building projects. With the promotion of the usage of sustainable raw materials including bamboo, aluminium formwork, recycled steel, and reclaimed wood, the theory matches the goal of finding cost-effective, environmentally friendly solutions working towards less environmental impact of construction processes. The second research objective, including its research question, is also strengthened by the theory as it advocates the addition of environmental responsible processes, including waste, energy, and water consumption reduction, which can be translated directly into cost-savings during the lifecycle of a building. More so, the third research objective and question which are based on the combined effects of green building materials and practices are supported by the theory since it emphasizes on the fact that adoption across industries of green sustainable approaches can provide synergistic advantages to the economic performance as well as ecological preservation. Finally, its focus on stakeholder responsibility, harmonization of policies, and the set of institutional arrangements that promote the use of green technologies helps it to support the fourth research question and objective since they are the means to implement the right strategy to boost the use of green technologies. The Green Industry Theory offers a policy-based argument to enhance the adoption of green building technologies in Nairobi County based on the national and global sustainability agenda by entrenching such values in the construction operations.

2) 2.6.2 Lean Construction Theory

The theory of Lean Construction can be described as the production management strategy developed in terms of the construction business that emphasizes the continuous

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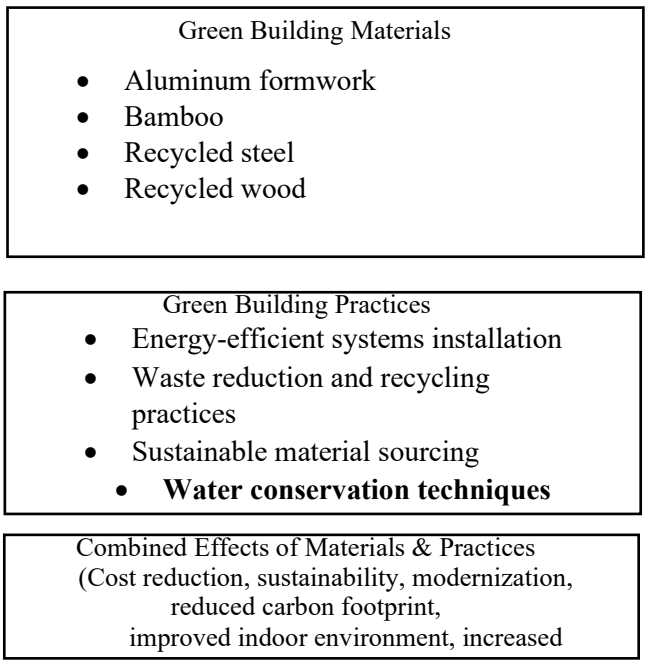
improvement, collaboration, waste removal, and customer-oriented approach to the delivery of the project. It focuses on value addition to the clients by knowing and satisfying their needs and also enhance the efficiency of its operations (Habib et al., 2023). This theory is directly related to the first research objective and question, which concern the impact of green material usage on the cost construction since it promotes the use of inexpensive materials with higher input and output of resources balanced by less valued materials into the final product. It also addresses the second research aim and question involving the correlation between green building practices and cost by enhancing efficient processes and team planning that incorporates sustainable practices including energy efficient installations, sustainable source of materials as well as water conservation into the project workflow in a manner that maximizes cost and performance. The Lean Construction Theory also overlaps with the third research question and objective refers to the cumulative impact of green materials and green practices since the focus on process optimization can be seen as reflecting on the benefits of intertwining both elements to maximise the project value and minimize waste. Lastly, the fourth research objective and the corresponding research question (related to means of increasing the adoption of green technologies) is supported by the theory, which suggests such an approach as a culture of constant learning, engagement of stakeholders, and sharing of the best practices. These are the key points in building the technical capability and mental shifts that lead to popularization of correcting the environment by using more sustainable construction techniques in the County of Nairobi. Essentially, the Lean Construction Theory will not only serve as the structure to enhance efficiency and to save costs but rather demonstrate a systematic method of integrating sustainability in all aspects of the construction process and would be immensely useful in the case of evaluating green building technologies in the local setting.

H. Conceptual Framework

The green industry theory and lean construction theory have been amalgamated to the conceptual frame work as follows:

Figure 2.1 Conceptual framework
(Source: Author, 2024)



The research conceptual framework was based on the relationship between the independent variables, which were green building materials, green building practices and policy-driven strategies, and the dependent variable, which was cost performance of a construction project. It was based on the concept that sustainable building technology adoption has both direct and indirect impacts on project outcomes, in terms of direct impact on the cost of a project and indirectly through the long-term environmental and benefits to the operations of a project. Materials like bamboo, interlocking blocks, recycled steel among other green materials were also conceptualized as an input that would cut down costs on lifecycle and enhance the viability of the project. Other practices like the use of energy efficient designs, conservation of water and waste were as well considered input methods that would lower lifecycle cost and increase project viability. The policy and regulatory variables such as awareness creation, financial incentives, and training were addressed as moderating variables, which promote the adoption process or set back the adoption process. The framework thus offered an ordered prism through which it can be tested whether these sustainable inputs result in quantifiable cost reduction in construction cost in Nairobi County and whether external economic and policy environments might enhance or weaken the relationship.

I. Research Gap

There is need to understand the impacts that green building materials and practices have on the construction industry of Kenya. This is an existing research gap because past studies have not covered this issue in details. There is limited information on the viability of green building materials and practices on construction projects in the country. Furthermore, the challenges that are faced in the process have not been fully outlined and discussed as well as their respective solutions. Thus, this study will cover this research gap by accessing sufficient data sources and extracting significant information to explain the viability of green building technologies (materials and practices) in construction project in Nairobi County and recommend on how the identified challenges will be solved to increase the transition from conventional building technologies to green building technologies across Nairobi and Kenya at large.

2.9 Chapter Summary

Chapter two has given the overall overview of theoretical and empirical literature regarding the green building technologies and their influence on the construction project cost. It discussed major theories including the Innovation Diffusion Theory, Resource-Based View, and Sustainability Theory that explain the forces and issues surrounding sustainable construction practice adoption. Empirical research was examined in order to emphasize global and regional patterns in the utilization of green materials, sustainable practices, and policy frameworks. The chapter also defined knowledge gaps in the current body of research especially in the Kenyan construction industry where adoption has not been as high as there have been identified environmental and long-run economic advantages. The conceptual framework was based on these and it informed the study by analyzing the impact of green materials, practices and policy interventions in analyzing the performance of construction projects in Nairobi County

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III. METHODOLOGY

A. Research Design

The study adopted a mixed-method research design, integrating both quantitative and qualitative approaches to provide a comprehensive assessment of the viability of green building technologies in Nairobi County. Quantitatively, the study employed a descriptive survey design to collect numerical data from a representative sample of construction stakeholders, enabling statistical analysis of relationships between green building materials, practices, and construction costs. Qualitatively, case-based observations and open-ended responses were incorporated to capture contextual insights, stakeholder perceptions, and experiential accounts that could not be quantified. This hybrid design allowed for both empirical validation through statistical tools such as ANOVA and regression, and deeper exploration of underlying attitudes and barriers through thematic analysis, thereby ensuring robustness, triangulation, and a richer understanding of the research problem (Rahat et al., 2024).Location of the Study

The study was conducted in Kenya, chosen for its ongoing efforts to digitize procurement through systems like IFMIS. Despite progress, challenges persist, particularly in public construction projects. Kenya offered a relevant context to explore barriers, opportunities, and strategies for e-procurement adoption in a developing country setting, with findings applicable to similar environments.

B. Population of the Study

The study site was Nairobi County, Kenya, selected because it is the hub of Kenya's construction industry where green building technologies are increasingly being adopted. There were seven major stakeholders in Nairobi County construction sector, who were considered in this study as the target population; these are the stakeholders who are involved in commercial construction works. This involved green commercial builders, architects and designers, engineers and end-users or clients. All these population units perform distinct but fundamental roles in the actualization and feasibility of green building technologies and thus their inclusion becomes inevitable towards attainment of the research objectives.

C. Sampling Procedure and Sample Size

Stratified sampling was applied to categorize respondents into four groups: green commercial builders (40), architects or designers (35), engineers (35), and end-users or clients (40). Within each stratum, simple random sampling was conducted to ensure unbiased selection. This approach allowed fair representation of all key stakeholders while minimizing sampling bias.

In the study, the selection of the respondents was well-planned so as to cover the richness of the views within the construction industry in the Nairobi County. The sample of the project managers was done using stratified random sampling to ensure that there is a sufficient representation of different construction firms wastage, which are at the centre of project execution, management, and decision-making. A simple random sampling was used among the identified strata to select site engineers who could give a general perspective of on-site green technology occurrences and experiences. The sample was selected using purposeful sampling because the construction architects are the key players in sustainable design as well as in selecting the materials to be used in the building, which in turn predisposes the use of green building technologies. Lastly, contractors were sampled using simple random sampling to cover the opinion of both the small and large-scale firms whose implementation of the physical construction work directly influences the adoption of green technologies in practice.

The approach was beneficial because it would help get the variety of opinions and experience of various positions in the construction industry, which is important to consider the multi-purpose nature of the green building technologies adoption. What is more, the given technique permits comparative research both on the levels of professional categories, and makes the analysis of the work more in-depth and high-quality. This study conducted stratified sampling and random sampling, a combination of these two methods to sample the population to be used in the research poll, hence making it fair to all the key stakeholder groups. The identified target population was then split into four identifiable strata, namely: green commercial builders, architects/designers and engineers, and end-users or clients. At every stratum, respondents were randomly picked on revised industry lists, professional association lists, and client lists to do away with selection bias. In the case of green commercial builders, the sample was selected using contractors who were registered under the National Construction Authority and were identified to build sustainably with the use of green buildings. Random selection was done of architects and designers in the Architectural Association list of members but only those that designed commercial projects were selected. The professional institutions that were used to select the engineers include the Institution of Engineers of Kenya where structural, mechanical and environmental engineers were included. End-users or clients were sampled based on recent projects of commercial buildings within the Nairobi County, and diversity in terms of building ownership and type of building construction was emphasized so as to capture diverse experiences to green technologies. The method implied that the sample would be representative and able to offer various insights that can be applicable to the goals of the study.

D. Data Collection

To acquire primary data, a semi-structured questionnaire was used in the study which was well tailored to the research aims and was able to collect both quantitative and qualitative information. The main method of gathering the quantitative data was in the form of structured questions in a closed-ended format with questions measured on a likert scale between one and five, allowing the translation of the attitudes and opinions of the respondents into the form of numbers that could be analyzed statistically. The questionnaire consisted of five broad subsets of questions as follows: demographic information concerning respondents; use of green building materials; use of green building construction activities; perceived cost implications and benefits of projects; and perception on approaches to enhancing adoption of green technologies. In

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support of this, qualitative data was obtained by asking open questions as part of the questionnaire where the respondents would give more detail about their experience, challenges, and recommendations that would not be found through the structured items. Statistical results were complemented with these qualitative responses that added context to the results and helped gain an idea of subjective attitude of people toward green building technologies.

Besides the questionnaire, the secondary data were also used to triangulate and substantiate the primary results. The Green Building Society of Kenya (GBSK), reports of the Nairobi County green building policies, international databases of construction costs of international certification like EDGE and LEED, as well as, construction cost report of requisite regulatory bodies and industry players would be reviewed. The availability of such secondary sources offered benchmarking, trends, and history in the policy setting that enhanced the understanding of the main findings. The use of quantitative instruments in the form of structured questionnaires, qualitative information gathered in open-ended questions along with the document review, as a secondary source of information ensured the maximum realization of the mixed-method design and contributed to the increased validity, reliability and completeness of the study findings.

E. Data Validity

To ensure validity, the study's questionnaires and interview guides were developed through literature review and expert consultation in e-procurement and public sector procurement (Bell et al., 2022). A pilot test was conducted with a small group of respondents to assess the clarity, relevance, and comprehensiveness of the instruments. Feedback from the pilot informed necessary adjustments to enhance content validity and ensure the tools effectively captured all aspects of e-procurement adoption.

F. Data Analysis

The mixed method approach was carried out in the study; therefore, both quantitative and qualitative data analysis were done to meet the objectives of the research. The analysis of quantitative data was carried out in terms of descriptive and inferential statistics, whereas the analysis of qualitative data was performed applying thematic analysis. The triangulated researching method guaranteed the research results as valid statistically, contextually rich, and that expressed the different views of various stakeholders of the construction industry in the Nairobi County.

G. Quantitative Data Analysis

The quantitative data that were measured using structured items in the questionnaire were coded and entered into SPSS version 29 and Microsoft Excel where the analysis was carried out. The characteristic of demographical variables and other important study variable was summarized by descriptive statistics frequencies, percentages, means, and standard deviations of variables in the studies. Hypothetical tests and analysis of relationships between variables was carried out with the help of inferential statistical methods. Particularly, ANOVA was used to determine the existence of significant variations in construction cost between projects utilizing green building materials and the projects using conventional methods. Besides, the correlation between green building practices and construction costs was studied with the help of regression and the identification of predictors which affect the application of green technologies was made. The complementarity of the descriptive and inferential analysis not only gave a wide coverage of patterns of data but also empirical data of the associations that are essential in tackling the aims of the study.

H. Qualitative Data Analysis

Qualitative data obtained from the open-ended questions in the semi-structured questionnaire were analyzed using thematic analysis. Responses were first reviewed and transcribed, then systematically coded to identify recurring ideas, perceptions, and experiences related to green building technologies. Codes were grouped into broader themes aligned with the study objectives, including cost implications, sustainability benefits, barriers to adoption, and strategies for enhancing uptake. These themes were interpreted to provide insights into the contextual realities, attitudes, and challenges faced by construction stakeholders in Nairobi County. The qualitative findings were then integrated with the quantitative results to enrich interpretation, offering a more holistic understanding of the viability of green building technologies in the construction sector.

IV. FINDINGS

A. Response Rate

Out of a targeted sample size of 150 respondents, 140 filled and returned the questionnaires, yielding a 93.3% response rate. This high rate of return indicates strong interest and engagement among. Nairobi County construction industry stakeholders regarding green building technologies. Such a response rate also enhances the credibility and dependability of the data collected, thereby forming a solid foundation upon which to draw meaningful and reliable conclusions from the study.

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Below is a table depicting the response rate:

Table 4.1: Response Rate

Respondent Category	Targeted Sample	Actual Responses	Response Rate (%)
Green Commercial Builders	40	37	92.5%
Architects/Designers	35	33	94.3%
Engineers	35	33	94.3%
End-Users/Clients	40	37	92.5%
Total	**150**	**140**	**93.3%**

B. 4.3 Descriptive Statistics of key Indicators

1) 4.3.1 Age Distribution

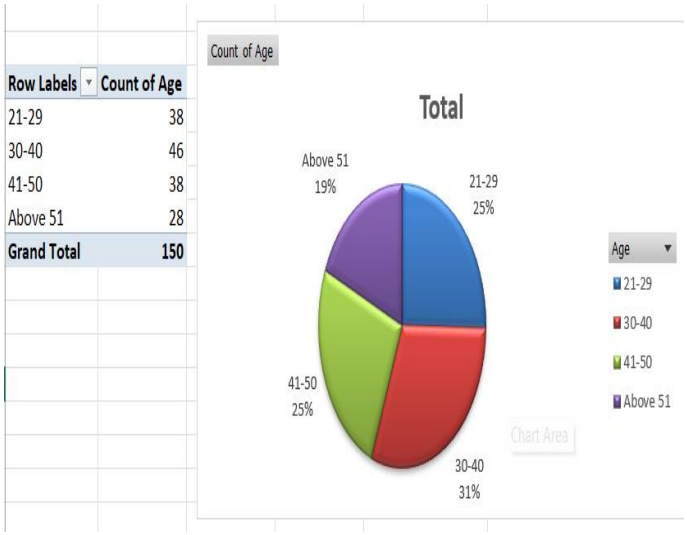

Figure 4.1: Age Distribution

This data shows the age distribution of 150 individuals across four age groups. The 30-40 age group represents the largest segment at 31% (46 people), followed by the 21-29 and 41-50 groups which are tied at 25% each (38 people in each group). The oldest group, above 51, makes up the smallest portion at 19% (28 people), indicating a younger overall population distribution.

2) 4.3.2 Gender of Respondents

Majority of respondents are identified as male as it has been presented in the below chart.

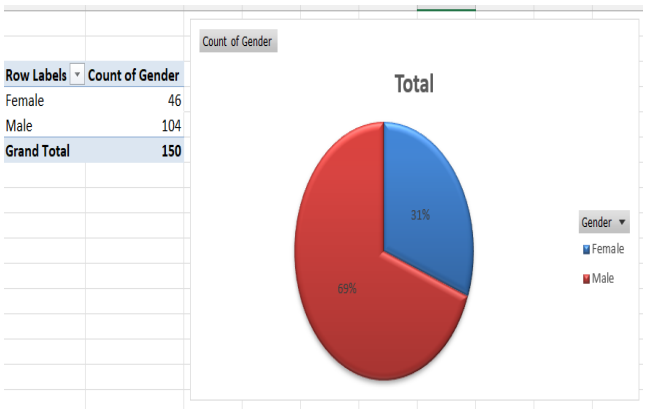

Figure 4.2: Gender of Respondents

This data displays the gender distribution of the same 150-person sample. Males comprise the majority at 69% (104 individuals), while females represent 31% (46 individuals). The distribution shows a significant gender imbalance, with more than twice as many males as females in this dataset.

C. 4.3.3 Education Level

A significant number of respondents have attained a bachelor's degree.

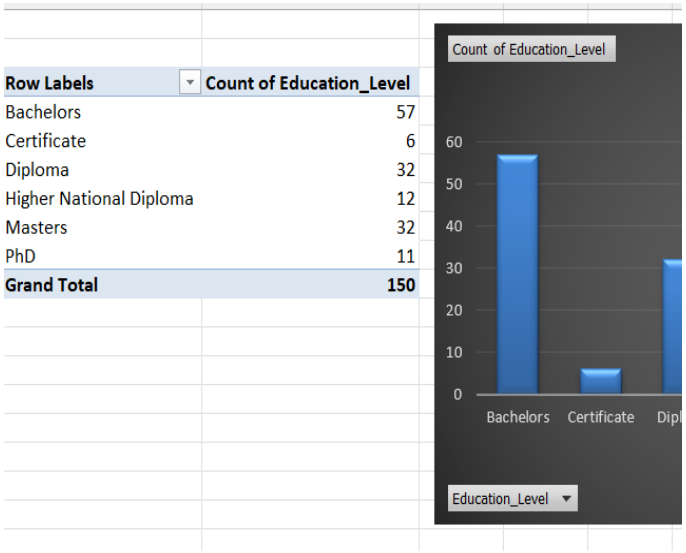

Figure 4.3: Education Level of Respondents

This data shows the educational attainment distribution among the 150 participants across six different levels. Bachelor's degree holders represent the largest group at 38% (57 people), followed by Diploma and Master's degree holders who are tied at 21% each (32 people each). The remaining participants are distributed among Higher National Diploma at 8% (12 people), PhD at 7% (11 people), and Certificate holders representing the smallest group at 4% (6 people).

Descriptive statistics were conducted to summarize the responses related to the key indicators of the study. The indicators covered perceptions on cost-effectiveness, environmental benefits, awareness, and adoption levels of green building technologies, as well as the frequency of use of green materials and practices. Some meaningful indicators are as indicated in the below:

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Table 4.2: Descriptive Statistics on Key Indicators

1. Objective 1: To analyze the effect of use of green materials on the cost of building construction projects.

Descriptive Statistics on the Effect of Green Materials on Construction Costs

Variable	Mean	Std. Dev (SD)	Scale/Unit
Perceived cost-effectiveness of green materials	4.3	0.78	1–5 Likert scale
Estimated % reduction in construction cost due to green technologies	15.2	5.6	Percentage reduction
Perception that green materials increase upfront construction costs	4.2		1–5 Likert scale
Perception of strong environmental benefits from green materials	3.8		1–5 Likert scale

INTERPRETATION:

The survey findings showed that there was a subtle viewpoint over the economic implication of green building materials and technologies among the respondents. Respondents showed a high level of agreement that green materials are a cost-effective investment in general with an average of 4.3 on the measurement scale. This optimistic vision was also enhanced by their positive expectations regarding cost savings because the respondents estimated that implementation of green building technologies would result in an average of 15.2 percent in construction costs savings. Nevertheless, the data also revealed one important issue that seems to give strains in the decision-making processes. Although some respondents realized that the cost-effectiveness of green materials would be long-term, they also admitted that green materials have expenses that are usually more expensive in the short term, giving this factor an average score of 4.2. This implies that concerns around initial capital requirements are also of great concern even though the stakeholders are aware of the final economic gains. Also, in assessing the environmental benefits, the respondents rated the long-term environmental benefits of green materials at an average of 3.8 which represented a moderate to strong appreciation of the environmental benefits of these materials. All these findings tend to indicate that despite the awareness of the economic and environmental advantages associated with green building materials, the price factor remains a major factor in shaping views and, perhaps, decision-making in the building sector.

Objective 2: To Establish the Relationship Between Green Practices and Construction Costs.

The research employed a simple linear regression analysis to examine the relationship between green building practices and construction cost outcomes. In this statistical model, the dependent variable (Y) was defined as construction cost reduction, which was quantified either as a percentage decrease or through a standardized cost index to ensure consistent measurement across different project scales and types. The independent variable (X) represented the adoption of green building practices, measured through Likert scale responses that captured participants' levels of implementation or commitment to sustainable construction methods. The primary objective of this regression analysis was to determine whether there exists a predictable relationship where increased adoption of green building practices serves as a reliable predictor of construction cost reductions. By establishing this statistical framework, the study aimed to provide empirical evidence for the hypothesis that greater integration of environmentally sustainable practices in construction projects would correspond to measurable decreases in overall building costs, thereby supporting the business case for green building adoption in the construction industry.

The regression equation was specified as:

$$y = \beta_0 + \beta_1 x + \epsilon$$

Where:

- Y= construction cost reduction
- β_0= intercept (baseline cost reduction when no green practices are adopted)
- β_1= slope coefficient (effect of green practices on cost reduction)
- X = adoption of green practices
- ϵ = error term

Predictor	B (Unstandardized)	Std. Error	β (Standardized)	t-value	p-value
Constant (β_0)	10.21	1.28	–	7.98	0.001
Green Practices (β_1)	-0.03	0.94	0.002	-0.03	0.976

INTERPRETATION

The simple linear regression analysis model resulted in the following equation: Cost Reduction = 10.21 - 0.03(Green practices) which gives a number of significant results concerning the relationship between sustainable building practices and construction cost savings. The intercept of 10.21 implies that despite the lack of any green building practice, the construction projects would still achieve an overall average decrease of about 10.2 in cost, implying that there are some base level cost efficiencies not based on environmental issues. The slope coefficient of -0.03 makes a counterintuitive discovery, since it shows that there is a negative relationship between the implementation of green practices and cost-reduction. In particular, this coefficient implies that every unit of the adoption of green building practice will lead to the marginal reduction of the cost by 0.03 percent. But this negative correlation is very small, and not statistically significant. The most important statistical value is the p-value of 0.976, which is significantly larger than the traditional significance level of 0.05, to show that there is no statistically significant data to prove the hypothesis that green building practices affect costs of construction reduction. This observation indicates that the opposite of this expectation is not the case since the data does not give solid evidence that more adoption of green building practices results in quantifiable changes in construction cost outcomes, either negative or positive.

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IMPLICATION

The results of the study bring to a very definite conclusion that green building practices, when studied in isolation, fail to show statistically significant effect of lowering short-term construction cost. This can be explained by a number of underlying factors which will act as obstacles to immediate cost benefits. Firstly, the adoption of the green building practice in many cases involves significant initial investments, especially when it comes to the installation of the elevated technologies like renewable energy systems, high-performance insulating materials, or the complex system of water management. Such initial capital outlays may counteract any short run savings of costs that can be realized as a result of other efficiencies. Also, economic benefits of green building practices are not usually reflected in the immediate construction period but are reflected in the long-term operational life of the edifice. These advantages will be substantial energy savings achieved by the use of better energy efficiency, less cost on maintenance as a result of the incorporation of better quality of sustainable materials and less cost on operations as a result of optimization of building systems. These benefits are however not reflected in the construction-phase cost analysis since they are recovered in years or decades of building use. These findings imply that incorporating green building practices on mass-scale probably needs support mechanisms to close the gap between short-term expenses and long-term gains in the future. This may involve specific policy interventions, government subsidies, tax breaks or other financial tools that make sustainable construction practices more economically appealing and feasible to developers and builders in the short term.

1) Objective 3: To Examine the Combined Effects of Green Materials and Practices on Construction Costs

Model Summary:

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.012	0.000	-0.014	9.801

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	0.844	2	0.422	0.004	0.996
Residual	14717.263	137	107.393		
Total	14718.107	139			

Dependent Variable: Construction Cost Reduction
Predictors: (Constant), Green Practices, Green Materials

Model	Unstandardized B	Std. Error	Standardized Beta	t	Sig.
(Constant)	10.191	1.864	–	5.467	0.000
Green Materials	-0.022	0.278	-0.009	-0.079	0.937
Green Practices	-0.011	0.322	-0.004	-0.034	0.973

The third objective sought to establish whether the combined use of green building materials and green practices has a significant effect on construction cost reduction. To test this, a multiple regression analysis was conducted with construction cost reduction as the dependent variable and green materials and green practices entered as independent variables. Model Summary results ($R = 0.012$, $R^2 = 0.000$) show that the combined predictors explained virtually none of the variance in construction costs. This indicates that, statistically, the model had no explanatory power. The ANOVA results confirmed this finding ($F(2,137) = 0.004$, $p = 0.996$**),** suggesting that the regression model was not statistically significant at the 0.05 confidence level. Therefore, the hypothesis that combining green materials and practices significantly reduces construction costs was not supported by the data.

The Coefficients table further revealed that neither green materials ($\beta = -0.009$, $p = 0.937$) nor green practices ($\beta = -0.004$, $p = 0.973$) were significant predictors of cost reduction. The regression equation generated from the analysis was:

Cost Reduction=10.191−0.022(Green Materials)
−0.011(Green Practices)

This implies that for every one-unit increase in green materials or green practices, there was an almost negligible and non-significant decrease in cost reduction.

INTERPRETATION:

Although the statistical results indicate that green materials and practices, even when combined, did not significantly reduce construction costs in the short term, respondents' perceptions highlighted a different narrative. Descriptive findings suggested that stakeholders believed the synergy of using both sustainable materials and efficient practices leads to long-term benefits, including enhanced durability, reduced environmental impact, and improved building performance. This implies that while immediate cost reductions may be minimal, the long-term economic, environmental, and health gains make the combined adoption of green materials and practices viable and desirable for sustainable construction in Nairobi County.

Objective 4: To evaluate strategies and policy-driven approaches that can effectively increase the adoption of green building technologies in Nairobi County.

For this objective, a multiple regression analysis was used, with adoption of green building technologies as the dependent variable and several barriers (awareness level, lack of knowledge, high cost of materials, and limited incentives) as predictors.

Model Summary:

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.154	0.024	-0.003	9.865

$R^2 = 0.024$. The model explained only 2.4% of the variance in adoption. This Indicates a weak explanatory power.

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	341.314	4	85.328	0.879	0.478
Residual	14149.688	145	97.583		
Total	14491.002	149			

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IMPLICATIONS

The research findings reveal that high material costs represent the most significant barrier to the widespread adoption of green building technologies, even though this relationship did not reach statistical significance in the study. This cost barrier suggests that the primary obstacle to sustainable construction practices is fundamentally economic rather than technical or knowledge-based. The implication is that effective policy interventions must directly address these financial constraints through targeted economic mechanisms. Subsidies that reduce the upfront costs of green materials, financial incentives such as tax breaks or low-interest loans for sustainable construction projects, and strategic support for establishing local manufacturing capabilities for green building materials emerge as critical policy tools. By developing domestic production capacity, countries can reduce import dependencies, lower material costs through reduced transportation and tariff expenses, and create local employment opportunities while making sustainable construction more economically viable.

While awareness and training programs remain important components of a comprehensive strategy for promoting green building adoption, the findings suggest that educational initiatives alone are insufficient to drive large-scale transformation in the construction sector. Without concurrent efforts to make green technologies economically competitive with conventional alternatives, even well-informed builders and developers are likely to choose traditional materials and methods due to cost considerations. This conclusion is consistent with broader literature on sustainable practice adoption in developing countries, which consistently identifies economic feasibility as the primary determinant of whether environmentally beneficial technologies are embraced by practitioners. The research thus supports a policy approach that prioritizes economic interventions while maintaining complementary educational and capacity-building programs, recognizing that sustainable development initiatives must address practical financial realities to achieve meaningful scale and impact.

The study confirms the need to sensitize and equip stakeholders with knowledge through capacity-building programs, including low-cost seminars and training programs to reduce this gap. Through providing the stakeholders with knowledge and skills to conceive, deploy and scale up green technologies, such training initiatives help in changing mindset and deactivating resistance that is among the main limiting factors in evaluating the feasibility of green building practices.

D. Qualitative Analysis

The qualitative information gained through answers to open ended questions on the questionnaires and through observations carried out on a case-by-case basis gave further details on how the perceptions, experiences and problems of implementing green building technologies evolve in Nairobi County. Thematic analysis demonstrated some common themes which were in harmony with the quantitative results. On the positive side, the various respondents also accepted the advantages of green building materials especially the use of aluminium formwork, bamboo and the recycled steel. As observed by the participants, these materials aided not only in environmental degradation reduction, but also in enhancing the durability and the beauty of buildings. Some stakeholders stressed on the use of locally sourced bamboo and reclaimed timber as it helped to engage the community, which supports local economies and the cost of transportation.

Secondly, there was a difference in perception regarding cost. Although several developers thought that green materials could lower the operational costs in the future, the major implication was the high capital cost. This was especially pronounced among the small and medium contractors who reported that the financial institutions are less willing to finance projects that deal with relatively new technologies. Third, the cultural acceptance turned out to be an obstacle and an opportunity. Other respondents were sceptical of the practices of which they viewed as foreign practices in construction and it may be necessary to provide culturally relevant awareness campaigns. Alternatively, the compatibility of green building to inherent Kenyan values, of resourcefulness, and environmental stewardship is a value on its own which indicates that localising messages may enhance uptake.

Fourthly it was common to cite regulatory and institutional factors. Respondents said there was an irregularity in the implementation of green building codes and there was restricted technical advice available through professional organizations. It was suggested in many quarters that governments can influence adoption by clarifying its policy frameworks, subsidising, and offering training. The last but not least was the emphasis by the stakeholders on capacity building. Another common theme that emerged was that continuous professional development; affordable training workshops and demonstration projects are methods of building trust and confidence in green building technologies.

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