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An Exploration of the Extent of Monitoring and Evaluation of Sustainable Construction in Kenya: A Landscape Architecture Perspective

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Abstract: The practice of landscape architecture in Kenya is growing alongside the country's construction industry, which is currently experiencing exponential growth in tandem with construction trends globally. With the growth in the industry, there has been significant growth in the economy, high consumption of natural resources, a 50% increased contribution to the world's landfill waste, and pollution of the adjacent environment. These have given rise to high pressure to adopt environmentally sensitive approaches in the construction industry to achieve competitive advantage. It is therefore crucial to address the need for sustainability measures for landscape architecture projects to increase knowledge and awareness, create incentives geared toward supporting sustainable practices, and leverage legal instruments and policies. The aim of this study was to identify the barriers to the adoption of and improvement in the monitoring and evaluation of sustainable practices in landscape architecture in Kenya that prevent the industry from achieving sustainability. The objective of this research was to critically analyze the many challenges and barriers to the achievement of sustainability in the Kenyan construction industry with a focus on landscape architecture practices. It also examined the overall extent of the adoption, monitoring, and evaluation of sustainability, and possible solutions were proposed for the management of and reduction in said barriers. The study was carried out through extensive research of secondary data sources on the average level of knowledge and technical know-how of sustainable construction, the level of perception of compliance, the average cost of construction vis à vis sustainable construction, and the level of sustainability in the construction sector in Kenya. The collected data were analyzed empirically and, through the use of descriptive statistics and findings, the data were discussed. The preliminary findings from this study indicate that there is an overall poor attitude toward M&E of sustainability in Kenya, indicating the need to further improve processes.

Keywords: sustainability; sustainable construction; landscape architecture; monitoring and evaluation; life cycle assessment; green building; barriers/bias; public education



Citation: Tanui, S.J.; Tembo, M. An Exploration of the Extent of Monitoring and Evaluation of Sustainable Construction in Kenya: A Landscape Architecture Perspective. *Sustainability* **2023**, *15*, 14415. <https://doi.org/10.3390/su151914415>

Academic Editors: Volker Lüderitz and Petra Schneider

Received: 9 July 2023

Revised: 29 August 2023

Accepted: 4 September 2023

Published: 1 October 2023



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1. Introduction

Landscape architecture in Kenya is one of the relatively new sectors of the already complex construction industry in sub-Saharan countries. The practice is currently unregulated compared with the existing AEC practices in the country, leaving room for creating poor-quality landscape projects due to lack of adherence to the set global standards of practice for the profession, thus compromising sustainability standards in landscape architecture. Landscape architecture is essential in shaping the environment by prioritizing resilient and ecologically sensitive construction. It is the leading practice of sustainable construction practices globally, mitigating the negative impacts of construction, such as storm water runoff, air filtration, phytoremediation, microclimate control, the use of sustainable materials, advocacy, and sustainable site design. However, the practice faces

significant challenges that impede the realization of a holistic, sustainable construction approach, especially for megaprojects that affect the public. This study was necessitated by the public uproar that occurred due to the derelict landscape spaces created during and after the completion of megaprojects in the country, such as the Nairobi Expressway and the Standard gauge railway projects, which posed significant ecological concerns. According to [1], emphasis on environmental sustainability is crucial in the overall achievement of sustainable development goals, especially in developing countries where the concept of sustainability is yet to be fully assimilated into construction processes.

The American Society of Landscape Architects (ASLA) states that sustainable landscape architecture should create value through significant environmental, social, and economic benefits by reflecting the views of both private and public sectors. Since landscape architecture practices are relatively new in Kenya, there is a need to ensure that, as the practice grows in the country, sustainability assessments and monitoring are core strategies used to meet the global industry standards and trends. This reiterates the importance of addressing the challenges facing sustainability policy implementation in Kenya. Therefore, it is of paramount importance to properly analyze the overall challenges faced in the monitoring and evaluating of sustainable development through landscape project design and building to ensure environmentally sustainable construction (ESC) is achieved. This study aimed to explore how sustainable practices have been embedded in Kenya and the steps taken toward the monitoring and evaluation of these practices in private and public projects.

2. Literature Review

According to [2], “sustainable landscape management is a philosophical approach to creating and maintaining landscapes that are ecologically stable and require less inputs”. Sustainable construction practices in landscape architecture and engineering projects therefore encompass the social, economic, and environmental tiers of a society. Sustainable practices should commence from landscape design to the construction, maintenance, and post occupancy stages of a project by incorporating the use of sustainable practices, technology, materials, and processes, as stipulated in sustainable development principles.

The authors in [1] state that emphasis on environmental sustainability is crucial in the overall achievement of sustainable development goals, especially in developing countries, where the concept of sustainability is yet to be fully assimilated into their construction processes. Further research in the field has indicated that there has been a bias toward research on operational phases, neglecting other important phases from design to deconstruction, which also need further emphasis to achieve a holistic approach toward sustainable construction and environmentally sustainable construction (ESC). This has led to gaps in the holistic approach to monitoring and evaluating sustainability.

There are several sustainability theories that have previously been developed in order to aid in the understanding, implementation, and evaluation of SC globally. These theories include corporate social responsibility (CSR), corporate sustainability (CS), stakeholder theory, institutional theory, resilience theory, ecological modernization theory, and green economics. CSR and CS are interchangeable theories that state the obligation of companies to implement sustainable practices even in instances where there are no legal requirements. However, according to [3,4] there is still room for further improvement in the existing CSR model to improve the practical, legal, and institutional frameworks to mandate all contractors to adopt these strategies. According to [5], stakeholder theory argues that stakeholder cooperation follows a specific purpose. The complexity of sustainable construction often leads to reluctance to accept sustainability proposals; therefore, they influence the uptake and evaluation of sustainability in their projects. All of these theories collectively dissect the compliance and complacency of the uptake and evaluation of the effectiveness of sustainable construction practices locally and globally.

Holistic sustainable construction practices include sustainability literacy, sustainable procurement practices, sustainability compliance, and sustainability assessment frame-

works. According to [6], sustainability literacy entails understanding the need for change towards sustainable practices, sufficient knowledge by practitioners to favor sustainable development, and the ability to recognize and reward people's positive actions towards upholding sustainable practices.

Sustainable procurement evaluates the value for money in sustainable construction and is key to the improvement and monitoring of trends within the construction industry. In Kenya, sustainable procurement practices have recently been adopted such as ensuring green inventory management, green specifications, and green tendering processes by encouraging suppliers and contractors to incorporate sustainable or recycled products to attain good value for money. However, the acceptance of sustainable construction is still lagging due to other challenges faced in the construction industry that directly affect the procurement processes [7].

2.1. Sustainability Compliance Globally and in Kenya

The level of compliance with sustainability practices varies from one continent to another as well as within different countries in the same regions due to various reasons. The compliance with and uptake of sustainable practices is generally high in countries in the European, American, and Asian continents in comparison to Africa. The driving factors influencing high levels of sustainability include the existence of mandatory construction regulations, legislations, and drivers that positively influence the growth and adoption of green building. Despite the existence of initiatives promoting these practices, there are still some challenges facing the quality management and implementation of sustainable and green construction due to reluctance, partial compliance, and misunderstandings due to unfamiliarity with sustainable practices [8].

Most of the compliance tools used in the rating of sustainability, such as the LEED, BREAM, EDGE, and Greenstar rating systems, were devised in developed countries. One exception is the Safari Green building index tool, which was developed in Kenya, with the aim of localizing the criteria for rating the efficiency of sustainability in the projects within the country. These tools have different rating standards specific to each one. Notable differences in compliance with sustainable construction across different countries are related to the regulations and policy implementations in each country. Kenya has previously relied on the use of three different rating systems; therefore, the creation of a local tool will increase the acceptance of sustainability accreditation ratings with the aim of improving awareness within the country. Compliance with sustainable construction principles is spearheaded by government legislations and restrictions and has been significantly low, but it has shown significant growth over the last five years.

According to [9], there is a significant lack of sustainable construction strategy in Kenya and "the Kenyan government is yet to make sustainability a core subject in the construction industry operations". The legal framework in Kenya does not have sustainability as one of its facets, thus leaving the uptake and monitoring of sustainable practices in this highly fragmented industry entirely voluntary.

2.2. Sustainability Assessment Framework and Project Management

Globally, there are different sustainable building assessment methods with various strengths and weaknesses due to the influence of the scope of work, different requirements, and the different categorization of elements. These tools include material flow analysis, cost-benefit analysis, multi-criterion analysis, input-output models, sustainability indicator indices, and optimization methods. Despite the availability of several assessment tools, there is a lack of proper standardization across all methods. The absence of standardization makes it challenging to compare and benchmark sustainable landscapes and buildings across multiple assessment methodologies because each one may utilize distinct criteria, categories, weighting systems, and documentation. Geographical variation in sustainable building assessments ensures that depending on elements like temperature, building codes, and cultural preferences, different assessment techniques may be more suited to

certain geographical areas. A sustainable building assessment technique needs to consider regional variations when choosing an evaluation method or assessing the sustainability of the projects.

A streamlined M&E regulatory policy for sustainability assessment is lacking in Kenya, contrary to the constitutional requirements of ensuring compliance with the principles of good governance. This gap should be addressed by ensuring that these existing strategies are incorporated into the Kenyan AEC industry specifically in ongoing landscape projects. According to [10], “policy framework and implementation significantly influences the implementation of monitoring and evaluation practices”. Similarly, the support from top management, improved budgetary allocations, and stakeholder involvement affect the success of monitoring and evaluation practices, thus creating a holistic approach to M&E. The periodic monitoring and evaluation of sustainable practices should be subjected to a log frame, therefore ensuring that the output of landscape project planning is achievable and provides measurable results that can be used to improve sustainability compliance. All stakeholders should be involved in the assessment of landscape sustainability through defining the scope, prioritizing indicators, establishing targets, determining indicator values, analyzing trends and tradeoffs, and identifying good practices. This ensures the maximum assessment of sustainability goals in landscape architecture projects. According to [11], sustainability is not a final state to be achieved; rather, it is an ongoing process that should emphasize social and institutional processes to assimilate good practices. Therefore, continuous monitoring and evaluation is expected to ensure the identification of good practice, to guide decision making, and to facilitate the achievement of goals set by all stakeholders.

3. Methodology

This study involved a qualitative and a quantitative research process. An empirical study of both published and unpublished secondary data from a literature review, previous publications from journals, books, findings from interviews, and from observations of construction industry contractors, clients, and all other key stakeholders in Kenya was conducted. It was undertaken to provide a clear understanding of the extent of the monitoring and evaluation of sustainable construction measures in Kenya, as well as to ascertain the extent of knowledge on sustainable practices. This was informed by previous research, such as [12,13], which was conducted using a similar methodological approach in instances where there was lack of unbiased primary data, as is the case in Kenya in the field of landscape architecture. This is justified by the existence of studies such as by [14–16], among many other examples.

Data samples were obtained from journals, books, articles, dissertations and theses, and other publications from libraries and government institutions. The study used a non-probability sampling technique due to the specific nature of the research problem and the requirement to use secondary qualitative data collection techniques. The population of the study included contractors, developers, architects, engineers, and landscape architects.

4. Findings

A comparative analysis of the extent of knowledge on sustainable practices was conducted, and the findings were collected from sources such as the Architectural Association of Kenya, Kenya Green Building Society, and journals published and tabulated to understand how the results impact the monitoring and evaluation of sustainability in construction projects, as indicated in Figure 1 below. The findings indicate that there are fewer practitioners with a very good understanding of sustainability in construction than those who have an average understanding of these concepts. The evidence indicates that there is a higher level of concern and knowledge about economically related practices than environmental and social-related practices. This has a direct impact in the formulation and implementation of participatory M&E steps for landscape architecture projects in Kenya.

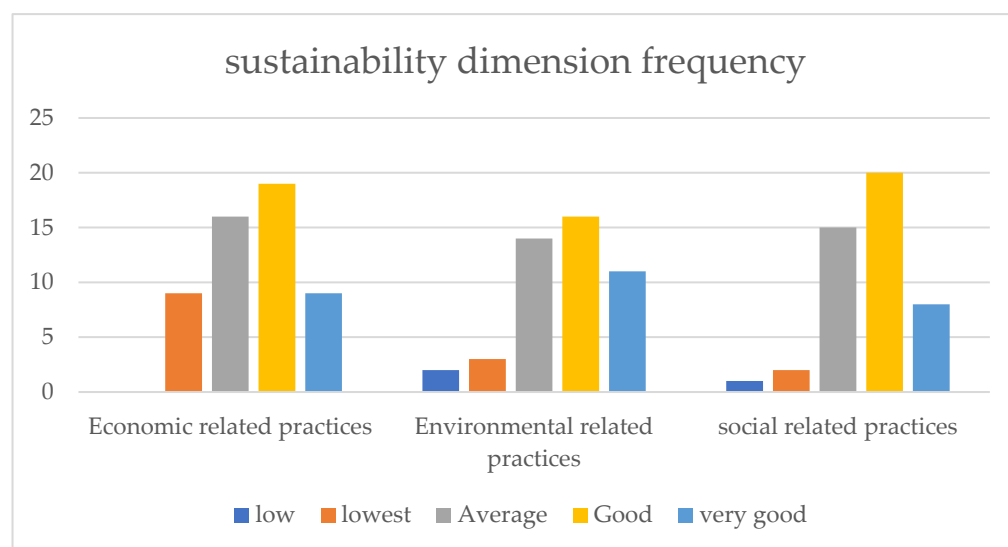


Figure 1. Respondents' understanding of sustainable construction practices. Source: [17].

Further research on the level of incorporating sustainable construction methods into the existing curriculum indicates a significant gap in ensuring that landscape architecture is introduced into universities in Kenya to create awareness of the benefits of landscape architecture in other AEC departments in higher learning institutions.

The findings from [18], indicate that there are several opportunities to increase the number of institutions offering landscape architecture as an avenue to promote visibility within the Kenyan market and enhance the knowledge of the benefits of sustainability. Of note, 7.8% of the institutions offer courses in architecture and 1.6% offer courses in landscape architecture, with only 4.7% of the institutions offering training on green building certification, which forms part of the M&E framework. The findings and observations are shown in Tables 1 and 2.

4.1. Sustainable/Green Rating Tools

Assessment and monitoring of sustainable construction practices in Kenya have been spearheaded by the Architectural Association of Kenya (AAK) in liaison with the Kenya Green Building Society (KGBS). Kenya uses the Leadership in Energy and Environmental Design (LEED) standards, Environmental Design for Greater Efficiencies (EDGE), and the Green Star rating system in monitoring and documenting green buildings to achieve sustainability in the country. In 2019, the AAK unveiled the Safari Green Building Index, developed over the past five years to streamline the rating system in Kenya. The tool allocates different percentages to the seven performance categories sectioned into prerequisite requirements (0%), building landscapes (5%), noise control and acoustics (5%), passive design strategies (45%), energy efficiency (10%), resource efficiency (30%), and innovation (5%). Like the other international rating tools, the green building rating collaborates with localized benchmarks and guidelines (Architectural Association of Kenya, 2022). It is important to note that these rating tools are heavily subjective toward buildings; therefore, landscape architecture projects are considered secondary to architecture and other engineering projects.

Table 1. Sustainable education in higher learning institutions. Source: [18].

Total No. of Kenyan Universities	No. of Universities Offering Architecture Course	No. of Universities Offering Landscape Architecture Course	No. of Institutions/Organizations Offering Green Building Certification Courses
64	5	1	3

Table 2. Summary of literature review.

Authors	Origin	Source	Target Population	Major Themes	Summary Points
Thomas, W.C. & Anne, M.V (2011) [2]	USA	Book	Landscape Architects/Civil Engineers	Sustainable landscape design and construction, retrofitting existing landscapes for sustainability	Evaluation of existing landscapes is a critical role of landscape managers and it should determine how the maximum efficiency of landscape projects can be achieved. Landscape ecosystems should be aesthetically pleasing and provide ecosystem services without encroaching on the natural state of the construction sites.
Sarfo, M., Joshua, A. & Gabriel, N. (2018) [1]		Journal	Contractors	Environmentally sustainable construction	Contractors are yet to fully achieve the ability to undertake sustainable construction, thus creating an enormous effect on the environment due to lack of compliance with SC practices. This can be improved by ensuring that isomorphic drivers, technology, and resilience theory are enforced to ensure compliance with SC principles.
Otieno, O.S. (2012) [3]	Kenya	Thesis	Contracting firms	Corporate social responsibility	The practice of CSR in Kenya by construction companies is significantly lower than expected. Most companies are aware, but are yet to fully embrace it, thus leaving room for future improvement in adoption of CSR concerned with sustainability.
Rami, B.Y. & Samuel, M. (2011) [5]	Stockholm	Book	Construction stakeholders	Sustainable development	Stakeholder cooperation follows specific purposes in any construction project. There is a significant reluctance to adopt sustainable construction practices due to their complexity, thus reducing the adoption and evaluation of sustainability.
Paul E. Murray, Alison J. Cotgrave (2007) [6]	UK	Paper	Construction professionals	Sustainability literacy	Sustainability literacy among construction professionals, as the key decision makers, influences how to reduce or reverse the negative impacts that construction places on the environment. Construction bodies are mandated to monitor and control education as well as embed sustainable development within the accreditation criteria for all construction courses. The attitudes of practitioners significantly affect the education of students due to mixed feelings towards this attempt, thus further complicating the efforts to ensure implementation of SC principles in the curriculum.
Eunice, K.M., Edward, W. & Peter. K.M. (2015) [7]	Kenya	Journal	Construction Procuring entities, Environmental managers	Sustainable procurement, green procurement	Environmental managers face several challenges in implementation of sustainable practices. This is largely due to resistance to change by procuring departments and poor policy communication. Integration of green procurement can be implemented through consistent integration of green practices into the environmental management systems as well as total cost ownership of sustainable practices through the use of life cycle costing tools to estimate the benefits of green construction practices.

Table 2. Cont.

Authors	Origin	Source	Target Population	Major Themes	Summary Points
Joshua, A., De-Graft, J.O., Prince, A.-A. & Rita, Y.M.L. (2022) [8]	Ghana	Journal	Construction project managers	Sustainable building processes and management	Sustainable construction practices and management face significant challenges such as inadequate training and education, high initial cost of green and sustainable construction practices and materials, and unfamiliarity with green technologies, thus hindering implementation. Project management teams can combat these challenges by ensuring that stakeholders are educated on the benefits of green buildings and ensuring that sustainable priorities are set out early in the project development stages.
Onkangi, R. & Getugi, Y. (2020) [9]	Kenya	Book	Policy makers and Government	Sustainability and law	Kenya lacks a sustainable construction strategy. The industry is heavily fragmented; thus, it is important for the Kenyan government to enforce sustainability as a core subject in the construction industry for policy improvement and provision of sustainable practices. The use of regulations will enable the overall achievement of sustainability in the Kenyan construction industry.
Virginia, D.H., Keith, K.L., Esther, P.S. & Sarah, E.E. (2019) [11]	USA	Journal	Construction stakeholders	Sustainability and stakeholders	Stakeholders should facilitate training, identify good practices, and guide decision making.

Further research indicates that a significant percentage of Kenyan developers are unaware of how these green building rating tools work; therefore, the implementation of sustainable and green building uptake and monitoring is significantly low. The state department for public works, in liaison with the Kenya Building and Research Centre (KBRC), is mandated to conduct research and coordinate the government's sustainable and green building agenda as per the 2017/2018 to 2021/2022 strategic plan. KBRC's key action areas include researching climate-resilient and sustainable building construction materials and technologies, developing green building policies, regulations, and guidelines, and mainstreaming green building principles in design and construction (United Nations Development Program, 2019).

4.2. Sustainability Assessment Process

According to [19], Kenya has only one published sustainability assessment process, a low number compared to other African nations on the continent. A comparison between five African countries showed that Egypt, Nigeria, and South Africa are highly productive in creating sustainability assessment processes for their local construction industries compared to Kenya and Malawi. As asserted by Figure 2 [19], these three countries have significantly higher economies than Kenya, causing a much higher environmental risk and, thus, the need for sustainability practices in their local industries. Kenya, being among the countries with a lower GDP than the above-stated countries, has a lower implementation of sustainable infrastructure projects and, thus, fewer sustainability assessments. This [19] several higher education institutions ranked among the top five hundred universities worldwide, according to Times Higher Education (THE), compared to Kenyan institutions. Kenya has only published one sustainability assessment process, similar to Malawi, South Africa, and Nigeria, while Egypt has three publications. This translates to a significantly low level of commitment and accountability in terms of M&E.

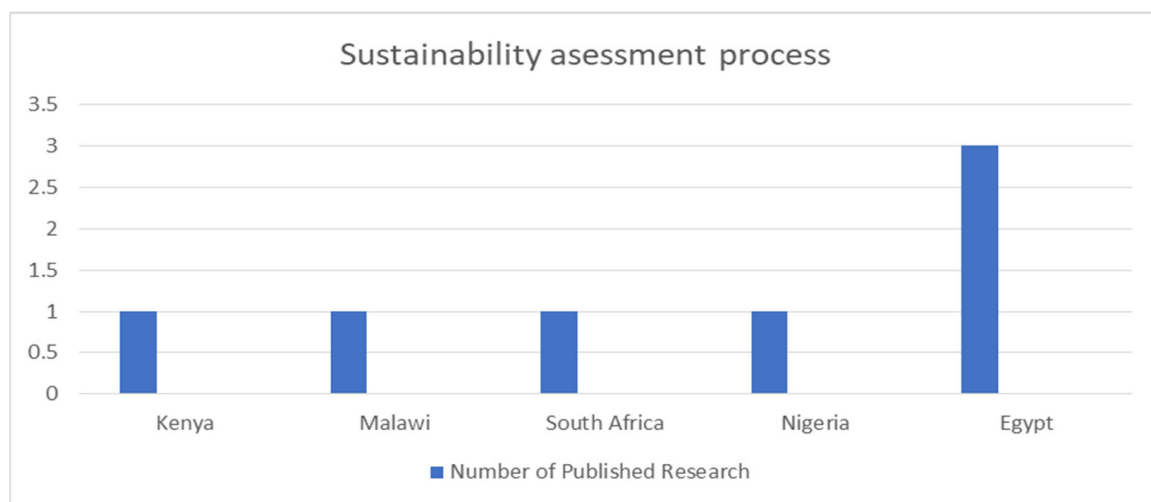


Figure 2. Sustainability assessments. Source: [19].

4.3. Sustainable Construction Materials

Data on sustainable or alternative construction materials in Kenya are significantly low, with less than 20% of the data being readily available. In contrast, approximately 47% of the data was missing, hindering the significance of the assessment and monitoring of the sustainability of alternative construction materials in the country, according to findings from [20] and illustrated in Table 3.

Table 3. Construction material data availability. Source: [20].

	Generic Data Available	Local Data Available	No Data Available
Conventional walling materials	87.5%	12.5%	-
Alternative walling materials	36.1%	16.7%	47.2%

However, the KNBS and the construction cost handbook published by the Institute of Quantity Surveyors of Kenya (IQSK) did not cover further research on the cost of these alternative construction materials. Therefore, it is challenging to facilitate a total cost assessment of sustainable construction since the cost of alternative materials varies from one contractor to the next. The data above indicate that there is a significant gap in the efforts made towards monitoring the types and quality of the available substitute materials that promote sustainable designs in Kenya.

Currently, the country uses other international European EPD databases since there is a lack of data on locally specific embodied energy for any of the materials surveyed, thus lacking a local life cycle inventory database. This creates a significant barrier in substantiating the sustainability of almost all alternative materials in Kenya [20].

The State Department for Housing and Urban Development is mandated to facilitate the use of appropriate building materials and technology (ABMT). However, the department faces challenges in assessing said policy due to the variations in geographical and project scope [21]. The findings indicate that the challenges associated with the uptake and monitoring of ABMT arise from the slow adoption by professionals, the prevailing research gap, the lack of a harmonized regulatory framework, and the low capacity to drive ABMT in fabrication, maintenance, and equipment servicing.

Findings from construction assessment research data on the level of monitoring of the efficiency of sustainable practices, such as energy and water consumption, indicate that the sustainable construction assessment standards and tools that exist in Kenya are below average [17]. Currently, observations suggest that sustainability assessment is not deemed a necessary project requirement; therefore, there is a lack of sufficient information for decision making in the monitoring and assessment of sustainable projects [17].

From the findings indicated in Figure 3, effective sustainable assessments are subjective and depend on the participant's attitudes and awareness of sustainable construction practices and frameworks. As can be seen, 90% of the participants indicated that they are unfamiliar with the framework guidelines that form the basis of sustainable assessments, while almost 80% were unaware of how to measure the performance of sustainable construction. These are significantly high numbers and dampen the efforts of M&E due to poor awareness of the information meant to help in decision making.

4.4. Monitoring Cost of Sustainable Landscape Materials

Data from the construction cost handbook of Kenya published by the Institute of Quantity Surveyors of Kenya (IQSK) (see Table 4) [22], in liaison with the state department for public works indicated a lack of a comprehensive cost analysis for landscape construction materials, directly affecting the efficient implementation of high-quality landscape projects. The published cost estimates in Kenyan shillings (KES) from the year 2018 to 2022 in Nairobi were analyzed, and an average was calculated for each category as indicated in the table below.

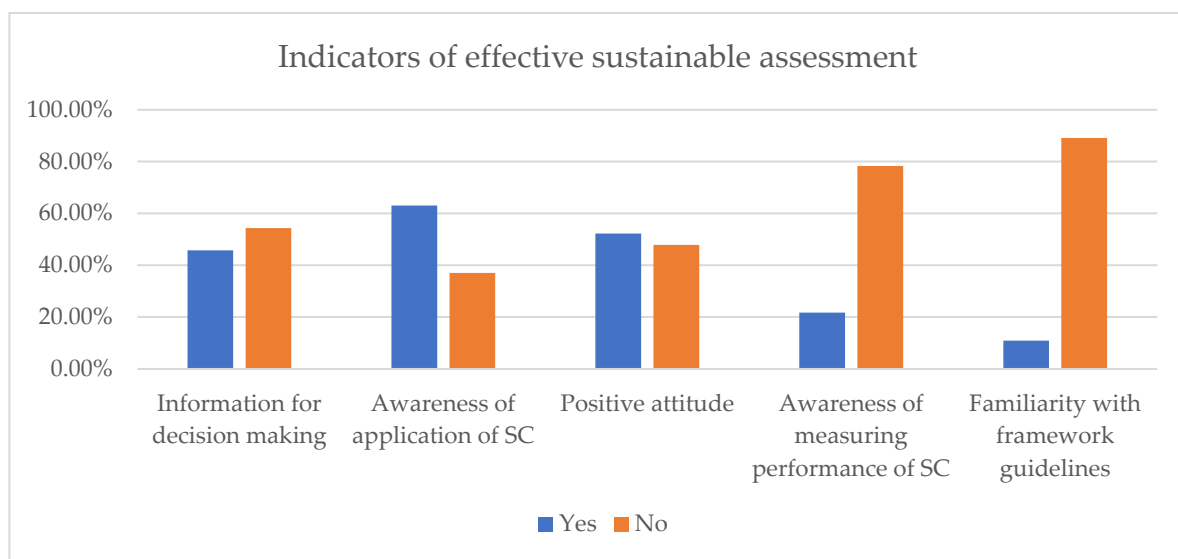


Figure 3. Indicators of effective sustainable assessment. Source: [17].

Table 4. Cost of landscape materials. Source: Institute of quantity surveyors [22].

Year	Earthworks/ Excavations (KES/M3)	Carting away (KES/M3)	Site Clearance (KES/M2)	Grassing (KES/M2)	Ground Covers (KES/No.)	Shrubs (KES/No.)	Trees (KES/No.)	Irrigation	Lighting	Landscape Maintenance
2017/ 2018	300	600	75	-	273	347	2017	-	-	-
2018/ 2019	350	538	90	320	316	327	1500	-	-	-
2019/ 2020	700	520	50	320	559	333	2875	-	-	-
2020/ 2021	1270	-	50	320	876	690	8050	-	-	-
2021/ 2022	2630	-	90	-	368	600	6200	-	-	-

The findings indicate a significant gap in the monitoring of landscape construction costs for the period stated since it depicts a reduction in the expenses for some aspects from one year to another, contrary to the evidence of increased construction cost indices in the country. The handbook does not cater to all aspects of sustainable practices, such as monitoring water consumption in landscape projects from irrigation or the cost of permeable paving materials with lower embodied carbon. Some findings indicate that sustainable construction materials like paving blocks are slightly cheaper at KES 850 per square meter compared to traditional concrete pavers retailing at KES 950 per square meter; however, the costs of these new and alternative materials are not published in the handbook. The summaries in the construction cost handbooks published do not give a composite building cost per square meter for landscape work, thus leaving room for a higher margin of error during costing for landscape work and other sustainable construction projects.

The findings from the Jenga green tool, a directory of green building materials and their respective costs, are significant in the overall projections and comparison of costs between predominant construction materials and sustainable materials. However, the library does not have a vast array of construction materials since it is a relatively new library; therefore, there is a significant gap in the documentation and evaluation of available sustainable materials and their respective costs across all construction disciplines and, more specifically the variations in the cost of sustainable landscape architecture materials.

According to [23], resource pricing in the construction industry is difficult due to the variation in geographic locations and unstable economic conditions. Therefore, the need to achieve the triple bottom line affects the pricing of construction materials, hence the need

for a proper understanding of the pricing indices of sustainable materials. The authors argue that in Ghana, the barriers towards the proper pricing of sustainable materials are associated with a lack of awareness, challenges involved with sustainability measuring tools, economic challenges, and information challenges, all of which cut across the Kenyan market as well. Similarly, a poor attitude and resistance towards sustainable practices also affect proper costing efforts, since sustainability can only be achieved when there is sufficient support from all relevant stakeholders.

Research [24] has indicated that there are several traditional sustainable construction materials that have been developed, but they also have a low level of acceptability due to the lack of further research on the development and applications of said materials. The availability, usability, and acceptability of such materials further influence the cost, which is therefore indicative of the opportunity to conduct proper costing of sustainable materials.

5. Results

Globally, there are different sustainable assessment methods with different strengths and weaknesses due to the influence of the scope of work, different requirements, and the different categorization of elements. Despite the availability of several assessment tools in Kenya, there is a lack of proper standardization across all methods and tools. Monitoring and evaluating in the country indicated a significant gap in the procedural monitoring of sustainability practices from the inception of projects to the completion and operationalization of landscape projects similar to architectural and engineering projects. It was noted that only four tools are used in the country. Still, there is a significant gap in the evaluation, monitoring, and assessment of sustainability practices during and after the commissioning of construction projects.

According to [6], powerful policy drivers are needed to integrate sustainability into the curriculum in order to influence decision making for professional bodies that want to embrace sustainable construction programs and improve personal responsibility towards achieving sustainable construction practices through monitoring and evaluation. Studies have indicated that 83 buildings in the country have been cumulatively certified as green buildings, up from 25 in the year 2021. In contrast, there are no certified sustainable landscape or civil engineering projects despite the high number of construction projects ongoing. This number indicates a slow increase in the monitoring and policy development of landscape and civil engineering projects.

The development of the Safari Green building tool, localized to suit the assessment of projects implemented within Kenya and the East African market, has been instrumental in ensuring that parameters are monitored within the context of the geographical location of the projects. Despite the unveiling of this tool, the main challenge faced in its use is the lack of a specific website or repository dedicated to the tool. The tool has only been in use for less than five years; it is subject to more improvements in terms of performance criteria for different elements. Therefore, there is room to incorporate a rating criterion specific to landscape architecture projects. The use of different international rating tools infers different rating standards, affecting the classification of rated buildings and constructions subject to the tool used. For instance, LEED certification is classified into four levels: Platinum (80+ points), Gold (60–79 points), Silver (50–59 points), and Certified (40–49 points).

On the other hand, the Greenstar rating system uses four to six stars to evaluate the construction's efficiency, with different stars allocated for different categories, such as communities, design and build interiors and fit-outs, and performance categories. The Safari green index rates sustainability using percentages allocated to the different performance categories expounded into prerequisite requirements (0%), building landscapes (5%), passive design strategies (45%), energy efficiency (10%), resource efficiency (30%), noise control (5%), and innovation (5%). These three rating systems allocate different weights to different aspects of sustainable practices; therefore, there is a likelihood that these rating systems may have some differences when used to rate the same project. The challenge,

therefore, is to ensure that the development of the safari green building tool is continuous in order to improve on any possible gaps in its monitoring of sustainability.

Institutions such as KBRC have the mandate to research sustainability, but face significant challenges in collecting data for alternative construction materials, impeding the accuracy level in analyzing the effectiveness of sustainable construction. The Kenya National Bureau of Statistics (KNBS) should also incorporate statistics on landscape construction, sustainable construction materials, and costs to inform further research and certification by the Kenya Bureau of Standards (KEBS), whose mandate is to test and certify the standards for use in construction. The findings indicate that only one environmental product declaration (EPD) has been published in Kenya compared to other countries such as Egypt. It is paramount that there should be a deliberate effort in the research and publishing of more EPDs to inform future assessments of the impact of construction materials on the environment, facilitating more data on the feasibility of sustainable construction. More often than not, it is challenging for construction project managers to be able to explain to and convince clients of the overall cost benefit of sustainable practices. The cost of sustainable construction should be assessed as a long-term view instead of initial cost only in order to effectively portray the benefits of sustainability to all stakeholders.

Life cycle analysis is also lacking for construction projects in Kenya. The National Environmental Management Authority (NEMA) is mandated to conduct environmental audits in the country. However, frequent audits are not undertaken on existing landscapes after the operationalization of landscape and civil construction projects. Consequently, this translates to a lack of post-occupancy assessments of landscape projects and the lack of monitoring of possible sustainable and unsustainable materials. The lack of an existing policy on life cycle assessment for Kenyan projects has left room for private assessments of the efficiency of projects using different variables, thus leaving room for unstandardized reports. This implies that there is room for growth in a holistic approach toward monitoring and evaluating the post-occupancy efficiency of projects in the future.

6. Conclusions

The level of technical know-how and knowledge regarding sustainable construction practices in construction and landscape architecture is average at slightly higher than 50%. Less than 5% of construction practitioners incorporate landscape architects in their projects from inception, leaving room for a lack of sustainability in outdoor spaces. There is a significant lack of existing academic structures in place for teaching sustainability in higher institutions of learning in Kenya, especially in landscape architecture and green building academia, therefore impeding the practice of monitoring and life cycle assessment of ongoing and completed landscape architecture projects.

Sustainable construction in landscape architecture should focus on environmental sustainability. However, the findings indicate that the Kenyan market generally focuses more on social and economic aspects than on environmental aspects. Therefore, sustainability assessment frameworks should be further developed and broken down into suitable categories and scales to include clients, developers, designers, and the public. Public education on the benefits of sustainability monitoring will increase awareness, thus placing emphasis on implementing sustainability assessments, leading to a high acceptance of sustainable construction practices.

Notably, 99.8% of construction projects and buildings in Kenya have not been certified as sustainable, despite the availability of sustainability rating tools. There is a general reluctance to assess the sustainability performance of constructions due to a lack of familiarity with the assessment standards and the cost of incorporating frequent assessment drills throughout the project life cycle. In Kenya, several independent landscape architecture projects have been implemented. However, the green rating tools have accredited none compared to other countries where landscape projects have been certified under the SITES accredited professionals (AP) credentials through green building certifications. It is crucial to create a long-term monitoring system of ecosystems that will form the basis for assess-

ing the growth and impact of sustainable construction practices, especially in landscape architecture projects in Kenya.

Several government bodies are mandated to oversee the research of sustainable materials, the cost of alternative materials, the creation of policies for implementation and assessments, and for education on the benefits of sustainable practices. However, these government bodies have not been entirely successful in performing their duties and have hindered further development in sustainable construction, especially in emerging practices such as landscape architecture. This leads to poor attitudes towards monitoring and assessment strategies for sustainability in landscape architecture. It is, therefore, essential to streamline the mandate of these governing bodies to ensure their ability to monitor and evaluate sustainable construction trends and practices in Kenya by allocating the necessary budget, ensuring sufficient stakeholder involvement, and enhancing technical competencies.

Similar to the findings from [23], the Kenyan construction sector should also ensure that there is capacity in terms of human resources and skills in order to address the existing challenges in the realistic and adequate pricing of sustainable materials.

This study aimed to identify the gaps in the monitoring and evaluation frameworks in the AEC sector that affect sustainability achievements. In summary, the gaps between sustainability literacy, the costing of sustainable materials, and poor awareness of sustainable assessment frameworks impede the realization of a seamless sustainability monitoring and evaluation process. The Kenyan government should ensure that stringent policies are set up to improve M&E in landscape architecture projects and the construction industry at large. Further research should also be conducted in order to expand the available data on the cost of sustainable construction materials and create a database of trends for sustainable construction assessments.

To conclude, the M&E of sustainability should consider proper compliance with set regulations, encourage green building certifications, enforce public participation, inform life cycle assessments, embrace technology, and establish standard feedback loops in order to establish clear goals. This can be achieved through the comprehensive establishment of a data collection system for sustainability performance throughout the construction industry.

Author Contributions: Writing—original draft, S.J.T.; Supervision, M.T. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Conflicts of Interest: The authors declare no conflict of interest.

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