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Service Life of Floor Finishes in Nairobi's Public Buildings: *Lessons for Sustainable Materials*

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Abstract
Accurate knowledge of the long-term performance of building materials, particularly the service life of components and systems, is fundamental to sustainable construction practices. In Kenya, limited application of service life assessment and prediction has contributed to economic, social, environmental, and physical challenges, including high maintenance costs, aesthetic deterioration, increased material waste, safety risks, and adverse environmental impacts. This study investigated common floor finish types used in public office buildings, the motivations behind their selection, and their observed service life based on field data, with the aim of informing sustainable material selection and maintenance planning. Data were collected from 49 public office buildings using a mixed-methods approach and analysed through comparative interpretation. Findings indicate that the predominant floor finishes are ceramic tiles, granito tiles, terrazzo, and carpets. Observed service life, defined as the period between installation and replacement, ranged from 39.5 to 49 years and was strongly influenced by building function and changing aesthetic preferences, particularly in representational spaces. Premature replacement was found to undermine sustainability by increasing waste and life-cycle costs. The study recommends integrating service life prediction models into design decision-making to balance aesthetics and durability, contributing to localized, evidence-based maintenance policy and improved resource efficiency.

Keywords: Service life prediction, sustainable construction, floor finishes, public buildings, life-cycle costing, circular design

INTRODUCTION

Buildings are made up of various components that get to the end of their service life at varying points of the building's life cycle. In addition, building components are divided into two main parts (substructures and superstructure). Other authors (Nowogonska, 2025; Wardach et al., 2022) additionally draw attention to the building's subdivision into durability layers, which indicates the different rates of degradation that occur in construction subsystems. These can be categorized as "the structure", the "skin", "the systems" and the "interior layout finishes", which ideally encompasses the whole building and outlines the areas likely to degrade during the building's life cycle (Ferreira et al.,2021).

Maintenance works are typically directed toward the most exposed components, such as finishes, which experience frequent wear and tear from user interaction Tamosaitiene et al.,(2021) highlights various types of building repairs and maintenance normally carried out as; day-to-day; annual; special; additions or alterations or preventive maintenance. The building maintenance officers may adopt any of the programs, either as planned or unplanned, depending on whether the failure is due to usage over time or an emergency. Consequently, finishes, being the most visible and user-interactive elements, often demand the highest maintenance attention throughout a building's lifecycle. In practice, maintenance decisions are often driven by immediate functional needs rather than long-term durability considerations. As a result, many public buildings in Kenya experience premature degradation of finishes, especially floors, which affects not only functionality and aesthetics but also safety and user comfort. **Figures 1** and **2** illustrates typical cases of deteriorated floor finishes in public office buildings.

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FIGURE 1
Broken floor tiles at Works Building
Source: Field study, 2026

FIGURE 2
Dilapidated floor at Works Building
Source: Field study, 2026

In addition, the growing interest in sustainable construction has led to an increase in the understanding of material performance and life cycle costs. The accurate prediction of a material's service life enables better planning, resource efficiency, and waste reduction, key elements in achieving sustainability goals (Figueiredo et al., 2021; Lima et al., 2021). In Kenya, this phenomenon can be seen by the involvement of the clients in the design process, when they give design briefs and walk with the Architects even in giving guidance on the preferred specifications for finishes and other building materials. There is also increased awareness by the stakeholders in the construction sector that construction costs, maintenance, and repair broadly define the quality of a building; hence the owners are normally quite keen on the various options available for materials together with the related costs. However, in many developing contexts, including Kenya, design and maintenance decisions remain focused on reducing initial construction costs, with minimal consideration of long-term performance or environmental impact. This short-term approach contributes to increased waste generation, higher maintenance costs, and decreased building quality, in the long term.

Local Context and Rationale

In Kenya, the absence of systematic service life prediction in construction and maintenance practices has resulted in economic and environmental losses. Building owners and managers often prioritize aesthetics and immediate functionality over durability and cost-effectiveness, leading to frequent replacement of materials such as floor finishes. This pattern undermines sustainability objectives by increasing embodied energy, waste, and carbon emissions from material production and transportation (Ahmed, 2020). As such it is critical that data driven approaches to material selection and maintenance be prioritized especially for public buildings given their high foot traffic.

Problem Statement

Despite the critical role of finishes in maintaining building performance and aesthetics, limited attention has been given to understanding their service life and performance in Kenya's public buildings. Ideally, service life prediction should inform maintenance planning and the allocation of resources, thereby reducing repair and replacement costs (Saihi et., 2023). However, this approach is largely underutilized within Kenya's construction and maintenance practices. This results in economic losses, poor aesthetics, increased waste generation, and increased safety risks (Riahinezhad et al.,2021). This study therefore seeks to investigate the service life performance of floor finishes in public buildings in Nairobi, with the aim of informing sustainable material selection.

Research Statement

To address the above identified gap, this study sought to investigate the phenomena of service life performance and its influence on service life

prediction with specific emphasis on the floor finishes of public buildings in Kenya. Specifically, the research aimed at analysing the common floor finishes found in public buildings together with the factors that determine their selection at initial construction stage, and during the user phase in the life cycle of a building. It also analysed the observed service life of different floor finish types and derived insights on how flooring choices affect long-term sustainability in building maintenance practices and operations. This will then inform the development of practical service life assessment practices that can enhance maintenance planning, reduce waste generation, and promote sustainability within Kenya's construction sector.

Research Gap

Poor floor finishes among other things also reduce the aesthetics of the building and make the building less appealing to both the users and the overall surroundings. Poorly finished floors can also have negative health effects on users, including an increased risk of domestic accidents, falls, skin abrasions, instability, sinking, and collapsing (Kim, 2021). If the floor is too smooth, too sharp, or slippery, some of these risks are exacerbated. Human hazards can have serious repercussions, including premature death and injury, if they are present.

At the core of this paper is the lack of a systematic model that can be used by stakeholders who are developing buildings in guiding informed path of making choices of floor finishes prior, to avoid adverse occurrences. The target is to ensure easy decision-making with a guarantee of knowing the value addition to be realised during the life cycle of the floor and other building finishes. This has been undertaken in the study by seeking to propose service life practices that can help mitigate the consequences, leading to a more sustainable construction sector in Kenya.

THEORY

Durability and Building Performance

Key to a building's performance is durability since it shows how long a building material or component can be functional and aesthetically pleasing with as little maintenance as possible. Recent studies show that durability directly influences user safety, comfort, and economic performance by minimizing repair and replacement frequency (Bungau et al., 2022 ; Makinde et al.,2024).

Earlier research had taken durability as mainly a technical issue but more recent studies have tried to look at it from an environmental and social perspective (Bungau et al., 2022). For instance, (Hu, 2023) notes that durable materials not only extend a building's lifespan but also contribute to sustainability by reducing embodied carbon and waste thus contributing to better environmental outcomes. This broader understanding supports the integration of durability into sustainable construction frameworks.

Sustainability and the Built Environment

Sustainable Construction Theory

One of the theories anchoring this study is the Sustainable Construction Theory. The initial definition by Kibert included six principles: reducing the consumption of resources, maximizing the re-use of resources, adopting the use of renewable and recyclable resources, protection of the natural environment, creation of healthy environments and achievement of quality in the making of the built environment (C.J.Kibert, 2007). The definition was later compressed by (Hill & Bowen, 1997)in terms of four sustainability principles: social, economic, biological, and technical as shown in **Table 1**.

Recent research reinterprets these pillars through concepts such as circular economy, life-cycle thinking, and material reuse (Rahla, Mateus & Bragança, 2021).

Social sustainability relates to improvements in the human living environment and quality of life that should come about because of sustainable construction. Economic sustainability advocates for the efficient use of resources through mechanisms such as real price costing and full-cost accounting. Biological sustainability is concerned with the protection of the natural environment and the use of renewable resources in all phases of a construction project. Service life prediction can help with the selection of renewable and long-lasting materials to achieve biological sustainability.

Technical sustainability requires that buildings should be durable, of high quality and performance and encourages mixed-use buildings. One area of

TABLE 1
Common floor finishes

S/No.	Area	Common Initial Finish	Frequency	Common Current Finish	Frequency
1.	Common areas	PVC tiles	20.6%	Granito tiles	22.9%
2.	Staircases	Terrazzo	42.6%	Terrazzo	44.8%
3.	Toilets and kitchens	Ceramic tiles	36.5%	Ceramic tiles	54.5%
4.	Staff offices	PVC tiles	25.9%	Ceramic tiles	23.3%
5.	Management offices	PVC tiles	22.2%	Carpets	34.5%
6.	Boardrooms	PVC tiles	24.6%	Carpets	34.6%

Source: Field study, 2026

interest to technical sustainability is materials and resources where technical sustainability advocates for the use of sustainable building materials including recycled, reclaimed and locally sourced materials to reduce the carbon footprint in the construction industry. Technical sustainability also promotes the use of durable materials to reduce the need for repairs and replacement as well as to reduce waste and service life prediction can help with the selection of durable materials in line with technical sustainability.

In addition, life-cycle costing complements sustainability goals by accounting for a material's performance from installation to disposal, ensuring value for money across the building's lifespan. This shift from cost-based to performance-based decision-making aligns with emerging sustainability frameworks in Africa, which emphasize local resource efficiency and climate resilience (Nouhoun et al., 2025).

Service Life Prediction Methods

Service life prediction provides a scientific and managerial framework for estimating the period during which a material remains fit for use under defined conditions. Service life prediction not only considers durability but it widens the scope to include maintenance practices, environmental exposure, workmanship and the quality of materials (Sandak et al., 2019; Silva et al., 2021).

Modern service life prediction approaches, especially those guided by ISO 15686, integrate probabilistic modeling, field data, and environmental simulation to predict degradation patterns and inform maintenance schedules (Lacasse et al., 2020). In Kenya, however, empirical data on building component longevity remain limited, constraining the development of localized prediction models. As Marteinsson (2005) noted, service life estimation should be viewed as a minimum performance requirement; achieving this requires structured maintenance systems, quality workmanship, and a culture of preventive care.

Figure 3 shows the different phases of the building process and where service life prediction is placed in the whole process.

Conceptual Framework Linking Service Life Prediction and Sustainable Construction

Figure 4 presents the conceptual framework guiding this study, linking durability, service life prediction, and sustainability outcomes within the Kenyan construction sector.

Figure 4 illustrates how sustainability outcomes in Kenya's construction sector emerge from the interaction between material durability, service life prediction, and sustainability-oriented decision-making. At the base of the framework is material durability and building performance, which determine how long building components—particularly floor finishes—remain functional, safe, and aesthetically acceptable. Durable materials reduce the frequency of repairs and replacements, leading to improved economic performance and user safety.

Service life prediction builds on durability by providing a structured approach to estimating

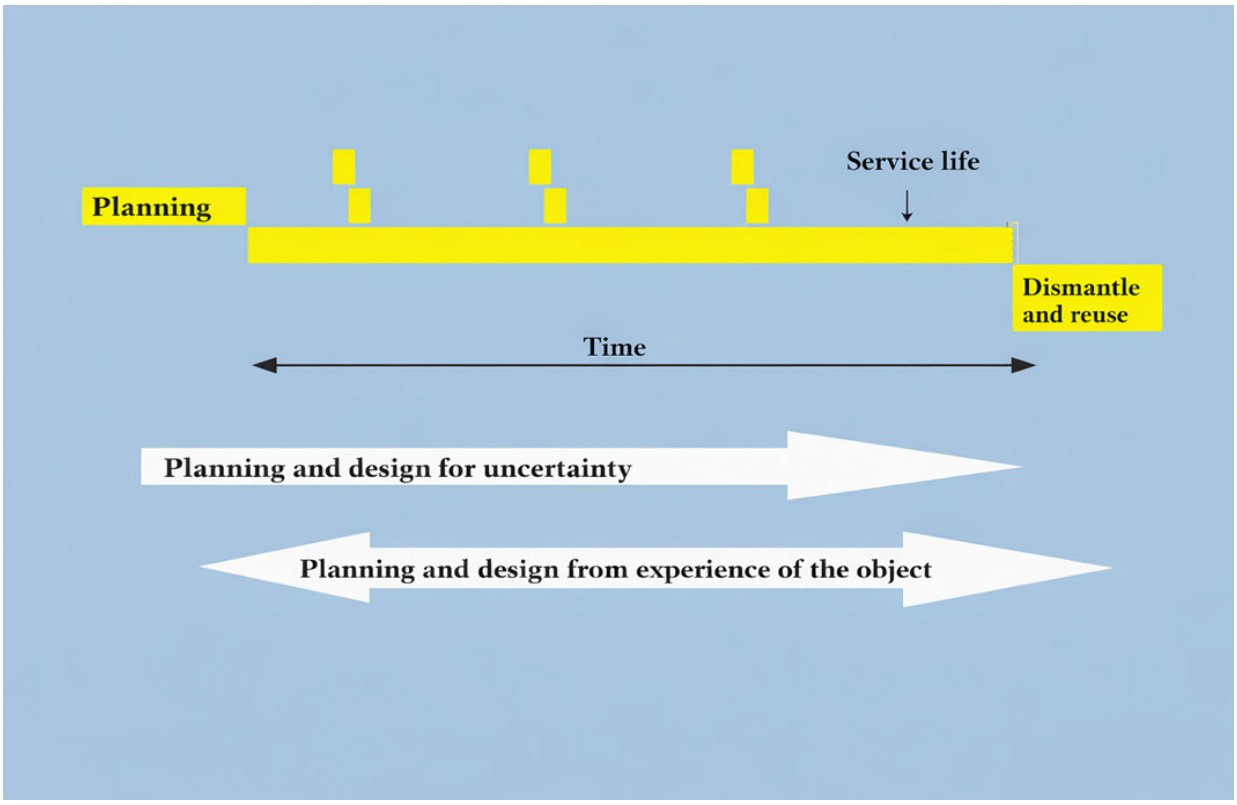

FIGURE 3
Building process stages and service life across planning, use, and reuse phases
Source: Adapted from Marteinsson (2005)

material performance under specific conditions, including environmental exposure, workmanship quality, maintenance practices, and usage intensity. In the Kenyan context, this highlights the importance of developing localized service life data to support informed material selection and maintenance planning.

The framework integrates sustainable construction principles encompassing social, economic, biological, and technical sustainability. These principles are operationalized through decision-making tools such as life-cycle costing and circular design, which shift practice from short-term, cost-driven choices toward performance-based and resource-efficient solutions.

The framework culminates in sustainable construction outcomes, including reduced material waste, lower life-cycle costs, improved resource efficiency, and enhanced environmental performance in public buildings. Overall, it demonstrates that aligning service life prediction with sustainability principles provides a coherent pathway for improving material selection and maintenance practices in Kenya's construction sector.

Floor Finishes and the Case for Sustainability

The floor of a building is its horizontal structural component. The main purpose of the floor is to sustain both live and dead loads. As part of skeleton systems, it must support its own weight and transfer it to the system, strengthening solid masonry systems by connecting the walls. It must also withstand specific elements, such as heat, moisture, dampness, and noise, depending on where it is located in a building. The floor coating, base, structural system, and, if suspended, ceiling coating are the four layers that make up a floor section (**Figure 5**).

Contemporary classification divides floors into hard, resilient, and soft finishes (Binggeli, 2014), each exhibiting distinct life spans and maintenance demands. Research highlights durability, cost, and maintenance as key drivers of finish selection (Onochie et al., 2017). However, recent sustainability discourse calls for extending these criteria to include recyclability, embodied

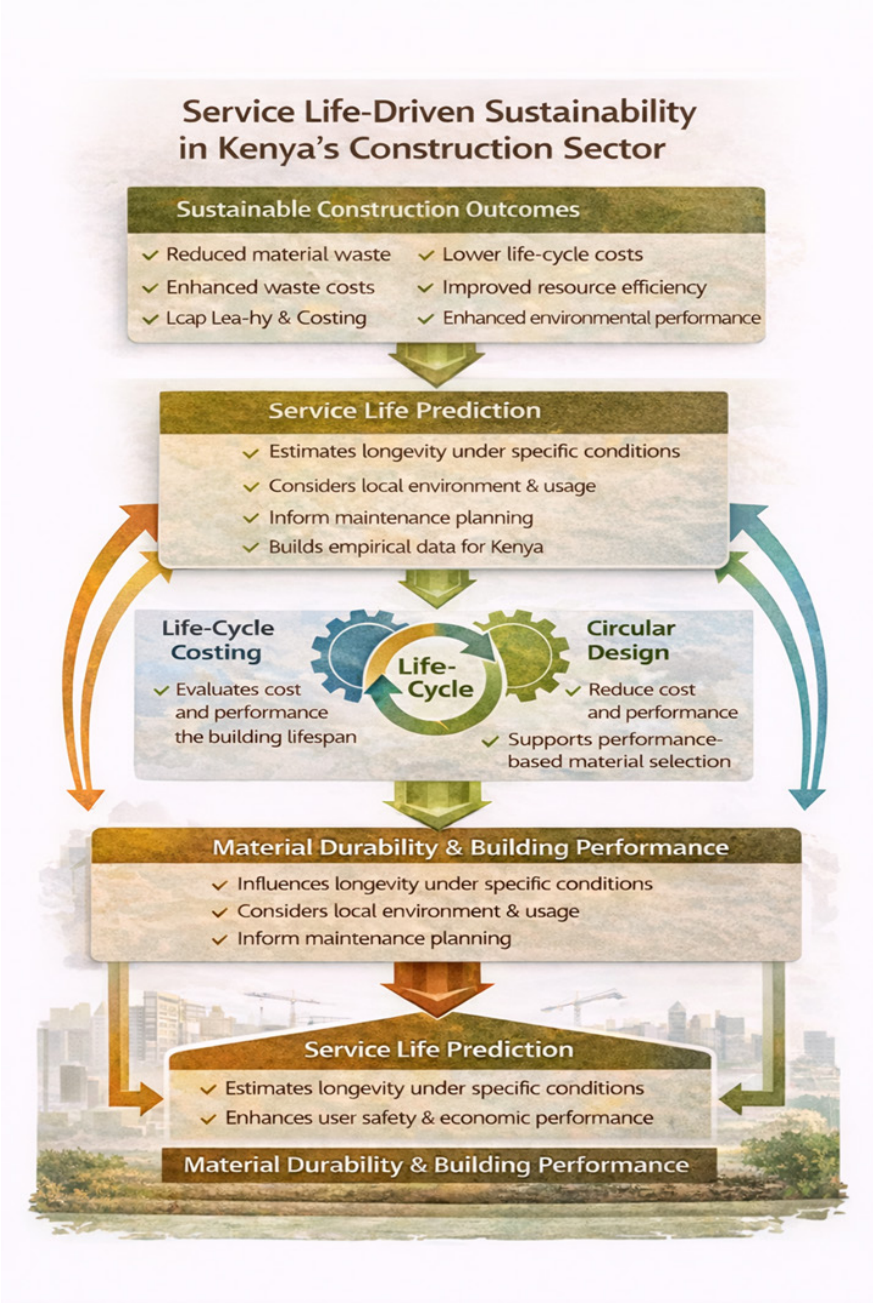

FIGURE 4
Service life–driven sustainability framework for Kenya's construction sector
Source: Author's analysis adapted from life-cycle costing sustainability theory (2026)

energy, and environmental impact (Ahmed, 2020).

As per the principles of circular design, floor finish materials that have a long service life and can be recycled such as terrazzo are more inline with the objectives of sustainability. In contrast, synthetic materials such as carpets and PVC which have a shorter service life and also are less recyclable, stray away from sustainability objectives (Rahla et al., 2021). Therefore, integrating service life prediction with sustainability assessment enables a balanced approach that considers both technical performance and environmental responsibility.

The role that floor finishes play in sustainability in the built environment cannot be overlooked. This is especially so for public buildings that experience high foot traffic and have to balance between durability and cost effectiveness. Therefore, when selecting floor finishes for such buildings, it is important to consider the long-term impact on sustainability instead of just

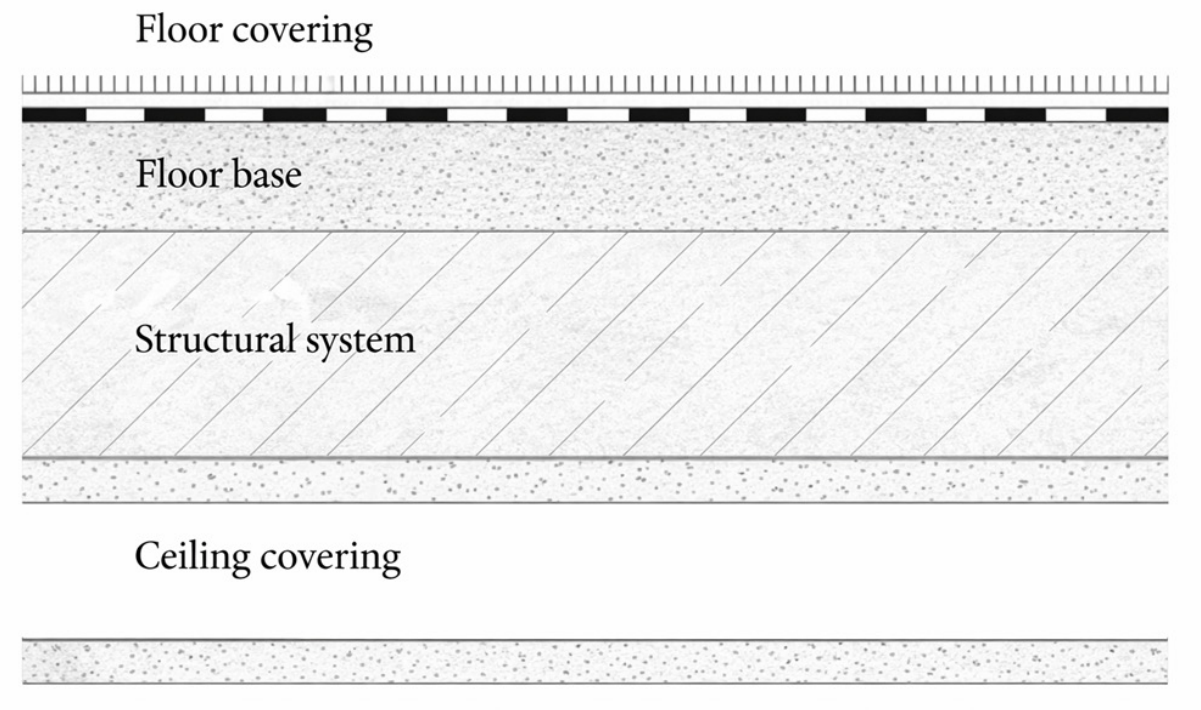

FIGURE 5
Typical floor section showing functional layers
Source: Adapted from Toydemir et al. (2000)

considering the function of spaces and aesthetics. By doing so, public buildings will be able to balance functionality and aesthetics while also minimizing negative economic and environmental consequences.

RESEARCH METHODS

The study adopted a mixed methods approach using both qualitative and quantitative. Qualitative research strategies were used to analyze descriptive data while quantitative methods were used in the analysis of numerical data. The choice of this approach was preferred as given the nature of the data, it provided a comprehensive understanding of the research problem thereby ensuring accuracy, depth and reliability of the results.

The study's target population was the public office buildings based in Nairobi County. The studied buildings were based in Nairobi, which eliminated the impact of climate on the subject of the study due to similarity in the geographical location. A preliminary survey was conducted to obtain a list of all the public office buildings as well as their characteristics, so that they can be profiled for the purposes of this study. A list of 72 public office buildings that are in-house managed was obtained from the Ministry of Housing's public building's register. In addition, a list of 5 buildings that are managed by private agencies was also obtained from the respective agencies.

The study employed the census sampling technique where data was collected from the identified public buildings. This sampling technique was preferred due to a relatively small and well-defined study population, that allowed the collection of data from all eligible public buildings. From the initial obtained list of 77 public office builings,9 buildings were omitted since they have already been demolished. 14 buildings with a plinth area of less than 4000 square feet were also excluded from the, study to ensure generalizability of the study findings, given that the small buildings represented 21% of the population while buildings with a plinth area larger than 4000 represented 79% of the population. In addition, the preference for buildings with a plinth area of 4000 square feet and above was due to them providing a significant area for the subject under study. Additionally, 5 buildings were inaccessible due to security reasons and unknown locations, prompting their exclusion. The final study list consisted of 49

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buildings of which responses were received from 42 buildings (85.7%) with 10 buildings being part of the pilot study. The piloted buildings were also included in the main study. **Figure 6** illustrates the step-by-step building selection process used in the study, showing how the initial sample of public buildings was systematically refined through defined exclusion criteria to arrive at the final set of buildings included for analysis.

Figure 7 shows the spatial distribution and location of the sampled buildings within the study area.

Data was provided by the facility managers, maintenance officers, and building owners who provided key information for the study including the types of floor finish in the different public office buildings sampled, the service life performance factors of the chosen floor finishes, the type of maintenance that is carried out, the pattern of maintenance, conditions of total replacement if any and when and why the floor finishes were replaced if already done (**Figure 8**).

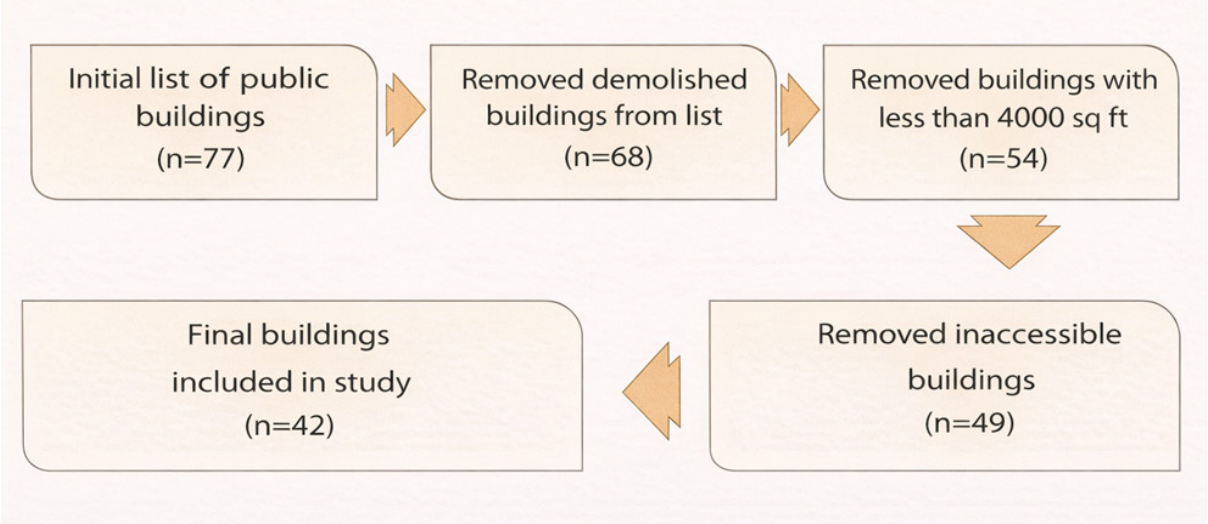

FIGURE 6
Building selection and screening process
Source: Author's analysis (2026)

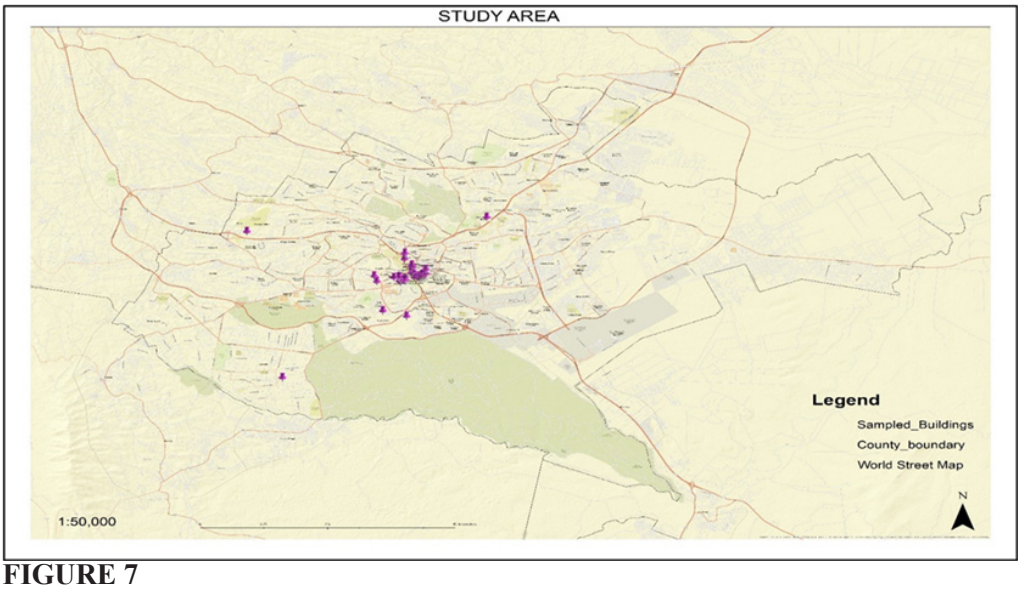

FIGURE 7
Spatial distribution of sampled buildings within the study area
Source: Author's analysis (2026)

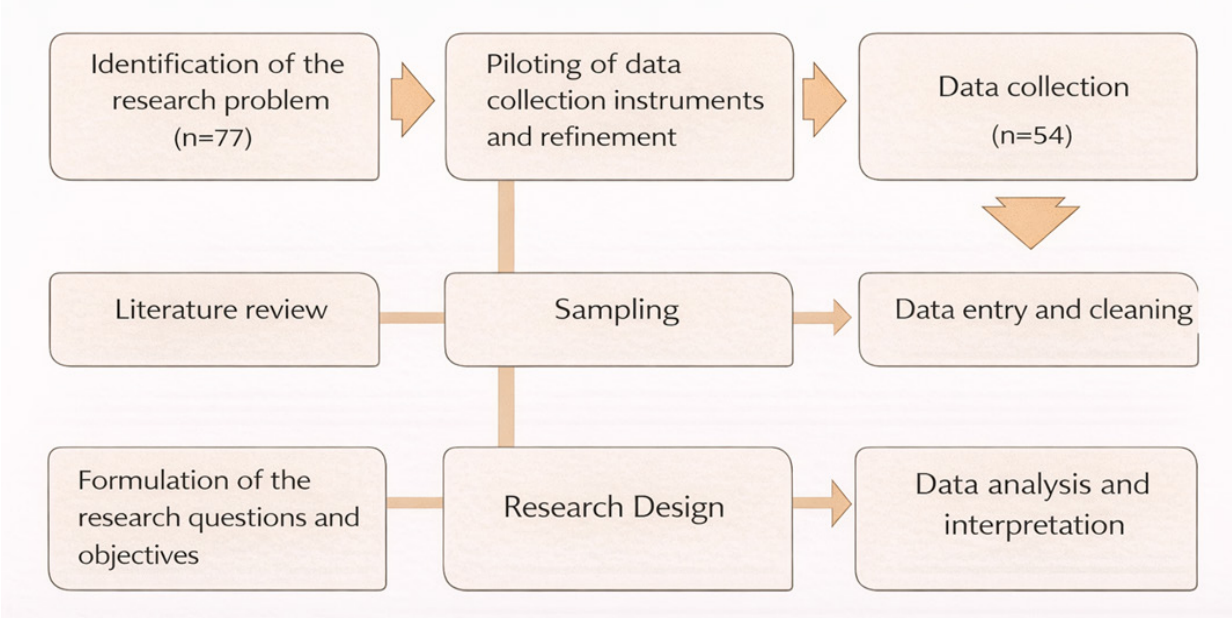

FIGURE 8
Study methodology and research workflow
Source: Author's analysis (2026)

To ensure data reliability and validity, triangulation techniques including comparing qualitative insights with quantitative results as well as consistency checks were performed during data coding and analysis.

To uphold research ethics, the researcher obtained a research license from the National Commission for Science, Technology and Innovation (NACOSTI). They also sought consent from relevant building management authorities before data collection. In addition, the confidentiality and anonymity of all respondents was upheld throughout the research process.

RESULTS

Common types of Floor Finishes

The findings of the study revealed the current common types of floor finishes in public office buildings and the common initial finishes, as shown in **Table 1**.

The choice of floor finish was informed by both status and functionality. A general observation was that the management offices and boardrooms had more high-end finishes such as carpets and laminates compared to other areas in the public office buildings. This can be attributed to the fact that these offices occasionally host dignitaries and high-level guests hence the need for them to look executive. The floor finishes in management offices and boardrooms also looked better maintained as compared to other rooms. Also, some offices were moving away from the use of carpets due to carpets being expensive to maintain and also due to their ability to harbor dust.

While the use of some floor finishes such as terrazzo and ceramic tiles had been retained in staircases and toilets and kitchens, the use of PVC tiles in common areas, staff offices, management offices and boardrooms had reduced with PVC tiles being replaced by granito tiles, ceramic tiles and carpets.

Choice of Floor Finishes

The selection of floor finishes was guided by several factors including durability, aesthetics, ease of cleaning, and maintenance. As shown in **Table 2**, terrazzo and granito tiles were primarily selected for their durability and ease of maintenance, while carpets were favored in management spaces for their aesthetic appeal. PVC tiles were initially preferred for cost-effectiveness and ease of installation, but have since declined in popularity due to poor durability and maintenance challenges. These findings were consistent with the findings of (Onochie et al., 2017) who established that the most important factors that were considered

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TABLE 2
Reasons for choice of floor finishes

	Reasons for choice of common floor finishes(Frequency)								
Floor Finishes	Easily Available	Easy installation	Easy to clean	Durability	Lightweight	Easy maintenance	Economical	Aesthetics	Non-slip
Granito	9.4%	11.3%	20.8%	22.6%	-	13.2%	5.7%	15.1%	1.9%
Terrazzo	4.7%		39.5%	14%	-	14%	9.3%	9.3%	9.3%
Ceramic Tiles	16.9%	3.1%	27.7%	12.3%	-	16.9%	9.2%	12.3%	1.5%
PVC Tiles	21.4%	14.3%	14.3%		-	14.3%	7.1%	28.6%	
Carpets	2.9%			2.9%	-	2.9%	5.7%	77.1%	8.6%

Source: Field study, 2026

while choosing floor finishes were durability, ease of maintenance and aesthetics. These reasons also influenced the rooms in which the finishes were placed with the aesthetic finishes being mainly placed in management offices and boardrooms, the durable finishes being placed in areas with high foot traffic and the easy to clean finishes being placed in areas that require regular cleaning.

From these findings, it can be deduced that the main factors influencing the choice of floor finishes in public buildings include the use of the space and aesthetics. For instance, for management offices and board rooms, where it is important to maintain a high-end look, carpets were the predominant floor finish.77.1% of the respondents cited aesthetics as the main reason behind the installation of carpets in those specific rooms. On the other hand, for general areas the choice of floor finish was more practical and was guided by factors such as ease of cleaning, maintenance and durability, granito tiles and ceramic tiles were the preferred finishes for these areas. These findings were consistent with the findings of (Bako and Jusan, 2012) who found that ceramic tiles were preferred mainly for their ease of cleaning. Terrazzo was preferred for staircases, perhaps the building areas with the most foot traffic, due to its ability to balance durability, economic efficiency and aesthetics.

Reasons for Replacement of Floor Finishes and the Observed Service Life

Four common reasons for the replacement of floor finishes were identified. They included change in tastes and preferences as the main reason behind the replacement as indicated by 51% of the respondents, followed by end of service life indicated by 29% of the respondents, routine maintenance as indicated by 11% of the respondents and emergency maintenance as indicated by 9% of the respondents. The change in preference resulted from changes in management where in some instances a new management brought about changes including changes in floor finishes. Change in preferences also came about from the desire to keep up with modern floor finishes such as ceramic and granito tiles as opposed to PVC tiles as shown in **Figure 9** and **Table 3**.

The observed service life was taken as the number of years the floor finishes were in place before replacement. As such, the finishes whose service life was considered were the initial finishes. The observed service life ranged between 42.4 years and 49 years and this was mainly informed by the reasons explained above. Comparing these findings with those reported by Building Cost Information Service 2006 in (Akanbi, et al., 2019) of 30 years for tiles and terrazzo in Japan and 50 years for tiles and terrazzo in the UK, the observed service life of the floor finishes in the public office buildings in Kenya is shorter than that of floor finishes in the UK and longer than that of floor finishes in Japan and this can be attributed to the different geographic contexts The predominance of aesthetic-driven replacements highlights sustainability concerns, as many finishes were replaced before the end of their functional service life.

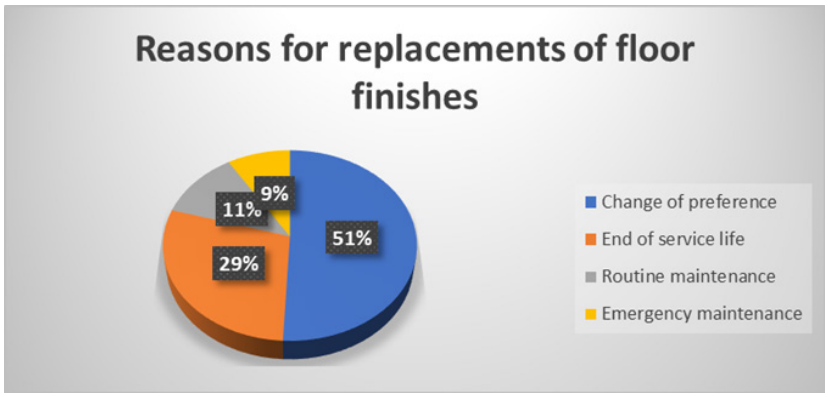

FIGURE 9
Reasons for replacement of floor finishes
Source: Author's field survey (2026)

TABLE 3
Observed versus expected service life

Floor Finish	Observed Service Life	Expected Service Life
PVC tiles	42.4 years	50 years
Terrazzo	45 years	75 years
Ceramic tiles	49 years	50 years

Source: Author, 2026

DISCUSSION

Alignment of Floor Finish Selection with Durability Theory

The findings of this study confirm that floor finishes in Nairobi's public buildings are selected primarily based on aesthetics, functional use of space, and perceived status, rather than on long-term durability considerations. This outcome partially aligns with durability theory, which emphasizes that finishes—classified as interior layout layers—are inherently more susceptible to degradation due to frequent user interaction (Ferreira et al., 2021; Nowogońska, 2025). However, durability theory also asserts that such components should be selected and managed using predictive service life planning, particularly because they require the most frequent maintenance interventions (Tamosaitiene et al., 2021).

The dominance of terrazzo and ceramic tiles in staircases, toilets, and kitchens supports earlier findings that hard finishes with high abrasion resistance are preferred in high-traffic and wet areas due to their superior durability and ease of cleaning (Binggeli, 2014; Onochie et al., 2017). Conversely, the continued preference for carpets in management offices and boardrooms reflects a divergence from durability-led decision-making toward symbolic and aesthetic considerations, a trend similarly observed in interior finish selection studies by Bako and Jusan (2012). This divergence exposes a structural tension between durability as a technical requirement and aesthetics as an institutional and cultural driver, a tension insufficiently addressed in current public procurement practices.

Observed Service Life versus Expected Performance

The observed service life of floor finishes—ranging between 42.4 and 49 years—demonstrates that many finishes in Nairobi's public buildings perform within or near internationally accepted benchmarks. Comparative studies report expected service lives of approximately 50 years for ceramic tiles and terrazzo in the UK and around 30 years in Japan, with variations attributed to climate, usage intensity, and maintenance regimes (Akanbi et al., 2019). The Kenyan results therefore indicate

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relatively strong material performance, especially given high foot traffic and limited preventive maintenance structures.

However, the discrepancy between observed and expected service life, particularly for terrazzo, which theoretically can exceed 75 years, suggests that replacement decisions are not failure-driven but preference-driven. This finding corroborates Marteinsson's (2005) assertion that service life estimation represents a minimum performance threshold, not a guarantee of longevity, and that institutional decisions can prematurely terminate a material's life irrespective of its physical condition. The study thus reinforces the argument by Lacasse et al. (2020) that service life prediction must incorporate behavioural, managerial, and institutional variables, not merely material properties.

Aesthetic-Driven Replacement and Sustainability Implications

One of the most significant insights emerging from this study is that 51% of floor finish replacements were driven by changes in taste and preference, rather than by material failure or end-of-life conditions. This pattern raises critical sustainability concerns. Circular economy principles emphasize material longevity, reuse, and delayed replacement as core strategies for reducing embodied energy and waste (Rahla, Mateus, & Bragança, 2021). Premature replacement of functional materials directly undermines these principles by accelerating material throughput and increasing construction waste.

Life-cycle carbon studies further demonstrate that finishes with shorter replacement cycles generate disproportionately higher environmental impacts. Ahmed (2020) shows that carpets, despite their aesthetic appeal, emit substantially more carbon per life-cycle than ceramic tiles due to frequent replacement and limited recyclability. The study's findings therefore substantiate Hu's (2023) argument that durability is inseparable from environmental performance, and that material choice must be evaluated beyond initial cost and appearance to include embodied carbon and end-of-life outcomes.

Service Life Prediction as a Decision-Making Gap

The limited application of service life prediction methods in Nairobi's public buildings reflects a broader challenge identified in developing construction contexts, where maintenance decisions remain reactive rather than predictive (Saihi et al., 2023). While ISO 15686 provides a structured framework for service life planning that integrates exposure conditions, workmanship, maintenance, and usage (ISO, 2011; Silva et al., 2021), the absence of localized empirical data has constrained its adoption in Kenya.

This study contributes directly to addressing this gap by generating context-specific service life data for common floor finishes. In doing so, it supports the call by Sandak et al. (2019) for regionally grounded service life models that reflect local material behaviour, climatic conditions, and institutional practices. Without such models, decision-makers continue to rely on generalized assumptions or aesthetic preferences, perpetuating unsustainable replacement cycles.

Policy, Institutional, and Governance Considerations

The findings also highlight a disconnect between policy intent and implementation. Kenya's National Building Code (2024) and National Building Maintenance Policy (2015) both recognize durability, inspection, and maintenance as essential components of building performance. However, the prevalence of premature replacement suggests weak enforcement and limited integration of sustainability tools such as life-cycle costing and service life prediction into procurement and maintenance frameworks.

This observation aligns with broader critiques of sustainability governance in the built environment, which emphasize that policy effectiveness depends not only on regulatory provisions but also on institutional capacity, professional culture, and accountability mechanisms (Hill & Bowen, 1997; Kibert, 2007). The study therefore reinforces the need for mandatory incorporation of service life prediction and life-cycle costing within public sector decision-making, supported by digital maintenance records and performance monitoring systems.

This paper recommends that for sustainability to be achieved, there is a need to fully enforce the current policies. In addition, the policies can be further amended to include and mandate sustainability

principles including circular design and life-cycle costing as presented in **Figure 10**. This will align Kenya's efforts with global sustainability efforts. Beyond practice, local material production should also be encouraged to avert the negative impacts associated with importation.

Contribution to Sustainable Construction Knowledge

By linking empirical service life data with sustainability theory and durability frameworks, this study advances understanding of how material performance, institutional behaviour, and cultural preferences intersect in shaping sustainability outcomes. It extends existing literature by demonstrating that sustainability challenges in public buildings are not solely technical, but also behavioural and governance-related, echoing findings by Bungau et al. (2022) and Makinde et al. (2024) on the socio-technical nature of material performance.

Ultimately, the study positions service life prediction not merely as a technical assessment tool, but as a strategic governance instrument capable of aligning durability, aesthetics, and sustainability objectives. Integrating such an approach into Kenya's public building sector offers a viable pathway toward reduced waste, lower life-cycle costs, and improved environmental performance.

CONCLUSION

This study investigated floor finish selection, replacement drivers, and observed service life in Nairobi's public office buildings, with the aim of drawing sustainability lessons for materials and maintenance planning. The findings show that the dominant floor finishes currently in use are ceramic tiles, granito tiles, terrazzo, and carpets, and that finish choice is strongly shaped by space function and perceived status. High-traffic and wet areas largely retain hard finishes that are associated with durability and ease of cleaning, while executive spaces disproportionately favor aesthetic-driven finishes.

The observed service life of initial floor finishes ranged from approximately 42.4 to 49 years, indicating generally strong performance in the Kenyan public building context. However, the study also shows that replacement decisions are frequently not failure-driven. Changes in taste and preferences were the most reported reason for replacement, meaning that some finishes—especially in management offices and boardrooms—were replaced before the end of their functional service life. This practice has significant sustainability implications because it increases waste generation, embodied environmental impacts, and life-cycle costs.

Overall, the study concludes that sustainability in Kenya's public building floor finishes will be advanced by shifting practice from short-term and appearance-led choices toward performance-based decision-making that integrates durability, service life planning, and life-cycle costing. The findings provide locally grounded evidence that can support the development of a Kenyan service life database and guide improved procurement and maintenance policies for public buildings.

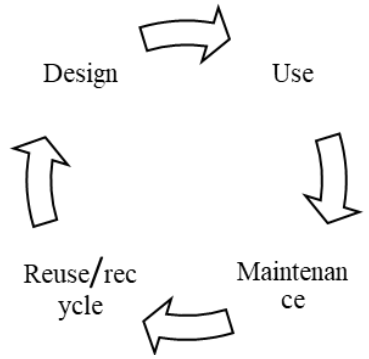

FIGURE 10
Circular design principles
Source: Author's illustration (2026)

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RECOMMENDATIONS

i) Integrate Life-cycle Costing into Procurement

Public sector procurement of floor finishes should move beyond initial cost comparisons and require life-cycle costing to evaluate long-term value, including durability, maintenance frequency, replacement cycles, and end-of-life implications. Procurement documents should require bidders to submit life-cycle cost estimates and provide justification for finishes proposed in high-traffic and prestige spaces.

ii) Institutionalize Service Life Prediction in Specification and Planning

Public building projects should adopt service life planning as a standard requirement during design and refurbishment. Specifications should include expected service life ranges, usage assumptions, maintenance requirements, and clear replacement triggers based on measured condition rather than preference. This will support consistent planning and reduce premature replacement of still-functional finishes.

iii) Reduce Preference-driven Replacement through Design Strategies

For boardrooms and management offices, design approaches should balance executive aesthetics with durable performance. This can be achieved through robust hard finishes with refined detailing, modular finish systems that allow partial replacement, and maintenance-friendly layouts that preserve appearance without requiring full material change. Aesthetic refresh decisions should be separated from full material replacement decisions.

iv) Strengthen Preventive Maintenance and Condition-based Replacement

Facility managers should prioritize preventive maintenance programs for finishes, including routine inspections, periodic restoration where feasible, and systematic cleaning regimes tailored to each finish type. Condition rating tools should guide replacement decisions to ensure materials are only replaced when they no longer meet safety, functionality, or performance requirements.

v) Establish a National Maintenance Database and Service-life Evidence Base

A centralized maintenance database for public buildings should be developed to record installation dates, maintenance actions, repair history, replacement timing, and reasons for replacement. This will generate a long-term evidence base for service life performance and enable the development of localized service life benchmarks for Kenyan building finishes.

vi) Embed Circular Design Principles in Public Building Maintenance

Public agencies should adopt circular design approaches that prioritize longer-lasting finishes, repairability, and selective replacement rather than full removal. Maintenance policies should emphasize reuse, refurbishment, and material recovery pathways where feasible, reducing waste and improving resource efficiency.

vii) Strengthen Implementation of Existing Policy Frameworks

Implementation and enforcement mechanisms should be strengthened to ensure that public building maintenance and material selection align with national policy direction. Institutional accountability mechanisms—such as inspection requirements, performance reporting, and procurement audits—should ensure that service life planning and sustainability criteria translate into measurable outcomes.

viii) Support Local Material Systems and Sustainable Supply Chains

Public procurement can encourage sustainability by supporting locally available durable finishes, strengthening local supply chains, and reducing environmental impacts linked to imports and frequent replacements. This should be paired with capacity building for maintenance officers and procurement teams to enable evidence-based material decisions.

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