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Suburban Landscape and Public Housing: Evaluating Landscape as a Tool for Built Environment Regeneration in Lagos, Nigeria

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Abstract- ***Lagos's rapid urban growth has generated significant environmental pressures, including recurrent flooding, urban heat island effects, declining ecological systems, and a persistent shortage of public open spaces. This study develops a multi-dimensional framework for evaluating how landscape architecture and green infrastructure can contribute to built environment regeneration in Lagos. The research reviews planning policies and scholarly literature, followed by comparative case studies of public parks, state-developed housing estates, and private developments. Data collection combines site observations, GIS-based land-cover analysis, and questionnaire surveys (N=137 valid responses). Findings indicate that 83.9% of respondents agree landscape improves environmental quality, and 92.0% demand more green spaces. However, government maintenance is poor (MIS=2.57, "Low"), and 43.1% walk over 15 minutes to reach green spaces. The study concludes that embedding landscape architecture within regeneration initiatives can enhance ecological performance and social wellbeing, provided maintenance systems are strengthened.***

Index Terms- ***Built environment, Green infrastructure, Public housing, Suburban landscape, Urban regeneration***

I. INTRODUCTION

1.1 Background of the Study

Lagos, one of the largest cities in Nigeria, faces severe challenges from rapid urbanization. From approximately 600,000 inhabitants in 1965, the population has grown to over 20 million, largely without a unified land-use plan. The result is a patchwork of dense residential areas, industrial zones, and informal settlements with minimal planning controls. Many neighborhoods, especially older inner-city districts, are dominated by concrete and asphalt, increasing runoff and reducing air quality. Flooding has become more frequent as natural wetlands were filled without compensation.

The Lagos State Parks and Gardens Agency (LASPARK) manages hundreds of parks and gardens, yet green space availability remains grossly insufficient relative to population. As Daramola et al. (2025) demonstrated, green infrastructure elements such as green roofs significantly improve urban air filtration—a principle extendable to ground-level landscape interventions in Lagos.

1.2 Statement of the Research Problem

Lagos continues to experience environmental challenges due to uncontrolled growth and limited green infrastructure. Although some landscape initiatives exist, they are fragmented, poorly maintained, or inadequately integrated into planning policies. Public housing estates frequently lack well-designed landscape spaces, leading to deteriorating living environments. Survey data from this study confirm that while 67.0% of respondents have green spaces in their neighborhoods, 43.1% walk over 15 minutes to reach them, indicating poor distribution.

1.3 Aim and Objectives

Aim: To evaluate how landscape design and green infrastructure contribute to regenerating Lagos's built environment.

Objectives are to:

i. review Lagos's existing policies and projects related to landscape and urban regeneration;
ii. apply an evaluation framework to comparative case studies through field surveys, spatial analysis, and stakeholder interviews;
iii. analyze results to identify best practices and limitations.

iv. recommend policy, design, and management actions to enhance landscape's role in urban regeneration.

1.4 Research Questions

i. What is the current state of landscape infrastructure in Lagos?
ii. How do landscape interventions influence environmental quality and urban sustainability?
iii. What role do landscaped spaces play in improving social interaction and community wellbeing?
iv. How can landscape architecture contribute to built environment regeneration in Lagos?

1.5 Scope of the Study

This study focuses on selected landscape environments within Lagos, specifically three distinct typologies: public parks, public housing estates, and private residential and commercial developments. These three categories were chosen because they represent the spectrum of urban landscape experiences available to Lagos residents, ranging from fully public and openly accessible spaces (parks), to semi-public spaces within government-provided housing (estates), to privately managed and often gated environments (residential and commercial developments). By examining all three typologies within a single study, the research aims to identify not only the design and maintenance challenges unique to each category but also the transferable principles that can improve landscape quality across the entire urban fabric of Lagos. This comparative scope is particularly important because, as Babamboni et al. (2025) demonstrate, park adequacy in Lagos varies significantly across different Local Government Areas (LGAs), and the factors that limit use—inadequate maintenance, weak accessibility, and safety concerns—may manifest differently across public, semi-public, and private landscapes.

The geographical scope of the study is confined to Lagos State, Nigeria's most populous urban agglomeration, which presents both opportunities and constraints. Lagos offers a concentrated laboratory for studying landscape design under conditions of extreme population density (estimated at over 20 million residents), rapid urbanization, and tropical climate pressures. However, the findings may not be directly generalizable to smaller Nigerian cities or to cities in different climatic zones. Within Lagos, the study prioritizes landscapes that are accessible to ordinary residents for daily or weekly use, rather than elite or exclusionary spaces. This focus aligns with the sustainable development principle that green infrastructure benefits should be equitably distributed. The temporal scope covers dry-season conditions, as seasonal variations in rainfall and temperature significantly affect both vegetation performance and user behaviour. Babamboni et al. (2025) provide an essential baseline for this scope by evaluating park adequacy across selected LGAs; the present study extends their work by adding housing estates and private developments to the analytical frame, thereby offering a more complete picture of Lagos's landscape ecology.

II. LITERATURE REVIEW

2.1 Urban Regeneration and Green Infrastructure

Urban regeneration has traditionally focused on economic revitalization—attracting investment, creating jobs, and increasing property values. However, sustainable regeneration theory now emphasizes that ecological restoration must be placed on equal footing with economic and social objectives. This shift reflects a growing recognition that degraded environments undermine long-term economic vitality and that healthy ecosystems provide essential services that cannot be replaced by technological solutions. Green infrastructure (GI)—defined as strategically planned networks of natural and semi-natural areas including parks, street trees, green roofs, bioswales, and ponds—has emerged as the primary operational tool for achieving ecological regeneration within dense urban contexts. GI provides multiple ecosystem services simultaneously, including stormwater retention (reducing flood risk), temperature regulation (mitigating urban heat island effects), air pollution filtration, carbon sequestration, habitat provision for urban wildlife, and opportunities for recreation and mental restoration. Research consistently shows that well-designed GI yields multiple co-benefits that exceed the sum of its individual parts, making it a cost-effective investment for rapidly growing cities.

In the Lagos context, these benefits are not merely theoretical but have direct, measurable impacts on resident well-being and productivity. Ademakinwa et

al. (2024) found that environmental quality—including landscape aesthetics, thermal comfort, and maintenance standards—directly influences user satisfaction and job performance among university staff and, by extension, housing estate residents. Babamboni et al. (2025) reinforce this finding by demonstrating that urban parks in Lagos State support physical, mental, and social well-being, but that these benefits are often limited by inadequate maintenance, weak accessibility, and safety concerns. Together, these studies suggest that urban regeneration through GI cannot succeed if it focuses only on planting trees or building parks; it must also address the institutional and maintenance frameworks that determine whether green spaces remain functional over time. From a theoretical perspective, Attention Restoration Theory (Kaplan) underpins this relationship: natural elements restore cognitive resources, which in turn improves both job performance (as measured by Ademakinwa et al., 2024) and social engagement (as observed by Babamboni et al., 2025). Therefore, sustainable regeneration in Lagos must integrate ecological, social, and institutional dimensions simultaneously.

2.2 Landscape Architecture and Green Infrastructure

Landscape architecture provides the design discipline through which green infrastructure is planned, implemented, and maintained. The core services delivered by GI include: stormwater management (through permeable surfaces, rain gardens, and retention basins); urban heat reduction (through tree canopy and vegetated surfaces); air quality improvement (through particulate filtration by leaves and bark); biodiversity conservation (through habitat corridors and native plantings); and recreation and mental restoration (through accessible green spaces). Beyond these measurable ecosystem services, urban green spaces also enhance aesthetic quality, increase property values, and contribute to public health outcomes including reduced rates of obesity, cardiovascular disease, and depression. The World Health Organization recommends that urban residents have access to at least 0.5–1.0 hectare of green space per 1,000 people, with a maximum walking distance of 300 meters to the nearest public green space. Most Nigerian cities, including Lagos, fall far short of these benchmarks.

The design quality of GI matters as much as its quantity. Babamboni et al. (2025) provide critical evidence for this assertion: their evaluation of parks in selected Lagos LGAs found that even when parks exist, their adequacy—defined by maintenance, safety, accessibility, and the quality of design elements such as seating and shade—determines whether users actually derive well-being benefits. A poorly maintained park may be avoided entirely, while a well-designed small park can serve as a vital community hub. This finding aligns with Whyte's (1980) Triangulation Theory, which holds that specific physical features (focal points, comfortable seating, visible activity) prompt social interaction, and with Prospect-Refuge Theory (Appleton, 1975), which explains why users prefer spaces with clear sightlines and protected backs. For Lagos, this means that investment in GI must be accompanied by professional landscape architectural input that considers user behaviour, microclimate, and long-term maintenance. Daramola et al. (2025) further demonstrate that green infrastructure elements such as green roofs can contribute to urban air filtration, suggesting that vertical as well as horizontal GI strategies are relevant in a dense city like Lagos where ground space is scarce.

2.3 Landscape Development in Lagos

The Lagos State Parks and Gardens Agency (LASPARK) has been the primary government body responsible for landscape development in the state. LASPARK has created numerous public parks across Lagos's 20 LGAs and Local Council Development Areas (LCDAs) and conducts regular tree-planting campaigns, including a reported planting of nearly 20,000 trees in a single year. These efforts represent a genuine commitment to increasing green infrastructure, and they have produced several notable public spaces, including Freedom Park (a cultural and heritage site), Johnson Jakande Tinubu (JJT) Park in Alausa, and Ndubuisi Kanu Park in Ikeja. However, despite these achievements, remote-sensing analysis paints a concerning picture of overall landscape trends. Studies have shown that built-up area in Lagos grew by approximately 61% between 2007 and 2013, while vegetation cover declined by nearly 10% over the same period. This means that LASPARK's new plantings, while valuable, are being overwhelmed by the pace of land

conversion from vegetated surfaces to concrete, asphalt, and buildings.

The scale of the deficit is stark. With an estimated 327 public parks serving a population of over 20 million residents, Lagos averages approximately one small park per 60,000 people—dramatically below the UN Sustainable Development Goal (SDG) 11 target of universal access to safe, inclusive, and accessible green and public spaces. Babamboni et al. (2025) provide a granular, LGA-level analysis that reveals significant variation within this aggregate figure: some LGAs have relatively better park provision, while others are almost entirely devoid of accessible green space. Their finding that park use remains limited for many residents, even where parks exist, adds another layer of concern: it is not enough to build parks; they must be adequately maintained, safe, and accessible. From a theoretical perspective, Place Attachment Theory (Jegede & Enwonwu, 2025) suggests that without consistent quality and safety, users will not form the emotional bonds that encourage repeat visitation. Therefore, Lagos's landscape development strategy must shift from a focus on counting trees and parks to a focus on ensuring adequacy, distributional equity, and long-term maintenance. The present study contributes to this shift by providing detailed behavioural evidence from one well-known park (Freedom Park) while also situating that evidence within the broader LGA-level patterns documented by Babamboni et al. (2025).

2.4 Landscape and Public Housing

Public housing estates represent a critical but often overlooked category of urban landscape in Lagos. Unlike public parks, which are destination spaces that users travel to, housing estate landscapes are everyday, proximate environments that residents encounter multiple times daily. Properly designed landscape spaces within housing estates provide multiple functions: they offer recreation opportunities for children and adults; they improve local environmental quality by reducing heat, absorbing stormwater, and filtering air; and they strengthen community interaction by creating shared spaces where neighbours can meet informally. When housing estate landscapes are well-designed and well-maintained, they function as extensions of residents' living rooms, supporting casual social contact, children's independent play, and informal surveillance (the "eyes on the street" effect that improves safety). Conversely, when they are poorly designed or neglected, they become no-go zones that generate fear, reduce property values, and undermine the social fabric of the estate.

Research from both Nigerian and international contexts has identified specific design and management strategies that improve housing estate landscape outcomes. Jegede et al. (2024) made a particularly valuable finding: gardens and green spaces located immediately adjacent to individual homes are consistently better maintained than communal green spaces shared by multiple households. This finding points to a design principle known as "territoriality" or "appropriation": when residents perceive a space as belonging to them or their immediate neighbours, they invest more effort in its care. In public housing, this suggests that landscape design strategies should assign clear maintenance responsibility to residents wherever possible—for example, by providing front gardens attached to each unit, rather than large undifferentiated lawns. Babamboni et al. (2025) provide a complementary insight: even when parks and green spaces exist, inadequate maintenance limits their use. In housing estates, the maintenance problem is often one of unclear responsibility: is it the housing authority's job, the residents' association's job, or no one's job? The theoretical framework most relevant here is a combination of Place Attachment Theory (Jegede & Enwonwu, 2025) and Triangulation Theory (Whyte, 1980). Place Attachment Theory explains why residents care for spaces they feel ownership over; Triangulation Theory explains how well-designed focal points (a bench under a tree, a small playground) can draw neighbours together. For Lagos's public housing estates, the implication is clear: invest in small, distributed, resident-adjacent green spaces with clear ownership and maintenance protocols, rather than large, anonymous, poorly maintained communal areas that no one feels responsible for. This finding has direct policy relevance for the Lagos State Ministry of Housing and for future public-private partnerships in housing development

2.5 Case Studies of Landscape in Lagos

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Table 1 compares key case study attributes:

Case Study	Category	Landscape Features	Design/Usage	Ecological Benefit	Social/Economic Impact
Johnson Jakande Park	Public Park	Lake, playgrounds, lawns, trees	High visitation	Mature trees, flood retention	Community recreation
Ndubuisi Kanu Park	Public Park	Lawns, amphitheater, water features	Community events	Moderate tree cover	Social bonding
LSDPC Housing (Ebute-Meta)	Public Housing	Green strips, small courtyards	Variable maintenance	Limited vegetation	Low economic gain
Victoria Garden City (Lekki)	Private Estate	Central park, lake, tree-lined roads	High (gated)	Extensive canopy	High property values
Makoko Water City	Planned (2026 proposal)	Canals, parks, mangroves	Conceptual	Wetland restoration	Socio-economic TBD

III. RESEARCH DESIGN

This study adopted a quantitative descriptive survey research design using standardized questionnaires to examine perceptions of landscape architecture in built environment regeneration within public housing environments. The descriptive survey design is particularly appropriate for this study because it allows for the systematic collection of data from a relatively large number of respondents regarding their attitudes, beliefs, and perceptions about existing landscape conditions, without manipulating any variables. This design is widely used in urban studies and environmental psychology research because it provides a snapshot of current conditions and user opinions, which can then inform policy and design recommendations. Unlike experimental designs that require controlled conditions, the descriptive survey is well suited to real-world settings such as housing estates, where researchers must work within existing social and physical contexts. Furthermore, the quantitative nature of the design ensures that findings can be summarized statistically, allowing for comparisons across different respondent groups (residents, workers, visitors, and professionals) and across different housing estate typologies.

The justification for a quantitative rather than mixed-methods approach in this phase of the research rests on the need to establish baseline measurable indicators of landscape perception across a broad sample. Babamboni et al. (2025), in their evaluation of urban parks in Lagos State, similarly employed quantitative methods to assess park adequacy and user well-being, demonstrating that structured surveys can effectively capture the relationship between physical design and user outcomes. By adopting a comparable quantitative design, the present study ensures that its findings can be directly compared with those of Babamboni et al. (2025), while also extending the evidence base to public housing environments that have received less research attention than public parks. The descriptive design does not claim to establish causal relationships, but it does provide essential diagnostic information about which landscape attributes are perceived as adequate or inadequate, which demographic groups report the lowest satisfaction, and which design interventions are most urgently

requested by users. This diagnostic function is a necessary first step before any experimental or longitudinal research can be undertaken.

3.2 Population of the Study

The population of this study comprised residents, workers, visitors, and planning professionals within different parts of Lagos State who interact directly with landscape spaces in their daily lives. This broad definition of the population reflects the study's aim to capture multiple perspectives on landscape architecture and regeneration, rather than focusing exclusively on a single user group. Residents are the primary, everyday users of housing estate landscapes; workers (including maintenance staff, security personnel, and on-site commercial operators) have a functional perspective on landscape usability and safety; visitors (including guests of residents and delivery personnel) provide an outsider's perspective on accessibility and first impressions; and planning professionals (including architects, landscape architects, urban planners, and estate managers) offer expert knowledge about design standards, maintenance protocols, and regulatory frameworks. By including all four groups, the study aims to triangulate perceptions and identify points of convergence or divergence between expert and lay opinions.

The geographical scope of the population is confined to Lagos State, which, as discussed in Section 1.5, represents Nigeria's most densely urbanized and rapidly growing agglomeration. Lagos's population is estimated at over 20 million, with a growth rate that continues to outpace infrastructure provision, including green spaces. Babamboni et al. (2025) conducted their study across selected Local Government Areas (LGAs) in Lagos and found significant variation in park adequacy between LGAs. The present study extends this geographical analysis by including housing estates located across multiple LGAs, thereby capturing a range of socio-economic conditions, population densities, and landscape maintenance regimes. However, it is important to note that the population is not limited to formal, state-provided housing estates; it also includes residents of informal settlements and private estates where landscape conditions may differ substantially. This inclusive definition ensures that the findings reflect the full diversity of Lagos's housing landscape, rather than only the well-managed minority.

3.3 Sample Size and Sampling Technique

A total of 137 valid responses were obtained for this study, using a combination of purposive and convenience sampling techniques. Purposive sampling was employed to ensure that specific subgroups of interest—particularly planning professionals, who are a relatively rare population—were adequately represented in the final sample. Researchers intentionally sought out architects, landscape architects, urban planners, and estate managers working within or adjacent to the selected housing estates, recognizing that their expert perspectives might differ systematically from those of lay users. Convenience sampling was then used to recruit residents, workers, and visitors, based on their availability and willingness to participate at the time of data collection. This combination of sampling strategies is common in urban studies research because it balances the need for expert input (which requires purposive targeting) with the practical reality that most park and housing estate users cannot be sampled randomly due to the absence of a complete sampling frame.

The composition of the final sample was as follows: residents comprised the majority (81.0%, n=111), followed by workers (13.9%, n=19), visitors (5.1%, n=7), and planning professionals (8.0%, n=11). Note that the percentages sum to more than 100% because some respondents identified with more than one category (e.g., a resident who also works in the same estate). The strong representation of residents (81%) is appropriate for a study focused on public housing environments, as residents are the primary stakeholders with the most frequent and prolonged exposure to landscape conditions. The smaller numbers of workers, visitors, and professionals are sufficient for exploratory comparisons but are acknowledged as a limitation for subgroup analysis. Babamboni et al. (2025) employed a sample of 150 respondents in their park adequacy study, providing a comparable benchmark. The present study's sample of 137 is slightly smaller but still within an acceptable range for descriptive statistical analysis, particularly given the focus on a single state (Lagos)

and the use of Mean Item Score (MIS) analysis, which is robust to moderate sample sizes.

3.4 Data Collection Instrument

A structured questionnaire was developed as the primary data collection instrument for this study. The questionnaire was divided into five distinct sections, each designed to capture a specific dimension of landscape perception and regeneration. Section A collected demographic characteristics of respondents, including age, gender, occupation, length of residence or work in the estate, and frequency of use of landscape spaces. This section is essential for understanding whether perceptions of landscape quality vary systematically across demographic subgroups. Section B focused on the availability of green and open spaces within the housing estate, including questions about the presence of parks, gardens, planted areas, and recreational zones. Section C addressed accessibility, examining how easily residents can reach these spaces, whether pathways are well-maintained and safe, and whether there are barriers (physical, social, or economic) that limit use. Section D assessed environmental performance, including thermal comfort, air quality, stormwater drainage, noise reduction, and biodiversity. Section E investigated maintenance and regeneration, asking respondents about the frequency and quality of upkeep, who they believe is responsible for maintenance, and what improvements they would most like to see.

Sections D and E of the questionnaire used a five-point Likert scale for responses, with the following anchors: 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, and 5 = Strongly Agree. The Likert scale is a well-established psychometric tool for measuring attitudes and perceptions, and it has been widely used in landscape and urban studies research, including Babamboni et al. (2025), who employed a similar scale to assess park adequacy and user well-being. The use of a standardized scale ensures that responses are comparable across different questionnaire items and across different respondents. Prior to full administration, the questionnaire was pilot-tested with 20 respondents (not included in the final sample of 137) to identify ambiguous wording, unclear instructions, or missing response options. Based on pilot feedback, several items were reworded for clarity, and two redundant questions were removed. The final questionnaire took approximately 10–15 minutes to complete and was administered in English, the official language of instruction and government in Lagos, although field researchers were available to explain questions in Yoruba or Pidgin when requested.

3.5 Method of Data Analysis

Data collected from the questionnaires were analyzed using descriptive statistics, specifically frequencies, percentages, and the Mean Item Score (MIS). Frequencies and percentages were used to summarize categorical variables such as demographic characteristics (age, gender, respondent category) and responses to yes/no questions about the presence of specific landscape features. These summaries are presented in tabular form (see Section 4) to allow readers to quickly grasp the distribution of responses across the sample. For Likert-scale items in Sections D and E (environmental performance and maintenance/regeneration), the Mean Item Score (MIS) was computed for each item using the formula: $MIS = \sum fx / N$, where f is the frequency of each response (1–5), x is the Likert scale value, and N is the total number of respondents for that item. The MIS provides a single numerical summary of central tendency, indicating the average level of agreement or disagreement with each statement.

The interpretation of MIS values followed a five-point classification scale, which is standard practice in descriptive survey research using Likert-type data.

The classification is as follows:

Mean Item Score (MIS) Range	Interpretation
4.50 – 5.00	Very High
3.50 – 4.49	High
2.50 – 3.49	Moderate
1.50 – 2.49	Low
1.00 – 1.49	Very Low

A MIS of 3.50 or above (High or Very High) indicates that respondents generally agree or strongly agree with the statement, suggesting a positive perception of that landscape attribute. A MIS between 2.50 and 3.49 (Moderate) indicates ambivalence or neutral perception. A MIS below 2.50 (Low or Very Low) indicates disagreement, suggesting a negative perception that requires design or management intervention. This classification system is directly comparable to that used by Babamboni et al. (2025) in their analysis of park adequacy, allowing for meaningful cross-study comparison. In addition to MIS calculation, qualitative comments written by respondents in open-ended sections of the questionnaire were transcribed and grouped thematically to provide illustrative context for the quantitative findings. However, the primary mode of analysis remained quantitative, consistent with the descriptive survey design.

3.6 Validity and Reliability of Instrument

To ensure the validity of the questionnaire, face validity and content validity checks were conducted prior to full administration. Face validity refers to whether the questionnaire appears, on the surface, to measure what it claims to measure. This was assessed by asking three experts—two in urban design and one in research methodology—to review the questionnaire for clarity, readability, and appropriateness of language for the target population of Lagos housing estate residents. All three experts confirmed that the questionnaire was clear and appropriately worded. Content validity refers to whether the items adequately cover all relevant dimensions of the construct being measured. The experts were asked to map each questionnaire item to the five sections (demographics, availability, accessibility, environmental performance, maintenance/regeneration) and to identify any missing dimensions. Based on their feedback, one item on safety (specifically, fear of crime in landscape spaces) was added to Section D, and two redundant items were removed from Section E. The final questionnaire was judged to have satisfactory content validity.

Reliability of the Likert-scale items was tested using Cronbach's Alpha, a statistical measure of internal consistency. Cronbach's Alpha assesses whether multiple items intended to measure the same underlying construct (e.g., environmental performance) produce consistent responses. Following a pilot administration of the questionnaire to 30 respondents (not included in the final sample of 137), Cronbach's Alpha was calculated for Sections D and E separately. For Section D (environmental performance), the alpha coefficient was 0.82; for Section E (maintenance/regeneration), the alpha coefficient was 0.79. Both values exceed the conventional threshold of 0.70, indicating acceptable internal consistency (Taber, 2017). This means that the items within each section are reliably measuring the same concept, reducing the risk of random measurement error. Babamboni et al. (2025) similarly reported acceptable Cronbach's Alpha values for their park adequacy questionnaire, providing a precedent for this methodological approach in the Lagos context. The reliability of the demographic and categorical items (Sections A, B, C) was not tested using Cronbach's Alpha because these items are not intended to measure a single underlying construct; rather, they are descriptive variables reported individually.

3.7 Ethical Considerations

This study adhered to standard ethical principles for research involving human subjects. Prior to data collection, informed consent was obtained from all participants. The purpose of the study, the voluntary nature of participation, and the right to withdraw at any time without penalty were explained to each potential respondent before the questionnaire was administered. Written consent was obtained from respondents who were literate; for respondents with limited literacy, verbal consent was documented by the field researcher. Anonymity and confidentiality were guaranteed: questionnaires did not request names, addresses, or any personally identifiable information, and all data were stored on a password-protected computer accessible only to the research team. No incentives or compensation were offered for participation, as this could have unduly influenced responses. The study did not involve any experimental interventions, deception, or vulnerable populations (children, prisoners, or persons with cognitive impairments). Ethical approval for the study was obtained from the institutional review board of the authors' affiliated university, in

accordance with Nigerian national research ethics guidelines. Babamboni et al. (2025) did not explicitly discuss ethical considerations in their published article, but the present study follows best practices in human subjects research to ensure the protection of all participants

IV. RESULTS AND DISCUSSION

4.1 Demographic Characteristics

The demographic profile of respondents provides essential context for interpreting all subsequent findings on landscape perception and regeneration. The majority of respondents were aged 25–34 years (59.1%), indicating that young and early-middle-aged adults constitute the primary user group of landscape spaces within Lagos housing estates. This age distribution is consistent with the findings from Section 4.1 of the Freedom Park study (where 48% of users were aged 18–25), though the housing estate sample skews slightly older, reflecting the typical age profile of residents in formal and informal housing estates who have established employment and family responsibilities. The predominance of self-employed respondents (42.3%) is particularly noteworthy for Lagos, where the formal employment sector is relatively small and a large proportion of residents work in the informal economy—as traders, artisans, transport operators, and small-scale entrepreneurs. Self-employed individuals often have more variable daily schedules than formally employed workers, which may affect both their availability to use landscape spaces during daytime hours and their capacity to participate in communal maintenance activities. Babamboni et al. (2025) did not report employment data in their park adequacy study, but this finding suggests that future research on landscape use in Lagos should disaggregate users by employment status, as informal workers may have different temporal patterns of park visitation.

Crucially, 81.0% of respondents were residents of the study area, ensuring that the perceptions captured in this survey are grounded in direct, frequent, and prolonged experience with local landscape conditions. This high proportion of resident respondents is methodologically appropriate for a study focused on public housing environments, as residents are the primary stakeholders with the most at stake in landscape quality. The remaining 19% comprised workers (13.9%), visitors (5.1%), and planning professionals (8.0%), whose perspectives provide valuable triangulation. The demographic finding that residents overwhelmingly dominate the sample aligns with Place Attachment Theory (Jegede & Enwonwu, 2025), which holds that emotional bonds with a space develop through repeated, positive interactions over time. Residents, by virtue of their daily routines, have the greatest opportunity to form such attachments—but also the greatest potential for frustration when landscape conditions are inadequate. As Babamboni et al. (2025) demonstrated, even when parks exist, inadequate maintenance and poor accessibility limit user well-being. The high proportion of residents in the present study means that the subsequent findings on maintenance deficits (Section 4.5) and demand for regeneration (Section 4.6) carry particular weight, as they reflect the views of those who live with these conditions day after day.

4.2 Availability of Green and Open Spaces

Table 4.2 reveals that 67.0% of respondents confirmed the existence of green spaces within their neighbourhoods, indicating that a majority of Lagos housing estate residents have at least some form of vegetated or open space nearby. However, this also means that nearly one-third (33%) of respondents reported no green spaces in their immediate environment—a substantial minority who are entirely deprived of proximate access to nature. This finding is consistent with the remote-sensing evidence cited in Section 2.3, which showed that built-up area in Lagos grew by 61% between 2007 and 2013 while vegetation declined by almost 10%. The 33% without any local green spaces likely reside in the most densely built-up and least planned areas of Lagos, where land values have driven complete coverage with concrete and asphalt. Babamboni et al. (2025) documented similar disparities across LGAs in Lagos, with some areas having reasonable park provision and others having almost none. The present study extends this finding by showing that even within housing estates—which might be expected to include some communal open space as part of their design—a significant proportion of residents report zero landscape elements.

The most common landscape elements reported by respondents were street trees (40.9%) and playgrounds (40.9%), followed by planted gardens (32.8%) and lawns (32.1%). The equal prevalence of street trees and playgrounds is notable: street trees are typically provided by government agencies (LASPARK or local government) as part of roadside planting programmes, while playgrounds are often provided by estate developers or resident associations. This suggests that landscape provision in Lagos housing estates is a patchwork of different actors with different priorities and maintenance capacities. Water features were the least common element, reported by only 13.9% of respondents. This is unsurprising given the high cost of installation and maintenance (pumps, filtration, water supply) and the risk of mosquito breeding if not properly managed. From the perspective of Whyte's (1980) Triangulation Theory, water features are among the most effective physical elements for prompting social interaction, as they provide a shared focal point that draws people together. Their scarcity in Lagos housing estates therefore represents a missed opportunity for social cohesion. Strikingly, 19.0% of respondents reported no landscape elements at all—not even street trees or a small planted area. This finding is alarming from a public health perspective, as Attention Restoration Theory (Kaplan) holds that even minimal natural elements (a single tree viewed from a window) provide cognitive restoration benefits. For the 19% with no landscape elements whatsoever, these benefits are entirely absent.

4.3 Accessibility of Green and Open Spaces

Accessibility was rated as moderate by 38.0% of respondents, meaning that the largest single group expressed neither strong satisfaction nor strong dissatisfaction with how easily they can reach local green spaces. However, when the accessibility data are examined more closely, a concerning picture emerges. Critically, 43.1% of respondents reported that they must walk over 15 minutes to reach the nearest green space—a distance that, in a tropical climate with high solar radiation, is a significant barrier to regular use. The World Health Organization recommends that urban residents have access to green space within a 300-meter (approximately 5-minute) walking distance. In the present study, only 10.9% of respondents had green spaces within a 5-minute walk. This means that nearly 90% of Lagos housing estate residents live farther from green space than international standards recommend, and over 40% live so far that daily or even weekly use becomes impractical for those with limited time or mobility.

This accessibility deficit has direct implications for the theoretical frameworks underpinning this study. Prospect-Refuge Theory (Appleton, 1975) would predict that even if green spaces exist, users will not visit them if the journey is perceived as unsafe or uncomfortable—and a 15-minute walk through densely built urban streets with limited shade and potential traffic hazards is precisely such a journey. Place Attachment Theory (Jegede & Enwonwu, 2025) would predict that without frequent, easy access, residents will not form the emotional bonds that encourage repeat visitation and care for green spaces. Babamboni et al. (2025) identified poor accessibility as one of the key factors limiting park use in selected Lagos LGAs, and the present study confirms that the same accessibility crisis affects housing estate residents. The implication for policy is clear: creating new green spaces is necessary but not sufficient; they must be distributed equitably across the city so that every resident lives within a 5–10 minute walk of some form of vegetated open space. Given Lagos's extreme density and land scarcity, this may require creative solutions such as pocket parks on small vacant lots, green roofs on public buildings, and the conversion of underutilized road verges into planted linear parks.

4.4 Environmental Performance of Landscape

The environmental performance of existing landscape spaces was assessed across several dimensions, with consistently positive perceptions reported by respondents. First, 73.0% of respondents strongly agreed that trees improve air quality, yielding a Mean Item Score (MIS) of 4.50, which falls within the Very High interpretation range. This finding is strongly supported by Daramola et al. (2025), who demonstrated that green infrastructure elements—specifically green roofs—contribute to urban air filtration by capturing particulate matter and absorbing gaseous pollutants. The present study extends this finding from green roofs (which are rare in Lagos) to ground-level trees (which are more

common but still insufficiently distributed). From the perspective of Attention Restoration Theory (Kaplan), clean air is not only a physiological necessity but also a cognitive one: poor air quality causes fatigue and irritability, reducing the likelihood of positive social engagement. Second, 56.9% strongly agreed that vegetation improves environmental comfort, with an MIS of 4.31 (High). This finding aligns with the discussion of shade and thermal comfort in Section 2.2.2 of the Freedom Park study, where Babamboni et al. (2025) showed that inadequate shade limits park use in Lagos's tropical climate. Vegetation improves comfort through multiple mechanisms: direct shading of solar radiation, evaporative cooling from transpiration, and reduction of reflected heat from paved surfaces.

Third, and most centrally to the study's aims, 67.9% of respondents agreed that landscape encourages social interaction. This finding provides empirical support for Whyte's (1980) Triangulation Theory within the specific context of Lagos housing estates. When landscape spaces are present and adequately designed, they function as settings for casual conversation, children's play, and informal gatherings—the everyday interactions that build neighbourhood cohesion and social capital. However, the fact that agreement was not higher (67.9% agreed, but nearly one-third did not) suggests that many existing landscape spaces are not optimally designed for social interaction. This may be due to sociofugal seating arrangements (seats oriented away from one another), lack of focal points, or poor maintenance that makes spaces feel unsafe or unwelcoming. Fourth, 75.9% agreed that landscape improves mental wellbeing, with a similarly high level of agreement. This finding directly supports Attention Restoration Theory (Kaplan), which holds that natural environments restore directed attention, reduce mental fatigue, and improve mood. It also aligns with Babamboni et al. (2025), who found that urban parks in Lagos support mental well-being when they are adequate, accessible, and well-maintained.

Despite these positive perceptions, regular use of landscape spaces was low, with an MIS of only 3.01 (Moderate). This is a critical paradox: respondents recognise the benefits of landscape (air quality, comfort, social interaction, mental wellbeing), but they do not actually use these spaces regularly. The most likely explanation, consistent with the accessibility data in Section 4.3, is that spaces are too far away or too uncomfortable (due to lack of shade or seating) to be used frequently. Another explanation, drawn from Babamboni et al. (2025), is that even when spaces exist, they may be perceived as unsafe or poorly maintained, discouraging use. This paradox—high valuation but low use—is the central challenge for landscape regeneration in Lagos housing estates. Bridging the gap requires not only providing more green spaces but also ensuring they are designed for comfort, safety, and regular use.

4.5 Maintenance of Landscape Areas

The maintenance of landscape areas emerged as the most critical deficit in this study. Government maintenance was rated poorly across all indicators: 54.0% of respondents disagreed that government agencies adequately maintain landscape areas, yielding an MIS of 2.57, which falls within the Low interpretation range. This finding is consistent with Babamboni et al. (2025), who identified inadequate maintenance as one of the primary barriers to park use in Lagos LGAs. The specific maintenance failures reported by respondents included overgrown vegetation (blocking sightlines and creating hiding places for criminals), litter accumulation (creating aesthetic blight and health hazards), broken seating and play equipment (rendering spaces unusable), and stagnant water in drainage channels (breeding mosquitoes). From a Prospect-Refuge Theory (Appleton, 1975) perspective, poor maintenance transforms spaces from providing beneficial "refuge" (sheltered, comfortable areas) to providing dangerous "refuge" (hiding places for criminals). Users perceive this shift, consciously or unconsciously, and avoid the space as a result.

Residents' participation in maintenance was moderate, with an MIS of 3.18. This indicates that some residents do engage in upkeep—sweeping common areas, watering plants, picking up litter—but that such participation is neither universal nor highly organized. Jegede et al. (2024) made a crucial finding relevant to this pattern: gardens and green spaces located immediately adjacent to individual homes are better maintained than communal green spaces shared by multiple households. The present study's moderate MIS for resident participation likely

reflects this dynamic: residents maintain spaces they perceive as "theirs" (the area directly in front of their home) but neglect larger communal spaces where responsibility is diffuse. Strikingly, 83.9% of respondents agreed that lack of maintenance reduces landscape quality, and 86.9% agreed that regular maintenance would improve usage. These near-consensus findings indicate that residents are not indifferent to maintenance; they recognise its importance and believe that improvements would lead to more use. The policy implication, consistent with Jegede et al. (2024), is to design landscape spaces that assign clear maintenance responsibility to residents—for example, by providing front gardens attached to each housing unit, or by organizing residents into small maintenance teams responsible for specific, well-defined zones.

4.6 Landscape and Built Environment Regeneration

The final section of the questionnaire assessed respondents' perceptions of how landscape contributes to built environment regeneration, using a series of Likert-scale items. The ranked results are presented in the table below, with the highest and lowest items highlighted:

Variable	MIS	Rank	Interpretation
More green spaces should be provided	4.54	1st	Very High
Trees improve air quality	4.50	2nd	Very High
Regular maintenance improves usage	4.31	3rd	Very High
Contributes to regeneration	4.20	5th	Very High
Improves environmental quality	4.20	7th	Very High
Government maintains landscape	2.57	18th	Low

The highest-ranked item, with an MIS of 4.54 (Very High), was the statement "More green spaces should be provided," supported by 92.0% of respondents agreeing or strongly agreeing. This overwhelming demand for additional green spaces is the single most important policy finding of this study. It indicates that Lagos housing estate residents are not opposed to green infrastructure; they actively want more of it. The demand is likely driven by the scarcity documented in Section 4.2 (33% with no green spaces at all) and the accessibility deficit documented in Section 4.3 (43.1% walking over 15 minutes). Babamboni et al. (2025) found that even where parks exist, adequacy is often limited; the present study shows that in many housing estates, the problem is not adequacy but sheer absence. The second-ranked item, "Trees improve air quality" (MIS=4.50), reinforces the finding from Section 4.4 and aligns with Daramola et al. (2025) on the air filtration benefits of green infrastructure. The third-ranked item, "Regular maintenance improves usage" (MIS=4.31), reflects the near-consensus (86.9%) reported in Section 4.5.

The fifth and seventh-ranked items—"Contributes to regeneration" (MIS=4.20) and "Improves environmental quality" (MIS=4.20)—both fall within the Very High range, indicating strong agreement that landscape is not merely an amenity but a core component of regeneration. Overall, 83.3% agreed that landscape improves environmental quality, 83.9% agreed that green spaces improve residential satisfaction, and 84.0% agreed that landscape contributes to urban regeneration. These findings provide direct empirical support for the sustainable regeneration theory discussed in Section 2.1, which holds that ecological restoration must be placed on equal footing with economic and social objectives. In contrast, the lowest-ranked item was "Government maintains landscape" (MIS=2.57, Low), confirming the maintenance deficit discussed in Section 4.5. This low rating is particularly striking given the high demand for more green spaces: respondents want more landscape, but they do not trust the government to maintain what already exists. This paradox suggests that future landscape regeneration in Lagos must include not only capital investment (building new parks and planting trees) but also institutional reform (improving maintenance systems) and community engagement (giving residents a role in upkeep). Without such reforms, new green spaces

will likely follow the same trajectory as existing ones: initial investment followed by gradual decline due to neglect.

4.7 Integrated Discussion

The findings of this study collectively confirm that landscape architecture plays a significant and measurable role in built environment regeneration within Lagos public housing environments, but that current provision is inadequate in quantity, accessibility, maintenance, and design quality. The demand for more green spaces is overwhelming (92.0%), yet nearly one-third of respondents have no local green spaces at all, and 43.1% must walk over 15 minutes to reach the nearest green space—far exceeding international standards for equitable access. When green spaces do exist, they are valued for their environmental performance (air quality, comfort, mental wellbeing) and their contribution to social interaction, but regular use remains low (MIS=3.01) due to a combination of accessibility barriers and maintenance deficits. The finding that government maintenance is rated as Low (MIS=2.57) while residents recognise that regular maintenance would improve usage (86.9% agreement) points to a clear institutional failure that must be addressed before new landscape investments can achieve their full potential.

These findings align closely with the literature reviewed in Section 2. Ademakinwa et al. (2024) demonstrated that environmental quality directly affects user satisfaction in institutional settings; the present study extends this finding to housing estate environments, showing that satisfaction with landscape is strongly correlated with perceived maintenance quality and accessibility. Daramola et al. (2025) showed that green infrastructure (specifically green roofs) improves urban air quality; the present study confirms that ground-level landscape elements—particularly trees—are perceived by residents as delivering the same air quality benefits, and that this perception is a key driver of demand for more green spaces. The maintenance deficit observed (MIS=2.57) directly mirrors Jegede et al. (2024), who found that communal green spaces in Lagos public housing suffer neglect unless residents are given individual responsibility. The present study's finding that resident participation in maintenance is only moderate (MIS=3.18) suggests that most housing estates have not yet implemented the design strategies (e.g., front gardens attached to individual units) that Jegede et al. (2024) recommend.

Babamboni et al. (2025) provide the most directly comparable evidence base. Their study of urban parks in selected Lagos LGAs found that park adequacy is closely tied to user well-being, and that inadequate maintenance, weak accessibility, and safety concerns limit the benefits that parks might otherwise provide. The present study confirms all three of these findings within housing estate environments, while adding two additional insights. First, the demand for more green spaces in housing estates is even more urgent than in public parks, because housing estate residents have no alternative: if their estate lacks green space, they cannot easily travel to a distant public park, especially given the accessibility barriers documented in Section 4.3. Second, the maintenance problem in housing estates is compounded by unclear responsibility: is it the government's job (as residents believe, given their low rating of government maintenance), the residents' association's job, or an individual responsibility? Jegede et al. (2024) offer a design-based solution (individual front gardens), but this requires retrofitting existing estates or incorporating into new developments.

From a theoretical perspective, the findings validate all four frameworks discussed in Section 2. Whyte's (1980) Triangulation Theory is supported by the finding that landscape encourages social interaction (67.9% agreement), though the fact that regular use remains low suggests that existing triangulating features are insufficient. Appleton's (1975) Prospect-Refuge Theory explains why poorly maintained spaces are avoided: overgrown vegetation blocks sightlines (reducing prospect) while creating hiding places (dangerous refuge). Place Attachment Theory (Jegede & Enwonwu, 2025) explains why residents who have positive landscape experiences are more likely to visit regularly and participate in maintenance. Attention Restoration Theory (Kaplan) explains the high agreement (75.9%) that landscape improves mental wellbeing, and the finding that trees improve air quality (MIS=4.50) adds a physiological

pathway to the cognitive restoration pathway. Collectively, these validated theories provide a robust explanatory framework for understanding the landscape-regeneration nexus in Lagos housing estates.

The study concludes that landscape regeneration in Lagos public housing must be pursued through an integrated strategy that addresses quantity, accessibility, design quality, maintenance, and governance simultaneously. Providing more green spaces (the top demand) is necessary but not sufficient; they must be distributed equitably so that every resident lives within a 5–10 minute walk, designed for thermal comfort and social interaction, maintained regularly through clear institutional responsibility, and governed in ways that encourage resident participation without placing unfair burdens on the most vulnerable households. Babamboni et al. (2025) demonstrated that adequacy—not just existence—determines well-being outcomes; the present study confirms that adequacy is currently lacking across multiple dimensions in Lagos housing estates, and that residents are acutely aware of this deficit and eager for change.

V. CONCLUSION AND RECOMMENDATIONS

5.1 Summary of Findings

This study evaluated landscape architecture as a tool for built environment regeneration within Lagos public housing environments, drawing on survey data from 137 respondents including residents, workers, visitors, and planning professionals. The key findings span five thematic areas: availability, accessibility, environmental performance, maintenance, and demand for regeneration. First, regarding availability, green spaces exist in 67% of respondents' neighborhoods, meaning that approximately two-thirds of Lagos housing estate residents have at least some form of vegetated or open space nearby. However, this also means that one-third (33%) have no local green spaces whatsoever—a finding consistent with the remote-sensing evidence cited in Section 2.3, which showed that vegetation cover in Lagos declined by nearly 10% between 2007 and 2013 while built-up area grew by 61%. The most common landscape elements were street trees and playgrounds (40.9% each), while water features—which Whyte's (1980) Triangulation Theory identifies as powerful social magnets—were least common (13.9%). Second, regarding accessibility, 43% of respondents reported that they must walk over 15 minutes to reach the nearest green space, far exceeding the World Health Organization's recommended maximum of 5 minutes (300 meters). Only 10.9% have green spaces within a 5-minute walk, indicating a severe distributional inequity that particularly affects residents of the most densely built-up and least planned areas of Lagos.

Third, regarding environmental performance, 83.9% of respondents agreed that landscape improves environmental quality, with specific high-agreement items including trees improving air quality (MIS=4.50, Very High), vegetation improving environmental comfort (MIS=4.31, High), landscape encouraging social interaction (67.9% agreement), and landscape improving mental wellbeing (75.9% agreement). These findings align with Daramola et al. (2025) on the air filtration benefits of green infrastructure, with Whyte's (1980) Triangulation Theory on social interaction, and with Attention Restoration Theory (Kaplan) on mental wellbeing. However, despite this high valuation, regular use of landscape spaces remained low (MIS=3.01, Moderate), creating a paradox of high appreciation but low utilization that is best explained by the accessibility and maintenance deficits documented below. Fourth, regarding maintenance, government maintenance was rated poorly, with 54.0% of respondents disagreeing that government agencies maintain landscape areas adequately (MIS=2.57, Low). Strikingly, 83.9% agreed that lack of maintenance reduces landscape quality, and 86.9% agreed that regular maintenance would improve usage. These near-consensus findings indicate that residents are keenly aware of the maintenance deficit and believe that addressing it would directly increase their use of green spaces. Babamboni et al. (2025) similarly found that inadequate maintenance is a primary barrier to park use in Lagos LGAs, and Jegede et al. (2024) demonstrated that communal spaces suffer neglect unless residents are given individual responsibility. Fifth, regarding demand for regeneration, 92.0% of respondents agreed that more green spaces should be provided (MIS=4.54, Very

High, ranked first among all items). Overall, 83.3% agreed that landscape improves environmental quality, 83.9% agreed that green spaces improve residential satisfaction, and 84.0% agreed that landscape contributes to urban regeneration. These findings provide direct empirical support for the sustainable regeneration theory discussed in Section 2.1, which holds that ecological restoration must be placed on equal footing with economic and social objectives.

5.2 Conclusion

This study concludes that landscape architecture is not merely an aesthetic amenity in Lagos public housing environments but rather a functional and essential component that supports built environment regeneration across multiple dimensions—environmental, social, and psychological. The evidence demonstrates that when landscape spaces are present, accessible, well-designed, and properly maintained, they deliver measurable benefits: improved air quality (supported by Daramola et al., 2025), enhanced thermal comfort (consistent with Babamboni et al., 2025 on the importance of shade in tropical climates), increased social interaction (supporting Whyte's Triangulation Theory), and better mental wellbeing (supporting Attention Restoration Theory). However, the study also concludes that Lagos currently underutilizes this potential due to a combination of weak institutional coordination, inadequate maintenance systems, inequitable distribution of existing green spaces, and a design paradigm that treats landscape as ornamental rather than infrastructural. The paradox identified in Section 4.4—high valuation of landscape benefits but low regular use—is not a contradiction in user preferences but rather a rational response to the objective conditions of poor accessibility and neglected maintenance.

The theoretical implications of this study are significant. The findings validate all four frameworks discussed in Section 2 within the specific context of Lagos public housing. Whyte's (1980) Triangulation Theory is supported by the finding that landscape encourages social interaction (67.9% agreement), though the low regular use suggests that existing triangulating features are insufficient or poorly located. Appleton's (1975) Prospect-Refuge Theory explains why poorly maintained spaces with overgrown vegetation are avoided: they block sightlines (reducing prospect) while creating dangerous hiding places (negative refuge). Place Attachment Theory (Jegede & Enwonwu, 2025) explains why residents who have positive landscape experiences are more likely to visit regularly and participate in maintenance, and also explains why the 33% with no local green spaces cannot form any attachment. Attention Restoration Theory (Kaplan) is supported by the 75.9% agreement that landscape improves mental wellbeing, and the high rating for trees improving air quality (MIS=4.50) adds a physiological pathway to the cognitive restoration pathway. Babamboni et al. (2025) provide the essential local empirical anchor for these theoretical conclusions, demonstrating that park adequacy in Lagos is inseparable from user well-being. The present study extends their work by shifting the unit of analysis from public parks (destination spaces) to housing estates (everyday, proximate spaces) and by adding a specific focus on regeneration—how landscape can transform degraded environments into functional, valued, and sustainable communities. The study therefore concludes that for landscape to contribute effectively to built environment regeneration in Lagos, it must be treated as core infrastructure on par with roads, water supply, and drainage, rather than as an optional decorative afterthought.

5.3 Recommendations

Based on the findings of this study, the theoretical frameworks validated in Section 2, and the empirical evidence from Babamboni et al. (2025), Ademakinwa et al. (2024), Daramola et al. (2025), and Jegede et al. (2024), the following recommendations are proposed across five domains: policy, design, maintenance, accessibility, and monitoring.

1. Policy: Mandate minimum green cover in public housing estates. The Lagos State Parks and Gardens Agency (LASPARK), in collaboration with the Lagos State Ministry of Housing, should mandate a minimum of 15% green cover in all new public housing estates, with at least 5% of estate land area allocated to actively managed communal gardens or pocket parks. This recommendation directly responds to the finding that 33% of respondents have no local

green spaces and that 92.0% demand more green spaces. The 15% figure is adapted from international best practices (e.g., Singapore's 47% green cover target, London's 40% target) but adjusted for Lagos's extreme density and land scarcity. For existing estates where retrofitting 15% green cover is impossible due to built structures, LASPARK should prioritize the conversion of underutilized spaces (e.g., road verges, abandoned lots, rooftop areas) into green infrastructure, including vertical gardens and green roofs as demonstrated by Daramola et al. (2025).

2. Design: Incorporate resident-managed garden plots following Jegede et al. (2024). New housing estates should be designed with front gardens or individual allotment plots attached to each residential unit, rather than large undifferentiated communal lawns. Jegede et al. (2024) demonstrated that spaces adjacent to individual homes are significantly better maintained than shared communal spaces, because residents perceive them as "theirs" and invest effort accordingly. In existing estates, landscape retrofits should subdivide large communal areas into smaller, identifiable zones that can be assigned to specific households or small clusters of households, with clear boundaries (low fences, hedges, or paving changes) that signal ownership. This design recommendation also supports Place Attachment Theory (Jegede & Enwonwu, 2025), as residents who actively maintain a garden plot are more likely to form emotional bonds with the space and with their neighbours.

3. Maintenance: Establish community-based maintenance agreements with local government support. Given the finding that government maintenance is rated as Low (MIS=2.57) and that 86.9% of respondents believe regular maintenance would improve usage, a hybrid maintenance model is recommended. Under this model, LASPARK or the local government would provide essential services that require specialized equipment or skills (e.g., tree pruning, drainage clearing, major repairs), while residents would take responsibility for daily and weekly upkeep (e.g., litter collection, watering, weeding) through organized rotas or voluntary associations. To incentivize resident participation, local governments could offer small material supports (e.g., free seedlings, tools, or waste bags) or recognition programmes (e.g., "Best Kept Estate Garden" awards). This hybrid model addresses the moderate resident participation observed (MIS=3.18) by reducing the burden on any single household while maintaining the sense of ownership that Jegede et al. (2024) identified as critical for maintenance success.

4. Accessibility: Ensure every housing estate has a green space within 10 minutes walking distance. The finding that 43.1% of respondents walk over 15 minutes to reach the nearest green space is unacceptable by international standards and represents a fundamental failure of distributional equity. LASPARK should conduct a spatial audit of all public housing estates in Lagos, mapping existing green spaces and calculating walking distances from each residential block to the nearest green space. Where gaps exceed 10 minutes (approximately 800 meters for a typical adult walking pace), LASPARK should prioritize new interventions: pocket parks on vacant lots, linear parks along pedestrian routes, or green courtyards within estate boundaries. For estates where land is entirely built up, alternative solutions include green roofs on community buildings (following Daramola et al., 2025) or adopting and greening underutilized road verges adjacent to the estate. This recommendation also responds to Babamboni et al. (2025), who identified poor accessibility as a key factor limiting park use in Lagos LGAs.

5. Monitoring: Annual landscape performance audits using the MIS framework developed in this study. To ensure accountability and continuous improvement, LASPARK should conduct annual landscape performance audits across all public housing estates, using the Mean Item Score (MIS) framework developed in this study. The audit should include: (a) quantitative indicators (percentage of estate area with green cover, number of trees per 100 residents, distance to nearest green space, maintenance response times); (b) user perception indicators (resident satisfaction with availability, accessibility, environmental performance, and maintenance, measured using the same five-point Likert scale employed in this study); and (c) observational indicators (behavioural mapping of how many residents use green spaces, at what times, and for

which activities). Audit results should be publicly reported annually to create transparency and allow residents to hold government accountable. This recommendation also addresses Babamboni et al. (2025)'s finding that adequacy—not just existence—determines well-being outcomes; annual audits would ensure that adequacy is systematically measured and improved over time.

5.4 Limitations and Avenues for Future Research

This study has several limitations that should be acknowledged to guide appropriate interpretation and to inform future research. First, data collection was conducted exclusively during the dry season (November to March), when weather conditions are relatively favourable for outdoor activities and for survey administration. During the wet season (April to October), heavy rainfall, waterlogging, high humidity, and increased mosquito activity may significantly alter patterns of landscape use, maintenance requirements, and user satisfaction. For example, drainage performance—which was not assessed in this study—becomes critically important during the wet season, as poorly drained green spaces can become unusable or even hazardous. Similarly, the finding that 43.1% walk over 15 minutes to reach green spaces may be less problematic during the dry season but may become a complete barrier during the wet season when walking is unpleasant or unsafe. Babamboni et al. (2025) conducted their park adequacy study without explicit seasonal stratification, but future research should include wet-season assessments to provide a full annual picture of landscape-regeneration dynamics in Lagos housing estates. Ideally, a longitudinal study spanning 12–18 months would capture seasonal variations and allow for time-series analysis.

Second, this study relied on self-reported perceptions rather than objective biophysical measurements. While self-reported perceptions are appropriate for capturing user satisfaction, well-being, and demand for regeneration, they are subject to several biases: recall bias (respondents may not accurately remember how often they use green spaces), social desirability bias (respondents may overstate their appreciation for nature because they believe it is expected), and framing effects (responses may be influenced by the order or wording of questions). Future research should complement self-reported data with objective microclimatic measurements (temperature, humidity, air quality, noise levels) and behavioural observations (actual counts of users, duration of stays, types of activities). For example, temperature sensors placed in shaded versus unshaded areas within the same estate could provide objective evidence for the perceived comfort benefits of vegetation reported in Section 4.4. Similarly, observational counts of park users during different times of day and different days of the week would provide a behavioural validation of the self-reported "regular use" variable (MIS=3.01). Daramola et al. (2025) combined air quality measurements with user surveys, providing a methodological model that future Lagos landscape studies should emulate.

Third, the study employed purposive and convenience sampling rather than random sampling, which limits the generalizability of findings. While the sample size of 137 is adequate for descriptive statistical analysis (including MIS calculation), the purposive over-sampling of planning professionals (8.0%) and the convenience-based recruitment of residents may have introduced selection bias. Specifically, residents who are more interested in landscape issues may have been more willing to complete the questionnaire, potentially inflating agreement scores for items such as "more green spaces should be provided" (92.0% agreement). Future research should employ stratified random sampling where feasible, with strata defined by LGA, estate type (formal vs. informal, public vs. private), and distance from city centre. Babamboni et al. (2025) sampled across multiple LGAs, providing a geographical stratification; the present study's focus on housing estates should be extended through a multi-estate random sample that includes estates with varying socio-economic profiles, building densities, and landscape conditions.

Fourth, the study focused on housing estates as the unit of analysis but did not disaggregate findings by estate type (formal government-built estates vs. informal self-built settlements vs. private sector estates). These different estate typologies have very different governance structures, maintenance regimes, and resident demographics, and aggregating them may obscure important variations. For example,

the finding that government maintenance is rated poorly (MIS=2.57) may be driven primarily by formal public housing estates where government is nominally responsible, while residents of private estates may have different maintenance experiences (managed by homeowners' associations) and residents of informal settlements may have no expectation of government maintenance at all. Future research should disaggregate by estate typology and, where possible, include qualitative interviews with estate managers and resident association leaders to understand the institutional mechanisms that produce good or poor landscape outcomes. Jegede et al. (2024) provided a model for this by examining variation in maintenance outcomes across different garden typologies; future research should extend this to variation across estate typologies.

Fifth, the study did not explicitly assess safety and security as a dimension of landscape perception, yet Babamboni et al. (2025) identified safety concerns as a key factor limiting park use in Lagos. Some respondents may have mentioned safety in open-ended comments (which were not systematically analyzed), but the structured questionnaire did not include Likert-scale items on perceived safety, fear of crime, or lighting quality. Given that poorly maintained green spaces with overgrown vegetation can become sites for crime (negative refuge, in Prospect-Refuge Theory terms), this omission is significant. Future research should include a safety module with items such as "I feel safe using green spaces in my estate during the day," "I feel safe using green spaces after dark," and "Poor lighting in green spaces discourages me from using them." Such items would allow for a more complete test of Appleton's (1975) Prospect-Refuge Theory within the Lagos context.

Finally, the study did not include a cost-benefit analysis or economic valuation of landscape interventions. The recommendation that LASPARK mandate 15% green cover in new housing estates has implementation costs (land acquisition, planting, irrigation, maintenance) that must be weighed against benefits (improved air quality, reduced heat-related illness, increased social cohesion, higher property values, mental health benefits). Future research should employ economic valuation methods such as contingent valuation (willingness to pay for green space improvements) or hedonic pricing (comparing property values in estates with and without green spaces) to provide evidence for policy makers who must allocate scarce public resources. Such economic evidence would complement the perceptual evidence provided by this study and would strengthen the case for treating landscape as core infrastructure rather than optional amenity.

Despite these limitations, the present study provides a robust empirical foundation for understanding landscape as a tool for built environment regeneration in Lagos public housing. By integrating the findings with the theoretical frameworks of Whyte (1980), Appleton (1975), Kaplan (Attention Restoration Theory), and Jegede & Enwonwu (2025), and by situating the results within the empirical context established by Babamboni et al. (2025), Ademakinwa et al. (2024), Daramola et al. (2025), and Jegede et al. (2024), the study offers actionable recommendations for policy makers, designers, and estate managers. Future research should address the limitations identified above—seasonal variation, objective measurements, random sampling, estate typology disaggregation, safety assessment, and economic valuation—to build even stronger evidence base for landscape-led regeneration in Lagos and other rapidly growing African cities

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