Impact of Building Design and Materials on Performance Outcomes in Millennium Housing Estates in Lagos State

ADETOYE M. ADERINSOLA[1], DARE - ABEL OLADIPO (PH. D)[2], OLATUNDE ARAYELA[3], OLUWATOYIN O. AJAYI (PHD.)[4]

[1, 2, 3, 4]*Department of Architecture, College of Environmental Science and Management, Caleb University, Imota, Ikorodu, Lagos, Nigeria*

Abstract- This study investigates the impact of building design and material selection on the performance, durability, and livability of Millennium Housing Estates in Lagos State, Nigeria. Through a critical review of spatial planning, construction practices, and material usage, the research identifies major shortcomings such as poor ventilation, limited adaptability, and the high cost of conventional materials. Empirical evidence highlights the potential of alternative materials like stabilized laterite to improve thermal comfort, reduce maintenance demands, and support sustainable housing delivery. Based on these findings, the study proposes climate-responsive design strategies, policy reforms, local material promotion, community-inclusive planning, and technical training programs. These recommendations aim to enhance the functionality and resilience of public housing estates in Lagos.

Indexed Terms- Building design, Material selection, Housing performance, Climate-responsive design, Lagos housing.

I. INTRODUCTION

Housing represents more than just physical shelter it serves as a foundation for individual well-being, societal integration, and the broader development of sustainable communities. In rapidly urbanizing contexts such as Lagos State, Nigeria, the design and material composition of residential buildings play a critical role in shaping living experiences, comfort, and long-term structural performance. The Millennium Housing Estates, initiated as part of Lagos State's response to rising housing demand, were envisioned to bridge the affordability gap and meet the needs of the state's growing population. However, emerging evidence reveals persistent performance challenges, many of which stem from the interplay between architectural design, material choices, and contextual factors such as climate and socio-economic realities (Akande, Olubajo, & Ibraheem, 2024; Oyero, n.d.).

Building design elements such as spatial layout, ventilation, and thermal control affect not only physical durability but also psychological comfort and resident satisfaction (Johnson, 2025). Poor spatial planning, substandard ventilation, and inefficient material use have been shown to compromise living conditions and exacerbate environmental risks such as flooding and overheating, particularly in low-income housing developments (Stephen, 2024). Similarly, the choice of building materials often limited to conventional and cost-intensive components like concrete blocks and imported finishes has not always aligned with sustainability goals or the income levels of intended beneficiaries (Oyero, n.d.; Akande et al., 2024). As a result, many residents face affordability pressures, maintenance burdens, and reduced building longevity, which collectively affect their quality of life and overall satisfaction with their housing environments.

Empirical studies in Lagos have further revealed that residents in public housing schemes often express dissatisfaction with aspects such as noise disturbance, poor waste disposal systems, and lack of adequate services highlighting the need for improved neighborhood design and infrastructure integration (Akinola et al., 2024; Johnson, 2025). These deficiencies are not only architectural or technical but are also reflections of broader socio-economic barriers, including income disparity, weak housing finance systems, and ineffective housing delivery strategies (Obioha, 2021; Akinwamide, Hahn, Paradza, & Aweh, 2022). Furthermore, issues of rapid

population growth, informal land development, and weak policy enforcement continue to exacerbate the poor performance of housing estates, undermining efforts to provide sustainable and inclusive urban housing.

This study aims to assess the impact of building design and materials on performance outcomes in Millennium Housing Estates in Lagos State, with particular attention to how these variables influence structural quality, durability, livability, and user satisfaction. In doing so, it seeks to provide a deeper understanding of the architectural and material factors that determine the success or failure of public housing estates in urban Nigeria.

The Objectives are to:

i. analyze how building design characteristics such as spatial layout, ventilation, and façade configuration influence structural performance and residential comfort in Millennium Housing Estates;

ii. evaluate the performance of building materials used in the construction of Millennium Housing Estates with respect to affordability, durability, and maintenance demands; and

iii. Investigate how socio-economic and contextual factors interact with design and material choices to shape overall housing performance and resident well-being.

The significance of this study lies in understanding the dynamics between design, materiality, and building performance is vital for improving the long-term sustainability and livability of housing estates in developing urban contexts. This study contributes to the growing body of knowledge on public housing by offering evidence-based insights into the architectural and material-related factors that determine residential satisfaction, structural stability, and environmental performance in Lagos State (Akande et al., 2024; Johnson, 2025). These findings are essential for informing government agencies, urban planners, architects, and housing developers about best practices for design and material application in low-income housing. Additionally, this research provides a framework for integrating user-centered, climate-responsive, and cost-effective design principles into future public housing schemes. It also underscores the necessity of reviewing current housing policies, including procurement practices, design standards, and post-occupancy evaluation mechanisms, in order to enhance the effectiveness of housing delivery for vulnerable populations (Obioha, 2021; Akinwamide et al., 2022). By bridging the knowledge gap between design intentions and performance realities, the study promotes a more resilient, inclusive, and sustainable approach to housing development in Lagos and comparable urban settings.

The findings from this study are expected to provide valuable insights for policymakers, urban planners, architects, estate developers, and other housing stakeholders by revealing how building design features, material specifications, and socio-economic factors collectively influence performance outcomes in Millennium Housing Estates across Lagos State. This understanding will support the formulation of more effective housing policies and infrastructure strategies that respond to the climatic vulnerabilities and affordability constraints prevalent in Lagos's urban context (Akande, Olubajo, & Ibraheem, 2024; Obioha, 2021). It also offers practical guidance to architects and estate managers on adopting climate-responsive and cost-efficient building materials that enhance structural durability, energy efficiency, and user comfort (Akinwamide, Hahn, Paradza, & Aweh, 2022; Johnson, 2025). Additionally, the study addresses pressing issues such as overcrowding, poor ventilation, and rising maintenance costs by highlighting how design quality and housing delivery approaches affect long-term livability and resident satisfaction in public estates (Oyero, n.d.; Akande et al., 2024). By integrating these insights, the research contributes to the development of inclusive and sustainable residential environments, aligns with global housing rights and sustainability goals, and informs future policy reforms aimed at improving housing performance and well-being outcomes for low- and middle-income households in Nigeria's rapidly urbanizing cities (Obioha, 2021; Johnson, 2025).

II.   LITERATURE REVIEW

The performance of Lagos State's Millennium Housing Estates is shaped by a complex interaction of architectural design, material specifications, and the

socio-economic realities of their residents. Although these estates were planned to provide cost-effective and durable accommodation, evidence suggests that shortcomings in climate-responsive design, reliance on cost-intensive construction materials, and limited post-occupancy maintenance have compromised durability, comfort, and resident satisfaction (Akande, Olubajo, & Ibraheem, 2024; Johnson, 2025). This section critically reviews the extant scholarship on three interwoven determinants design, materials, and socio-economic context to illuminate their collective impact on estate-level performance outcomes in Lagos.

Table 1: shows various housing types and their classification

Type of Housing Classification	Characteristics
By housing type	Room in the apartment Apartment in a multi-apartment residential building or non-residential Building multi-apartment residential building Family house Other
By housing size	One-room, One-room apartment, Two-room apartment, Three-room apartment, and more, Family house, Other
By housing amenities	Housing with all the amenities, Housing with part of amenities, Housing without amenities
By housing location	Housing in a city, Housing in a rural territory
By group of population living in the housing	Any resident, Persons with low-income or other social group at risk
By type of housing ownership rights	State-owned housing, Municipality-owned housing, Natural person's owned building, Legal person's owned housing, Other
By the construction period of the housing	Housing built before World War II, Housing built from 1945 to 1990, Housing built from 1990 until now.
By energy efficiency indicators of housing	Minimum regulatory energy performance level allowed for new Buildings, Minimum regulatory energy performance level allowed for, reconstructed or renovated buildings, Almost zero energy consumption housing, Other
By construction materials used in the exterior wall of the housing	Brick wall, Wood, Brick/panel, Reinforced concrete/ Lightweight concrete, Wood/masonry, Other.

Source: Mbazor, Aigbavboa & Thwala (2024)

Design-Related Determinants of Performance

Design-related factors significantly influence the quality, usability, and long-term performance of residential buildings in public housing estates. Research has shown that fundamental aspects such as spatial configuration, internal zoning, circulation, ventilation, and natural lighting play a critical role in determining how well housing units perform under environmental and functional stressors. In Lagos State's Millennium Housing Estates particularly in Abesan, Isolo, Iba, and Amuwo-Odofin numerous design shortcomings have been documented. These include narrow kitchens (often under 1.8 meters wide),

poor storage provision, and poorly located staircases that impede movement and compromise safety during emergencies (Johnson, 2025). Studies by Akinola et al. (2024) indicate that residents in units with higher ceiling heights, functional zoning (e.g., bedrooms placed away from noise-heavy living areas), and strategic window placement for cross-ventilation report greater levels of indoor comfort, spatial satisfaction, and privacy. Conversely, rigid and non-adaptable unit layouts discourage flexible space use and have led to an increase in informal and often unsafe building extensions by occupants attempting to meet their evolving needs (Ojo-Fafore, n.d.).

The limitations of the original housing design have inadvertently fostered the proliferation of structurally questionable modifications such as balcony enclosures, unauthorized rooftop additions, and staircase extensions which compromise both building integrity and urban aesthetics. These modifications are commonly undertaken without engineering oversight, violating planning codes and exposing residents to structural risks. They also accelerate building deterioration by obstructing airflow, overloading foundation systems, and interfering with rainwater management infrastructure (Ojo-Fafore, n.d.). In addition to structural risks, post-occupancy studies have revealed persistent complaints related to inadequate daylighting, poor acoustic performance, and limited communal open spaces. Farinmade et al. (2021) and Jegede et al. (2021) observed that deep-plan unit designs limit the penetration of natural light into core living areas, increasing daytime reliance on artificial lighting. Partition walls made of hollow sandcrete or temporary materials fail to block noise between units, reducing auditory privacy and disrupting residents' quality of life. These issues are compounded by the lack of designated recreational spaces or shared green areas, which contribute to social disengagement and diminish estate prestige over time.

Accessibility, inclusivity, and safety are also critical design dimensions often neglected in these housing estates. Many buildings lack ramps, elevators, or other universal design features, making them unfit for elderly residents, people with disabilities, and households with infants. Staircases are frequently narrow, steep, and inadequately lit—posing serious safety risks, especially during power outages. Such oversights not only undermine the basic principles of inclusive design but also breach international best practices and Nigeria's obligations under the UN Convention on the Rights of Persons with Disabilities (Akinola et al., 2024). Ultimately, the architectural shortcomings observed in Millennium Housing Estates reflect a broader failure to align housing design with climatic realities, household diversity, and functional expectations. Without the integration of flexible, responsive, and user-informed design strategies, the performance of these estates will continue to decline, contributing to rapid deterioration, resident dissatisfaction, and increased maintenance burdens.

Climate-Responsive Design and Spatial Configuration

Lagos's hot-humid climate necessitates the integration of passive design strategies such as cross-ventilation, solar shading, and stack-effect ventilation to reduce internal heat gain and dependence on mechanical cooling. However, post-occupancy evaluations of Millennium Housing Estates including those in Abesan, Isolo, and Iba highlight widespread shortcomings in this regard. Many estate blocks rely on single-loaded corridor layouts, shallow overhangs, and minimal operable glazing, resulting in interiors that trap heat and remain uncomfortably warm during the day (Akinola, Ibem, Opoko, Oluwatayo, Aduwo, & Ugah, 2024). Inadequate climatic responsiveness has led occupants to implement informal modifications such as the removal of louvre blades, the punching of ad-hoc windows, and the installation of makeshift vents all of which compromise façade durability and regulatory compliance (Johnson, 2025). In contrast, housing units with well-ventilated stairwells, bedroom zoning away from direct western sunlight, and ceiling heights exceeding 3 meters have recorded perceived comfort increases of 20–30%, underscoring the role of passive architectural elements in enhancing thermal comfort and user satisfaction (Akinola et al., 2024).

Beyond thermal concerns, the rigidity of spatial configurations in many Millennium Housing Estates has undermined the capacity for functional adaptation, particularly as household needs evolve. Buildings with fixed internal layouts and no allowance for

incremental expansion have led to the proliferation of informal extensions such as cantilevered balconies, rooftop kiosks, and side annexes that are often structurally unsound and poorly integrated with the original design (Ojo-Fafore, n.d.). These alterations not only compromise the structural stability of the buildings but also obstruct drainage systems and increase long-term maintenance burdens. The failure to design with flexibility in mind reveals a disconnect between architectural planning and the socio-economic realities of urban residents who often require space for home-based enterprises, growing families, or multi-generational living. Therefore, both environmental responsiveness and spatial adaptability are essential components of residential building performance in hot-humid urban contexts like Lagos, where design rigidity frequently triggers unintended, risk-laden user interventions that degrade building integrity over time.

 Material Specifications and Long-Term Durability

Material selection plays a decisive role in determining the performance trajectory of residential buildings, particularly in hot-humid urban contexts like Lagos. The prevailing use of sandcrete block walls, reinforced concrete structural frames, and imported finishes in Millennium Housing Estates contributes to elevated initial construction costs and heightened long-term maintenance burdens especially for low-income residents who lack the financial resilience to manage ongoing repairs (Oyero, n.d.). These conventional materials, though structurally reliable, often perform poorly in thermal regulation without supplementary treatments, resulting in indoor discomfort and increased reliance on cooling systems. Furthermore, fluctuations in the prices of cement, steel, and aggregates have created volatility in formal housing production, prompting many households to resort to substandard self-build methods. These informal extensions typically bypass proper structural detailing and contribute to accelerated building deterioration, undermining the performance goals of mass housing schemes (Igboekulie, Monye, & Joseph, 2022).

Conversely, research into indigenous and alternative materials has shown promising outcomes for enhancing the durability and affordability of public housing. Materials such as stabilized laterite, bamboo,

silica sand masonry units, and bitumen composites when properly sourced and detailed can offer up to 70% cost savings compared to conventional systems, while simultaneously delivering lower embodied energy and better thermal mass performance (Stephen, 2024). Despite these benefits, the mainstream adoption of such materials remains constrained by regulatory conservatism, limited codification in local building standards, and a pronounced skills gap among contractors and artisans (Akinwamide, Hahn, Paradza, & Aweh, 2022). Pilot implementations of hybrid material systems such as combining laterite masonry with reinforced concrete ring beams have demonstrated improved thermal performance and reduced maintenance expenditure, thereby highlighting the viability of climate-appropriate and cost-effective alternatives for low-income urban housing. Encouraging broader integration of these materials requires institutional reforms, investment in vocational training, and a shift in construction culture towards context-sensitive innovation.

Maintenance Pathways and Estate Governance

The long-term performance of residential estates is heavily influenced by the clarity and functionality of their maintenance governance structures. In many Millennium Housing Estates in Lagos, maintenance responsibilities are distributed across multiple, often uncoordinated, institutional actors. State housing corporations frequently retain ownership and oversight of external building elements, while resident associations are tasked with the management of internal service infrastructure, and local government councils assume responsibility for external public amenities such as roads and drainage systems (Ezekiel, Folake, & Alli, 2024). This fragmented arrangement dilutes accountability and hampers timely intervention, allowing minor faults to escalate into significant structural failures. Resident feedback consistently emphasizes the importance of prompt maintenance interventions particularly in the areas of borehole repairs, refuse collection, and estate lighting as these directly influence perceptions of safety, hygiene, and overall livability (Akinola, Ibem, Opoko, Oluwatayo, Aduwo, & Ugah, 2024). In contrast, systemic neglect of critical elements such as external wall cracks, blocked drainage, and pest infestations

contributes to a gradual erosion of estate value, tenant satisfaction, and neighborhood desirability.

Socio-economic constraints further complicate effective maintenance execution. Akande et al. (2024) identify a significant maintenance funding gap among low- to middle-income households within these estates, noting that families with less than ₦15,000 monthly disposable income are often unable to finance periodic repainting, roof resealing, or waterproofing key interventions that prevent long-term deterioration. This underinvestment contributes to early manifestation of structural issues such as water ingress, ceiling collapse, and concrete spalling (commonly known as "concrete cancer") within the first decade of occupation. Moreover, evidence from Jegede, Adewale, Jesutofunmi, and Loved (2021) shows that estates operating with established maintenance protocols such as structured sinking funds, transparent contribution mechanisms, and professional facilities management report defect rates up to 30% lower than those relying on informal, reactive systems. This underscores the critical link between institutional governance and physical building performance. Without robust estate management models, maintenance becomes ad hoc, costly, and ineffective, ultimately compromising building lifespan, safety, and user satisfaction.

Theories of Determinants of Building Performance in Residential Estates

The assessment of building performance in Millennium Housing Estates in Lagos State necessitates a multifaceted theoretical approach that incorporates environmental, structural, and human-centered perspectives. Three key theoretical constructs Sustainable Building Theory, Environmental Behavior Theory, and Systems Theory form the foundational pillars guiding this study.

Sustainable Building Theory provides the ecological and material basis for evaluating how architectural design and material selection affect building performance. This theory emphasizes the need for climate-responsive architecture that minimizes energy consumption, maximizes thermal comfort, and promotes the long-term integrity of buildings through appropriate material use (Kaushik et al., 2025; Ige, 2017; Errante et al., 2022). In Lagos's hot-humid environment, the use of sandcrete blocks, reinforced concrete, and imported finishes in Millennium Estates has raised concerns regarding thermal discomfort and high maintenance costs (Oyero, n.d.; Johnson, 2025). Conversely, pilot studies involving locally available alternatives such as stabilized laterite and hybrid material systems have shown promising improvements in both durability and affordability (Stephen, 2024; Akinwamide et al., 2022). This theory therefore underlines the importance of integrating low-embodied energy materials, passive ventilation, and context-sensitive construction into housing policy and practice.

Environmental Behavior Theory supports the socio-behavioral dimension of the research, explaining how occupants' characteristics, lifestyles, and socio-economic status influence the way residential spaces are used and maintained. Factors such as income level, education, tenure security, and cultural practices shape how residents interact with their built environment, including how they modify structures, manage utilities, and perceive comfort and privacy (Ezennia & Hoskara, 2021; Habila et al., 2023). In Lagos, empirical observations show that rigid housing layouts in estates like Isolo and Abesan have triggered informal extensions that compromise building safety and drainage efficiency (Ojo-Fafore, n.d.; Akinola et al., 2024). Similarly, lack of awareness about sustainable practices has resulted in façade deterioration, poor ventilation, and waste mismanagement, particularly in lower-income households (Ukpong et al., 2023). This theory reinforces the idea that user behavior must be considered a core variable when assessing long-term building performance.

Systems Theory offers a macro-level understanding by positioning Millennium Housing Estates as interconnected systems comprised of physical infrastructure, institutional frameworks, and community-level dynamics. It highlights the significance of integrated planning, stakeholder collaboration, and feedback mechanisms for sustaining building quality over time (Nkpite & Okoye, 2020; Maina et al., 2021). In the Nigerian context, fragmented housing policies, limited regulatory oversight, and weak coordination among public-private partnerships have undermined

maintenance efficiency and long-term serviceability (Mbazor et al., 2024; Olayiwola et al., 2020). This systems-oriented lens explains why even technically sound buildings may underperform if governance structures, funding mechanisms, and user engagement are misaligned. It also justifies the need for holistic policy interventions that simultaneously address material design, social behavior, and institutional accountability.
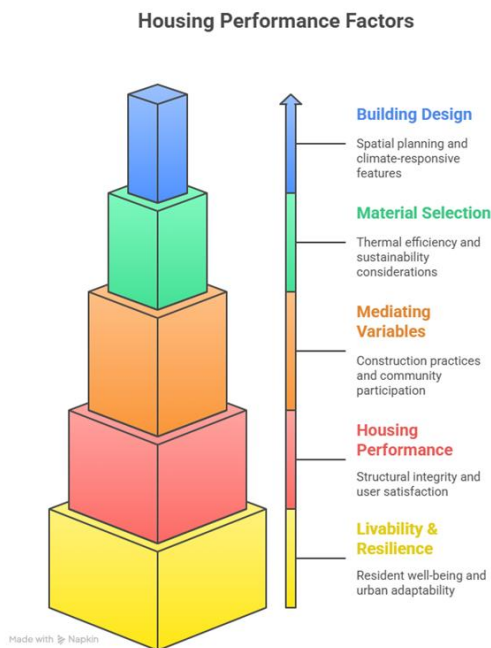

Figure 1: Housing Performance Factors

Source: Research Fieldwork (2025)

Determinants of Building Performance in Residential Estates

A considerable body of empirical research has examined how design and material choices influence the performance outcomes of public housing estates, particularly in rapidly urbanizing contexts like Lagos State. Within Millennium Housing Estates, post-occupancy evaluations have consistently revealed that poor spatial configuration, rigid floor plans, and inadequate ventilation strategies undermine indoor environmental quality and long-term usability. Akinola et al. (2024) noted that residents living in units with thoughtful design elements such as higher ceilings (over 3 meters), rear-zoned bedrooms away from western sun exposure, and effective cross-

ventilation reported significantly improved thermal comfort, privacy, and satisfaction. Conversely, housing blocks in estates like Abesan, Isolo, and Iba were found to incorporate narrow kitchens, minimal storage, and poorly placed staircases that limited circulation, posed safety concerns, and contributed to functional obsolescence (Johnson, 2025). When original design layouts do not permit flexible use or expansion, residents often resort to informal alterations such as cantilevered balconies, unauthorized extensions, and rooftop kiosks which not only compromise structural integrity but accelerate deterioration (Ojo-Fafore, n.d.). These modifications reflect not only user dissatisfaction but the limitations of initial design responses in addressing evolving household needs.
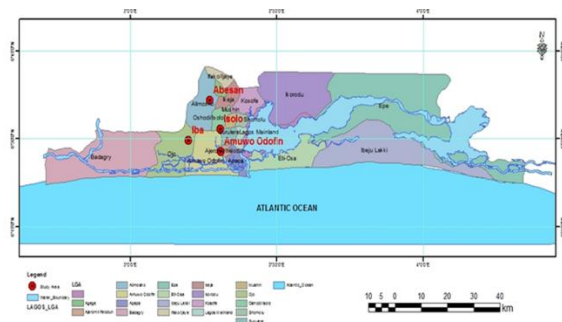

Figure 2: Map of Lagos State showing selected residential schemes

Source: Johnson (2025)

In addition to spatial design, empirical findings have shown that material selection significantly influences the operational and long-term performance of housing estates. Conventional construction materials such as sandcrete blocks, reinforced concrete, and imported ceramic finishes dominate public housing developments in Lagos, yet often lead to costly maintenance and thermal inefficiencies for low-income occupants (Oyero, n.d.). Studies by Igboekulie, Monye, and Joseph (2022) observed that escalating prices of cement and steel have contributed to a decline in formal housing delivery and an increase in informal, poorly executed self-build projects. These structures typically suffer from low durability and raise safety concerns due to poor workmanship and substandard materials. However, empirical work by Stephen (2024) highlights the performance potential of indigenous alternatives such as stabilized laterite

blocks, bamboo, and silica sand masonry. These materials have been shown to reduce construction costs by up to 70%, lower embodied energy, and enhance indoor thermal mass, especially when detailed using hybrid systems (e.g., concrete ring beams). Despite these advantages, uptake remains low due to policy rigidity, conservative building codes, and limited contractor skillsets (Akinwamide, Hahn, Paradza, & Aweh, 2022). Where these context-appropriate materials have been piloted, significant improvements have been observed in indoor temperatures, maintenance efficiency, and overall livability.

Table 2: Factors Investigated

Local Government	Housing Estates/Location	Total Numer of Units	Retrieved
Ifako-ijaiye	Ogba Phase 2	280	258
Ikeja	Hos Staff Quarters	94	32
Ifako-Ijaiye	Ijaiye Medium Housing	26	23
Ifako-Ijaiye	Lsdpe Estate Ojokoro	18	16
Oshodi-Isolo	General Hospital, Isolo quarters	14	5
Amuwo Odofin	Amuwo Odofin Low cost	94	68
Ikorodu	Tos Benson Estate, Owutu, Ikorodu	98	59
Ifako-Ijaiye	Millenium Estate	40	20
Agege	Ijaiye Low Cost Pen Cinema	24	19
	Total	688	500

Source: Akinola et.al (2024)

Socio-economic conditions and institutional governance also emerge as recurring themes in the empirical literature concerning housing performance. Ezennia and Hoskara (2021) demonstrated that households with higher income and education levels tend to adopt better maintenance practices, manage utilities efficiently, and demonstrate greater concern for the physical upkeep of their homes. In contrast, low-income residents often the primary beneficiaries of public housing schemes face challenges in sustaining adequate maintenance, which leads to quicker building decay. Habila et al. (2023) expanded on this by showing how poor user awareness, inadequate sanitation infrastructure, and limited access to responsive maintenance services further deteriorate building performance in low-income estates. Governance structures have also been shown to play a pivotal role. For instance, Maina et al. (2021) and Mbazor, Aigbavboa, and Thwala (2024) identified persistent lapses in post-occupancy monitoring, inter-agency collaboration, and enforcement of design and construction standards. This administrative vacuum has allowed for widespread infrastructural failures such as faulty drainage, leaky roofs, and service outages across many Lagos estates. Public-private partnership (PPP) housing schemes in areas like Amuwo-Odofin and Ipaja illustrate these failures, with residents expressing dissatisfaction over poor lighting, inadequate public open spaces, and rapid façade deterioration (Jegede, Adewale, Jesutofunmi, & Loved, 2021; Farinmade, Oluwo, & Avwenagha, 2021). These findings reinforce the importance of aligning technical design standards with social realities and robust policy implementation.

In conclusion, empirical evidence from Millennium Housing Estates and similar developments across Lagos highlights a complex interplay between building design, material use, socio-economic status, and institutional dynamics in determining residential performance outcomes. High-performing estates tend to reflect integrated approaches merging passive design strategies, locally appropriate materials, responsive planning, and resident-centered governance mechanisms. The existing body of research underscores the urgent need for adaptive architectural standards, inclusive policy reform, and enhanced capacity building among contractors and developers to address the multifaceted challenges of housing sustainability in rapidly growing urban areas.

Identification of Gaps in Literature

Despite the growing body of empirical and theoretical studies on residential housing performance in developing urban contexts, several critical gaps persist in the literature that limit a holistic understanding of how building design and material choices influence performance outcomes, especially in Millennium Housing Estates in Lagos State. Firstly, many studies tend to focus on either the architectural or socio-economic dimensions of building performance without integrating these aspects into a cohesive framework. For instance, while Akinola et al. (2024) and Johnson (2025) investigate design inadequacies such as poor spatial layout and lack of ventilation, they do not sufficiently examine how material performance over time interacts with these design constraints to impact long-term building usability and occupant satisfaction.

Secondly, there is a limited body of context-specific empirical research evaluating the performance of indigenous and hybrid materials in low-cost housing developments. While Stephen (2024) and Akinwamide et al. (2022) demonstrate the thermal and economic advantages of materials like stabilized laterite and bamboo, their studies are either experimental or limited to isolated pilot projects. The broader application of such materials within formal housing estates like those developed under the Millennium Housing Program remains underexplored. This lack of real-world, longitudinal studies constrains the understanding of how local materials behave under Lagos's hot-humid climate, heavy rainfall, and user-driven modifications.

Thirdly, while post-occupancy evaluations have provided insights into resident satisfaction and housing durability, the role of informal extensions and user-led design adaptations has not been fully investigated. Ojo-Fafore (n.d.) notes that many buildings undergo unsanctioned modifications that threaten structural stability, yet the underlying drivers whether cultural, economic, or spatial are rarely addressed in a systematic way. This gap leaves a weak link between formal design decisions and informal performance outcomes.

Moreover, institutional and policy dimensions of housing delivery are often underrepresented in performance research. Studies such as Mbazor et al. (2024) and Maina et al. (2021) highlight issues of fragmented governance and poor regulatory oversight, but few have traced how these systemic weaknesses influence the specific failure of building materials and components over time. There remains a need for in-depth analysis of how construction quality assurance mechanisms, procurement practices, and enforcement frameworks affect long-term building resilience in public housing schemes.

Finally, although Lagos has been the subject of extensive urban housing research, there is a notable gap in literature specifically addressing Millennium Housing Estates as a distinct typology. Most existing studies generalize findings across mixed housing schemes without isolating the unique policy objectives, construction methods, or demographic targets that characterize the Millennium Estates. Consequently, insights into how these estates perform relative to their design intent, user profile, and material selection are fragmented and insufficiently addressed in existing literature.

In summary, the gaps in current literature include the lack of integrated frameworks linking design, material, and socio-economic variables; insufficient longitudinal studies on local material performance; underexploration of user-driven modifications; and inadequate analysis of institutional failures. This study seeks to bridge these gaps by offering a comprehensive evaluation of how building design and

materials influence the performance of Millennium Housing Estates in Lagos State, while considering the socio-technical and policy environment that shapes housing outcomes.

III. METHODOLOGY

This study adopts a Systematic Literature Review (SLR) as its research methodology. An SLR is a structured and replicable process used to locate, appraise, and synthesize existing studies to answer a defined research question with transparency and academic rigor (Dewey & Drahota, 2016). This approach is particularly appropriate for examining the complex interplay between building design, material choices, and performance outcomes in large-scale residential estates, such as those developed under the Millennium Housing Scheme in Lagos State. By applying a systematic review strategy, the study ensures that findings are drawn from a curated body of credible, methodologically sound literature, thereby minimizing bias and allowing for the development of evidence-based conclusions relevant to urban housing performance in developing contexts.

For this review, a total of twenty peer-reviewed articles and technical reports were carefully selected based on their relevance to the performance of housing estates in terms of architectural design, construction materials, climate responsiveness, and socio-economic conditions. Studies focused on Nigeria and comparable Sub-Saharan African cities, with supplementary insights from other developing regions experiencing similar urban and infrastructural pressures. Academic databases such as Scopus, JSTOR, ScienceDirect, Google Scholar, and SpringerLink were systematically searched using keywords including: "millennium housing estates," "building design and layout," "construction materials," "residential building performance," "low-income housing," "thermal comfort," and "urban housing in Lagos." Inclusion criteria emphasized empirical validity, conceptual clarity, methodological robustness, and contextual relevance to mass housing schemes.

The literature review process was guided by a three-stage filtering strategy screening by title, abstract, and full-text relevance followed by a quality appraisal using criteria from Maina et al. (2021), Mbazor et al. (2024), and Stephen (2024) to ensure the validity of each source. The selected documents encompass studies that detail the role of passive design features (Akinola et al., 2024), socio-economic influences on user satisfaction and maintenance practices (Ezennia & Hoskara, 2021), and the implications of material specifications for lifecycle performance (Oyero, n.d.; Akinwamide et al., 2022). This comprehensive synthesis of scholarly work not only consolidates existing knowledge but also identifies patterns, contradictions, and critical knowledge gaps regarding performance disparities across Lagos's Millennium housing typologies. Overall, the SLR approach provides a reliable empirical and theoretical foundation for understanding how design and material decisions influence the durability, comfort, and usability of residential buildings in Nigeria's evolving urban landscape.

IV. FINDINGS AND DISCUSSION

The analysis of existing studies reveals that building design significantly influences the functional performance and long-term usability of Millennium Housing Estates in Lagos State. Several estate including Abesan, Iba, Isolo, and Amuwo-Odofin suffer from spatial inefficiencies such as cramped kitchens, poorly located stairwells, and minimal storage provisions, which negatively affect circulation and occupant safety (Johnson, 2025). Evidence from post-occupancy evaluations indicates that when ceiling heights exceed 3 meters, bedroom zoning considers solar exposure, and stairwells are well-ventilated, occupants report notably improved comfort, privacy, and overall satisfaction (Akinola et al., 2024). However, many designs across these estates lack the flexibility for household expansion, prompting informal structural extensions that are often unstable and exacerbate building deterioration (Ojo-Fafore, n.d.). Furthermore, several Public-Private Partnership (PPP) housing schemes exhibit inadequate daylighting, poor acoustic separation, and a lack of communal spaces, resulting in reduced social cohesion and declining neighborhood value (Jegede et al., 2021; Farinmade et al., 2021). These findings emphasize the urgent need for climate-responsive design strategies, passive cooling systems, and adaptable layouts that

anticipate both user needs and environmental conditions.

Material selection equally plays a vital role in shaping the performance outcomes of these estates. Many housing units are constructed with cost-intensive and thermally inefficient materials such as sandcrete blocks, reinforced concrete, and imported finishes, which contribute to higher life-cycle costs and maintenance burdens for low-income residents (Oyero, n.d.). With recurring inflation in the prices of cement, steel, and aggregates, formal construction has seen a decline, while substandard self-built extensions have become more common, posing further risks to structural stability (Igboekulie et al., 2022). On the other hand, empirical studies on indigenous and hybrid materials including stabilized laterite, bamboo, silica sand masonry, and laterite-concrete composites show that these alternatives offer up to 70% cost savings, improved thermal mass, and lower embodied energy when properly detailed (Stephen, 2024). Despite their proven advantages, the adoption of such materials remains limited due to regulatory rigidity, lack of skilled labor, and poor policy integration (Akinwamide et al., 2022). Nevertheless, pilot projects that combine modern and traditional materials have shown promising reductions in both interior heat loads and long-term maintenance costs (Stephen, 2024). These insights reinforce the need for a material policy shift that embraces climate-sensitive, affordable, and locally sourced alternatives as part of broader housing reform strategies.

Table 2: Analysis of Research Articles Relating to Building Performance

S/N	Title of Article & Author's & Year	Aims & Objectives	Methodology	Results	Limitation of study
1	Maina (2021). Socioeconomic and demographic predictors of residential satisfaction within public housing estates in Northern Nigeria.	This research investigates how socioeconomic status (SES) and demographic characteristics of residents relate to their satisfaction with public housing environments in Northern Nigeria. The objectives were to analyze the associations between SES and demographic factors with residential satisfaction, and to identify which of these variables best predict satisfaction levels among public housing occupants.	Employing a quantitative survey design, the study sampled 1,033 housing units from eight public housing estates spanning three geopolitical zones in Northern Nigeria. Based on Yamane's formula and accounting for expected non-responses, 335 questionnaires were administered, with 178 valid responses included in the analysis.	Results indicated that residential satisfaction was significantly affected by demographic factors such as marital status, income level, and duration of residence, with demographic variables exerting more influence on satisfaction than socioeconomic status.	The study's limitations include its exclusive focus on public housing estates in Northern Nigeria, thereby limiting the applicability of its findings to other regions or to private housing sectors.
2	Jegede, F. O., Adewale, B. A.,	The study aimed to assess residential	The research adopted a	Findings revealed that	The study was limited to only two

	Jesutofunmi, A. A., & Loved, K. S. (2021, March). Assessment of Residential Satisfaction for Sustainability in Public-Private Partnerships (PPPs) Housing Estates in Lagos State, Nigeria	satisfaction within Public-Private Partnership (PPP) housing estates in Lagos State to evaluate how well these estates meet the housing needs of residents. The objectives included examining the socio-economic characteristics of residents, housing conditions, shared services, and identifying factors influencing housing satisfaction.	quantitative survey approach using structured questionnaires administered to residents in two selected PPP housing estates in Lagos State LSDPC Low-Income Housing Estate, Isolo and FHA Diamond Estate, Isheri-Olofin. The study analyzed housing characteristics, infrastructure, facilities, and satisfaction indicators such as building materials, utilities, and maintenance practices.	most residents occupied 3-bedroom single-family bungalows built with low-cost materials like sandcrete blocks and aluminum windows, indicating affordability considerations in PPP housing delivery. Residents expressed high satisfaction with housing features but showed lower satisfaction with maintenance practices, which were largely left to individuals rather than the estate managers.	PPP housing estates in Lagos State, which may not fully represent all PPP housing developments in Nigeria. Also, the study relied primarily on self-reported satisfaction, which is subject to personal bias and temporal perceptions.
3	Farinmade, A., Oluwo, M. D., & Avwenagha, O. Urban Residents' Housing Satisfactions In Iponri Housing Estate, Lagos, Nigeria.	The study aimed to evaluate residents' satisfaction and experiences with the Iponri public housing estate in Lagos State. Specifically, it sought to assess the physical conditions of the housing units and evaluate the occupants' levels of satisfaction with housing facilities and services.	A quantitative research design was employed, targeting a sample of 126 residents selected purposively from a total tenant population of 2,650, using Morris's sample size formula. Data were gathered through structured interviews and analyzed using descriptive statistics to	The findings showed that residents generally rated paints, walls, windows, and toilets as being in good condition, while roofs, ceilings, doors, and lighting were rated poorly. Satisfaction was highest for privacy, water supply, ventilation, and the housing environment, but dissatisfaction	The study's focus on a single housing estate limits the generalizability of the findings to other public housing areas. Additionally, the use of self-reported satisfaction measures may introduce subjective bias based on personal expectations and perceptions.

			measure housing conditions and satisfaction levels.	was noted for interior design, electricity supply, ornaments, and pollution.	
4	Ezekiel, A. E., Folake, A. F., & Alli, K. A. (2024). Evaluation Of Public Private Partnership In Housing Provision In Nigeria: The Lagos State Perspective	The study aims to evaluate the role and effectiveness of public-private partnerships (PPP) in housing provision in Lagos State, Nigeria. It seeks to analyze how PPP can address the growing housing deficit amidst rapid urbanization and financial constraints faced by the government.	The research primarily adopts a qualitative and descriptive approach, reviewing existing literature and housing delivery frameworks to understand the dynamics of PPP in housing provision. It analyzes the housing demand drivers and the challenges in financing social housing in the Nigerian context, especially in Lagos State.	The study highlights that rapid urban population growth has increased demand for housing, which the government alone cannot meet due to limited financial resources. It finds that PPP offers a viable mechanism for faster, more affordable social housing delivery by combining public regulatory support and private sector efficiency.	The study relies heavily on secondary data and theoretical frameworks, which may limit the practical applicability of findings without empirical validation. Additionally, challenges such as regulatory bottlenecks and inconsistent policy implementation in Nigeria may affect the full success of PPP models in housing provision.
5	Ojo-Fafore, E. M. Assessment Of Residential Housing Projects In Lagos State.	The study aims to assess residential housing projects in Lagos State, with a focus on evaluating the planning, development, and approval processes. It seeks to understand how these factors affect the sustainability and delivery of affordable housing for urban residents.	The research appears to adopt a descriptive and evaluative approach, drawing on literature reviews, urban development data, and analysis of housing policies. It uses observations and hypothesis testing to assess the role of private	The study reveals that inadequate construction planning and cumbersome government approval procedures hinder the timely and affordable delivery of residential housing. It also identifies land acquisition processes and non-compliance by developers as	The study is primarily qualitative and may lack empirical field data to quantify the full extent of housing project challenges. Additionally, it does not deeply explore the perspective of end-users or tenants, which could limit the comprehensiveness of its findings.

			developers and regulatory processes in housing delivery.	major constraints to sustainable housing development in Lagos.	
6	Akinola, A. O., Ibem, E. O., Opoko, A. P., Oluwatayo, A. A., Aduwo, E. B., & Ugah, U. K. (2024, May). Residents' Satisfaction with Neighbourhood Socio-economic Environment of the Public Sector Employee Housing Schemes in Lagos State, Nigeria	The study aimed to gauge residents' satisfaction with the neighbourhood socio-economic environment in nine public-sector employee housing estates across Lagos State. Specifically, it sought to identify which neighbourhood features most strongly shape occupants' satisfaction and highlight aspects needing improvement in future employee-housing projects.	A cross-sectional quantitative survey was conducted between September 2020 and March 2021: 688 housing units were purposively selected, and 500 properly completed questionnaires were analysed. Stratified and cluster sampling determined the estates and local governments, while descriptive statistics in SPSS summarised satisfaction levels with 15 socio-economic indicators.	Respondents were most pleased with estate security, outdoor air quality, and the level of religious activities, but least pleased with opportunities for collective activities, noise levels, and prices of goods and services around the estates. Overall, the findings underscore security and environmental quality as top drivers of satisfaction, whereas social vibrancy and affordability of local services remain weak points.	Because the survey covered only nine estates and relied on self-reported perceptions, the results may not generalise to all public-sector employee housing schemes in Lagos or beyond. Additionally, its cross-sectional design captures residents' views at one time-point, limiting insights into how satisfaction may evolve as neighbourhood conditions change.
7	Akinola, A. O., Ibem, E. O., Opoko, A. P., Oluwatayo, A. A., Aduwo, E. B., & Ugah, U. K. (2024, May). Satisfaction with Maintenance of the Public Sector Employee Housing Schemes in Lagos State, Nigeria.	This study aimed to assess residents' satisfaction with maintenance services in public sector employee housing estates in Lagos State, Nigeria. Specifically, it sought to identify which maintenance	The study adopted a quantitative cross-sectional survey design between September 2020 and March 2021. Stratified and cluster sampling were used to select nine	The results show that while security and utilities are relatively well-managed, infrastructure maintenance lags behind, particularly in environmental and	The study was limited by its geographical scope (only nine estates) and reliance on self-reported data, which may introduce bias. Also, the cross-sectional design does not account for long-term trends or seasonal variations

		components (e.g., power, refuse disposal, security, drainage) most influenced satisfaction levels and where significant gaps or dissatisfaction existed, with the goal of informing improved maintenance practices.	estates across local government areas, and purposive sampling was used to select 688 housing units. Out of these, 500 valid responses were analyzed using descriptive statistics in SPSS to assess satisfaction with various maintenance features such as frequency and responsiveness of services.	transportation aspects.	in maintenance services. Furthermore, the subjective nature of satisfaction may vary widely based on residents' expectations and prior experiences, which were not deeply explored in this study.
8	Akinola, A. O., Ibem, E. O., Opoko, A. P., Oluwatayo, A. A., Aduwo, E. B., & Ugah, U. K. (2024). Satisfaction with Housing Design Features of the Public Sector Employee Housing Schemes in Lagos State, Nigeria Using Principal Component Analysis	The primary aim of this study was to evaluate residents' satisfaction with housing design features in public sector employee housing schemes in Lagos State, Nigeria. The objectives were to identify key design elements that influence satisfaction and to reduce the large dataset into major components using Principal Component Analysis (PCA), providing insights into what housing design elements should be prioritized in future housing policy and	A quantitative cross-sectional survey was conducted from September 2020 to March 2021. Data were collected using a structured questionnaire administered to 500 residents across nine purposively selected public housing estates in Lagos State. The data were analyzed using descriptive statistics and Principal Component Analysis (PCA) via SPSS. PCA was employed to identify the most	Residents were most satisfied with bedroom location, entrance/exit door placement, and ceiling height, but least satisfied with the size of the study, kitchen, and store. PCA revealed seven main components, including lighting and ventilation, spatial layout, privacy, and circulation features influencing satisfaction.	The study focused on nine estates only, limiting generalizability across Lagos State. It also excluded other key housing factors like construction quality and neighborhood environment, and the cross-sectional design restricts understanding of satisfaction over time.

		architectural design.	influential dimensions of design features contributing to residents' satisfaction.		
9	Stephen, G. O. I. D. Indigenous Building Materials for Affordable Housing in Lagos State, Nigeria.	The study aimed to explore the potential of indigenous building materials (IBMs) in enhancing housing affordability in Lagos State. Its objectives included identifying locally available materials, evaluating their suitability for construction, and recommending strategies for their wider adoption.	A qualitative research approach was used, primarily based on extensive literature review and analysis of secondary data from research institutes and previous studies. Key focus areas included the identification, properties, and applications of materials like clay, timber, bitumen, and glass sand.	Findings revealed that indigenous materials are significantly more affordable than imported alternatives, with cost differences reaching up to ₦66,000 per unit. Additionally, these materials demonstrated environmental benefits, cultural relevance, and thermal efficiency suitable for Nigeria's tropical climate.	The study relied mainly on secondary data, limiting the inclusion of real-time field validation or empirical case studies. Also, it did not assess the structural performance of IBMs in comparison to modern materials under standardized testing conditions.
10	Igboekulie, I. E., Monye, C., & Joseph, F. F. Assessment of the Effect of Building Materials Cost On Housing Development in Owerri, Imo State, Nigeria.	The study aimed to assess how the cost of building materials affects housing development in Owerri, Imo State, Nigeria. It sought to establish predictive relationships between rising material costs and the rate of residential development within the state.	The researchers used a mixed-methods approach, collecting primary data through structured questionnaires distributed to 90 construction professionals and secondary data from OCDA records and material merchants from 2009 to 2018. Four critical materials	The study found a strong positive correlation between the increase in material prices and the decline in residential housing development, identifying cost escalation as a major constraint. Shortage in housing delivery was revealed as the most significant effect, supported by over 50%	The research was limited to four building materials and focused only on the urban setting of Owerri, possibly omitting rural dynamics and other influential variables. Furthermore, reliance on historical price records and respondent opinions may have introduced data accuracy and recall bias.

			cement, high tensile iron bars, sharp sand, and granite were selected to analyze their impact on residential housing output over a decade.	agreement among respondents on all identified cost-related factors.	
11	Oyero, H. G. CHALLENGING OF HOUSING AFFORDABILITY IN LAGOS METROPOLIS.	The aim of the study was to assess the challenges of housing affordability in Lagos Metropolis within the context of rapid urbanization and rising costs. It focused on identifying the key factors limiting access to affordable housing and evaluating the socio-economic impacts on residents.	The study employed a qualitative and descriptive research approach, using literature reviews, population data analysis, and affordability benchmarks to evaluate housing conditions in Lagos. Key indicators such as income levels, population growth, housing costs, and government policy interventions were analyzed to determine affordability challenges.	The findings revealed that most Lagos residents spend over 30% of their income on housing, thereby exceeding the affordability threshold and leaving little for other essential needs. Major challenges identified include high land and construction costs, inadequate planning, insufficient housing finance systems, and population pressure leading to overcrowding and infrastructure strain.	The study is primarily based on secondary data and general observations, limiting its empirical depth and the ability to draw strong statistical inferences. Additionally, the absence of detailed household-level survey data may have restricted the robustness of affordability assessments across different socio-economic groups.
12	Ukpong, Akah, & Abubaker, (2023). Improving residential outdoor space experience in developing countries: Evidence from a housing estate in Nigeria.	This research investigates the aesthetic appeal and functional quality of outdoor residential spaces within Ewet Housing Estate in Akwa Ibom State, Nigeria. It aims to	The study utilized a dual-method approach: expert field observations using a structured observation checklist, and a	Findings revealed that although the housing structures in Ewet estate are of high quality, the overall residential experience is	The study is limited by its focus on a single estate within Nigeria's South-South region, which may restrict the general applicability of the results. Moreover,

		identify the key challenges limiting effective site development and to propose conceptual strategies for improving residential outdoor environments— offering guidance for architects, urban planners, and policymakers in Nigeria and other developing contexts.	questionnaire survey administered to estate residents through stratified random sampling. Data were analyzed using weighted averages from a 5-point Likert scale and simple regression techniques to determine the influence of various factors on residential site development.	undermined by poor outdoor spatial design, insufficient site maintenance, and a lack of well-planned open spaces. Residents pointed to the absence of standardized site development guidelines and spatial constraints as significant issues. The study emphasizes the importance of prioritizing outdoor space design both functionally and aesthetically to enhance the livability of residential environments.	variations in individual homeowner preferences and lifestyle choices could affect the consistency and interpretation of outdoor space experiences.
13	JOHNSON, M. (2025). Incorporating Neighborhood Physical Characteristics and Well-Being in Selected Public Residential Schemes of Lagos State	The study aimed to examine how neighborhood physical characteristics influence residents' well-being in selected public residential schemes in Lagos State. It sought to evaluate the role of residential design, spatial planning, and environmental quality in shaping the health, safety, and social experiences of	The research utilized case study analysis of four major public housing schemes— Abesan, Isolo, Iba, and Amuwo-Odofin— combining physical design assessment with literature review and conceptual frameworks on well-being. Parameters considered included spatial layout,	Findings revealed that the quality of design, infrastructure, and neighborhood layout significantly affect residents' physical and psychological well-being, particularly in relation to health, privacy, and social belonging. The integration of thoughtful design, open spaces, and	The study primarily focused on four estates, limiting the generalizability of findings to all public housing schemes across Lagos State. Additionally, the absence of quantitative surveys or direct resident feedback limited the measurement of subjective well-being to theoretical and observational insights.

		occupants in LSDPC estates.	accessibility to services, open spaces, dwelling types, and subjective well-being indicators like safety, comfort, and cultural identity.	responsive infrastructure was shown to directly enhance quality of life and subjective well-being in the studied estates.	
14	Nkpite, & Esau. Appraising elements of post-occupancy evaluation influencing improvement of residential satisfaction in public housing estates In Nigeria.	This study assessed the factors that contribute to enhanced residential satisfaction within public housing, focusing on Federal Housing Estates in Abia State, Nigeria. The primary goal was to evaluate how various elements of Post-Occupancy Evaluation (POE) influence residential satisfaction and to identify the specific POE indicators that support improved living conditions in these housing estates.	An investigative POE method was used, targeting long-term residents—those who had lived in the estates for over five years—at Ogbo-Hill in Aba and Umuahia. Out of 105 housing units, 75 households were selected for the survey. Primary data were collected using face-to-face, self-administered questionnaires rated on a 5-point Likert scale. Responses were analyzed using mean scores to determine satisfaction levels.	The findings revealed that elements such as architectural design, maintenance management, daily functional support, compliance with building standards, and financial value were major contributors to residential satisfaction. Additionally, aspects like resident engagement, participatory maintenance, innovative technologies, efficient procurement systems, and lifecycle-focused building management played a significant role in improving living conditions and fostering sustainable residential environments.	The study was geographically limited to two federal housing estates in Abia State and focused only on the types of buildings within these specific locations. While a broader national scope would have been ideal, the insights from this research are intended to inform public housing improvements across Nigeria.

| 15 | Okoye, Olotuah, & Ezeji. (2020). Tenure of residents as a determinant of maintenance conditions of residential buildings in housing development corporation estates In Enugu | The study explored how the tenure status of residents affects the maintenance condition of residential buildings within housing estates developed by the Enugu State Housing Development Corporation (ESHDC). Specifically, it aimed to determine whether residents' length of stay or ownership status influences their level of responsibility toward maintaining public housing infrastructure. | Using a survey research approach, the study adopted a multistage stratified random sampling technique to gather responses from 326 residents across four ESHDC housing estates in Enugu metropolis Ekulu East, Golf Course, Republic Layout, and Riverside Estate selected based on their development period (pre- and post-2000). The number of respondents from each estate was proportionate to its housing unit count. | Results showed that residents with long-term or permanent tenure were more inclined to take responsibility for the upkeep of their properties, resulting in better-maintained buildings. The study further suggested that instilling a sense of collective responsibility among residents with shorter tenure could positively influence maintenance culture and improve overall housing conditions. | The findings are limited to ESHDC-managed estates in Enugu and may not reflect the broader conditions or practices in other public housing developments across Nigeria. |
| 16 | Ige, Binuyo, & Jimoh. (2017). Maintenance practice and occupant's satisfaction in public housing estates: An Osogbo, Nigeria perspective. | This study examined the relationship between maintenance practices and occupant satisfaction within public housing estates in Osogbo, Nigeria. It aimed to assess how well residents' needs are being met and to identify the factors influencing maintenance culture and the | The research employed a quantitative method, using structured questionnaires distributed to both residents and estate surveyors in selected public estates. Responses were recorded using Likert scales to evaluate satisfaction levels and | Findings indicated that although some public housing facilities were in reasonably good physical condition, the level of occupant satisfaction varied widely. The results emphasized that infrastructure provision alone is inadequate; sustained resident | A key limitation of the study is its narrow focus on public housing estates in Osogbo and its exclusion of private housing developments, which restricts the generalizability of the findings across different housing contexts. |

		condition of housing infrastructure. The ultimate goal was to enhance the quality and long-term sustainability of public housing in the region.	infrastructure quality. Data analysis involved calculating weighted mean scores, severity indices, and conducting chi-square tests via SPSS to identify statistically significant maintenance-related factors.	satisfaction depends on effective, responsive, and coordinated maintenance management that aligns with user needs.	
17	Kaushik, Singh, & Kapshe. (2025). Changing vertical wind profile and its importance for wind-induced natural ventilation in high-rise buildings–a case of Pune.	The study explores how wind-driven natural ventilation behaves in high-rise buildings, emphasizing the distinct airflow patterns compared to low-rise structures. It highlights the critical need to obtain site-specific wind data rather than relying solely on generalized design assumptions, as actual wind speeds can differ significantly from standard values used in current design practices.	An experimental approach was adopted to measure wind velocity at a height of 100 meters in a warm, humid climate zone. In parallel, a mathematical model was developed using interpolated secondary wind data to estimate wind speeds at the same height. A comparison between the empirical measurements and analytical estimates revealed significant disparities in predicting the vertical wind profile.	The study concludes that traditional reliance on wind rose diagrams and predictive models should be supported by actual site measurements to ensure accurate design of natural ventilation systems for high-rise buildings	Further research on wind speed variations at mid-building levels, the formulation of average wind velocity gradients, and the introduction of correction factors to refine predictive models. Notably, the research is context-specific, focusing on external wind conditions on the windward side of a building in Pune.
18	Errante. (2022, June). A green technological rehabilitation of the	This study evaluated public housing performance in	Data were gathered through a structured questionnaire	Findings showed that residents viewed water supply,	The study's dependence on subjective resident

built environment. From public residential estates to eco-districts.	Lagos, Nigeria, by examining residents' perceptions of residential quality. Its primary goal was to identify core indicators that influence housing satisfaction such as neighborhood environment, accessibility to amenities, and the physical characteristics of dwellings to support the enhancement of public housing schemes.	administered to heads of households across four randomly selected public housing estates. Using systematic sampling, responses were collected from 1,232 units, with 1,022 valid responses analyzed. Twenty housing quality indicators were assessed using a weighted Likert scale, and relationships between variables were examined using correlation matrices at the 0.01 and 0.05 significance levels.	ventilation, natural lighting, and privacy as the most satisfactory elements, while space availability, drainage, and electricity supply were identified as major shortcomings. Strong correlations between several indicators suggest that targeted improvements in these areas could significantly enhance residential satisfaction.	opinions may introduce potential bias, and its focus on selected estates in Lagos limits the broader applicability of the results to other housing settings or regions.
19	Akinwamide, D. O., Hahn, J., Paradza, P., & Aweh, D. S. (2022, January). Barriers to the Adoption of Smart Housing Concept in African Smart City Projects: Case of Akwa Millennium City	The aim of the study was to investigate the barriers to the adoption of the smart housing concept within the context of African smart city developments. It specifically focused on evaluating the challenges facing the implementation of smart housing in the Akwa Millennium City Project in Nigeria.	A case study approach was adopted using structured questionnaires administered purposively to staff members involved in the Akwa Millennium City project. All retrieved questionnaires were deemed valid and analyzed to identify key constraints	The findings revealed that major barriers include high cost of smart technologies, lack of local technical expertise, poor infrastructure, and inadequate policy support. Additionally, respondents cited low awareness among end-users and weak institutional frameworks as	The study was limited to a single smart city project, which may not fully represent the diverse conditions across other African urban contexts. Moreover, the sample was restricted to project staff, excluding perspectives from end-users, policymakers, or external stakeholders.

			limiting smart housing adoption.	critical impediments to successful implementation.	
20	Olayiwola, & Shakede. (2020). Socioeconomic determinants of formal residential land affordability in Ibadan, Nigeria.	The study investigated the socioeconomic factors influencing the affordability of formal residential land in Ibadan, Nigeria, with the aim of generating evidence to support policies that promote fair access to secure housing plots for urban residents.	Using a purposive and systematic sampling technique, the researchers surveyed 354 original allottees from 30 government-planned residential estates, drawn from a total accessible population of 4,602. Data were obtained through structured questionnaires distributed in proportion to plot density: 185 to medium-density areas, 152 to high-density, and 17 to low-density areas.	Findings revealed that key socioeconomic variables access to loans, level of education, household size, and income significantly influenced residential land affordability. Among these, access to credit facilities had the strongest predictive impact, while income level had the least influence.	The study was confined to the formal land market in Ibadan and did not examine informal land acquisition practices or conditions in other urban centers, which could present different socioeconomic patterns and policy environments.
21	Obioha, E. E. (2021). Mission unaccomplished: Impediments to affordable housing drive in addressing homelessness in Sub-Saharan Africa	This research investigated the underlying challenges hindering the effective provision of affordable housing as a means of tackling homelessness across Sub-Saharan Africa. It focused on assessing how well housing rights are integrated into	Using a qualitative methodology, the study conducted an in-depth content analysis of legal frameworks, global declarations, policy papers, and academic literature, situating them within the	The results indicated that while housing is widely acknowledged as a fundamental human right within constitutional and international provisions, the actual realization of affordable housing is obstructed by	The exclusive use of secondary data limited the exploration of real-life experiences of homeless populations. Additionally, the broad geographical scope may have overlooked specific local nuances and variations in housing issues and policy effectiveness

		national development agendas and implemented across countries in the region.	political, economic, and social contexts of different Sub-Saharan nations.	weak institutions, unstable political environments, deep economic disparities, and flawed urban planning. The study further emphasized the gap between policy rhetoric and practical implementation.	across different countries..
22	Akande, O. K., Olubajo, O. O., & Ibraheem, Y. (2024). Quality and Perception of Public Housing Provision in Nigeria and Implications for Low-Income Earners.	The study aimed to evaluate the quality of public housing provision in Nigeria and its implications for low-income earners, particularly in Abuja. Specific objectives included assessing how housing quality influences well-being, understanding low-income earners' housing preferences, and identifying critical sustainability indicators for improved housing quality.	The study employed a quantitative questionnaire survey administered among low-income residents of public housing in Abuja. Responses were analyzed to gauge satisfaction levels, perceptions of housing quality, and the economic and social challenges faced by occupants.	Findings revealed widespread dissatisfaction with housing quality due to affordability constraints, poor waste disposal, and noise disturbances, though respondents were generally indifferent to housing design and natural ventilation. Housing quality was found to affect safety, security, and loan accessibility but had minimal perceived influence on lifestyle and utility costs.	The study's scope was limited to Abuja's public housing schemes, which may not fully represent conditions across Nigeria. Additionally, while economic and physical aspects were explored, deeper qualitative insights into residents' lived experiences were not captured.
23	Habila (2023). Assessment of residential satisfaction as a determinant of neighbourhood	The purpose of the study was to evaluate how residential satisfaction influences the	A quantitative research design was employed, utilizing survey methods such as questionnaires,	Results indicated that middle-income residents in the selected public housing estates reported a	The study was confined to certain public housing estates in Owerri, which limits its applicability to

choice among residents of public housing estates in Owerri, Imo state, Nigeria.	choice of neighbourhood among residents living in public housing estates in Owerri, Imo State. The objectives included analyzing residents' demographic and physical estate features, measuring their satisfaction levels, and identifying the factors guiding their neighbourhood preferences.	oral interviews, and personal observations to gather primary data from residents. Secondary data were also drawn from relevant literature and housing records to support the analysis of satisfaction and neighbourhood selection patterns.	moderate level of satisfaction, largely attributed to affordable rent, consistent water supply, and adequate security. Although there was a notable positive association in satisfaction levels between federal and state estates, the variation was not statistically significant.	other residential contexts or geographic locations. Moreover, the demographic and locational focus presents challenges in extending the findings to a wider population beyond the study area.

Source: Author (2025)

CONCLUSION AND RECOMMENDATIONS

This study has shown that both building design and material selection critically influence the overall performance, durability, and livability of Millennium Housing Estates in Lagos State. The findings indicate that inadequate spatial planning such as poor room orientation, limited ventilation, and restricted expansion flexibility negatively affects thermal comfort, privacy, and structural longevity (Johnson, 2025; Akinola et al., 2024). Furthermore, the absence of climate-responsive features like sun shading, operable windows, and ventilated stairwells often results in excessive indoor heat buildup and the emergence of informal, unsound extensions (Ojo-Fafore, n.d.). These shortcomings are compounded by the use of conventional, cost-intensive construction materials such as reinforced concrete and sandcrete blocks, which not only elevate initial costs but also increase long-term maintenance demands especially for low-income households (Oyero, n.d.; Igboekulie et al., 2022). In contrast, evidence from empirical studies reveals that alternative materials such as stabilized laterite and hybrid combinations offer economic, environmental, and thermal advantages when thoughtfully applied (Stephen, 2024; Akinwamide et al., 2022). Collectively, these findings affirm the urgent need to rethink architectural approaches in Lagos's public housing sector.

To address these issues, the study recommends several strategic actions. First, housing design in Lagos State should be guided by climate-responsive principles incorporating features such as cross-ventilation, deep eaves, and modular spatial configurations that allow for future adaptation without compromising structural integrity (Akinola et al., 2024; Johnson, 2025). Second, regulatory bodies must encourage the use of locally sourced, thermally efficient, and low-maintenance building materials by revising current standards and offering incentives for innovation in affordable housing technologies (Stephen, 2024; Akinwamide et al., 2022). Third, housing policy implementation should prioritize post-occupancy evaluation and feedback loops that empower residents to engage with the design and maintenance processes of their estates (Jegede et al., 2021; Farinmade et al., 2021). Lastly, skills development programs should be introduced to bridge the technical gap among local artisans and contractors, enabling them to competently apply context-appropriate construction methods. These interventions, if systematically enforced, will not only improve the quality and sustainability of Millennium Housing Estates but also contribute to broader urban resilience goals in Lagos and similar urban centers.

REFERENCES

[1] Dewey, A., & Drahota, A. (2016). *Introduction to systematic reviews: online learning module Cochrane Training*.

[2] Emami, A., & Sadeghlou, S. (2021). Residential satisfaction: A narrative literature review towards identification of core determinants and indicators. *Housing, Theory and Society*, *38*(4), 512-540.

[3] Errante, L. (2022, June). A Green Technological Rehabilitation of the Built Environment. From Public Residential Estates to Eco-Districts. In International Conference on Technological Imagination in the Green and Digital Transition (pp. 683-693). Cham: Springer International Publishing.

[4] Ezennia, I. S., & Hoskara, S. O. (2021). Assessing the subjective perception of urban households on the criteria representing sustainable housing affordability. *Scientific African*, *13*, e00847.

[5] Habila, J. (2023). ASSESSMENT OF RESIDENTIAL SATISFACTION AS A DETRMINANT OF NEIGHBORHOOD CHOICE AMONG RESIDENTS OF PUBLIC HOUSING ESTATES IN OWERRI, IMO STATE, NIGERIA (Doctoral dissertation).

[6] Ige, V. O., Binuyo, O. P., & Jimoh, D. A. (2017). Maintenance Practice and Occupant's Satisfaction in Public Housing Estates: An Osogbo, Nigeria Perspective. Nigerian Journal of Environmental Sciences and Technology (NIJEST) Vol, 1(2), 309-317.

[7] Kaushik, A., Singh, S., & Kapshe, M. (2025). Changing vertical wind profile and its importance for wind-induced natural ventilation in high-rise buildings–a case of Pune. Journal of Engineering, Design and Technology, (ahead-of-print).

[8] Maina, J. J. (2021). Socioeconomic and demographic predictors of residential satisfaction within public housing estates in Northern Nigeria. Covenant Journal of Research in the Built Environment.

[9] Jegede, F. O., Adewale, B. A., Jesutofunmi, A. A., & Loved, K. S. (2021, March). Assessment of Residential Satisfaction for Sustainability in Public-Private Partnerships (PPPs) Housing Estates in Lagos State, Nigeria. In *IOP Conference Series: Earth and Environmental Science* (Vol. 665, No. 1, p. 012031). IOP Publishing.

[10] Mbazor, D., Aigbavboa, C., & Thwala, W. (2024). A Review of Adequate Residential Housing Provision for Enhanced Occupants' Work Performance. International Journal of Real Estate Studies, 18(1), 66-75.

[11] MOHAMMED, B. M. (2021). IMPACT OF PROJECT QUALITY MANAGEMENT ON THE PERFORMANCE OF RESIDENTIAL ESTATES IN NORTH-CENTRAL NIGERIA (Doctoral dissertation).

[12] NKPITE, B. E. S., & ESAU, J. E. Appraising Elements of Post-Occupancy Evaluation Influencing Improvement of Residential Satisfaction in Public Housing Estates in Nigeria.

[13] Okoye, B., Olotuah, A., & Ezeji, K. (2020). Tenure Of Residents As A Determinant Of Maintenance Conditions Of Residential Buildings In Housing Development Corporation Estates In Enugu Metropolis, Nigeria. coou African Journal of Environmental Research, 2(1), 90-101.

[14] Olayiwola, O. M., & Shakede, O. P. (2020). Socioeconomic determinants of formal residential land affordability in Ibadan, Nigeria. Covenant Journal of Research in the Built Environment.

[15] Farinmade, A., Oluwo, M. D., & Avwenagha, O. Urban Residents' Housing Satisfactions In Iponri Housing Estate, Lagos, Nigeria.

[16] Ukpong, E., Akah, U., & Agbabiaka, H. (2023). Improving residential outdoor space experience in developing countries: Evidence from a housing estate in Nigeria. Cogent Engineering, 10(1), 2163570.

[17] EZEKIEL, A. E., FOLAKE, A. F., & ALLI, K. A. (2024). EVALUATION OF PUBLIC PRIVATE PARTNERSHIP IN HOUSING PROVISION IN NIGERIA: THE LAGOS STATE PERSPECTIVE. *Journal of Biodiversity and Environmental Research*.

[18] Ojo-Fafore, E. M. ASSESSMENT OF RESIDENTIAL HOUSING PROJECTS IN LAGOS STATE.

[19] Akinola, A. O., Ibem, E. O., Opoko, A. P., Oluwatayo, A. A., Aduwo, E. B., & Ugah, U. K. (2024, May). Residents' Satisfaction with Neighbourhood Socio-economic Environment of the Public Sector Employee Housing Schemes in Lagos State, Nigeria. In *IOP Conference Series: Earth and Environmental Science* (Vol. 1342, No. 1, p. 012028). IOP Publishing.

[20] Akinola, A. O., Ibem, E. O., Opoko, A. P., Oluwatayo, A. A., Aduwo, E. B., & Ugah, U. K. (2024, May). Satisfaction with Maintenance of the Public Sector Employee Housing Schemes in Lagos State, Nigeria. In *IOP Conference Series: Earth and Environmental Science* (Vol. 1342, No. 1, p. 012029). IOP Publishing.

[21] Akinola, A. O., Ibem, E. O., Opoko, A. P., Oluwatayo, A. A., Aduwo, E. B., & Ugah, U. K. (2024). Satisfaction with Housing Design Features of the Public Sector Employee Housing Schemes in Lagos State, Nigeria Using Principal Component Analysis

[22] Stephen, G. O. I. D. Indigenous Building Materials for Affordable Housing in Lagos State, Nigeria.

[23] Igboekulie, I. E., Monye, C., & Joseph, F. F. Assessment of the Effect of Building Materials Cost On Housing Development in Owerri, Imo State, Nigeria.

[24] Oyero, H. G. CHALLENGING OF HOUSING AFFORDABILITY IN LAGOS METROPOLIS.

[25] JOHNSON, M. (2025). Incorporating Neighborhood Physical Characteristics and Well-Being in Selected Public Residential Schemes of Lagos State. *UNIABUJA Journal of Engineering and Technology (UJET)*, *2*(1), 232-241.

[26] Akinwamide, D. O., Hahn, J., Paradza, P., & Aweh, D. S. (2022, January). Barriers to the Adoption of Smart Housing Concept in African Smart City Projects: Case of Akwa Millennium City. In *Conference paper*.

[27] Obioha, E. E. (2021). Mission unaccomplished: Impediments to affordable housing drive in addressing homelessness in Sub-Saharan Africa. *Social Sciences*, *10*(8), 310.

[28] Akande, O. K., Olubajo, O. O., & Ibraheem, Y. (2024). Quality and Perception of Public Housing Provision in Nigeria and Implications for Low-Income Earners.