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Case study comparison of maintenance approaches in three Nigerian theatres: Lessons for future design

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Abstract

Performing arts theatres are vital public facilities that represent cultural identity and architectural expression. In Nigeria, however, many of such structures have sunk into neglect, especially due to poor maintenance strategies originating from oversights at the design stage. In this study, we present a comparative case analysis of three Nigerian theatres; the National Theatre Lagos, the Oba Akenzua Cultural Centre Benin, and the Aminu Isa Kontagora Theatre Makurdi, focusing on the interrelationship between decisions made at the architectural design stage and subsequent long-term maintenance outcomes. Via structured interviews, check list examinations and visual surveys, data were retrieved for variables concerning site planning, material used, spatial organization, roofing systems and accessibility.

The findings indicate persistent design-related issues such as poor detailing; insufficient drainage systems; incorrect material specification; and/or inaccessibility for routine maintenance. Although the National Theatre Lagos is distressed by widespread surface weathering and complex inaccessible shapes, the Oba Akenzua Centre has better organized exterior whilst the drain and weathering issue still become a problem. Modest as it was, however, the Aminu Isa Kontagora Theatre is a poster child for adversities of critical neglect and accelerated physical decay due to lack of attention to maintainability. According to the study, maintenance-conscious designs, ranging from simple building forms, workable service areas, dataset material selection, and proper site drainage embedded in the design process can drastically limit long-term maintenance loads. The insights provide a framework for upcoming theatre design in Nigeria: through its buildings, the role of architectural decisions in ensuring sustainable building performance cannot be overemphasised.

Keywords: Building Maintenance; Public Theatres; Design Decisions; Maintainability; Case Studies; Climatic Response.

1. Introduction

Theatres also serve as cultural and architectural icons that embody and showcase the artistic expression and cultural heritage of a society. In Nigeria, these structures sometimes imbued with a striking, symbolic aesthetic double as performance settings and tourism products. Now the National Theatre Lagos, Oba Akenzua Centre Benin, and Aminu Isa Kontagora Theatre Makurdi among others are in a state of significant disrepair and are thus counterproductive to their intended purpose and symbolic status [1,2]. This phenomenon of widespread degradation is also primarily attributed to maintenance practices, as well as design-related inadequacies and lack of proactive maintenance strategies, which only serve to compound the issue [3,4].

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Previous studies on building maintenance in Nigeria have focused on cost-saving strategies and management practices [5]. These methods are good but generally fail to address the underlying causes of maintenance problems that tend to come from the design decisions taken during the conceptual and architectural stages [6,7]. According to [8], the design process is vital to the long-term performance and maintenance requirements of a building; material selection, construction techniques, and spatial configurations all affect a building's workflow and function. Thus, architects do have a pivotal function in the reduction of future maintenance loads through design that integrates durability, accessibility, and environmental responsiveness [9,10].

Maintenance issues such as poor detailing, incorrect material specification, and inaccessibility of structural components have often been linked to inadequate planning during the design stage [11,12]. Given the complex nature and substantial scale of theatre buildings, poor detailing can lead to significant maintenance challenges [13]. Furthermore, defects like spatial dead zones, inadequate drainage, and insufficient ventilation commonly affect user comfort and accelerate structural deterioration [14,15,16].

The case study theatres in this paper, the National Theatre Lagos, Oba Akenzua Cultural Centre Benin, and Aminu Isa Kontagora Theatre Makurdi, embody a variety of scales and maintenance contexts across Nigeria. By comparing the maintenance outcomes of these buildings, the research aims to reveal the extent to which architectural design has impacted on operational performance and to identify lessons for the impact on the planning and design of future theatres. The study proposes that for the various aspects of maintenance to be assessed, we need to conduct visual surveys, structured interviews and review of checklists, enabling an understanding of how form, materiality, site planning and functionality intersect to inform maintenance outcomes.

This comparison, in the end, is meant to validate the common knowledge, however wrongly it is often perceived, that design is more than aesthetics, but a process that dictates the performance and cost of the building in the long run [17]. The results will direct architects, engineers and policymakers towards a way to reduce lifecycle costs by considering maintainability in the architectural design of public theatres from the start.

2. Literature Review

2.1. The Concept of Building Maintenance

Building maintenance is an important activity in the building life cycle that focuses on improving, preserving or restoring the functionality of buildings and their appearance. According to [18] building maintenance is defined as the effort carried out to preserve the usefulness and worth of a building for its users, tenants and owners. According to [19], maintenance refers to the technical and administrative activities which are designed to enable a building to continue to perform its functions, or to restore it to an adequate condition.

There are two broad categories of maintenance, referred to as planned maintenance and unplanned maintenance (BS 3811, 1984). Planned maintenance comprises preventive (time-based or condition-based) and corrective actions, whilst unplanned maintenance relates to emergency repairs which were not previously scheduled [20]. This preventive approach can help ease long term costs and keep the essence of the building intact, driving the need for a proactive estate management plan from the earliest opportunity.

[21] posits that in order to maintain finishes or structural components or other installations, one must first understand the facility. Timely interventions planned out and executed in a structured manner with quality workmanship greatly prolong the life and performance of buildings.

2.2. Architectural Design and Maintenance Correlation

Decisions about design made in the planning process are key to a building's maintainability. According to [22], design quality defines post-occupancy performance, which consists of factors that may affect the quantity and quality of maintenance issues in the building. Unfortunately, the critical relationship between design and maintainability is often under-estimated, resulting in buildings that are smart and highly priced but have appalling maintainability characteristics [7,23].

Maintenance obligations are determined by key architectural topics, from building form to detailing and material selection and spatial organization to roof design. More sophisticated forms, for example, might elevate aesthetics but hinder access and reparability [24,25]. Similarly, not providing access routes to allow for maintenance, e.g. catwalks in theatres or accessible roofing systems, means that stages are simply neglected [15,26].

Clear evidence for these arguments lies in the case study salient findings from the National Theatre Lagos, Oba Akenzua Centre Benin and Aminu Isa Kontagora Theatre Makurdi. The state of disrepair of each theatre varied as a result of design flaws such as inadequate drainage, inaccessible roofing, and partial incorrect material specifications, demonstrating that designing is related to maintenance in the long term, and that architectural choices made initially must be preserved over time.

2.3. Maintenance Challenges in Nigerian Theatres

Despite being iconic expressions of both culture and architecture in Nigeria, theatres have suffered from neglect, functional decay and increasing maintenance costs over the years. Due to systemic lapses in maintenance, as pointed by [2] most of these buildings are in decline, [3] ascribed the decline to negligence and indifference, as well as the absence of sustainable maintenance plans, a sentiment also expressed by [4] and Art and Culture (2012) in connection with the National Theatre Lagos.

Factors contributing to maintenance issues include:

- Complex Architectural Forms: Aesthetic ambitions lead to intricate designs with minimal consideration for access or long-term upkeep [13].
- Improper Material Specification: Incompatible materials with local environmental conditions deteriorate rapidly [27].
- Poor Detailing: Incomplete or unclear design documentation causes misinterpretation during construction and eventual defects [15].
- Inaccessible Design Features: Roofs, façades, and utility systems often lack provision for safe maintenance [28].
- Environmental Factors: Harsh weather, poor ventilation, and pollution accelerate material degradation [29,30].

The case studies reveal that the National Theatre Lagos suffers from ponding due to poor drainage, the Oba Akenzua Theatre faces façade and roof damage, and the Aminu Isa Kontagora Theatre shows widespread interior and structural deterioration. These findings reinforce the need for maintenance-aware design approaches tailored to Nigeria's unique climatic, economic, and cultural conditions.

2.4. Theoretical Framework: Design for Maintainability

The research is grounded in a theoretical framework based on Design for Maintainability (DfM), an approach in which design for maintainability is vividly considered from the beginning of the conceptualization phase. DfM promotes user accessibility, material durability, responsiveness to environment, and the ability to be adapted for future needs [9,10].

The proposed framework is modelled on Syce [5] and [14] studies and promotes such maintenance-optimal design solutions that favour modular systems, flexible components, and clear detailing. According to [28], the relationship between design and maintenance is inverse: as the quality of the design increases, the demand for maintenance decreases.

3. Methodology

This study adopted a qualitative comparative case study approach to analyze maintenance challenges and practices in three prominent Nigerian theatres: the National Theatre Lagos, the Oba Akenzua Centre Benin, and the Aminu Isa Kontagora Theatre Makurdi. The aim was to draw lessons from their maintenance conditions to inform future design strategies that can mitigate maintenance burdens from the conceptual phase.

The research was exploratory and comparative in nature, focusing on the relationship between architectural design decisions and resulting maintenance outcomes. Data was collected through a combination of field surveys, structured interviews, and checklist-based assessments. The study utilized purposive sampling to select case study sites and informants due to their significance, accessibility, and relevance to the research objectives.

3.1. Case Study Selection Criteria

The selection of case studies followed purposive sampling based on the following criteria:

- Functionality: All selected buildings function as performing art theatres.
- Ownership: All are publicly owned and serve state or national functions.

- Geographic Representation: Selected from different geopolitical zones in Nigeria (South-West, South-South, and North-Central) to capture a range of climatic, cultural, and usage conditions.
- Architectural Significance: Each building holds symbolic architectural and cultural relevance in their respective regions.

These criteria ensured that the theatres studied were comparable in purpose while allowing for variations in design and context that might influence maintenance dynamics.

3.2. Data Collection Methods

To gain a comprehensive understanding of the maintenance issues and their links to architectural design, a triangulated data collection approach was employed. This included:

3.2.1. Visual Survey

Field observations were conducted to document physical deterioration, structural inefficiencies, and visible defects. Particular attention was given to areas such as roofing systems, façade treatments, material degradation, and circulation spaces. Photographs supported these observations.

3.2.2. Checklist Assessment

A structured checklist was developed to evaluate key building elements with respect to maintenance. The checklist covered:

- Site planning and landscaping
- Spatial organization
- Structure and materials
- Building aesthetics
- Accessibility for maintenance

This tool provided a standardized basis for comparison across the three case studies, ensuring consistency and objectivity in evaluating maintenance-related design features.

3.2.3. Structured Interviews

Interviews were conducted with facility managers, technical staff, and maintenance personnel at each theatre. The interview schedule focused on:

- Types and frequency of maintenance interventions
- Challenges encountered in executing maintenance
- Suggestions for design improvements to minimize maintenance burden
- This provided experiential insight that complemented the physical assessments.

3.3. Data Analysis Procedures

Analysed thematically, the data obtained were recategorized based on their similarities and to establish correlations between design choices and operational performance. Comparative analysis was used to synthesize the visual and checklist data, whilst content analysis was used to analyse and group interview responses into emergent themes. Cross-case synthesis was performed to compare and contrast the three theatres and to facilitate generalizable conclusions.

Triangulation of findings allowed for the cross-checking of outcomes from observational, documentary, and interview data during the analysis process, which contributed to the robustness of our conclusions. These recommendations were phrased in terms relevant to architects such as material specification, spatial layout, construction methods, and environmental adaptability.

3.4. Case Study Analysis

An investigation to study the management of theatres is imperative because across Nigeria these structures have become neglected.

3.4.1. National Theatre, Lagos

The National Theatre Lagos, once a classic piece of architecture, is reported to be a "symbol of decay and decadence" owing to "persistent neglect" [31]. Many of these problems have been attributed to returning to the drawing board, bad architectural/structural design, unsuitable selection of materials and difficulty in construction have been incurring charges on maintenance and depreciation in the years to come [8,5,9,10]. This section discusses the National theatre of Lagos extensively with respect to its design and maintenance results.

Site Planning and Landscaping

Extensive hard and soft landscaping elements were part of the National Theatre's site planning. In a variety of access zones, compact concrete pavements and interlocking tiles were used for these parts, which marked their sustainability and minimized the need for frequent surface maintenance. However, the site displayed poor drainage as shown in Figure 1, which led to ponding, particularly after rain, contributing to the degradation of paved surfaces and increasing the cost of landscape maintenance.

Figure 1 Poor drainage resulting in the separation and disjoint of access route

Lawns and ornamental trees, landscaping elements, have been poorly maintained. High maintenance was attributed to the lack of simplified, low maintenance landscape design approaches such as use of gravel or limited vegetation. In addition, pedestrian routes were not always properly defined, resulting in zones of random usage and a higher degree of wear.

Spatial Organization and Access

The theatre adopts a radial plan consisting of a central performance zone, around which the various support spaces radiate. Although the major entrance and circulation cores were well-formed, the internal plan has several functional "dead zones", small and poorly defined spaces that encourage neglect and probably vandalism [Figure 2].

Figure 2 Poor state of maintenance within dead zones at the National Art Theatre, Lagos. [Source: Author's survey, 2014]

The separation of functional areas leads to limited physical and visual continuity. For example, service routes do not lead directly to mechanical and roofing components, making it difficult to perform maintenance operations. Simply accessing high ceilings and facade surfaces introduces significant routine maintenance challenges, corroborating Ramly's (2007) findings that inadequate accessibility design introduces costs for increased maintenance.

Structural Design and Material Usage

The National Theatre is a brutalist concrete structure best known for its floating curved roof and monolithic appearance. The materials are precast concrete panels, marble floor finishes, and wooden decorative elements. The use of concrete is, no doubt, a durable option; however, many joints are affected by water infiltration resulting from poor detailing and flat roof design, causing wear to structures and degradation of ceilings (Figure 3).

Figure 3 Covering of roof felts with damp proof membrane due to high rate of leakages

Ideally the roof was a high-pitch slope that would drain better [30], but instead the roof includes flat with complex profiles that collect water, causing leaks and damage. Ceiling boards and exterior paints, for example, have had to be replaced more than once owing to flaking and decay as indicated in Figure 4, which suggests either poor initial selection of materials or an environmental incompatibility. This is indicative of [27] and [32] worries on material properties not being aligned with the demands of the environment.

Figure 4 Replacement of ceiling materials as a result of degradations

Finally, there is no modular or flexible construction component such as bolted steel assemblies, so that repair and replacement are invasive and expensive.

Key Maintenance Challenges

The key challenges facing the National Theatre stem from a combination of design oversights and environmental exposure. They include:

Inadequate drainage around the building and on the roof, leading to water accumulation and structural damage [Figure 5].

Figure 5 The deterioration of exterior walling material

Poor accessibility to high or concealed areas for maintenance, including roof and ceiling systems.

Material failures due to environmental exposure, such as sun-induced fading, rain damage, and corrosion, particularly affecting ceiling boards, external wall paint, and wooden decoration [Figure 6].

Figure 6 Damaged suspended ceiling rails with visible rust

Neglect of non-utilised zones, which become dumping grounds or decay hotspots **[Figure 6].**

Figure 7 Poor state of maintenance within dead zones

Complex roof forms that hinder maintenance and promote leakage.

In summary, while the National Theatre was conceived as a symbolic structure, inadequate attention to maintainability during design has led to significant operational and financial challenges. Future designs must prioritize accessible detailing, durable and context-appropriate materials, simplified landscape strategies, and functional zoning to reduce such burdens.

3.4.2. Oba Akenzua Cultural Centre, Benin

Benin's Oba Akenzua Cultural Centre is a girding cultural and artistic base in southern Nigeria. This analysis assesses the maintenance challenges and architectural effectiveness of the centre as part of a comparative case study with the National Theatre Lagos and Aminu Isa Kontagora Theatre Makurdi. Demonstrating the implication of sound in adequate integration with the environment for reduced maintenance across architectural history [1,2,4,5].

Architectural Characteristics

The Oba Akenzua Cultural Centre was designed with relatively serviceable architecture; detailing of open ceilings and cantilevered facades to avoid direct solar gains (Figure 8). The spatial organization is simple, with a clear separation between service and performance areas. Yet, aspects of the centre, particularly façades and rooflines, are vulnerable to the weather, suggesting failings in climatic responsiveness, despite façade cantilevers.

Figure 8 Display of some of the building materials used

Unlike the National Theatre Lagos, which to some extent plays monuments in the identity formation stake as well need a headquarters, this centre dispenses a mutilated utilitarianism that, although cheaper to erect, establishes limited aesthetic value as it is devoid of cultural affinity.

3.4.3. Material Specifications and Façade Durability

Oba Akenzua Cultural Centre uses standard concrete block walls, basic aluminium roofing, and minimal interior/exterior finishes. However, distress of these materials has been detected, most prominently on the outer walls and roofing elements (Figure 9).

Material specification is a very crucial aspect of the maintenance profile of public buildings [27]. In this instance, the walling materials seem vulnerable to environmental degradation, suggesting a misalignment between material properties and climatic conditions in Benin.

Surface flaking and discoloration has occurred, consistent with [29] on UV-related degradation and with [33] on the effects of atmospheric pollution, due to exposure to intense solar radiation and moisture. Cantilevered facades can be employed to attempt at periphery some of these effects, but the durability of the material envelope as a whole is not tight enough to ensure long-term performance in a high-humidity environment.

Drainage and Roofing Conditions

The Oba Akenzua Centre has faced major obstacles in drainage and roof design. Even though drainage pipes can be found at various sites, roof leakages are still significant [Figure 9], which indicates that detailing might be improper, or slope design was not sufficient, as pointed out by [3]. They avoided complex roof geometry, but even the simplified roofscape still didn't encourage effective shedding of water.

Figure 9 Deterioration of walling material

These shortcomings indeed confirm the doubts mentioned by [15,28] stressing the importance of proper architectural detailing particularly roof-water discharge. Rainwater accumulation and intrusion are also strong indicators of inadequate pitch gradients or inadequate drainage.

3.4.4. Aminu Isa Kontagora Theatre, Makurdi

General Design and Usage

Makurdi's Aminu Isa Kontagora Theatre is a multipurpose cultural center primarily housing theatrical performances, civic events, and educational or governmental functions dotingly. The spatial plan is rather modest compared to other national theatres, illustrating its regional character. The theatre consists of a central performance area that opens out into a tiered concrete seating, as well as multi-purpose rooms that include dressing rooms and administration offices. Combining the local climatic factors, its open-air amphitheatre design has partial roofing in some parts, mostly around the stage and central entrance, in order to partially shield from direct sun rays and rain.

The building maintains a simple design language and aesthetic focusing on the function. Types of materials noted included cement for walls and floors, aluminium roofing sheets, timber framing in some sections. Architectural motifs of the local neighbourhood are found in subtle detailing and in the layout and plan of the small theatre, despite its simple form

Areas of Deterioration

The theatre has likely experienced significant wear-and-tear over its many structural and aesthetic elements. A major concern observed is the flaking and peeling of paints on walls, especially around areas that were previously persistently leaked bout due to entry of moisture and poor waterproofing detailing as shown in Figure 10.

Figure 10 Deterioration of some areas within the theatre

Door and window systems show physical damage, corrosion on metal parts, blasting of external surfaces and decay of exposed finishes, all indicative of mid to low performance of materials with respect to regional environmental factors, and more so in withstanding severe sun light and rainfall.

Issues of Accessibility and Upkeep

Accessibility for both users and maintenance personnel is a critical issue at the theatre. Notably, several areas around the building, including backstage and rooftop components, lack proper access routes. This deficiency hinders regular inspections and emergency interventions, ultimately contributing to the progressive decline of the facility. The absence of clear demarcated paths and service zones further complicates routine upkeep efforts.

In terms of upkeep, limited funding and poorly coordinated management contribute to the inadequate servicing of electrical, plumbing, and ventilation systems. The mismanagement of resources, improper material storage, and lack of a comprehensive maintenance schedule exacerbate the degradation of critical components.

Spatial Organization

The design of dead zones and also the non-utilized areas give room for poor maintenance practice and vandalistic attitudes by users as reflected in Figure 11

Figure 11 Poor maintenance of nonutilized and dead spaces

3.5. Cross-Case Comparison and Emerging Patterns

Analysing the three case studies; National Theatre Lagos, Oba Akenzua Cultural Centre Benin, Aminu Isa Kontagora Theatre Makurdi, and comparative study elicits common trend(s) as to emergence and handling of architectural design maintenance challenges as shown in Figure 12 below. While each of the theatres has its own specific contextual and architectural conditions, a number of cross-cutting themes arise that build an evidence-based argument for the deep connection between design decisions and long-term building performance.

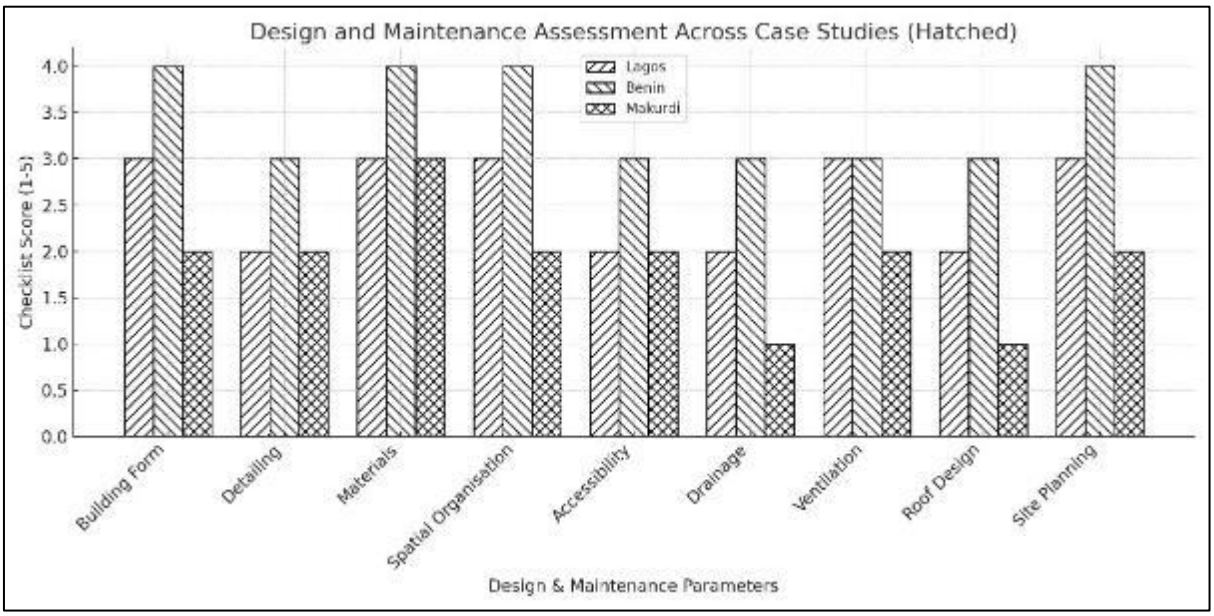

Figure 12 Comparative analysis of the three theatres using various parameters

3.5.1. Site Planning and Landscaping

In all three theatres, site planning and landscape design deficiencies led to considerable maintenance responsibilities. The National Theatre Lagos where poor drainage planning had led to ponding and this has also been the case with the Makurdi theatre observed with blocked drainage and exposed drainage channels. In comparison, while the Oba Akenzua Centre featuring a more intentional zoning of the landscape. its maintenance was adversely affected by the lack of provision for access, for sub-surface services.

These trends indicate a failure to assess site hydrology properly at the outset and a lack of integrated landscaping solutions that leads to the gradual degradation of both theatre exteriors and supporting, adjacent infrastructure.

3.5.2. Spatial Organization and Dead Zones

All the case studies showed evidence of 'dead zones' of areas not used or underutilised which often became an afterthought and filled with debris and showing signs of physical decay. Corridors and service access points were poorly maintained or inaccessible Road access to both the National Theatre Lagos and Aminu Isa Kontagora Theatre.

3.5.3. Material Specification and Durability

The three theatre designs, although based on different material palettes, faced similar problems as a demonstration of environmental incompatibility. Some materials were subjected to rapid degradation due to moisture infiltration and UV exposure in Makurdi and Lagos due to the use of inappropriate paint and wood elements. Such issues affirm observations by [27] and [34], who hold that improper selection of materials, particularly in respect to environmental threat factors, increases the demand for maintenance [36, 37].

The performance of this part of the building was relatively better, as most wall finishes are sturdy and some weather-resilient materials were used. However, the inconsistency of material quality between the three cases suggests systemic gaps in maintenance-informed design.

3.5.4. Roof Design and Accessibility

Complex roof forms and insufficient access provisions were common features negatively impacting maintenance operations. The National Theatre Lagos, in particular, lacked roof access and displayed evidence of leaking due to poor drainage detailing. Similar observations were made in Makurdi where water ingress from the roofing system had caused interior damage.

These various researchers [15,30] both highlighted how poor roof pitch and detailing, especially in flat roofs lead to persistent water management issues, a phenomenon consistently observed in this study.

3.6. Maintenance Culture and Facility Management

The physical design issues were clear, but what emerged from interviews was a more pervasive cultural problem: an endemic failure to plan for proactive maintenance. Each theatre was indicative of a reactive rather than preventative maintenance regimes. This discovery supports claims made by [4] and [36] reports of the systematic target neglect of public theatre infrastructure in Nigeria.

Facility managers said widespread absence of maintenance-friendly design features, including demountable elements, clear service routes and durable finishes, remained significant impediments to their work. This assertion was found to be an indispensable aspect of participating in the design stage work process, corroborated by [35] for the assessment of the facility managers' involvement.

4. Summary of Emerging Patterns

- The cross-case comparison illustrates several recurring deficiencies:
- Neglect of environmental compatibility in material selection, contributing to premature aging.
- Poorly designed access points for maintenance, particularly in roofing and high interior zones.
- Improper spatial organization, leading to underutilized zones that become neglected.
- Flat or complex roof forms prone to leakage, especially where detailed drainage solutions were lacking.
- Reactive maintenance culture, exacerbated by the lack of design provisions that support efficient maintenance.

These trends collectively support the assertion made by [7] and [6] that many maintenance problems emanate from the drawing board. Maintainability should become a primary goal in future theatre designs through choices of form, access, materials and responsiveness to the environment.

5. Discussion

Based on the analysis of the maintenance performance recorded in the three Nigerian theatres under review, it becomes evident that a vital link between architectural design and maintenance lies at the essence of any public theatre's operational life, operational maintenance and efficiency performance in Nigeria. The areas of discussion are the three architectural factors that determine maintenance performance, design and theatre longevity, and strategic planning for future facilities.

5.1. Architectural Determinants of Maintenance Performance

Through the case studies, it was evident that the choices made during architectural design have a significant impact on the amount of intervention needed throughout a theatre's lifecycle. Design choices like building form, material specification, detailing, and accessibility were found to facilitate or inhibit maintenance. At the National Theatre Lagos, complex building forms and poor drainage detailing have been recurrent problems leading to phenomena such as water leakage and ponding. In similar manner, the difficult access to roof tops and key infrastructure delayed maintenance, contributing to the increase of wear.

The site planning and organization of Oba Akenzua Centre to a great extent, was better which allowed for easy access and maintenance access. Nevertheless, the early degradation of facades and roofing material was due to the use of incorrect materials and poor environmental response (sun and wind exposure). Maintenance is often neglected when accessibility and detailing are not taken into consideration during design [15,37]. Using three different theatres, these were validated in an interlinked manner, easily showing the crucial relationship between architectural foresight and development performance.

5.2. Impacts of Design Decisions on Theatre Lifespan

Early decisions, especially with regards to the design, greatly determine the lifecycle and performance of the theatres. Poorly articulated spatial organization, as evident in Makurdi Theatre, created dead zones and low use areas, which deteriorated rapidly. This corresponds with [14] and [13] who pointed out that spaces that are unused or inaccessible are often neglected within maintenance regimes.

Lifespan also depends on material choice. For example, the selection of low-durability materials to line high-traffic areas, including the wood panelling responsible for enlivening the National Theatre, proved problematic when exposed to the rigours of the human experience: Likewise, internal materials without proper shading or protection were more susceptible to deterioration, reconfirming previous findings by [29] and [32] about the environmental sensitivity of materials. Furthermore, inflexible-built theatres, one that does not have demountable elements or modular roof systems are very challenging and costly to modify or repair. This reinforces the importance of adaptive design strategies and the theories of design-for-maintenance as highlighted by [3].

5.3. Implications for Future Design of Public Facilities

The lessons from this comparative study point toward clear recommendations for future public facility designs:

- Design for Accessibility: All components, especially those subject to frequent wear, should be designed to be easily accessed for maintenance. This includes catwalks, roof access routes, and utility zones [15,26].
- Material Selection Based on Performance: Materials should be selected not just for aesthetics but based on durability, climatic compatibility, and ease of replacement. [32] emphasizes robust, low-maintenance materials for public use.
- Simplified and Functional Forms: Complex architectural forms that serve symbolic purposes must be weighed against their long-term maintenance demands [24,25]. Simpler forms generally facilitate drainage, cleaning, and repairs.
- Environmental Consideration in Design: As shown by [7], accounting for local environmental conditions (solar exposure, humidity, wind) during the design phase reduces the rate of material degradation and maintenance frequency.
- Flexible and Modular Systems: Employing modular structural and envelope systems allows for efficient replacement and adaptability over time. This approach aligns with sustainable and cost-effective facility management strategies [3,38].

Integration of Maintenance Planning from Inception: Architects and engineers must embrace a maintenance-conscious mindset during the early design stages, embedding provisions that anticipate wear and enable preventative strategies [9,11].

Ultimately, the sustainability and operational efficiency of public theatres and indeed all public buildings depend not only on the budget allocated post-construction but on strategic design decisions made from inception. By integrating maintenance considerations into design, it becomes possible to reduce long-term costs, extend facility lifespan, and enhance user satisfaction.

6. Conclusion and Recommendations

This study examined the maintenance challenges of three major Nigerian performing art theatres; National Theatre Lagos, Oba Akenzua Cultural Centre Benin, and Aminu Isa Kontagora Theatre Makurdi to identify how architectural design decisions influence long-term building upkeep. The findings underscore the critical need for maintenance-oriented design principles that address functionality, durability, and ease of access for upkeep activities. The lessons drawn from the condition and performance of these theatres form a crucial basis for shaping future theatre designs in Nigeria and similar contexts.

6.1. Summary of Findings

The comparative analysis of the three case studies revealed several recurring maintenance-related issues:

- Poor detailing: Incomplete and ambiguous architectural detailing (e.g., in drainage systems and façade finishes) led to significant deterioration, especially in roofing systems and wall cladding.
- Inaccessible components: Inadequate provision for maintenance access, such as lack of catwalks or roof ladders, made upkeep of high interior spaces and roof areas difficult or impossible.

- Inappropriate material specifications: Theatres were often built with materials unsuited to their environmental conditions, leading to deterioration from moisture, solar radiation, and atmospheric pollutants.
- Neglected spatial design: Dead zones and poorly utilized spaces led to neglect and higher risks of vandalism or decay, reflecting a lack of foresight in spatial planning.
- Complex forms and aesthetics: While the theatres are architecturally iconic, the complexity of their designs introduced challenges for practical and cost-effective maintenance.
- Environmental insensitivity: Many materials and construction techniques did not align with local climate conditions, resulting in faster degradation.

Recommendations for Maintenance- Oriented Design

To reduce future maintenance costs and extend the functional lifespan of theatres, this study recommends the following design strategies:

- Integrate Maintenance Access into Design: Incorporate catwalks, roof ladders, service shafts, and modular wall panels for ease of inspections and repairs.
- Simplify Building Forms: Opt for geometric simplicity and structural clarity that balance aesthetics with accessibility for maintenance
- Prioritize Material Durability: Specify robust, climate-appropriate materials with proven resistance to UV rays, moisture, and human traffic. Selection should consider physical, chemical, and biological durability.
- Enhance Drainage and Roofing Solutions: Use pitched roofs with clear water runoff paths and avoid flat roofs unless technically justified with proper waterproofing and drainage.
- Design for Flexibility: Employ modular construction systems and demountable elements that can be upgraded or replaced without major structural disruption.
- Site and Landscape Responsiveness: Site planning should promote self-draining landscapes, low-maintenance paving systems, and clear access routes around the structure.
- Educate on Maintainability: Embed maintenance education in architectural curricula and professional practices to cultivate a generation of design professionals who value long-term building performance.

Suggestions for Future Research

While this study has provided foundational insights into maintenance-oriented theatre design, several areas require further exploration:

- Post-occupancy evaluations of new theatre designs that have implemented maintenance-focused features should be conducted to measure real-world effectiveness.
- Development of a quantitative maintenance-cost model for public theatres to support lifecycle costing during design.
- Comparative studies across different climates in Nigeria to understand how regional environmental factors affect material selection and design response.
- Policy frameworks and incentives for incorporating maintainability into public building procurement processes.
- Digital design tools integration, such as BIM (Building Information Modeling), to simulate maintenance scenarios during design development.

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