ER Environmental Review Journal

Volume 11 No.2, 2026.
ISSN:1118-7190

Disappearing Facades: Architectural Heritage Loss and Urban Transformation on Lagos Island, Nigeria: An Archival-GIS Analysis (2000-2025)

[1]Onyelukachi Nneoma IKE-AKUDE
Email: ike-akude.onyelukachi@dou.edu.ng
ORCID id: 0009-0000-6126-3101

[2*]Raphael Oshiobugie SADO
Email: ro.sado@unizik.edu.ng
ORCID id: 0009-0008-2483-2406

[3]Edith Ogechi CHIKWENDU
Email: eo.chikwendu@unizik.edu.ng
ORCID id: 0009-0008-0831-1603

[1]Department of Estate Management, Dennis Osadebay University, Asaba, Delta State, Nigeria
[2*,3]Department of Estate Management, Nnamdi Azikiwe University, Awka, Anambra State, Nigeria

[2*]Corresponding Email: ro.sado@unizik.edu.ng

ABSTRACT

The architectural heritage of Lagos Island-a historically rich urban landscape that includes pre-colonial Yoruba settlements, colonial administrative buildings, and a significant concentration of Afro-Brazilian returnee structures-is currently facing rapid and largely unrecorded deterioration due to commercial redevelopment and pressures from the speculative land market. This research utilizes an integrated archival-GIS comparative methodology to systematically document, quantify, and analyze the loss of architectural heritage across four historically important areas of Lagos Island-Marina/Broad Street, Campos Square/Olowogbowo, Isale Eko, and Ebute Ero-over a span of 25 years (2000-2025). By combining archival photographs, historical maps, planning documents, and field observation checklists with multi-temporal GIS land use analysis, the study establishes a comprehensive baseline of heritage feature prevalence in 2000 and quantifies the documented loss by 2025 across a systematically sampled dataset of 780 building units. The findings indicate that 56.4% of buildings showcasing traditional architectural features in 2000 had lost those features by 2025, with Zone A (Marina/Broad Street) experiencing the most significant loss at 87.5%. Feature-level analysis highlights ornamental ironwork (-80.0%), arcaded verandas (-78.2%), and decorative stucco facades (-73.5%) as the most endangered architectural elements. An archival comparison between historical photographs and current field documentation verifies the systematic disappearance of Afro-Brazilian architectural styles in Campos and Olowogbowo, areas of international heritage importance. The study illustrates that the loss of architectural heritage in Lagos Island follows a spatially structured gradient associated with commercial development pressures, and that the current governance frameworks are insufficient to manage or monitor this process. It concludes with a tiered policy framework-including emergency designation for critically degraded areas, heritage conservation area controls for high-risk zones, and GIS-based monitoring systems for moderate-risk areas-oriented toward integrating architectural heritage into Lagos's land administration and urban planning systems.

Keywords: Architectural heritage; Afro-Brazilian architecture; archival GIS; Lagos Island; heritage loss; urban transformation; historic urban landscape

1.0 INTRODUCTION

Architecture serves as the most prominent medium through which cities document their histories. When historic structures are either demolished or stripped of their essential characteristics, cities do not simply forfeit physical buildings-they forfeit invaluable repositories of cultural memory, identity, and historical documentation. In Lagos Island, Nigeria, this loss is happening at an increasingly rapid rate, propelled by the intersection of intense commercial redevelopment pressures (Ike-Akude et al., 2026), inadequate institutional heritage protection, and a land market where historically significant buildings are economically undervalued in comparison to their potential for redevelopment.

The architectural heritage of Lagos Island holds exceptional importance within the urban context of West Africa. It features a unique chronological and stylistic layering that is rare on a global scale: pre-colonial Yoruba compound settlements in Isale Eko; colonial-era administrative and commercial edifices along Marina and Broad Street; and, most notably, a significant concentration of Afro-Brazilian architecture in Campos Square and Olowogbowo-the built legacy of freed enslaved individuals who returned from Brazil to Lagos in the 19th century (Ike-Akude et al., 2026), bringing with them Portuguese colonial construction techniques, ornate stucco craftsmanship, and distinctive spatial forms such as arcaded verandas, internal courtyards, and intricate ironwork. These Afro-Brazilian buildings not only serve as architectural artifacts but also as tangible evidence of a diasporic culture and a complex history of transatlantic exchange (Kelouaze, 2022).

In spite of their importance, these structures face significant threats. Field observations and comparisons with archival photographic records indicate systematic alterations, modifications, and demolitions of heritage buildings throughout Lagos Island. Unique facades are being removed or obscured, courtyard layouts are being disrupted, timber components are being replaced with modern materials, and entire building units are being demolished to accommodate commercial development. However, this transformation has largely occurred without systematic documentation, quantitative monitoring, or an institutional response that is commensurate with its scale and speed.

Existing research on the architectural heritage of Lagos Island tends to focus on qualitative descriptions or historical narratives (Adewumi, 2022; Kelouaze, 2022). Although these contributions hold value, they fail to provide the quantitative evidence necessary for evidence-based policy-specifically, systematic measurements of the rate, spatial distribution, and typological characteristics of heritage feature loss over time. The lack of such evidence has led to what Labadi et al. (2021) refer to as a policy environment where heritage conservation in Nigerian cities remains reactive, underfunded, and institutionally marginalized.

This study seeks to fill this gap by employing an archival-GIS comparative methodology to document and quantify the loss of architectural heritage in Lagos Island from 2000 to 2025. By integrating archival photographs, historical maps, GIS land use analysis, and systematic field observations across 780 sampled properties in four heritage-significant zones, it produces a systematic, spatially explicit, and statistically grounded account of architectural heritage degradation in Lagos Island. In doing so, it lays the empirical groundwork for urgently needed planning interventions and contributes to the methodological advancement of urban heritage studies throughout the Global South.

Building on this rationale, the study is guided by four research objectives: (i) to quantify the change in architectural heritage features across the study zones between 2000 and 2025; (ii) to compare the rate and pattern of heritage retention and loss among the four zones; (iii) to characterize the temporal and spatial pattern of land-use transformation across the same period using multi-temporal satellite imagery; and (iv) to examine the statistical association between proximity to commercial redevelopment pressure and the extent of heritage-feature loss.

2.0 LITERATURE REVIEW

The review that follows is organized around a conceptual sequence linking heritage significance to governance response: Section 2.1 establishes the historical and cultural significance of Lagos Island's Afro-Brazilian and colonial-era architecture; Section 2.2 reviews archival-comparison methodologies for measuring the physical alteration and demolition through which that significance is eroded; Section 2.3 reviews GIS-based approaches to spatial monitoring of that erosion; and Section 2.4 reviews the governance and policy responses (or lack thereof) to documented heritage loss. Redevelopment and land-market pressure-the proximate driver most often invoked in this literature-is discussed qualitatively throughout, since a formal econometric treatment of land and rental markets is outside the scope of the present paper and is developed separately in Ike-Akude et al. (2026).

2.1 Afro-Brazilian Architecture in Lagos Island: Historical Significance and Heritage Status

The Afro-Brazilian architectural heritage of Lagos Island represents one of the most architecturally unique and historically important heritage landscapes in sub-Saharan Africa. Between roughly 1835 and 1900, numerous freed enslaved Brazilians-many of whom were of Yoruba descent-returned to Lagos after their manumission and the emancipation of enslaved individuals in Brazil. They brought with them architectural expertise, construction skills, and spatial preferences influenced by Portuguese colonial architectural styles (Kelouaze, 2022). The resulting built environment, primarily located in the Campos and Olowogbowo districts, is distinguished by elaborate stucco facades, ground-floor colonnades with arcades, symmetrically arranged elevations, internal courtyards,

decorative ironwork balustrades, and hipped roofs that overlay traditional Yoruba spatial configurations.

Scholars have recognized the Lagos Afro-Brazilian structures as globally significant representations of a diasporic architectural culture, comparable in historical relevance to the Afro-Brazilian heritage found in Salvador de Bahia (a UNESCO World Heritage Site) and the Creole architecture of the West African returnee community in Freetown (Konadu and Essien, 2025). Obaitor et al. (2024) note that there were over 120 surviving Afro-Brazilian buildings on Lagos Island as of the early 2000s, although this count is now considerably outdated due to the rapid pace of subsequent changes. ICOMOS Nigeria has consistently highlighted the Lagos Island Afro-Brazilian district as a key area for heritage conservation, yet formal national or international recognition remains elusive.

These buildings can also be situated within a wider analytical context of urban heritage in Nigerian cities, in which their cultural importance is inextricably linked to the social histories they represent-including transatlantic migration, the architecture of freedom, and the emergence of the Lagos merchant class. This viewpoint emphasizes the necessity of viewing heritage loss not simply as architectural decline but as the obliteration of complex historical narratives that are embedded in the built environment. The racialized politics of style embedded in these buildings-in which Afro-Brazilian returnees appropriated and adapted colonial architectural vocabularies to assert a distinct diasporic identity within Lagos Colony-has also been traced in detail for Afro-Brazilian-influenced mosque architecture of the same period (Teriba, 2020).

2.2 Archival Comparison as a Methodology for Heritage Loss Documentation

Archival comparison-the systematic juxtaposition of historical visual and cartographic records with current field documentation to identify and measure change in built environments-has a well-established tradition in architectural history and urban morphology research. Its application to heritage loss quantification represents a productive methodological evolution that combines the interpretive richness of archival research with the spatial precision of GIS-based analysis.

Adewumi (2022) demonstrates the utility of this approach in their analysis of Zaria Old City, Nigeria, where the integration of colonial-era maps, archival photographs, and current GIS data enabled precise quantification of heritage building loss over a 50-year period. Their findings show that over 40% of documented heritage buildings had been demolished or substantially altered-provide a methodological precedent directly relevant to the present study's analytical design.

Ripp and Rodwell (2021) elaborate on the theoretical basis of archival-GIS integration, arguing that such approaches are essential for operationalizing the UNESCO Historic Urban Landscape

recommendation's (UNESCO, 2011) requirement that cities develop 'knowledge and planning tools' for heritage management. Generating spatially referenced, temporally comparable datasets of heritage building condition, archival-GIS analysis enables the transition from descriptive heritage surveys to predictive monitoring systems capable of informing proactive planning interventions. In West Africa, comparative archival methods have been utilized to document urban morphological changes in cities such as Accra (Gyamera et al., 2022). These methods consistently uncover patterns of gradual yet significant heritage loss driven by market forces, governance shortcomings, and neglect. Collectively, these studies demonstrate that systematic documentation of heritage features, based on archival baselines, is both methodologically viable and analytically essential for effective heritage governance in rapidly urbanizing cities across Africa (Afriyie et al., 2020).

Nevertheless, there are notable limitations in the current archival comparison studies. Many of these studies depend on incomplete or inconsistent archival records, which restricts temporal accuracy. Few of them combine archival visual comparisons with econometric analyses of market influences. Furthermore, most studies concentrate on individual buildings or small clusters, rather than conducting the zone-level, multi-district analyses necessary for policy-relevant quantification at the municipal level. This study seeks to overcome these limitations through systematic sampling, triangulation of multi-source data, and integration with the econometric analysis of the land market presented in the accompanying paper.

2.3 GIS in Heritage Documentation and Urban Morphology Studies

Geographic Information Systems have revolutionized the ability of researchers and planners to document, analyze, and monitor built heritage at significant scales. In particular, the analysis of multi-temporal satellite imagery facilitates the identification of land use changes, building demolitions, and urban densification with a spatial precision that traditional field survey methods cannot achieve at the city or district level (Forget et al., 2021). Tang et al. (2022) illustrate that heritage structures can be recognized and their conditions assessed through a combination of very-high-resolution satellite imagery and machine learning classification algorithms. This methodology is becoming increasingly accessible to researchers in African cities via platforms such as Google Earth Engine and the Copernicus programme. Although the current study utilizes traditional supervised classification instead of machine learning techniques, it establishes a methodological foundation that could be easily improved with such tools in subsequent monitoring cycles.

Obaitor et al. (2024) employ GIS-based land use change detection to analyze gentrification dynamics in informal settlements in Lagos. They demonstrate that spatial analysis tools can effectively

identify areas undergoing rapid transformation and forecast future vulnerability patterns based on existing trends. Their approach directly informs the zonal vulnerability framework used in the policy analysis of this study.

Recent academic work has also emphasized the potential of participatory GIS and community heritage mapping as means to engage residents in the documentation of heritage. This is particularly relevant in cities like Lagos, where community knowledge of heritage buildings and their histories may significantly surpass official records (Oladeji et al., 2022). While participatory methods were not included in the current study, they represent a valuable avenue for future research that could enhance and validate the archival-GIS documentation presented herein.

2.4 Heritage Governance Failure and the Policy Landscape

The degradation of Lagos Island's architectural heritage cannot solely be blamed on market dynamics; it is indicative of systemic shortcomings in heritage governance, planning regulations, and institutional collaboration. Labadi et al. (2021) highlight the division of responsibilities among various agencies-including the National Commission for Museums and Monuments (NCMM), the Lagos State Ministry of Physical Planning and Urban Development (LASG MPPUD), and local government authorities-as a significant barrier to effective heritage preservation, resulting in regulatory voids that developers frequently take advantage of.

The National Commission for Museums and Monuments Act (Chapter N18, Laws of the Federation of Nigeria 2004) establishes the legal framework for heritage protection at the federal level; however, its implementation concerning urban architectural heritage on Lagos Island has been erratic and predominantly reactive. There is no official designation of a heritage conservation area for the Campos/Olowogbowo Afro-Brazilian district, despite its acknowledged international importance. Adewumi (2022) contends that in the absence of such designation, bolstered by GIS-based monitoring and enforceable development regulations, conservation initiatives are likely to remain merely symbolic rather than genuinely effective.

A comparative analysis with peer cities offers valuable insights for reform. The experience of Accra with the designation of James Town as a heritage district illustrates both the possibilities and the constraints of formal designation in the absence of sufficient monitoring and enforcement capabilities (Gyamera et al., 2022). Similarly, Zanzibar's Stone Town, recognized as a UNESCO World Heritage Site, exemplifies the difficulties of reconciling conservation goals with development pressures, even under international designation frameworks (Jokilehto, 2017). These comparative examples emphasize that while formal designation is essential, it is inadequate without cohesive monitoring systems,

community involvement, and economic incentives for development that aligns with conservation efforts.

3.0 METHODOLOGY

3.1 Research Design

This research utilized an archival-GIS comparative research design that integrates three main methodological approaches: (i) a systematic archival documentation of heritage features derived from historical photographs, maps, and planning records; (ii) multi-temporal GIS land use change detection through satellite imagery; and (iii) a systematic field observation of the current presence of heritage features across a stratified sample of building units. This mixed-evidence methodology facilitates the necessary triangulation to transform archival qualitative records into quantifiable metrics of heritage loss.

3.2 Study Areas and Sampling

The research was carried out across four zones within Lagos Island, chosen based on their historical significance, architectural typological diversity, and observed levels of transformation: Zone A (Marina/Broad Street), Zone B (Campos Square/Olowogbowo), Zone C (Isale Eko), and Zone D (Ebute Ero) (Ike-Akude et al., 2026). The target population was defined as all identifiable pre-1985 building parcels within these four zones, as digitized from archival cadastral maps; this population was estimated at approximately 3,120 parcels. Because the four zones were themselves delineated on the basis of their concentration of pre-1985 traditional and Afro-Brazilian architectural typologies, archival screening confirmed that all sampled parcels exhibited at least one of the six target heritage features (Section 3.4) at the 2000 baseline; this is why the "2000" column of Table 1 equals the full number of buildings sampled per zone rather than a subset of it. The sampling frame was stratified by zone and drawn via systematic GIS grid overlay at a uniform 1:4 (25%) sampling ratio, yielding 780 sampled building units. Table 1a reports the population estimate, sampling ratio, and resulting sample size for each zone. Inclusion in the sampled dataset therefore required (i) location within one of the four designated zones, (ii) pre-1985 construction as evidenced by archival cadastral and planning records, and (iii) documented presence of at least one of the six heritage-feature categories at the 2000 baseline. This sampling strategy ensured spatial coverage across all four zones while preserving analytical feasibility.

Table 1: Target Population and Sample Allocation by Zone

Zone	Estimated Population, 2000 (Pre-1985 Parcels)	Sampling Ratio	Sample Size (n)
Zone A – Marina/Broad Street	480	1:4 (25%)	120
Zone B – Campos/Olowogbowo	840	1:4 (25%)	210
Zone C – Isale Eko	1,040	1:4 (25%)	260
Zone D – Ebute Ero	760	1:4 (25%)	190
Total	3,120	1:4 (25%)	780

Source: *Archival cadastral map digitization (2000 baseline); author's computation.*

3.3 Archival Data Collection

Archival data were gathered from three primary repositories: the Nigerian National Archives (Ibadan branch), which houses colonial-era maps, planning records, and photographic documentation of Lagos Island from the late 19th century to the 1980s; the Lagos State Ministry of Physical Planning and Urban Development, which keeps planning permission records, building surveys, and land use maps; and the archive of the Nigerian Institute of Architects (NIA) Lagos Chapter, which contains professional documentation of significant buildings. Additional archival materials were sourced from digitized historical collections at the Smithsonian Institution's Archives of American Art and the Bibliothèque Nationale de France, both of which preserve 19th and early 20th-century photographic records of Lagos Island.

The prevalence of heritage features in the year 2000 was determined using three converging sources of evidence: photographic documentation gathered during the community heritage mapping initiative of the 1990s, which was overseen by NIA Lagos; building-level records obtained from planning documents dated 1999-2001; and archival photographs and cadastral maps held at the Nigerian National Archives and the LASG MPPUD. These sources were cross-validated to create a solid baseline for the year 2000 for each property sampled. Each 2000-era building record was matched to its corresponding 2025 field-surveyed parcel using the cadastral parcel number recorded on 1999-2001 planning documents as the primary unique identifier; where a parcel number could not be recovered, buildings were matched manually using street address, building footprint outline, and adjacency to unambiguously identified neighbouring parcels, digitized in ArcGIS and georeferenced to the WGS 84 / UTM Zone 31N coordinate reference system with a positional tolerance of ±5 m. A building was coded as "demolished" rather than "feature lost" if no structure occupied the parcel footprint in the 2025 field survey. Where a 2000-era parcel had been subdivided by 2025, each resulting sub-parcel was traced back to the original parent parcel and treated as a single analytical unit inheriting the parent's 2000 baseline, to avoid artificially inflating the sample; conversely,

amalgamated parcels were treated as a single unit using the earliest available baseline. A heritage feature was coded as "present" in 2000 only where at least two of the three archival sources independently corroborated it; where archival evidence was incomplete or contradictory for a given feature, the feature was coded as "indeterminate" and excluded from that specific feature's numerator and denominator in Table 2, rather than being assumed present or absent.

3.4 Field Observation and Current Documentation

The current status of heritage features was recorded through methodical field surveys conducted from January to June 2025. For every sampled building unit, a structured observation checklist was utilized to note the presence or absence of six main categories of heritage features: decorative stucco or Afro-Brazilian facades; arcaded verandas or colonnades; timber shutters or jalousies; internal courtyard layouts; traditional roof styles (either hipped or pitched with overhanging eaves); and ornamental ironwork or balustrades. Additionally, the checklist documented the current usage (residential/commercial/vacant/demolished), building height, and overall structural condition (good/fair/poor/derelict/demolished).

For each of the six feature categories, buildings were coded using four operational states: "present" (the original feature is intact and clearly visible, matching its 2000-era archival appearance); "altered" (the feature survives but has been materially modified, e.g., painted over, partially removed, or reconstructed in non-original materials); "lost" (the feature is absent, having been removed, demolished, or built over); and, where the building itself no longer exists, "demolished" (superseding all feature-level codes for that unit). For the binary present/absent tabulation reported in Tables 1 and 2, both "altered" and "lost" states were conservatively combined into "not retained," meaning the reported loss percentages may understate the prevalence of partial degradation relative to complete loss. All 780 buildings were coded by a single trained field researcher using this checklist; no second independent observer re-coded any part of the sample, so no formal inter-rater reliability statistic (e.g., Cohen's kappa) could be computed for this study. This constraint is discussed further in Section 5.4 (Limitations).

Field photographs were captured for each sampled building to facilitate post-survey verification and to establish a contemporary photographic record that can be compared with archival images. A total of 3,840 field photographs were gathered across the four study zones.

3.5 GIS Analysis

Multi-temporal satellite imagery was acquired for four reference years: Landsat 7 ETM+ (30 m multispectral resolution) for 2000 (acquisition window: December 1999-February 2000, to align with the archival baseline), Landsat 8 OLI (30 m) for 2010 and 2020 (December-February acquisition windows in each case), and Sentinel-2 MSI (10 m for visible/near-infrared bands, 20 m for red-edge and shortwave-infrared bands) for 2025 (December 2024-February 2025). All scenes were selected for cloud cover below 10% over the study area. Landsat imagery was obtained as USGS Collection 2 Level-2 surface reflectance products (atmospherically corrected using the Landsat Ecosystem Disturbance Adaptive Processing System) via USGS EarthExplorer; Sentinel-2 imagery was obtained as Level-2A bottom-of-atmosphere surface reflectance products via the Copernicus Data Space Ecosystem (the successor platform to the retired Copernicus Open Access Hub), with Sen2Cor atmospheric correction already applied. All imagery was reprojected to WGS 84 / UTM Zone 31N, and Sentinel-2 bands were resampled to a common 30 m grid using nearest-neighbour resampling to allow direct comparison with the Landsat time series; this harmonization means the final land-use classification is reported at an effective 30 m spatial resolution across all four reference years. Classification used the near-infrared, red, and green bands (Landsat bands 4-3-2; Sentinel-2 bands 8-4-3) in a supervised maximum-likelihood classification implemented in ArcGIS 10.8. Training samples (620 polygons in total, 120-140 per land-use class) were digitized from high-resolution Google Earth historical imagery and cross-checked against field survey points for the 2025 classification; an independent validation sample of 441 points (not used in training) was drawn using stratified random sampling proportional to the mapped area of each class, and visually interpreted against the same reference imagery to compute the accuracy statistics reported in Section 4.5. The five land use categories encompassed traditional residential (low-rise compound typologies), commercial (office, retail, banking), mixed-use, vacant, and infrastructure. Post-classification processing included a 3x3 majority filter to reduce speckle and manual correction of obvious misclassifications along the Marina-CMS commercial corridor, followed by post-classification change detection to assess category-to-category conversion by zone and overall between successive reference years.

It is important to state explicitly the division of labour between the two evidentiary strands of this study. Heritage-feature loss at the level of individual buildings-stucco facades, arcaded verandas, timber shutters, courtyards, roof forms, and ornamental ironwork-was established entirely through the archival/field building assessment described in Sections 3.3 and 3.4, since these architectural elements are well below the detection threshold of 10-30 m satellite imagery. The GIS/remote-sensing analysis described above was used exclusively to characterize broader neighbourhood-scale land-use transformation and redevelopment context (e.g., the conversion of low-rise residential blocks to

commercial or mixed-use land cover) and to derive the distance-to-commercial-core variable used in Section 4.6; it was not used, and cannot be used, to detect individual architectural heritage features directly.

4.0 RESULTS

4.1 Overall Architectural Heritage Feature Retention (2000-2025)

Table 1 displays the comprehensive results of the heritage feature retention analysis conducted across the four study zones from 2000 to 2025.

Table 2: Architectural Heritage Feature Retention by Zone (2000 vs. 2025)

Zone	Buildings with Heritage Features (2000)	Buildings with Heritage Features (2025)	Number Lost	% Reduction
Zone A - Marina/Broad Street	120	15	105	-87.5%
Zone B - Campos/Olowogbowo	210	80	130	-61.9%
Zone C - Isale Eko	260	160	100	-38.5%
Zone D - Ebute Ero	190	85	105	-55.3%
Total	780	340	440	-56.4%

Source: *Field observation surveys (2025); archival documentation baseline (2000); NIA Lagos Heritage Records; Lagos State MPPUD Planning Records.*

The overall results are striking: among the 780 buildings sampled that displayed traditional architectural characteristics in 2000, merely 340 (43.6%) preserved any heritage features by 2025. This indicates a net reduction of 440 buildings showcasing heritage, equating to 56.4% of the original heritage building inventory, over a span of 25 years. This is equivalent to a compound annual attrition rate of approximately 3.3% per year-substantially higher than the naive figure of 2.3% obtained by simply dividing the cumulative 56.4% loss by 25 years, because, as Section 4.3 documents, the rate of loss was not uniform over the study period. Zone A (Marina/Broad Street) experienced the most substantial loss, at 87.5%, whereas even the comparatively more safeguarded Zone C (Isale Eko), where Yoruba compound designs continue to exist due to ongoing residential use, faced a significant loss of 38.5%.

4.2 Feature-Level Archival Comparison

Table 2 provides a detailed breakdown of heritage loss at the feature level, allowing for the identification of the most at-risk architectural elements and their geographical distribution.

Table 3: Feature-Level Architectural Heritage Loss (2000-2025), reporting counts (n) and percentages with 95% confidence intervals (denominator: all 780 sampled buildings)

Architectural Feature	n (2000)	% 2000 [95% CI]	n (2025)	% 2025 [95% CI]	Relative Change (%)	Zone of Greatest Loss
Decorative stucco / Afro-Brazilian facades	530	68.0 [64.6–71.1]	140	18.0 [15.4–20.8]	−73.5%	Zone B (Campos)
Arcaded verandas / colonnades	429	55.0 [51.5–58.5]	94	12.0 [10.0–14.5]	−78.2%	Zone A and B
Timber shutters and jalousies	484	62.0 [58.6–65.4]	172	22.0 [19.3–25.1]	−64.5%	Zone B and C
Internal courtyard layouts	351	45.0 [41.5–48.5]	117	15.0 [12.7–17.7]	−66.7%	Zone C (Isale Eko)
Traditional roof forms (hipped/pitched)	554	71.0 [67.7–74.1]	265	34.0 [30.7–37.4]	−52.1%	Zone C and D
Ornamental ironwork / balustrades	312	40.0 [36.6–43.5]	62	8.0 [6.2–10.1]	−80.0%	Zone A and B

Source: *Field observation checklists (2025); archival photographic analysis; historical building surveys. Percentages and counts (n) are calculated against the full sampled dataset (N = 780 buildings, all of which exhibited at least one heritage feature at the 2000 baseline); values in brackets are 95% Wilson confidence intervals for each proportion. Relative change is computed as the percentage change in prevalence between 2000 and 2025.*

Ornamental ironwork and balustrades have suffered the most significant proportional loss (-80.0%), which highlights their physical vulnerability and their tendency to be removed for scrap value or for modifications to facades without the need for complete demolition. Arcaded verandas (-78.2%) and decorative stucco facades (-73.5%) are the most representative features of the Afro-Brazilian architectural tradition, and the recorded loss in Zone B is particularly noteworthy due to the international heritage significance of the Campos/Olowogbowo district.

4.3 Temporal Pattern of Heritage Loss: Archival Comparison Timeline

Table 3 compiles the quantified temporal pattern of architectural heritage loss across four reference points (2000, 2010, 2020, 2025), reporting the number of sampled buildings retaining heritage features at each point, the number lost in each interval, the cumulative loss relative to the 2000 baseline, and the compound annual attrition rate; retained-building counts are drawn from the

same archival and field evidence base described in Section 3.3, and are disaggregated by zone in Table 3a.

Table 4: Quantified Temporal Pattern of Architectural Heritage Loss - Archival Comparison (2000-2025)

Period	Buildings Retained (n)	Lost in Period, n (% of Prior Count)	Cumulative Loss from 2000 (%)	Compound Annual Loss Rate (%/yr)	Primary Transformation Driver	Archival Evidence Type
Pre-2000 (baseline)	780	–	0.0	–	Limited commercial expansion	Historical photographs; colonial maps; 1990s field surveys
2000–2010	680	100 (12.8)	12.8	1.4	Infrastructure investment; banking sector expansion	Satellite imagery; estate firm records; newspaper archives
2010–2020	415	265 (39.0)	46.8	4.8	Speculative land acquisition; rent gap widening	Sentinel-2 imagery; planning permission records; GIS land use maps
2020–2025	340	75 (18.1)	56.4	3.9	Market maturation; continued commercial pressure	Field surveys; archival photograph comparison; GIS change maps

***Note**: Counts are aggregated across all four zones from the building-level dataset underlying Tables 1 and 2 (N = 780 at baseline). Compound annual loss rate = 1 - (retained at end / retained at start)^(1/years). Intermediate (2010, 2020) counts derive from archival and planning-record dating of feature removal or demolition for each sampled building.*

Table 5: Buildings Retaining Heritage Features by Zone and Reference Year (n)

Zone	2000	2010	2020	2025
Zone A – Marina/Broad Street	120	90	30	15
Zone B – Campos/Olowogbowo	210	180	95	80
Zone C – Isale Eko	260	245	185	160
Zone D – Ebute Ero	190	165	105	85
Total	**780**	**680**	**415**	**340**

***Source**: Nigerian National Archives; Lagos State MPPUD planning records; satellite imagery (USGS EarthExplorer; Copernicus Data Space Ecosystem); NIA Lagos building surveys; field data (2025).*

The archival evidence suggests that the loss of architectural heritage, a process that has been ongoing in Lagos Island for many years, significantly accelerated after 2010: the compound annual attrition rate rose from approximately 1.4% per year in 2000-2010 to approximately 4.8% per year in 2010-2020, before easing to approximately 3.9% per year in 2020-2025 (Table 3). This increase coincided with the widening rent gaps in the land market and a surge in commercial investment within the Marina-CMS corridor. During the period from 2000 to 2010, although there was a moderate loss in Zone A, the transformation in heritage-rich Zones B and C remained relatively contained. However, the decade from 2010 to 2020 marked the most destructive period for heritage building loss, characterized by large-scale demolitions and commercial redevelopment that fundamentally altered Zones A and B. In the post-2020 period, there has been a noticeable deceleration in the rate of loss in certain areas, which may be partly associated with the economic disruptions of the COVID-19 pandemic, although this study did not directly test that relationship and the slowdown could equally reflect market saturation or the exhaustion of readily redevelopable heritage stock in the most affected zones; nonetheless, there continues to be gradual erosion due to modifications and neglect.

4.4 Spatial Patterns of Heritage Loss and GIS Findings

GIS-based analysis of land use changes has confirmed that the loss of heritage buildings is not random but is spatially associated with proximity to commercial development nodes (see the statistical tests in Section 4.6). The Marina-CMS axis serves as the main driver of redevelopment pressure, with patterns of erosion spreading outward in a spatial gradient that lessens with increasing distance from the commercial core. Zone B (Campos/Olowogbowo), located directly next to the commercial core, has been significantly affected by this gradient despite its heritage importance, whereas Zone C (Isale Eko) has managed to retain a relatively greater amount of heritage fabric, partly due to its increased distance from the main commercial corridors. Furthermore, multi-temporal land use classification has revealed a significant transformation of traditional low-rise residential compound typologies into commercial uses, especially in Zones A and B. This transformation is consistent with commercial redevelopment being an important proximate pathway to the demolition of heritage buildings: commercial tenants and developers appear to demand structural configurations that are difficult to accommodate within the existing layouts of heritage buildings, which may make demolition more economically attractive than adaptive reuse for many owners. As no developers, owners, or planning officials were interviewed for this study, this remains a plausible interpretation consistent with the observed land-use conversion patterns rather than a directly confirmed causal mechanism. Because satellite-derived land-use classes describe neighbourhood-scale conversion, they are used here to characterize redevelopment context and not to measure heritage-feature loss itself (Section 3.5).

4.5 Land-Use Classification Accuracy Assessment

The reliability of the multi-temporal land-use classification described in Section 3.5 was assessed against the independent validation sample of 441 points using a standard confusion-matrix approach. Table 4a reports the resulting confusion matrix, producer's and user's accuracies for the 2025 classification.

Table 6: Land-Use Classification Confusion Matrix and Accuracy Statistics (2025; n = 441 validation points)

Reference Class	Residential	Commercial	Mixed-use	Vacant	Infrastructure	Row Total	Producer's Accuracy (%)
Residential	142	6	5	2	1	156	91.0
Commercial	4	108	7	1	2	122	88.5
Mixed-use	6	9	63	3	1	82	76.8
Vacant	2	1	2	38	1	44	86.4
Infrastructure	1	2	1	1	32	37	86.5
Column Total	**155**	**126**	**78**	**45**	**37**	**441**	–
User's Accuracy (%)	**91.6**	**85.7**	**80.8**	**84.4**	**86.5**	–	**Overall = 86.8**

Source: *Independent stratified random validation sample interpreted against high-resolution reference imagery; author's computation. Rows = reference data; columns = classified map.*

Overall classification accuracy across the five land-use categories was 86.8% (383 of 441 validation points correctly classified), with an overall Kappa coefficient of 0.82, indicating almost perfect agreement between the classified map and the reference points on the Landis and Koch (1977) scale. Producer's accuracies ranged from 76.8% (mixed-use, the category most prone to spectral confusion with both residential and commercial classes) to 91.0% (residential), while user's accuracies ranged from 80.8% (mixed-use) to 91.6% (residential); per-class F1 scores ranged from 78.8% (mixed-use) to 91.3% (residential). These accuracy levels are consistent with published benchmarks for medium-resolution supervised classification in dense, heterogeneous urban environments and support the reliability of the land-use transition patterns reported in Section 4.4, while reinforcing that this classification characterizes neighbourhood-scale land-use change rather than building-level heritage condition.

4.6 Statistical Association Between Commercial Proximity and Heritage Loss

To formally test whether heritage-feature loss is associated with zone location, a chi-square test of independence was conducted on the 2 x 4 contingency table of lost versus retained buildings by

zone (Table 1). The association was highly significant, $\chi^2(3, N = 780) = 83.91$, $p < .001$, Cramer's V = 0.33, indicating a moderate-to-strong association between zone membership and heritage-loss status. Inspection of the expected counts shows that Zone A had far more buildings with lost features (105) than expected under independence (approximately 68), while Zone C had far more buildings retaining features (160) than expected (approximately 113), consistent with the spatial gradient described in Section 4.4.

As a complementary, exploratory test of the proposed gradient, zone-level percentage heritage loss (Table 1) was correlated with the approximate straight-line distance of each zone's centroid from the Marina-CMS commercial core (Zone A = 0.3 km, Zone B = 0.8 km, Zone D = 1.4 km, Zone C = 2.1 km). Percentage loss was strongly and significantly negatively correlated with distance from the commercial core (Pearson $r = -0.96$, $R^2 = 0.93$, $p = .037$), such that zones closer to the core exhibited markedly higher heritage loss. Because this correlation rests on only four zone-level observations, it is illustrative rather than definitive, and is offered as a complement to the building-level chi-square test, which draws on the full sample of 780 buildings. Taken together, these results support describing heritage loss as spatially associated with commercial proximity, rather than establishing a direct causal mechanism, which would require parcel-level distance data and controls for other covariates (e.g., building age, tenure, zoning) beyond the present dataset.

5.0 DISCUSSION

5.1 The Extent and Importance of Heritage Erosion

The documented 56.4% reduction represents substantial loss of architectural heritage fabric over the study period. UNESCO's Operational Guidelines for the Implementation of the World Heritage Convention (UNESCO, 2021) partially define 'outstanding universal value' through the criterion of integrity-the completeness and intactness of attributes vital for conveying heritage significance. According to this criterion, the level of heritage loss documented in this study would, in most international contexts, necessitate urgent conservation actions, including the possibility of emergency designation or listing. However, in Lagos Island, this erosion has occurred largely without systematic documentation, regulatory action, or public policy intervention. This situation reflects what Jokilehto (2017) refers to as a 'conservation governance deficit', which is the structural gap between acknowledged heritage significance and the institutional capacity and political will to respond to that acknowledgment. In Lagos, this deficit is exacerbated by the economic invisibility of cultural heritage within land administration frameworks and the fragmentation of institutional responsibilities across various agencies with overlapping mandates and limited coordination (Adewumi, 2022).

5.2 Afro-Brazilian Heritage as a Special Concern

The recorded 73.5% decrease in decorative stucco facades and a 61.9% total loss of heritage buildings in Zone B (Campos/Olowogbowo) constitutes a central finding of this study. The Afro-Brazilian architectural heritage of Lagos Island holds not only national significance but also serves as a concrete representation of the transatlantic history of slavery, diaspora, and return, which is of global historical relevance. Kelouaze (2022) highlights that the remaining Afro-Brazilian structures in Lagos are invaluable primary sources for comprehending this history in its material form, comparable in importance to the architectural heritage found in Salvador de Bahia and Ouidah.

The lack of formal designation for the Campos/Olowogbowo district as a heritage conservation area-despite ongoing advocacy from ICOMOS Nigeria and the NIA-illustrates the institutional and political challenges to heritage governance in Nigerian cities, as documented by Labadi et al. (2021). At the current rates of attrition, the architectural integrity of the Afro-Brazilian district-the essential collection of buildings that renders Campos a recognizable heritage landscape rather than merely a series of isolated remnants-will face significant compromise within the next decade.

5.3 Toward a Heritage-Sensitive Planning Framework

The results of this study present specific and actionable policy recommendations. Table 4 outlines a tiered intervention framework categorized by heritage risk level, which is in alignment with the spatial findings derived from both archival documentation and GIS analysis.

Table 7: Heritage Risk Classification and Recommended Planning Interventions

Heritage Risk Level	Zone(s)	Primary Threat Mechanism	Recommended Intervention	Institutional Lead
Critical (>80% loss)	Zone A - Marina	Commercial redevelopment; near-total demolition	Emergency designation; development freeze; adaptive reuse incentives	LASG MPPUD; NCMM
High (60-80% loss)	Zone B - Campos/Olowogbowo	Speculative acquisition; facade removal; functional conversion	Heritage conservation area designation; restoration grants; planning overlay controls	LASG MPPUD; NCMM
Moderate (38-60% loss)	Zone C - Isale Eko; Zone D - Ebute Ero	Incremental modification; densification; neglect	GIS-based monitoring; heritage impact assessments for all redevelopments; community heritage registers	Local Government Authorities; NCMM

Source: *Study findings; UNESCO HUL Implementation Guidance (2022); Labadi et al. (2021). Abbreviations: LASG MPPUD = Lagos State Government Ministry of Physical Planning and Urban*

Development; NaCCA = National Council for Conservation of the Arts; NCMM = National Commission for Museums and Monuments.

The execution of this framework necessitates inter-agency collaboration among the NCMM, LASG MPPUD, and local government authorities-collaboration that has historically been insufficient but is now mandated by the urgency of the documented heritage crisis. An international partnership with UNESCO and ICOMOS could offer both external leverage and technical assistance for governance reform. Because UNESCO's List of World Heritage in Danger applies only to properties already inscribed on the World Heritage List, the appropriate route for the currently uninscribed Campos/Olowogbowo district would be to first pursue national heritage designation and inclusion on Nigeria's Tentative List, as a precursor to any eventual World Heritage nomination; only once the district were inscribed would the List of World Heritage in Danger become a relevant mechanism for addressing continued threats to its integrity.

Economic instruments are also vital. Heritage incentive mechanisms-such as development bonuses for conservation-compliant adaptive reuse, property tax relief for the maintenance of certified heritage buildings, and heritage impact assessment requirements for all redevelopment approvals within designated zones-have shown effectiveness in similar contexts in Accra, Dar es Salaam, and Cape Town (Jokilehto, 2017; Gyamera et al., 2022). Their adaptation to the institutional context of Lagos, tailored to the specific economic dynamics of the Lagos Island land market, presents a promising avenue for making heritage conservation economically feasible for private property owners.

5.4 Limitations of the Study

Several limitations should be considered when interpreting these findings. First, the 2000 baseline was reconstructed retrospectively from archival photographs, 1990s community heritage mapping records, and planning documents rather than from a contemporaneous field survey; although these sources were cross-validated as described in Section 3.3, archival incompleteness and differences in photographic coverage across zones may have introduced misclassification of baseline feature presence, particularly for less-photographed side streets, and the reliability of these secondary archival sources could not be independently audited. Second, all 780 buildings were coded by a single field researcher using the checklist described in Section 3.4; no formal inter-rater reliability assessment (e.g., Cohen's kappa) was conducted, so some subjectivity in the good/fair/poor/derelict condition ratings and in borderline present/altered/lost feature codes cannot be ruled out, and the binary present/absent tabulation may conceal partial degradation. Third, retrospective identification of 2000-era features from archival photographs is inherently less certain than contemporaneous assessment,

and survivorship bias cannot be fully excluded, since buildings that were well documented archivally may differ systematically from those that were not. Fourth, parcel subdivision and amalgamation between 2000 and 2025 required interpretive judgement (Section 3.3) that, despite the stated decision rules, may not capture every boundary change, and some positional uncertainty remains when linking historical maps and photographs to current parcels despite the ±5 m georeferencing tolerance. Fifth, the Landsat sensors (30 m) and the Sentinel-2 product (native 10-20 m, harmonized to 30 m) cannot detect facade-scale heritage features; the accuracy assessment in Section 4.5 pertains only to neighbourhood-scale land-use categories, not to building-level heritage condition. Finally, the zone-level correlation reported in Section 4.6 is based on only four zones and should be treated as illustrative; parcel-level distance measures would be needed to support stronger claims about the relationship between commercial proximity and heritage loss, and no land-price, rent, or transaction data were analysed here. Notwithstanding these limitations, the internal consistency of the heritage counts across Tables 1-3 and the statistically significant, theoretically expected pattern of association reported in Section 4.6 provide reasonable confidence in the study's central empirical findings.

6.0 CONCLUSION

This research has delivered a systematic, spatially explicit, and statistically grounded documentation of architectural heritage loss in Lagos Island during the 2000-2025 period. Utilizing an integrated archival-GIS comparative methodology, it has revealed that 56.4% of buildings exhibiting heritage across four historically significant zones have lost their traditional architectural features within 25 years, with the loss rate surpassing 87% in the most commercially pressured zone (Marina/Broad Street) and approaching nearly 62% in the internationally significant Afro-Brazilian heritage core of Campos/Olowogbowo. The analysis at the feature level indicates that the most culturally unique aspects of Lagos Island's architectural heritage-such as Afro-Brazilian stucco facades, arcaded verandas, and decorative ironwork-have declined by between 73% and 80% over the study period. This loss poses a significant threat to the architectural integrity that allows the Campos/Olowogbowo district to be perceived as a cohesive heritage landscape rather than merely a collection of isolated remnants.

The temporal archival comparison reveals that this deterioration has accelerated significantly since 2010, driven by increasing rent disparities and heightened commercial investment. If this trend continues unchecked, it will fundamentally transform the heritage character of Lagos Island within the next decade.

The GIS and statistical analyses indicate that the loss of heritage is spatially associated with proximity to commercial development nodes (chi-square and distance-based tests, Section 4.6), thereby providing a geographically explicit foundation for targeted conservation efforts. The policy framework proposed in this study-which includes emergency designation for critically degraded areas, heritage conservation area regulations for high-risk zones, and GIS-based monitoring systems for moderate-risk regions-presents a measured and evidence-based approach to the documented attrition of heritage.

However, the most significant contribution of this study is its assertion that the loss of architectural heritage in Lagos Island is neither random nor unavoidable. It is a systematic result of identifiable market forces operating within a governance framework that fails to adequately acknowledge or safeguard the cultural significance of the built environment. With sufficient institutional commitment, inter-agency collaboration, economic incentives for development that aligns with conservation goals, and the monitoring systems outlined in this study, the trajectory of loss can be redirected. The facades of Campos and the courtyards of Isale Eko are still recoverable-but the opportunity for effective intervention is diminishing.

REFERENCES

Adewumi, A. (2022). Built heritage and planning laws in Africa: The Nigerian experience. *Built Heritage*, *6*(7), 1-10. https://doi.org/10.1186/s43238-022-00052-2

Afriyie, K., Abass, K., and Adjei, P. O.-W. (2020). Urban sprawl and agricultural livelihood response in peri-urban Ghana. *International Journal of Urban Sustainable Development*, *12*(2), 202-218. https://doi.org/10.1080/19463138.2019.1691560

Forget, Y., Shimoni, M., Gilbert, M., and Linard, C. (2021). Mapping 20 years of urban expansion in 45 urban areas of sub-Saharan Africa. *Remote Sensing*, *13*(3), 525. https://doi.org/10.3390/rs13030525

Gyamera, E., Afram, S. O., and Buabeng, E. (2022). Adaptation, traditions and conservation: The case of the Asante traditional buildings World Heritage Site in Ghana. In *Digital Heritage* (pp. 459-474). Springer. https://doi.org/10.1007/978-3-031-13810-2_35

Ike-Akude, O. N., Sado, R. O. and Egonwa, O. D. (2026). Land market intensification and cultural landscape erosion in Lagos Island: A spatial-econometric analysis. *Iconic Research And Engineering Journals, 9*(11), 4897-4905. https://doi.org/10.64388/IREV9I11-1718499

Jokilehto, J. (2017). *A history of architectural conservation* (2nd ed.). Routledge. https://doi.org/10.4324/9780080523118

Kelouaze, L. (2022). Decolonizing modern heritage of Africa: Afro-Brazilian and neo-Moorish liberation architectures. *Curator: The Museum Journal*, *65*(3), 521-541. https://doi.org/10.1111/cura.12513

Konadu, K., and Essien, K. (2025). Entangled roots: Heritage and identity in the African mesa-diasporas. *African Studies*, *81*(2), 115-133. https://doi.org/10.1080/0067270X.2025.2517450

Labadi, S., Giliberto, F., Rosetti, I., Shetabi, L., and Yildirim, E. (2021). *Heritage and the sustainable development goals: Policy guidance for heritage and development actors*. ICOMOS. https://www.icomos.org/images/DOCUMENTS/Secretariat/2021/SDG/ICOMOS_SDGs_Policy_Guidance_2021.pdf

Landis, J. R., and Koch, G. G. (1977). The measurement of observer agreement for categorical data. Biometrics, 33(1), 159-174. https://doi.org/10.2307/2529310

Obaitor, O. S., Stellmes, M., and Lakes, T. (2024). Exploring spatio-temporal pattern of gentrification processes in intracity slums in the Lagos megacity. *Geographies*, *4*(2), 231-252. https://doi.org/10.3390/geographies4020015

Oladeji, S. O., Grace, O., and Ayodeji, A. A. (2022). Community participation in conservation and management of cultural heritage resources in Yoruba ethnic group of south-western Nigeria. *SAGE Open*, *12*(4). https://doi.org/10.1177/21582440221130987

Ripp, M., and Rodwell, D. (2021). The geography of urban heritage: Reflections on governance in an era of urban complexity. *Historic Environment: Policy and Practice*, *12*(1), 4-32. https://doi.org/10.1080/17567505.2021.1876978

Tang, Y., Chen, F., Yang, W., Ding, Y., Wan, H., Sun, Z., and Jing, L. (2022). Elaborate monitoring of land-cover changes in cultural landscapes at heritage sites using very high-resolution remote-sensing images. *Sustainability*, *14*(3), 1319. https://doi.org/10.3390/su14031319

Teriba, A. (2020). Style, race, and a mosque of the "Òyìnbó Dúdú" (White-Black) in Lagos Colony, 1894. In I. Cheng, C. L. Davis II, and M. O. Wilson (Eds.), Race and modern architecture: A critical history from the Enlightenment to the present (pp. 277-287). University of Pittsburgh Press.

UNESCO. (2011). *Recommendation on the historic urban landscape*. UNESCO. https://whc.unesco.org/en/hul/

UNESCO. (2021). *Operational guidelines for the implementation of the World Heritage Convention*. UNESCO World Heritage Centre. https://whc.unesco.org/en/guidelines/

UNESCO. (2022). *Historic urban landscape: Managing heritage in dynamic and constantly changing urban environments*. Retrieved from https://whc.unesco.org/en/hul/

Correspondence Author: Raphael Oshiobugie Sado; ro.sado@unizik.edu.ng; +2348039501432