

# ASSESSING THE SUSTAINABLE HOUSING OUTCOMES OF URBAN ENVIRONMENTAL MANAGEMENT IN A CIRCULAR ECONOMY: A MIXED-METHODS HOUSEHOLD STUDY IN LAPAI, NIGERIA

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## ABSTRACT

Rapid urbanisation in secondary cities of developing countries is heightening challenges related to housing quality, environmental degradation, and inefficient resource use. This study assessed the sustainable housing outcomes of urban environmental management within a circular economy framework, focusing on households in Lapai, Niger State, Nigeria. Anchoring on SDG 11 (sustainable cities and communities) and SDG 12 (responsible consumption and production), the study adopted a mixed-methods research design. Quantitative data were collected through a structured household survey administered to about 300 residential units, while qualitative insights were obtained from key informant interviews with urban planners, environmental health officers, and community representatives. Descriptive statistics and multivariate regression analysis were used to examine the influence of urban environmental management practices such as waste management, water and sanitation services and neighbourhood environmental maintenance on sustainable housing indicators including habitability, environmental quality, and resource efficiency. Qualitative data were analysed thematically to enrich the interpretation of household experiences and institutional practices.

The findings indicated that waste management, access to improved water and sanitation, and regular neighbourhood environmental maintenance have a significant positive effect on sustainable housing outcomes in Lapai. It also revealed that there is a low level of public awareness in the adoption of circular economy practices at the household level, particularly material reuse, waste management, and energy conservation due to key constraints such as weak institutional capacity and inadequate enforcement of environmental regulations. The study concludes that there should be the strengthening of urban environmental governance and mainstreaming circular economy principles into household practices to enhance sustainable housing outcomes in Lapai. The findings provide policy-relevant evidence to support local implementation of SDGs 11 and 12, while also contributing to SDG 13 (climate action) through improved urban resource efficiency and environmental management.

**Keywords:** Sustainable, housing, Urban, environmental management, Circular economy

## 1.0 INTRODUCTION

Rapid urbanization is increasingly shaping the development trajectory of many cities in the Global South, particularly in Sub-Saharan Africa. While urban growth can stimulate economic opportunities and infrastructure development, it also creates significant challenges related to housing quality, environmental degradation, and inefficient resource utilization (Bryan et al., 2020; Kuddus et al., 2020). These challenges are particularly pronounced in secondary cities where rapid population growth often occurs without adequate urban planning, environmental management systems, or infrastructure provision. Consequently, many emerging urban centers experience problems such as poor waste management, inadequate water and sanitation services, and deteriorating neighborhood environments, all of which directly affect housing habitability and environmental sustainability.

In Nigeria, improving the sustainability of housing environments has become increasingly important in the context of the global development agenda, particularly the United Nations Sustainable Development Goals. Of particular relevance are Sustainable Development Goal 11, which promotes inclusive and resilient cities, and Sustainable Development Goal 12, which emphasizes efficient resource use and waste reduction. Achieving these goals requires effective urban environmental management practices such as improved waste management, reliable water and sanitation services, and regular neighborhood environmental maintenance. These practices play a crucial role in shaping sustainable housing outcomes by improving living conditions and reducing environmental pressures within urban residential areas.

More recently, the Circular Economy has emerged as a strategic framework for promoting sustainable urban development. The circular economy emphasizes resource efficiency through waste reduction, material reuse, and energy conservation, offering a pathway for improving

housing sustainability while minimizing environmental impacts. Integrating circular economy principles into urban environmental management can therefore enhance housing conditions and contribute to broader urban sustainability objectives.

Despite the increasing relevance of these concepts, empirical studies examining the relationship between urban environmental management practices and sustainable housing outcomes within a circular economy framework remain limited in developing-country secondary cities. In Nigeria, existing research has largely focused on sustainable building design, urban growth patterns, or environmental governance, with relatively little attention given to how everyday environmental management practices at the household level influence housing sustainability outcomes. This gap is particularly evident in rapidly growing secondary cities such as Lapai in Niger State, where environmental management challenges increasingly shape residential living conditions.

Against this background, this study assesses the sustainable housing outcomes of urban environmental management within a circular economy framework in Lapai, Nigeria. Specifically, the study aims to assess the level of urban environmental management practices among households in Lapai, examine the influence of these practices on sustainable housing outcomes, including habitability, environmental quality, and resource efficiency, explore household awareness and institutional perspectives regarding circular economy practices in the study area.

Using a mixed-methods approach that combines household survey data with key informant interviews, the study provides empirical evidence on how environmental management practices influence sustainable housing conditions in a rapidly urbanizing secondary city. The study contributes to the literature by linking urban environmental management practices with housing sustainability outcomes within a circular economy perspective, while generating policy-relevant

insights to support the implementation of Sustainable Development Goal 11, Sustainable Development Goal 12, and Sustainable Development Goal 13 in Nigerian urban contexts.

## **2.0 LITERATURE REVIEW**

Rapid urbanization in developing countries has led to significant transformations in secondary cities, often resulting in unplanned growth, infrastructure deficits, and environmental pressures. In Sub-Saharan Africa, for instance, secondary cities like those in Ghana and Nigeria experience accelerated peri-urban expansion, driven by population influx and economic activities, which exacerbate land use conflicts and housing shortages (Abdulai et al., 2022; Korah et al., 2025). This pattern is echoed in other developing regions, such as Indonesia and China, where secondary urban centres face diseconomies including congestion, inadequate services, and vulnerability to climate risks, underscoring the need for integrated urban planning (Katherina and Indraprahasta, 2019; Du et al., 2024). In Nigeria, these challenges are particularly acute in secondary cities like Lapai, where economic volatility and institutional barriers hinder sustainable development, aligning with broader calls for resilient urban governance (Yahaya and Shaibu, 2020; Iduseri et al., 2024).

The intersection of urbanization and environmental degradation has amplified demands for sustainable housing solutions, particularly within the framework of the United Nations Sustainable Development Goals (SDGs). SDG 11 emphasizes inclusive, safe, and resilient cities, while SDG 12 focuses on responsible consumption and production, both critical for addressing urban inefficiencies in resource use and waste management (Mustapic et al., 2025). In Nigerian contexts, studies highlight the role of urban environmental management in achieving these goals, with evidence from cities like Abuja and Lagos showing that poor governance leads to vegetation loss, pollution, and inadequate housing, necessitating policy interventions for sustainable land use (Iduseri et al., 2024). Furthermore, integrating SDG 13 (climate action) through enhanced resource

efficiency is vital, as urban sprawl in Nigeria contributes to environmental vulnerabilities that indirectly affect housing quality.

The circular economy (CE) emerges as a promising framework for mitigating these challenges by promoting resource reuse, waste reduction, and closed-loop systems in urban settings. In developing countries, CE practices at the household level such as material recycling and energy conservation—are often necessity-driven, yet constrained by infrastructure gaps, low awareness, and regulatory weaknesses (Ahmed et al., 2022; Korsunova et al., 2022). Specific to Nigeria, adopting CE in the built environment faces barriers including limited institutional capacity, financial constraints, and sociocultural resistance, particularly in housing design and waste management (Suleman et al., 2024; Ayanrinde and Mahachi, 2025). Research on sustainable architecture in Nigeria underscores the potential of CE principles, such as low-carbon materials and modular construction, to enhance housing affordability and environmental quality, though implementation is hindered by weak enforcement and skills shortages (Moral et al., 2026).

Household-level adoption of CE practices in developing contexts reveals persistent constraints, including economic disparities, inadequate infrastructure for waste collection, and limited policy support, which perpetuate linear consumption patterns (Shollo et al., 2025). In Nigeria, these issues are compounded by low public awareness and institutional inefficiencies, limiting the integration of practices like reuse and conservation into daily urban life (Adams, 2024; Suleman, 2024). Studies from similar low-income settings, such as Bangladesh, indicate that while informal sectors drive value retention, formal policy alignment is essential to overcome barriers and achieve SDG-linked outcomes (Ahmed et al., 2022).

Despite these challenges, evidence suggests that strengthening urban environmental governance through CE mainstreaming can yield positive housing outcomes (Adesua-Lincoln, 2025). In

African contexts, integrating CE into life cycle assessments for buildings promotes sustainability, with recommendations for localized strategies to address regulatory and funding gaps. For Nigeria, policy-relevant interventions, such as enhanced regulations and community education, are proposed to foster habitability, resource efficiency, and environmental quality in secondary cities like Lapai, contributing to SDGs 11, 12, and 13. However, empirical evidence linking urban environmental management practices with sustainable housing outcomes within a circular economy framework at the household level in Nigerian secondary cities remains limited and this is what this research seeks to address using the following conceptual framework.

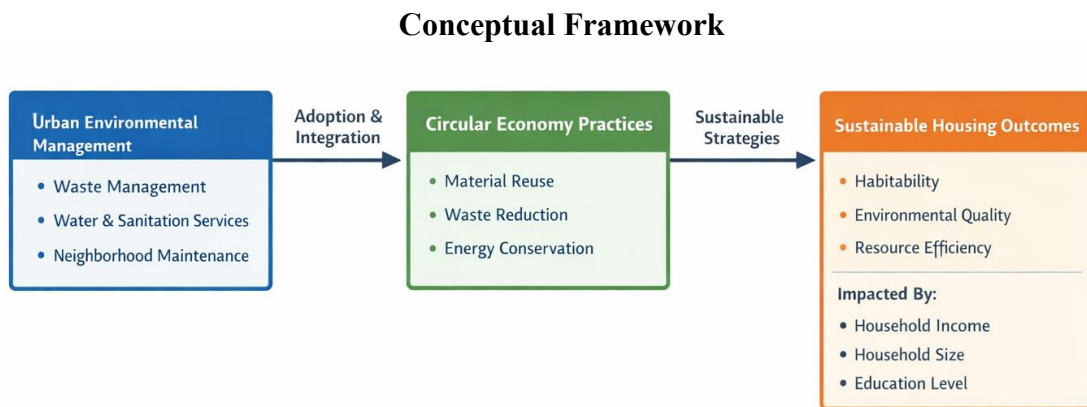


Figure 2.1: the relationships between Urban Environmental Management → Circular Economy Practices → Sustainable Housing Outcomes

Source: Computer Generated, 2026

### 3.0 METHODOLOGY

#### 3.1 Research Design

This study adopted a mixed-methods research design to comprehensively assess the sustainable housing outcomes of urban environmental management within a circular economy framework in Lapai, Niger State, Nigeria. The design integrated quantitative and qualitative approaches, allowing for triangulation of data to enhance the validity and depth of findings (Takona, 2024).

Anchored on Sustainable Development Goals (SDGs) 11 (sustainable cities and communities) and 12 (responsible consumption and production), the mixed-methods approach facilitated the examination of both measurable impacts and contextual insights into household and institutional practices.

### **3.2 Study Area**

The research was conducted in Lapai, a secondary city in Niger State, Nigeria, characterized by rapid urbanization and associated challenges such as housing shortages and environmental degradation. Lapai Local Government Area has a population of approximately 164,400, with significant urban expansion influencing land use and resource management (Yahaya and Shaibu, 2020). The selection of Lapai as the study site was informed by its representation of typical secondary urban centres in developing countries facing diseconomies of scale and infrastructure deficits (Yahaya and Shaibu, 2020).

### **3.3 Population and Sampling**

The target population for this study comprised households residing in residential units within Lapai Local Government Area of Niger State, Nigeria. According to available demographic records, Lapai has an estimated population of approximately 164,400 residents. Using the national average household size of about five persons per household in Nigeria, the estimated number of residential households in Lapai is approximately 32,880 households. This population provided the sampling frame for the quantitative component of the study.

To determine an appropriate sample size for the household survey, the study employed the widely used Yamane sample size formula, which is suitable for large populations and commonly applied in social science research to obtain representative samples. The formula is expressed as:

$$n = \frac{N}{1 + N(e)^2}$$

Where:

$n$ = required sample size

$N$ = population size

$e$ = level of precision (sampling error), typically set at 0.05 for a 95% confidence level

Substituting the estimated number of households in Lapai (32,880) into the formula:

$$n = \frac{32,880}{1 + 32,880(0.05)^2}$$

$$n = \frac{32,880}{1 + 32,880(0.0025)}$$

$$n = \frac{32,880}{1 + 82.2}$$

$$n = \frac{32,880}{83.2} \approx 395$$

The statistical calculation indicates that a sample size of approximately 395 households would be required for full representation at a 95% confidence level. However, due to field constraints typical of household surveys in developing urban settings such as time limitations, accessibility challenges, and non-response risks a sample size of 300 households was adopted. Sample sizes between 200 and 500 households are widely considered adequate for multivariate statistical analysis, particularly when regression techniques are employed in urban and housing studies.

For the quantitative survey, a multi-stage sampling technique was adopted to ensure representativeness across the study area. In the first stage, Lapai was stratified into identifiable neighbourhood clusters to account for spatial variation in housing and environmental conditions. In the second stage, residential streets within each neighbourhood were randomly selected. Finally,

individual residential units were selected through systematic random sampling. This approach ensured that households from different socio-economic and environmental contexts within Lapai were proportionately represented in the survey.

For the qualitative component, purposive sampling was used to identify key informants with relevant expertise and institutional knowledge related to urban environmental management. Participants included urban planners, environmental health officers, and community representatives. A total of 12 key informants were interviewed, which is consistent with qualitative research guidelines that emphasize depth of insight rather than large sample sizes. The interviews provided contextual understanding of governance structures, institutional constraints, and community-level practices related to circular economy adoption and sustainable housing outcomes.

### **3.4 Data Collection**

Quantitative data were collected via a structured questionnaire focusing on urban environmental management practices (e.g., waste management, water and sanitation services, and neighbourhood maintenance) and sustainable housing indicators (e.g., habitability, environmental quality, and resource efficiency). The instrument was pre-tested for reliability and validity. Qualitative data were gathered through semi-structured key informant interviews, which explored experiences with circular economy adoption, constraints, and governance issues. All data collection adhered to ethical standards, including informed consent and confidentiality.

### **3.5 Data Analysis**

Quantitative data were analysed using descriptive statistics to summarize patterns and multivariate regression analysis to examine the influence of independent variables (urban environmental

management practices) on dependent variables (sustainable housing indicators). Regression models assessed significance at a 95% confidence level, controlling for potential confounders such as household size and income. Qualitative data were analysed thematically (Braun and Clarke, 2006), involving coding, theme identification, and interpretation to enrich quantitative findings. Integration of results occurred at the interpretation stage to provide a holistic understanding of the study's objectives.

### 3.6 Model Specification and Operationalisation of Variables

To examine the influence of urban environmental management practices on sustainable housing outcomes in Lapai, a multiple linear regression model was employed. The model estimates the extent to which selected environmental management practices predict variations in sustainable housing indicators while controlling for relevant household socio-economic characteristics.

The general functional form of the regression model is expressed as:

$$SHO = \beta_0 + \beta_1 WM + \beta_2 WS + \beta_3 NEM + \beta_4 INC + \beta_5 HHS + \beta_6 EDU + \varepsilon$$

Where:

SHO = Sustainable Housing Outcomes (composite index derived from habitability, environmental quality, and resource efficiency indicators)

$\beta_0$  = Intercept (constant term)

$\beta_1$ – $\beta_6$  = Regression coefficients measuring the influence of each independent variable

WM = Waste management practices

WS = Access to improved water and sanitation services

NEM = Neighbourhood environmental maintenance

INC = Household income (control variable)

HHS = Household size (control variable)

EDU = Education level of household head (control variable)

$\varepsilon$  = Error term capturing unexplained variation in the dependent variable

The dependent variable, sustainable housing outcomes, was constructed as a composite index derived from multiple survey indicators measured on a five-point Likert scale ranging from 1 (very poor) to 5 (very good). These indicators captured three dimensions of housing sustainability: Habitability – adequacy of housing conditions, ventilation, and structural safety, Environmental quality – cleanliness of surroundings, sanitation conditions, and exposure to environmental hazards, Resource efficiency – household practices related to water conservation, energy use, and waste reduction.

Independent variables representing urban environmental management practices were also measured using Likert-scale responses based on household perceptions and reported practices. Waste management practices included indicators such as waste segregation, regular waste collection, and proper disposal methods. Access to water and sanitation services captured the availability and reliability of improved water sources and sanitation facilities. Neighbourhood environmental maintenance reflected the regularity of street cleaning, drainage maintenance, and community sanitation activities.

Control variables were included in the regression model to account for socio-economic differences among households that could influence housing conditions. Household income was measured in income brackets reported by respondents, household size represented the number of occupants in each dwelling, and education level referred to the highest educational attainment of the household head.

Prior to regression analysis, composite indices were constructed by averaging relevant Likert-scale items for each variable category. Diagnostic checks were conducted to ensure the suitability of the

regression model, including tests for multicollinearity among predictor variables and examination of residual distributions. Statistical significance was evaluated at the 95% confidence level ( $p \leq 0.05$ ).

This modelling approach enabled the study to quantify the relationship between environmental management practices and sustainable housing outcomes while integrating household socio-economic characteristics that may influence housing conditions in rapidly urbanising secondary cities.

## **4.0 RESULTS AND DISCUSSION**

### **4.1 Quantitative Results**

Descriptive statistics from the household survey ( $N = 300$ ) revealed varying levels of urban environmental management practices and sustainable housing outcomes in Lapai. Approximately 62% of respondents reported adequate access to improved water and sanitation services, while 54% indicated regular neighbourhood environmental maintenance. Waste management practices were less optimal, with only 48% of households engaging in proper segregation and disposal. On sustainable housing indicators, mean scores (on a 5-point Likert scale) were 3.2 for habitability, 2.9 for environmental quality, and 3.0 for resource efficiency, suggesting moderate performance but room for improvement.

Multivariate regression analysis examined the influence of urban environmental management practices on sustainable housing indicators, controlling for covariates such as household income, size, and education level. The model explained 42% of the variance in sustainable housing outcomes (adjusted  $R^2 = 0.42$ ,  $p < .001$ ). As shown in Table 1, waste management ( $\beta = 0.28$ ,  $p < .01$ ), access to improved water and sanitation ( $\beta = 0.35$ ,  $p < .001$ ), and neighbourhood

environmental maintenance ( $\beta = 0.24$ ,  $p < .01$ ) had significant positive effects on overall sustainable housing indicators. These findings align with the hypothesis that effective environmental practices enhance habitability, environmental quality, and resource efficiency.

Table 4.1: Regression Coefficients for Urban Environmental Management Practices on Sustainable Housing Indicators

Predictor Variable	$\beta$	SE	t	p-value
Waste Management	0.28	0.09	3.11	<.01
Water and Sanitation Services	0.35	0.08	4.38	<.001
Neighborhood Environmental Maintenance	0.24	0.10	2.40	<.01
Household Income (Control)	0.12	0.07	1.71	.09
Household Size (Control)	-0.05	0.06	-0.83	.41
Education Level (Control)	0.15	0.08	1.88	.06

Note. N = 300. Dependent variable: Composite sustainable housing score. SE = standard error. Source: Analysis, 2026

### 4.3 Qualitative Results

Thematic analysis of key informant interviews (n = 12) identified three main themes: low public awareness of circular economy (CE) practices, institutional constraints, and opportunities for governance strengthening. Participants highlighted limited household adoption of CE principles, such as material reuse (mentioned by 8 informants) and energy conservation (mentioned by 7), attributing this to inadequate education and cultural norms favoring linear consumption. Weak institutional capacity emerged as a barrier, with urban planners noting insufficient funding and staffing for enforcement (theme frequency: 10/12). Community representatives emphasized poor regulatory frameworks, leading to inconsistent waste management and sanitation services. However, informants suggested potential for mainstreaming CE through community-led initiatives and policy reforms.

#### 4.4 Discussion

The quantitative findings demonstrate that urban environmental management practices significantly positively influence sustainable housing outcomes in Lapai, consistent with prior research on secondary cities in developing contexts. For instance, effective waste management and water/sanitation access align with studies in Nigeria showing their role in reducing environmental degradation and improving habitability. Neighbourhood maintenance's positive effect echoes literature on urban governance in Sub-Saharan Africa, where regular upkeep mitigates diseconomies of scale and enhances resource efficiency. These results support SDG 11 by promoting resilient communities and SDG 12 through responsible resource use, while indirectly advancing SDG 13 via reduced urban vulnerabilities to climate impacts.

Qualitative insights enrich these findings by revealing low CE awareness at the household level, driven by institutional weaknesses and enforcement gaps, corroborating barriers identified in Nigerian built environment studies. This low adoption of practices like reuse and conservation mirrors necessity-driven but constrained CE in low-income settings, highlighting the need for targeted education and policy alignment. The interplay of quantitative and qualitative data underscores a gap in mainstreaming CE, as noted in broader African urban sustainability literature.

These results have policy implications for local SDG implementation in secondary cities like Lapai. Strengthening urban environmental governance through enhanced regulations, capacity building, and community awareness programs could amplify sustainable housing outcomes. Limitations include the cross-sectional design, which limits causality inference, and reliance on self-reported data, potentially subject to bias. Future research could employ longitudinal methods to track CE adoption over time. Overall, this study provides evidence-based recommendations for integrating CE into household practices, fostering sustainable urban development in Nigeria.

## **5.0 CONCLUSION AND RECOMMENDATIONS**

### **5.1 Conclusion**

This study has demonstrated that urban environmental management practices significantly contribute to sustainable housing outcomes in Lapai, a secondary city in Niger State, Nigeria. Quantitative findings from the household survey and multivariate regression analysis confirmed that effective waste management, improved access to water and sanitation services, and regular neighbourhood environmental maintenance positively influence key indicators of habitability, environmental quality, and resource efficiency. These results align with broader evidence from Nigerian and Sub-Saharan African contexts, where such practices mitigate the adverse effects of rapid urbanization on housing quality and resource use.

Qualitative insights from key informant interviews further illuminated persistent challenges, particularly the low level of public awareness and adoption of circular economy (CE) principles at the household level. Constraints including weak institutional capacity, inadequate enforcement of environmental regulations, and limited community education perpetuate linear consumption patterns, hindering the mainstreaming of practices such as material reuse, waste reduction, and energy conservation. These barriers resonate with documented issues in the Nigerian built environment and developing-country secondary cities, where economic volatility, infrastructure gaps, and regulatory weaknesses impede CE transitions.

The study underscores the interconnectedness of SDG 11 (sustainable cities and communities) and SDG 12 (responsible consumption and production), while contributing to SDG 13 (climate action) through enhanced urban resource efficiency and reduced environmental degradation. In Lapai, strengthening these linkages offers a pathway to more resilient and inclusive urban development,

addressing housing deprivation and environmental pressures characteristic of secondary cities in developing regions.

## **5.2 Recommendations**

To advance sustainable housing outcomes and accelerate CE adoption in Lapai and similar secondary cities, the following policy-relevant recommendations are proposed:

1. **Strengthen urban environmental governance:** Local authorities in Lapai should prioritize institutional capacity building, including increased funding, staffing, and training for urban planners and environmental health officers. Enhanced enforcement mechanisms for existing environmental regulations are essential to ensure consistent implementation of waste management, sanitation, and neighbourhood maintenance practices.
2. **Mainstream circular economy principles into household practices:** Targeted awareness campaigns and community education programs should be developed and implemented to raise public knowledge of CE benefits, focusing on practical actions such as material reuse, waste segregation, and energy conservation. Collaboration with community representatives can facilitate culturally appropriate interventions to overcome sociocultural resistance.
3. **Promote integrated policy frameworks for SDGs localization:** Niger State and federal agencies should integrate CE strategies into local urban planning and housing policies, aligning with national SDG implementation plans. This includes developing incentives for households and small enterprises to adopt sustainable practices, such as subsidies for improved sanitation infrastructure and waste recycling initiatives.
4. **Foster multi-stakeholder partnerships:** Engage public-private partnerships and community-based organizations to support infrastructure improvements and monitoring. Drawing from

successful models in other Nigerian contexts, such partnerships can enhance resource mobilization and ensure inclusive participation in environmental management.

5. Support further research and monitoring: Longitudinal studies in Lapai and comparative analyses across other secondary cities are recommended to track CE adoption trends and evaluate the long-term impacts of governance interventions. Regular data collection on sustainable housing indicators will enable evidence-based policy adjustments.

By implementing these recommendations, Lapai can serve as a model for advancing sustainable urban development in Nigeria's secondary cities, contributing meaningfully to national and global SDG targets while improving living conditions for residents.

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