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Assessing Local Government Capacity in Solid Waste Management in Nigeria: Evidence from Environmental Agency Reports, 2015–2024

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ABSTRACT

Background: Rapid urbanisation and population growth have significantly increased the volume of solid waste generated across Nigeria, placing enormous pressure on local governments, which bear the primary responsibility for waste management. Although numerous studies have examined solid waste management practices, few have synthesised evidence from environmental agency reports to assess the institutional capacity of local governments over time.
Objective: This study examined the capacity, performance, and institutional challenges of local governments in managing solid waste in Nigeria between 2015 and 2024.
Method: The study adopted a secondary data research design. Twelve reports published between 2015 and 2024 were purposively selected from the Federal Ministry of Environment, the National Environmental Standards and Regulations Enforcement Agency (NESREA), the National Bureau of Statistics (NBS), the World Bank, and UN-Habitat based on predefined eligibility criteria. Data were analysed using trend and thematic analysis.
Results: The analysis revealed a steady increase in urban population and corresponding growth in solid waste generation throughout the study period. Despite the existence of relevant policy frameworks, local governments faced persistent institutional constraints, including inadequate funding, weak regulatory enforcement, insufficient waste management infrastructure, limited recycling initiatives, inadequate technical capacity, and low levels of community participation.
Conclusion: The study concludes that the effectiveness of solid waste management in Nigeria is constrained less by the absence of policy than by weak institutional capacity at the local government level. Strengthening institutional frameworks, improving funding, enhancing regulatory enforcement, investing in waste management infrastructure, and promoting community participation are essential for achieving sustainable and efficient solid waste management.

Keywords: Community engagement; environmental planning; infrastructure development; local government capacity; public administration; sustainable waste management.

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INTRODUCTION

Effective solid waste management is a fundamental component of sustainable urban development, particularly in developing countries where rapid urbanisation has outpaced environmental infrastructure and service delivery. Inadequate waste collection, poor disposal practices, weak institutional capacity, and insufficient environmental infrastructure continue to undermine environmental sustainability and public health. Proper environmental sanitation depends on efficient systems for the collection, treatment, recycling, and safe disposal of solid waste to promote a healthy environment, improve public health outcomes, and support socio-economic development. Despite these objectives, many developing countries, including Nigeria, continue to experience significant challenges in managing solid waste effectively (World Bank, 2018).

Nigeria, the most populous country in Africa, has witnessed rapid population growth and urban expansion in recent decades, placing unprecedented pressure on existing waste management systems (United Nations, 2024). The growing concentration of people in urban centres has led to a corresponding increase in solid waste generation, stretching the capacity of local authorities responsible for waste collection and disposal. Although successive governments have introduced policies and regulatory frameworks to improve environmental sanitation, ineffective waste management remains a persistent challenge across many parts of the country. Common problems include indiscriminate refuse disposal, open dumping, blocked drainage systems, inadequate recycling facilities, and poor waste treatment practices (Ogwueleka, 2009).

Environmental sanitation and waste management are constitutionally recognised as concurrent responsibilities of the federal, state, and local governments in Nigeria. However, local governments occupy a particularly strategic position because of their proximity to communities and their statutory responsibility for environmental sanitation within their jurisdictions. As the tier of government closest to the people, local governments are expected to provide waste collection services, promote environmental awareness, mobilise community participation in sanitation programmes, and collaborate with relevant stakeholders to ensure clean, safe, and healthy communities (Agbodike et al., 2014). Despite these responsibilities, concerns persist regarding their institutional capacity to deliver effective waste management services. Previous studies have identified inadequate funding, poor waste management infrastructure, weak institutional frameworks, limited technical capacity, ineffective enforcement of environmental regulations, and low levels of public participation as major constraints to effective local government performance (Daramola & Ibem, 2010; Nzeadibe & Anyadike, 2012). These challenges have contributed to the accumulation of solid waste in both urban and rural communities, thereby exacerbating environmental pollution and increasing public health risks.

Over the years, reports produced by the Federal Ministry of Environment, the National Environmental Standards and Regulations Enforcement Agency (NESREA), the National Bureau of Statistics (NBS), the World Bank, and the United Nations Human Settlements Programme (UN-Habitat) have generated substantial evidence on the state of solid waste management in Nigeria. These reports provide valuable information on policy implementation, institutional

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performance, operational challenges, environmental outcomes, and the need for stronger intergovernmental collaboration. While previous empirical studies have largely relied on surveys and case studies conducted within individual states or local government areas, relatively few have synthesised evidence from environmental agency reports to evaluate local governments' capacity for solid waste management at the national level.

This study addresses this gap by synthesising evidence from environmental agency reports published between 2015 and 2024 to assess the institutional capacity, performance, and challenges of local governments in managing solid waste in Nigeria. By integrating findings from multiple authoritative sources, the study provides a comprehensive national perspective on the effectiveness of local government participation in solid waste management. The findings are expected to contribute to the literature on environmental governance and local government administration while providing evidence-based insights to inform policy reforms, strengthen institutional capacity, and promote sustainable solid waste management practices across Nigeria.

LITERATURE REVIEW

Concept of Waste Management

Waste management can be generally defined as the processes involved in garbage collection, transfer, treatment, recycling and disposal in a way that will be effective in the control of potential environmental and public health hazards. Waste management may apply to waste produced by households or by industrial, commercial or institutional establishments (World Bank, 2018). Effective management of waste is widely believed to be critical for environmental protection and sustainability, as lack of good waste disposal systems and practices often leads to pollution, disease, environmental destruction, and low quality of life (World Bank, 2018). Urbanization and population growth in many countries are increasing the rate of municipal solid waste generation globally. Waste management challenges have been noted to be more severe in developing countries due to weak institutional infrastructure, regulation, and finance (World Bank, 2018). Increasing urban population and consumption rates coupled with poor disposal infrastructures have contributed immensely to the problem of solid waste generation in both rural and urban settlements in Nigeria. Ogwueleka (2009) blamed poor planning processes, lack of financial capacity, weak institutional framework, and low technology capacity as some of the factors responsible for poor municipal solid waste management practices in Nigeria. On the other hand, Nzeadibe and Anyadike (2012) reported that ineffective solid waste collection mechanisms, weak recycling initiatives, and poor enforcement of environmental policies have posed serious threats to sustainable solid waste management practices in Nigerian cities. Nzeadibe and Anyadike (2012) also highlighted community participation and improvement in institutional collaboration as key factors influencing sustainable waste management practices. The studies therefore agreed that sustainable solid waste management required effective collaboration between government agencies, private refuse operators and local community members.

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Local Government and Environmental Service Delivery in Nigeria

Local governments are established by the constitution as the third tier of government in Nigeria and, by statute, have the responsibility to provide services closer to the grassroots, including environmental sanitation and solid waste management. They are expected to manage environmental sanitation at the grassroots level due to their proximity to the people they serve. It is also believed that local governments are strategically positioned to coordinate activities that promote waste collection and disposal, raise awareness about environmental sanitation, and supervise sanitation programs (Agbodike et al., 2014). To deliver environmental sanitation services effectively, adequate funding, institutional capacity backed by technical know-how, and effective administration are essential. Earlier studies by Daramola & Ibem (2010) identified a lack of funds, political interference, a weak administrative setup, and poor infrastructure as major constraints to service delivery by local governments. Sharma and Sharma (2020) found similar institutional problems, including finance, confronting municipal solid waste management in developing countries, such as a weak institutional setup, rapid urbanization, and poor technological capacity. This shows that, although their study focused on another country, it still shares similarities with Nigeria, since institutional problems cut across geographical locations.

Waste Management Practices in Nigeria

In Nigeria, institutions with legislative responsibility for solid and liquid waste management range from federal, state, and local government to private-sector operators involved in waste management activities. Waste management policies, legislation, and regulation have changed over time, resulting in the evolution of institutions responsible for environmental regulation, such as the establishment of the Federal Ministry of Environment and the National Environmental Standards and Regulations Enforcement Agency (NESREA) to improve environmental governance. However, solid waste management practices still face serious challenges in many parts of Nigeria. Nzeadibe and Anyadike (2012) noted that a poor waste collection system, ineffective recycling programs, and low enforcement of environmental laws have negatively impacted waste management practices, encouraging the indiscriminate disposal of solid waste in many cities and leading to the filling of dumpsites. As such, policy focus has increasingly centered on sustainable waste management approaches such as the waste hierarchy and its principles, which include waste reduction, reuse, recycling, recovery, and disposal, the circular economy, and Integrated Solid Waste Management (ISWM). These principles are founded on creating efficiency in resource utilization, stakeholder engagement, and environmentally sustainable waste management practices (Sharma & Sharma, 2020). However, most of these approaches have not been fully implemented in Nigeria due to limited funding, poor awareness, weak infrastructure, and poor collaboration among responsible institutions.

THEORETICAL FRAMEWORK

Institutional Theory

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To guide this study, Institutional Theory was used. This theory examines how organisational activities affect its performance based on formal rules, policies, regulations, and organisational institutional arrangements (Scott, 2014). Scott (2014) conceptualised three pillars of institutions, which are regulative, normative, and cultural-cognitive pillars. The regulative pillar shows how organisations respond to the environmental laws and regulations put in place. The normative pillar addresses the responsibility of the organisation, while the cognitive pillar addresses beliefs, thoughts, and attitudes shared among society. Institutional Theory applies to this study because the performance of local government depends on the presence or strength of institutional arrangements. Institutions in solid waste management are said to be weak where there is poor funding of environmental agencies, weak enforcement of environmental regulations, lack of inter-agency coordination on environmental issues and policies, weak physical infrastructure, and low participation of people in solid waste management. Institutional research on solid waste management performance was conducted through environmental agency reports to gather evidence on environmental policy implementation, institutional strength, and waste management performance at the local government level. Institutional Theory is therefore suitable because it helps analyse how institutions can affect local government capacity to manage solid waste generated in Nigeria.

EMPIRICAL REVIEW

Previous studies that have evaluated environmental services delivery, focusing on solid waste management in Nigeria, employed survey and case study designs (Onovughe, 2007; Ogwueleka, 2009; Nzeadibe & Anyadike, 2012; Agbodike et al., 2014). These studies were conducted at the state and local government areas with data collection methods including questionnaires, interviews, and observation of field activities. Results showed that insufficient funding, inadequate waste collection vehicles and infrastructure, lack of institutional capacity, limited recycling centres, lack of public awareness, and weak regulatory enforcement were challenges associated with environmental services delivery in Nigeria. Several recommendations, including institutional reform, improved infrastructure, public participation, and environmental education, were documented to improve solid waste management services delivery. Recent evidence, however, indicates that most of these challenges persist in Nigeria. In a rapid review of Nigeria's solid waste management literature, Akintayo (2023) identified weak multidisciplinary collaboration and low sociocultural integration as challenges still affecting waste management interventions and policy implementation. Another review study by Onungwe (2023), who used a systematic review approach, reported that while circular economy principles present opportunities to improve municipal solid waste management in Nigeria, weak institutional and operational capacity for sustainable practices persists. Findings from these reviews suggest that institutional gaps and issues remain pertinent research topics that need to be addressed to better understand intervention success and environmental services delivery in Nigeria.

The current study builds on the previous literature by reviewing evidence reported in waste management reports published by environmental agencies in Nigeria. While past empirical studies have provided valuable insights into the challenges of waste management in Nigeria, most studies were conducted at the state level using cross-sectional survey designs.

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Environmental performance across states may differ due to variations in institutional capacity and implementation capabilities at the local government level. Agency reports provide an opportunity to source credible evidence because they are published annually and will have information on local government implementation efforts, capacity, compliance enforcement, infrastructure, and outcomes within their jurisdictions. Data for this review study were obtained by extracting information from 12 environmental agency reports published between 2015 and 2024. Results from this secondary data review will provide a national-level analysis of local government capacity and performance in solid waste management. Furthermore, the use of secondary data will help identify institutional and recurrent themes that have hindered effective solid waste management implementation.

METHODOLOGY

Research Design

The study adopted a documentary research design utilizing secondary data analysis. The design enabled the researchers to systematically review and interpret environmental agency reports and statistical datasets relating to waste management in Nigeria between 2015 and 2024.

Sources of Data

The data for this research work were sourced from 12 environment reports published between 2015 and 2024 from reputable sources such as the Federal Ministry of Environment, National Environmental Standards and Regulations Enforcement Agency (NESREA), National Bureau of Statistics (NBS), World Bank, and United Nations Human Settlements Programme (UN-Habitat). Searching for relevant documents to be used was done online by using keywords that cut across solid waste management, environmental sanitation, local government, and Nigeria. Reports obtained were limited to those covering solid waste management and local government environmental service delivery in Nigeria only. Reports found that were duplicates of each other were excluded. Irrelevant copies of reports gathered during the search were excluded. Those used were deemed fit for the research because they have credible and policy-useful information on environmental governance and solid waste management in Nigeria.

Data Collection Procedure

Systematic document review was used to gather the data. In this method, documents were selected according to their relevance to the waste management system in Nigeria. Priority was given to study materials that specifically tackled urban waste generation and management, local government's role and participation in environmental sanitation, institutional capacity and infrastructure, enforcement mechanisms, recycling system, and public involvement. The time frame for the selected documents was 2015 to 2024, to include only recent developments in environmental governance and waste management reforms. Data were retrieved manually, and information was extracted and organized under themes relevant to the study's objectives. The coding and thematic analysis were performed by the researcher and were developed from data within reports and then placed into the thematic analysis categories based on the objectives of the study. Intercoder assessment was not applied because only a single researcher coded the data.

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The 12 reports were included in the analysis, and coding was completed when no new themes were identified in the reports.

Method of Data Analysis

Quantitative and qualitative methods of analysis were used to analyse data collected for this study. Trend analysis was conducted to understand how urbanization trends and the growth of urban populations have changed throughout the time frame of our study in Nigeria, using World Bank Data. Content analysis using the thematic gap analysis method was conducted on information gathered from Federal Ministry of Environment, National Environmental Standards and Regulations Enforcement Agency (NESREA), National Bureau of Statistics (NBS), World Bank publications, and United Nations Human Settlements Programme (UN-Habitat) reports. For purposes of this study, a gap was defined as the difference between an expected level of institutional responsibility and duty, and reported levels of implementation by environmental agencies. Gaps were determined through thematic coding and synthesis of evidence regarding institutional capacity to fund and enforce regulations, provide infrastructure, recycle and support community participation throughout the reports reviewed. Themes of importance with respect to waste management and local government performance included perceived evidence of inadequate funding, ineffective enforcement, lack of good infrastructure, poor recycling systems, and lack of community participation. Each theme was coded as either present (1) or absent (0) based on the evidence. Results from the trend analysis and thematic coding were combined to interpret local government involvement in waste management and institutional drivers of environmental service delivery in Nigeria. The results from both analysis methods were integrated to give a general interpretation of local governments' involvement in solid waste management in Nigeria and the institutional and operational factors affecting environmental service delivery.

RESULTS AND DISCUSSION

Results

Table 4.1: Trend in Urban Population in Nigeria (2015-2024)

Year	Urban Population	Growth Rate (%)
2015	106,266,334	–
2016	110,505,898	**3.99**
2017	114,843,267	**3.93**
2018	119,182,819	**3.78**
2019	123,515,077	**3.63**
2020	127,896,884	**3.55**
2021	132,362,871	**3.49**
2022	136,953,875	**3.47**
2023	141,685,483	**3.45**
2024	146,531,222	**3.42**

Source: Researcher's Compilation (2026)

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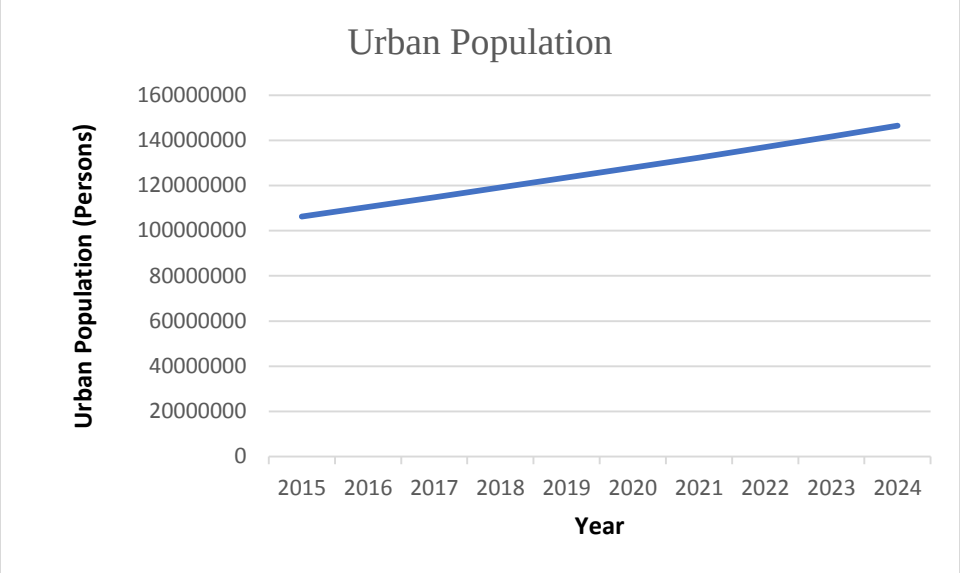
Table 4.1 reveals an increase in the number of persons living in urban centres as at the period under study. The 2015 population of persons living in urban centres in Nigeria stood at 106,266,334. In 2024, it stood at 146,531,222. This means an approximate increase of 40.26 million persons living in urban centres in Nigeria in a space of 10 years. *The observed trend suggests sustained urban growth during the study period.* The increasing urban population has resulted from population growth, rural-to-urban migration and centralization of employment opportunities and social amenities in cities. The consequence of this increase in urban population is an increase in solid waste generation; thus, increasing urban population translates into increased demand for waste management services. This research work indicates that local governments will be faced with the challenges of providing increased waste collection, transportation, treatment, and disposal services as a result of the increasing urban population. The need to provide adequate environmental sanitation programmes, waste management infrastructure and disposal facilities as the number of the urban population increases cannot be overemphasized. This trend, therefore, calls for local governments saddled with the responsibilities of environmental sanitation and waste management services at the grassroots.

Figure 4.1: Trend in Urban Population in Nigeria (2015–2024)



Source: Researcher's compilation from World Bank World Development Indicators (2015-2024)

Figure 4.1 displays Nigeria's urban population growth from 2015 to 2024. It can be seen that the trend line increases throughout time, supporting the urban population's persistent increase in Nigeria Table 4.1.

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Table 4.2: Thematic Gap Analysis of Local Government Waste Management in Nigeria (2015–2024)

S/N	Theme	Desired State (Policy Expectation)	Current State (Evidence from Documents)	Identified Gap	Implications for Local Government Performance	Sources
1	Inadequate Funding	Adequate and sustainable financing for local government waste management services, including waste collection, transport, and disposal	Reviewed reports consistently highlight insufficient financing, weak budget prioritization, and limited fiscal capacity of local governments to sustain waste management operations	Funding Gap: Waste management is constrained by inadequate and inconsistent financial allocation at the local government level	Reduces the capacity of local governments to provide efficient waste collection and disposal services.	NESREA (2025); World Bank (2018)
2	Weak Enforcement of Environmental Regulations	Effective enforcement of environmental sanitation laws, monitoring of compliance, and penalties for illegal dumping	Evidence from institutional reports shows weak enforcement capacity, poor compliance monitoring, and limited operational support for environmental officers	Enforcement Gap: Environmental regulations exist but are weakly implemented at the local government level	Encourages non-compliance with environmental regulations and indiscriminate waste disposal.	NESREA (2025); Federal Ministry of Environment (2023)
3	Inadequate Waste	Functional waste	Reports indicate	Infrastructure Gap: Poor	Limits effective	UN-Habitat (2020);

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	Management Infrastructure	collection systems, engineered landfills, transfer stations, and treatment facilities	widespread reliance on open dumping, lack of engineered landfills, and insufficient waste collection infrastructure across local governments	waste management infrastructure limits effective collection and disposal services	waste collection, transportation, treatment, and disposal	NESREA (2025); World Bank (2018)
4	Poor Recycling Systems	Structured recycling systems, material recovery facilities, and integrated waste segregation at source	Evidence shows low recycling capacity, dominance of informal recycling activities, and absence of structured recycling systems in most local government areas	Recycling Gap: Absence of formal recycling systems undermines resource recovery and sustainable waste management	Reduces resource recovery and increases dependence on landfill disposal.	World Bank (2018); NESREA (2025)
5	Low Community Participation	Active public engagement in waste segregation, sanitation programmes, and environmental compliance	Reports highlight low environmental awareness, poor participation in formal waste collection systems, and widespread indiscriminate dumping practices	Participation Gap: Weak community engagement reduces effectiveness of waste management systems	Weakens environmental sanitation programmes and public compliance with waste management initiatives.	UN-Habitat (2020); NESREA (2025)

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Source: Author's Compilations (2026)

Table 4.2 shows an alarming persistence of poor local government performance in waste management in Nigeria from 2015 to 2024. *A major challenge identified across the reviewed reports is inadequate funding.* The reviewed reports, particularly NESREA and the World Bank, identify that local governments are not allocated enough money to adequately service the waste sector. This challenge affects several aspects of waste management operations, including staffing, equipment acquisition, and service delivery. Related to the above is poor enforcement of environmental laws and policies.

While these laws and policies exist, local-level government capacity and will to implement them has been low. Monitoring and enforcement of penalties is not occurring, and illegal dumping is taking place with few ramifications. Another key finding of the assessment is the significant infrastructure gap that exists. A majority of the local government areas have no engineered landfill, transfer station, or a working solid waste collection system. Open dumping is therefore the prevailing practice in most communities, leading to a higher degree of environmental and public health risk. There are also poorly developed systems for recycling. Research by the World Bank and NESREA has shown that recycling in Nigeria is unstructured and often informal in nature. At the local government level, there are only a few facilities for separating waste or recovering materials in a formal sense. This means there is a low level of resource recovery and a linear "collect and dump" model is more commonly used. Lastly, community participation is weak. Evidence points to low public awareness levels, poor participation in sanitation programmes, and the prevalence of indiscriminate dumping. In addition, residents are not actively involved in the formal waste collection system, further hampering the efforts of the local government. In conclusion, the findings show that the waste management issues in Nigeria are interrelated. Insufficient funding hinders the development of necessary infrastructure, weak enforcement allows for the persistence of poor waste management practices, infrastructure gaps lead to inadequate service delivery, and low community participation exacerbates compliance issues. These challenges create a cycle where local governments struggle to effectively manage waste despite the presence of supportive policies and institutions.

DISCUSSION

Results from this study revealed that rapid urbanization, limited institutional capacity, and poor solid waste management are interlinked problems confronting Nigeria within the period of study from 2015 to 2024. Rapid increases in the urban population have resulted in increased demand for services such as waste collection, transportation, treatment, disposal, and local governments, saddled with environmental sanitation functions, are overstretched. This research finding corroborates findings by the World Bank (2018), which reported that urbanization rates have exceeded the capacity of waste management services in most developing countries. Inadequate funding tops the list of problems affecting solid waste management services delivery. Findings from NESREA (2025) and World Bank reports revealed that low budgetary allocations hamper local government's ability to provide waste collection infrastructure, buy equipment and employ

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staff, and embark on environmental sanitation exercises. Poor enforcement of environmental rules, lack of infrastructure, poorly developed recycling mechanisms, and low community participation have further diminished environmental services delivery efforts. These results suggest that the problems experienced by local governments are an indication of weak institutional capacity that affects the implementation of environmental programs across the board. The results partly confirm the Institutional Theory (Scott, 2014). The theory posits that without appropriate institutional arrangements, organizations are likely to perform poorly. Here, insufficient funds and lack of enforcement demonstrate the weaknesses in the regulative and normative pillars of institutions, which negatively affected local government's ability to adequately deliver environmental services. Therefore, environmental laws are futile if they are not backed up by relevant and resilient institutions, legislation, coordination amongst key stakeholders, and resources. The results also revealed recycling efforts were informal, suggesting few elements of the Circular Economy have been embraced. A Circular Economy entails sustainable waste management methods that encourage reduction, reuse, recycling, and recovery of waste in line with the waste hierarchy before final disposal (Sharma & Sharma, 2020). Continued use of waste collection and open dumping methods signifies sustainable forms of urban governance have not been embraced at the local level for waste management. In summary, the findings reveal solid waste management practices can be improved by increased institutional capacity, sustainable funding mechanisms, enforcement of laws and regulations, investing in appropriate waste management facilities, and increasing inclusivity in decision-making processes. If these institutional barriers are overcome, environmental services can be improved, promoting urban growth.

CONCLUSION

The study examined the capacity and performance of local governments in solid waste management in Nigeria between 2015 and 2024 using secondary data from major national and international environmental reports. According to the study's findings, despite having environmental policies and environmental agencies in Nigeria, environmental service delivery by local governments continued to suffer from institutional challenges brought about by a lack of funding, a lack of enforcement of environmental laws, poor waste management services and infrastructure, inadequate recycling systems, and a lack of participation of community members in environmental affairs. Thus, weak institutions continue to plague environmental service delivery by local governments. The study fills the gap in the literature by adding synthesized national-level evidence from environmental agency reports on what causes poor environmental outcomes of solid waste management service delivery by Nigeria's local governments. The study shows that contrary to Nigeria lacking institutions that enforce environmental policies, it is the weak institutions that are causing poor environmental service delivery by the country's local governments. This finding confirms Institutional Theory, which argues that when institutional arrangements are weak, they affect the ability of organizations to implement rules and policies. The results therefore imply that environmental service delivery and sustainable urbanization call for policy changes that should be hinged on improving institutional setup, proper financing policies, and efficient regulatory enforcement in Nigeria.

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RECOMMENDATION

1. Creation of waste management funds at the local government level to serve as revolving funds for waste management activities.
2. Empowerment of environmental regulators through logistics, manpower, legal aid, and enforcement monitors so they can meet the agency's mandate.
3. Provision of adequate engineered landfill, transfer stations, refuse collection trucks and other sanitation facilities.
4. Encouragement of private sector participation through public-private partnership and incentives that will promote creative thoughts towards reduction, reuse and recycling of waste leading to resource recovery as obtained in the Circular Economy model.
5. Continuous environmental sanitation education and public enlightenment, as well as community participatory approach to sanitation programmes.
6. Strengthen collaboration and delineation of roles of Federal, State and Local Government Institutions on environmental services.

Ethical Clearance
Ethical approval was not required for this study because it was based entirely on secondary data obtained from publicly available reports and documents. No human participants were directly involved, and no identifiable personal data were collected.

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Conflict of Interest
The authors declares that there is no conflict of interest regarding the publication of this study.

Author's Contribution
Obaren Thomas Igabor & Clement Oribhabor conceived and designed the study, collected and analysed the data, interpreted the findings, prepared the manuscript, and approved the final version for publication. The author accepts responsibility for the content and similarity index of the manuscript.

Artificial Intelligence (AI) Use Disclosure
During the preparation of this manuscript, the author used Artificial Intelligence (**AI)** for

language editing, grammar correction, readability improvement, and formatting assistance. All AI-generated outputs were carefully reviewed, revised, and verified by the author, who accepts full responsibility for the accuracy, originality, and integrity of the manuscript.

Data Availability Statement

The datasets supporting the findings of this study were obtained from publicly available reports published by the Federal Ministry of Environment, the National Environmental Standards and Regulations Enforcement Agency (NESREA), the National Bureau of Statistics (NBS), the World Bank, and the United Nations Human Settlements Programme (UN-Habitat). Additional information is available from the author upon reasonable request.

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