International Journal of Sub-Saharan African Research (IJSSAR)
Vol. 4, Issue 2, pp. 529-541, June 2026, ISSN: 3043-4467 (Online), 3043-4459 (Print)
https://doi:10.5281/zenodo.21031363

Urbanisation and Solid Waste Management in Oredo Local Government Area, Edo State, Nigeria: Challenges and Sustainable Management Strategies

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ABSTRACT

Background: Rapid urbanisation in Oredo Local Government Area, Edo State, Nigeria, has significantly increased solid waste generation and strained existing waste management systems. City expansion and changing consumption have sharply increased urban waste, while existing management structures struggle to cope. This has resulted in indiscriminate dumping, blocked drains, and public health risks in residential and commercial areas. Whereas numerous studies exist on the perception of residents on the issues of solid waste generation, there remains a gap on how urbanisation poses challenges on solid waste management. This study therefore investigated Urbanisation and Solid Waste Management in Oredo Local Government Area, Edo State, Nigeria.
Objective: To ascertain urbanization's effect on solid waste generation; identify measures for establishing an effective solid waste management programme in Oredo LGA; *and inves*tigate challenges affecting solid waste management in the area.
Method: A qualitative approach collected primary and secondary data. Primary data came from focus group discussions with 40 Oredo residents and in-depth interviews with 5 local government staff and 5 waste disposal workers. Secondary data were drawn from books, journals, and online sources. Data were analysed thematically using predetermined and emergent themes related to waste generation, management practices, and institutional challenges.
Results: Urbanization increased solid waste from households, markets, restaurants, and institutions. Higher consumption of packaged goods raised non-biodegradable waste-plastics, polythene, cans, glass-accumulating in drains and dumpsites. *Rapid urban expansion outpaced available waste management infrastructure, resulting in irregular waste collection and increased environmental pollution.*
Unique Contribution: *The study provides context-specific insights into waste generation patterns and management challenges in Oredo LGA, thereby addressing the paucity of location-specific evidence on urban waste management in Benin City.*
Key Recommendations: Improving waste collection logistics; promoting waste sorting and recycling; increasing funding for waste management infrastructure; and strengthening public-private partnerships.

Keywords: Composition, Management, Population, Trends, Waste Generation,

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INTRODUCTION

Urbanisation is a global phenomenon that refers to the increasing concentration of populations in urban centres due to migration, economic opportunities, and infrastructural development, often resulting in heightened pressure on environmental resources and public services. Across the world, solid waste management becomes particularly challenging in rapidly urbanising contexts where waste generation outpaces institutional capacities to handle, collect, and dispose efficiently (Igbinomwanhia, 2012).

In Nigeria, this phenomenon has accelerated dramatically over the years, with urban populations growing at an average rate of 4.3% annually. This growth is transforming cities into hubs of economic activity while simultaneously exacerbating issues such as waste accumulation, indiscriminate dumping, and environmental degradation (Agbebaku, Osaghae, & Uwadia, 2021). Solid waste management becomes particularly challenging in rapidly urbanising contexts where waste generation outpaces institutional capacities (Igbinomwanhia, 2012). The inability of authorities to match waste management services with population growth has made urban waste a pressing environmental and public health concern.

Also, Edo State, Benin City has experienced significant urban expansion over the last three decades. Oredo Local Government Area, which forms the core of Benin City and the state capital, is characterised by dense residential, commercial, and industrial zones. The rapid expansion has led to overcrowded low-income areas were existing waste management services lag behind population growth. This situation has resulted in environmental degradation, pollution, and health risks within the LGA (Otoghile & Akpomerha, 2022; Edo State Environmental Protection Agency, 2019).

Previous studies have largely examined waste management challenges in Nigeria major cities with emphasis on waste generation trends, collection systems, and policy frameworks. While these studies provide useful insights into urban waste dynamics at the national level, However, significant empirical attention has not been given to the specific effects of rapid urbanisation on solid waste management in Oredo LGA, despite its status as the core of Benin City, its growing population, and expanding urban landscape. This gap limits understanding of localized waste generation dynamics, resident disposal practices, and the effectiveness of existing policies within Oredo LGA. Against this backdrop, this study investigates Urbanisation and Solid Waste Management in Oredo Local Government Area, Edo State, Nigeria: Challenges and Sustainable Management Strategies.

STATEMENT OF THE PROBLEM

Rapid urbanisation in Oredo Local Government Area of Edo State has led to increased population growth, expansion of residential and commercial activities, and a corresponding rise in solid waste generation. However, existing waste management infrastructure and institutional capacity have not expanded at the same pace. Consequently, irregular waste collection, indiscriminate dumping, open burning of refuse, and blockage of drainage systems have become common occurrences in many parts of the area, posing serious environmental and public health risks.

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Despite efforts by government agencies and other stakeholders to improve waste management practices, challenges such as inadequate infrastructure, insufficient funding, weak institutional arrangements, and poor public attitudes toward waste disposal continue to undermine effective solid waste management in Oredo LGA. Previous studies have largely focused on general waste management challenges in Nigerian cities, with limited attention given to the specific influence of rapid urbanisation on solid waste generation and management in Oredo LGA. This lack of context-specific evidence creates a knowledge gap regarding the relationship between urbanisation and waste management in the area. It is against this backdrop that this study investigates the effects of urbanisation on solid waste management in Oredo Local Government Area, Edo State.

RESEARCH QUESTIONS

The following questions are stated as a guide in this study:

a. What is the effect of urbanisation on solid waste generation in Oredo Local Government Area?
b. What measures can enhance effective solid waste management in Oredo Local Government Area?
c. What are the challenges affecting solid waste management in Oredo Local Government Area?

The Concept of Urbanisation

Urbanisation refers to the increasing concentration of populations in urban areas resulting from rural-urban migration, natural population growth, and economic transformation. *Especially, it* is the consistent movement of people from a rural area to a city. According to the United Nations Habitat (2016), it is the process of people moving from rural areas to cities, resulting in the growth of urban populations. It's a complex phenomenon driven by factors such as the desire for better economic opportunities, better access to services and amenities, industrialization, and social mobility. As cities grow, urbanisation can lead to increased economic activity, cultural diversity, and pressure on infrastructure and resources (World Bank, 2020).

The Concept of Solid Waste Management

Solid waste management refers to the systematic collection, storage, transportation, treatment, recycling, and disposal of waste. Solid waste management is not just the collection, storage, transportation etc. alone, it also includes the generation of such unusable solid materials to minimise excessive accumulation. Effective solid waste management helps prevent environmental pollution, public health protection, and recovery of crucial resources through sustainable practices. While households, shops and business generate solid waste daily, it is believed that most organisations generate more of hazardous waste and play an important role in waste segregation and reduction. The responsibility of solid-waste management presents complex technical, economic, administrative and social challenges that must be managed carefully. Since solid waste management plays a crucial role in promoting environmental hygiene, it needs to be incorporated into environmental planning. As stated by the World Bank, (2018), without proper management of solid waste, it causes environmental pollution, health hazards, and degradation of land and water resources.

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LITERATURE REVIEW

Urbanisation Trends and Patterns in Oredo Local Government Area

Oredo Local Government Area, one of the main urban LGAs within Benin City in Edo State, serves as the administrative and commercial center of the city and has experienced rapid urbanisation over the years. Urbanisation in Oredo is driven primarily by many factors viz-a-viz: population growth, rural-urban migration, economic opportunities, and infrastructural development. The influx of people from rural communities and smaller towns in search of employment, education, healthcare, and improved living conditions has significantly increased population density and accelerated urban expansion, with Nigerian urban centers continuing to grow rapidly due to migration and natural increase (NPC, 2006).

This population pressure has triggered the expansion of residential neighbourhoods as demand for housing rises, leading to the development of new buildings and the conversion of previously undeveloped land and agricultural areas into housing estates and settlements. Urban growth spreads outward from the central areas of Oredo into surrounding wards, resulting in continuous physical expansion of the city. As the commercial hub of Benin City, Oredo hosts a high concentration of markets, banks, offices, shops, and small-scale enterprises that attract workers, traders, and customers from across Edo State and beyond. This concentration of economic activities strengthens the urban character of the area and encourages further development.

Urbanisation in Oredo is also reflected in infrastructure development, including road networks, electricity supply, schools, hospitals, and communication facilities that support economic growth and improve quality of life. However, rapid population growth often outpaces infrastructural provision, leading to traffic congestion, pressure on public services, and inadequate urban facilities. Consequently, land-use patterns in Oredo have transformed markedly, with open spaces, vegetation, and agricultural land gradually being converted into residential buildings, commercial centers, and public institutions as the area transitions from rural to urban land use.

Solid Waste Generation in Oredo Local Government Area

Solid waste generation is a critical aspect of environmental management in rapidly urbanising areas and Oredo LGA, as the administrative and commercial hub of Benin City, records high urban waste volumes due to its concentration of commercial and institutional activities. Early studies in Benin City estimated waste generation at approximately 0.425 kg per capita per day for Oredo LGA, rising to about 0.5 kg per person daily in metropolitan estimates (Igbinomwanhia, 2011). This rate aligns with findings from other major Nigerian cities where rapid urban expansion correlates with increased waste output, but it is slightly lower than Lagos averages of 0.63-0.75 kg/capita/day reported by Ogwueleka (2013) and Nzeadibe & Anyadike (2012). The variation suggests that while waste generation increases with urban intensity, the rate differs across cities depending on consumption patterns, economic activities and institutional capacity.

Recent empirical studies further confirm that commercial hubs and administrative centers generate disproportionately higher waste than residential peripheries. For instance, research by

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Ayeni (2023) and Abdul (2024) on Nigerian cities found that areas with dense markets, offices, and hospitality services produce larger proportions of packaging materials, plastics, and food waste compared to predominantly residential LGAs. However, most of these studies focused on Lagos, Abuja, and Port Harcourt, with limited disaggregated data for Benin City, and none specifically quantified the contribution of institutional waste from hospitals, schools, and government offices in Oredo LGA. This gap is significant because Oredo hosts the state secretariat, University of Benin Teaching Hospital (UBTH) and major markets which likely exacerbate its waste composition compared to other LGAs in Benin City. Therefore, while existing literature establishes the link between urban economic activity and high waste generation, there remains limited empirical evidence on the specific sources, composition, and spatial distribution of waste within Oredo LGA, limiting the development of targeted management strategies.

Composition of Solid Waste in Oredo Local Government Area

Solid waste generation in Oredo LGA is dominated by a waste stream with a high proportion of organic and food waste, which characterization studies consistently identify as the largest fraction of municipal solid waste in Benin City. Igbinomwanhia (2011) reported that food/organic waste constitutes over 50% of Oredo's waste stream, a finding that aligns with Ogwueleka (2013) and Nzeadibe & Anyadike (2012) who recorded 55-62% organic content for other Nigerian urban centers. This agreement across studies reflects a shared dietary patterns and consumption behaviors in Nigerian cities. However, while early studies provide baseline data for Oredo, recent empirical research from 2020-2024 has focused largely on Lagos, Abuja, and Port Harcourt, leaving limited current evidence on how Oredo's status as the administrative and commercial hub affects its waste composition. Specifically, the contribution of packaging materials, plastics, and paper from markets, offices, and hospitality services in Oredo remains under-quantified compared to residential LGAs. Understanding this composition, summarized in Table 1, is therefore essential for designing appropriate management methods such as composting for organics and material recovery for recyclables, rather than relying on generic landfill disposal.

Table 1
Solid Waste Composition in Oredo Local Government Area

S/N	Waste Composition	Percentage (%)	Average Weight (kg/person/day)
1	Food/Organic Waste	78.59	0.334
2	Plastic and Rubber	8.65	0.037
3	Metal Waste	4.11	0.017
4	Paper	3.67	0.016
5	Glass	2.83	0.012
6	Other Waste (textile, ash, ceramics, etc.)	2.10	0.009
Total		**100**	**0.425**

Source: Adapted from Atikpo**,** et.al (2022)

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THEORETICAL FRAMEWORK

The theoretical framework adopted for this study is Systems Theory. Ludwig von Bertalanffy developed General Systems Theory in the 1940s and 1950s. Systems Theory is a multidisciplinary approach that views complex phenomena as interconnected components of a larger system. This theory is particularly relevant to understanding urbanisation and solid waste management in Oredo Local Government Area, Edo State, as it highlights the intricate relationships between population growth, infrastructure, environmental factors, and waste management practices. Four major assumptions underpin this theory and they are:

a. Wholeness: The system is more than the sum of its parts;
b. Interconnectedness: Urbanisation, population growth, and waste management are interdependent;
c. Feedback loops: Changes in one part affect others; and
d. Equifinality: Multiple paths can lead to effective waste management outcomes.

In Oredo LGA, urbanisation affects waste generation through increased population density, changing consumption patterns, and higher per capita waste output as more residents shift from rural to urban lifestyles. The influx of people and commercial activities generates more food waste, packaging, and non-biodegradable materials than the existing system can handle. Inadequate infrastructure feeds back into environmental degradation because poor collection services, insufficient disposal sites, and weak enforcement create feedback loops. When waste is not collected regularly, residents resort to indiscriminate dumping and open burning. This clogs drainage channels, increases flooding, contaminates soil and water sources, and further degrades the urban environment. The degraded environment then reduces the efficiency of existing infrastructure and thereby creating a negative cycle.

Feedback mechanisms operate as follows: Increased urbanisation → higher waste generation → pressure on collection trucks and landfill capacity → delays in evacuation → more street dumping → environmental degradation and health risks → increased government/community response → possible investment in new infrastructure or policies → changes in waste management outcomes. This feedback loop shows that any intervention in one component, such as adding more trucks, affects the entire system and can either reduce or reinforce the problem depending on how other parts respond.

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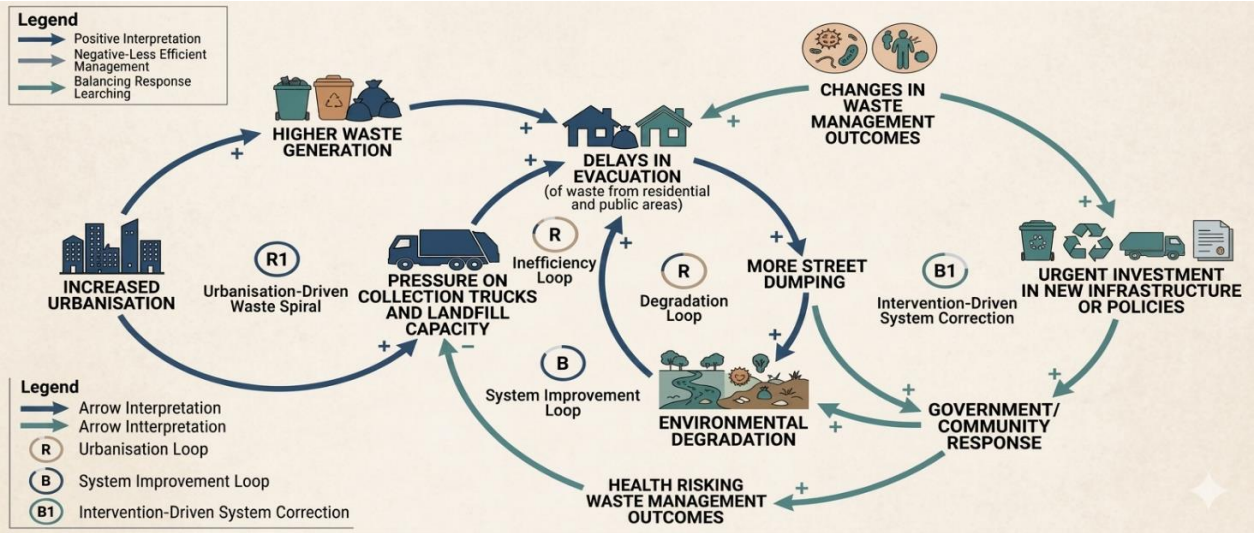
Figure 1
Feedback Mechanisms of Urbanisation, Waste Generation, and Environmental Degradation in Oredo Local Government Area



Source: Author, (2026)

This theory was adopted for its holistic understanding of complex interactions driving urban solid waste management challenges. Recognizing interdependencies between urbanisation, waste generation, and management systems enables policymakers to develop more effective, sustainable solutions.

METHODOLOGY

A qualitative method was used for data collection from primary and secondary sources. Primary data were generated from key informants selected through purposive sampling based on direct experience with solid waste management in Oredo LGA. Forty residents were selected across wards, plus five local government staff and five waste disposal workers selected by role and involvement in waste collection. Four focus group discussions were conducted with 10 residents per group, stratified by gender and age. In-depth interviews were held individually with five staff and five workers. All sessions used a semi-structured guide and were audio-recorded with consent. Secondary data came from books, journals, government reports, and online materials on urbanisation and waste management. Credibility was ensured through triangulation, member checking, and peer debriefing. Data were thematically analysed using sub-headings to reflect key conceptual areas, forming the basis of the findings.

RESULTS

Effect of Urbanisation on Solid Waste Generation in Oredo LGA

Data from FGDs with residents and IDIs with staff and solid waste workers showed that urbanisation has increased both the quantity and type of waste generated in Oredo LGA. Residents across different wards described how population growth and changing consumption

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patterns have made waste more visible and difficult to manage. Accordingly, participant in FGD 2 stated: "*Previously, we used to have little waste. Today, with several residents living in the area, consuming more packaged goods daily, the volume of waste continues to increase drastically."* This view was corroborated by another respondent in FGD 4 who infer saying that:

> *"Waste collection vehicles rarely come to our area to collect refuse. They come sometimes in three months demanding the complete payment for the three months which they did not show up. When they come, almost all the time, the waste on the truck is already too much and as they are going, you see refuse falling off the trucks and littering on the street."*

Furthermore, waste workers confirmed there were changes in solid waste composition. A situation in which a participant in IDI 3 explained thus: "These days we collect more nylon, plastic bottles and takeaway packs than before. It was not like this years ago." Another participant in IDI 2 added: "Urbanisation has changed what people buy. Everything now comes in plastic or nylon, and that is what we evacuate most of the times." Environmental and health effects emerged from resident discussions. A participant in FGD 1 in corroboration with FGD 3 said: "When waste stays too long, it blocks the gutter and when rain falls, everywhere is flooded……the dump site near us attracts flies and rats. Our children fall sick very often with malaria and typhoid as a result of the awful situation." Staff interviews revealed spatial constraints as respondent in IDI 4 remarked: "Land for new dump sites is no longer available. Everywhere is now building, building…….so, we keep using the old site until it overflows."

Establishing Effective Solid Waste Management Programme in Oredo LGA

Participants identified steps needed for effective management, based on their daily experiences. Residents in FGD 1 emphasized source identification as a perquisite for waste management:

> *"We know where waste comes from. Markets produce more waste than houses, and hospitals have their own dangerous waste even though they are more discrete in managing their waste. But if you go close to any of the public hospitals, you will see a heap of waste accumulated in the premises...a situation that further aggravate the health situation of those seeking treatment from considering the nature of their waste."*

On collection and waste minimization, a waste worker in IDI 5 and a staff in IDI 2 said:

> *"We don't have enough trucks and bins. Sometimes we work with broken vehicles and bad roads, so collection is not regular. If people separate waste at home, it will reduce what goes to landfill. Composting and recycling can help, but people don't know about it……"If government involves community leaders in planning, people will dump waste properly instead of on the roadside."*

In addition, other respondents in the same group said: "Batteries and chemicals are dangerous. They should be kept separate, but residents mix everything together….we still depend on open dumping because we don't have engineered landfill or modern incinerator. The old site is already full and causing problems."

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Challenges Affecting Solid Waste Management in Oredo LGA

Respondents across FGDs and IDIs reported operational and social challenges. Insufficient vehicles was a recurring issue. A waste worker in IDI 1 noted: "Most of our trucks are old and break down all the time. That is why waste stays on the road for days." This view was supported by a residents' opinion in FGD 4 when he said: "We see waste littering the roads because collectors cannot come regularly." Another challenge identified was lack of disposal facilities. Accordingly, a staff in IDI 3 observed: "There are no proper transfer stations. Sometimes we dump waste by the roadside because the facility is bad." Also, funding constraints were stressed by staff in IDI 4: "Our budget is not enough to buy new trucks or pay workers well. That is why we cannot keep good staff." Limited awareness emerged from residents in FGD 2: "Many people, especially traders by the roadside, dump waste into waterways because they don't know the effect."

DISCUSSION

Findings from FGDs and IDIs show that urbanisation in Oredo LGA has altered solid waste dynamics through increased volume of waste, changing composition, and pressure on management systems. Residents' reports that waste "continue to accumulate" and collection vehicles "rarely come to our area" provide empirical evidence of service delivery gaps consistent with UNEP (2015) and World Bank (2018) findings on rapidly urbanising cities. The three-month collection interval and refuse falling from overloaded trucks described by participants reveal how population density and commercial growth have exceeded municipal capacity to manage and thereby, encouraging indiscriminate dumping and street littering. Waste workers noted a shift toward nylon, plastic bottles, and takeaway packs, reflecting consumption transitions linked to urban lifestyles. This corroborates the United Nations Department of Economic and Social Affairs (2019) on increased use of packaged and single-use materials. The observation that "everything now comes in plastic or nylon" indicates that waste planning in Oredo must address non-biodegradable streams beyond the traditional focus on organic waste.

Environmental and health impacts highlighted by residents' underscore management deficits. Prolonged waste storage, blocked gutters, and seasonal flooding, along with dump sites attracting vectors that cause malaria and typhoid, mirror documented links between poor urban sanitation and public health burdens. Staff also identified spatial constraints, particularly the absence of land for new disposal sites and reliance on an overflowing old site, reflecting land scarcity in urban cores where housing and commercial demands limit options for engineered landfills. Participants suggested locally grounded strategies for effective management. Residents emphasized source identification, noting that markets and hospitals generate distinct waste streams, supporting Tchobanoglous, Theisen, & Vigil, (1993) on characterization as foundational to system design. However, accumulation of hospital waste within premises reveals gaps in hazardous waste compliance, indicating need for targeted regulation and monitoring in health facilities.

Operational challenges explain why recommended practices remain unrealized. Waste workers reported insufficient trucks and bins, broken vehicles, and poor roads that create irregular collection cycles, undermine trust, and encourage illegal dumping. Residents supported

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community involvement in planning, aligning with Nwankwo (2017), on decentralized, participatory approaches. Yet staff stressed funding constraints, including inadequate budgets for vehicles and remuneration, revealing structural limits to institutional capacity. This suggests technical solutions will be insufficient without addressing fiscal deficits. Calls for waste minimization through segregation, composting, and recycling, plus concerns about batteries and chemicals, indicate growing awareness of circular economy principles. However, statements that "people don't know about it" and residents "mix everything together" point to limited public education and weak enforcement, echoing Ogwueleka (2013) on the need for sustained awareness campaigns.

Finally, dependence on open dumping due to the absence of engineered landfills or modern incinerators places Oredo within a common trajectory for Nigerian LGAs documented by Adewumi et al. (2013). Staff did not cite incineration as viable, likely due to emission concerns and limited technology noted by Nwankwo (2017), positioning waste reduction and improved collection as more immediate priorities. Collectively, respondents' voices confirm that urbanisation has intensified waste challenges in Oredo LGA while identifying actionable entry points: strengthening collection logistics, investing in disposal infrastructure, integrating community structures, and expanding public education on segregation and hazardous waste. Alignment between participant experiences and literature validates this study's contribution and shows that effective interventions must be context-specific and address both infrastructural and behavioral dimensions.

CONCLUSION

The study on urbanisation and solid waste management in Oredo LGA shows that urban growth has increased waste volume and changed waste composition toward plastics, nylon, and takeaway packs. FGD and IDI findings reveal irregular waste collection, overloaded trucks, and insufficient vehicles that have led to street littering and indiscriminate dumping. Residents and staff also reported environmental and health impacts, including blocked gutters, flooding, and disease vectors causing malaria and typhoid. Spatial constraints were evident as the old dump site continues to overflow with no land available for new disposal facilities. These findings confirm that existing waste management systems in Oredo LGA are overstretched by urbanisation.

RECOMMENDATIONS

Distill from the forgoing discuss, the following recommendations are made:

a. Waste segregation at source should be introduced to mitigate challenges of mixing toxic and hazardous substances together with other non-hazardous waste. Therefore, household segregation will address the shift to plastics/nylon and reduce landfill pressure.

b. Encourage public-private partnerships to provide vehicles and funding to solid wase disposal agencies to close collection gaps identified by residents.

c. Solid waste recycling centers should be established in communities and towns in each ward to capture increasing recyclable plastics and nylon while promoting participation.

d. Encourage **w**aste-to-energy initiatives to reduce waste volume, address overflow, and mitigate flooding and health risks associated with waste accumulation.

Ethical Clearance
The study adopted a qualitative method in which data were collected from both primary and secondary sources. Secondary data were obtained from books, journals, and online materials. All sources were duly referenced and acknowledged.

Acknowledgement
I acknowledge Dr. Mrs. Iyamu, Dr. Obasogie and Dr. Onuh for reading the manuscript and supplying vital information for the successful completion of the study. I also acknowledge miss Tessy, Osaiyekemwen, Boaz and Goodness for helping to conduct and coordinate the FGD and IDI process. I equally acknowledge the librarian of Wellspring University for his support during the exercise.

Sources of Funding
The study was funded by Ambrose Osawonamen Eghaghe (the Author)

Conflict of Interest
There is no conflict of interest in any way

Author Contribution
The idea for this study was conceived by Ambrose Osawonamen Egaghe. He determines the design and the write up.

Availability of Data and Materials
The dataset upon which this study was conducted can be made available on reasonable request.

Citation
Eghaghe, A. O. (2026). Urbanisation and solid waste management in Oredo local government area, Edo state, Nigeria: Challenges and sustainable management strategies. *International journal of Sub-Saharan African Research,* 4(2), 529-541

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