

# Household Solid Waste Management Practices and Challenges in a Rural Nigerian Community: A Cross-Sectional Survey of Idumuje-Unor, Delta State

Osakwe Chukwudi Daniel<sup>1</sup>, Iboyi Charles Francis<sup>1</sup>, Obayehagweme. Ezekiel<sup>2</sup>

<sup>1</sup>Department of Civil Engineering, Delta State University, Abraka

<sup>2</sup>Department of Civil Engineering Technology, Federal Polytechnic Orogun, Delta State

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## ABSTRACT

Improper solid waste management poses significant environmental and public health challenges in rural communities across developing countries, yet research attention in Nigeria has concentrated on urban centres, leaving rural communities poorly characterised. This study assessed household solid waste management practices in Idumuje-Unor, a rural community in Aniocha North Local Government Area, Delta State, Nigeria. A descriptive cross-sectional survey was conducted using structured questionnaires administered to 65 randomly selected households, supplemented by field observation and key-informant interviews. Data were analysed using descriptive statistics. The mean household size was 4.23 persons (SD = 2.13), and the predominant occupation was trading (36.92%). Solid waste constituted 70.77% of waste generated, with food and agricultural waste (46.15%) the largest component, followed by plastics (30.77%) and paper (23.08%). Although 66.15% of respondents reported owning refuse bins, field observation revealed widespread indiscriminate disposal, with waste discarded into gutters (30.77%), bushes (23.08%), and a stream (3.08%); no formal collection service operated in the community. Waste sorting (38.46%) and recycling (12.31%) were uncommon, and the major perceived problems were odour (38.46%), flooding (33.85%), and mosquito breeding (18.46%). Despite weak minimisation behaviour, 73.85% of respondents preferred recycling and reuse to direct disposal, and 80.00% endorsed the need for awareness programmes. The study concludes that Idumuje-Unor lacks an effective solid waste management system and that the rural problem is a service vacuum distinct from the underperforming agencies of Nigerian cities. Recommendations include community-based composting, formalisation of existing informal recycling, enforcement of sanitation laws, and sustained public education to convert the community's evident readiness for change into practice.

**Keywords:** solid waste management, rural areas, household waste, waste disposal practices, agrarian.

## INTRODUCTION

Solid waste is broadly defined as any unavoidable material resulting from domestic, commercial, or industrial activities for which there is no immediate economic demand and which must be disposed of (Sridhar, 1996). In developing countries, solid waste generation has increased substantially due to population growth, urbanisation, and changing consumption patterns, and is projected to keep rising through this century (Hoorweg *et al.*, 2013; Ogwueleka, 2009). Nigeria generates approximately 25 million tonnes of solid waste annually, at a per capita rate of 0.44 to 0.66 kg per day, of which an estimated 60 to 80% is organic (Ogwueleka, 2009; Sridhar, 2006). Unlike urban centres, where some formal collection systems exist, rural communities in Nigeria remain largely underserved, with residents resorting to indiscriminate dumping, open burning, and burial as primary disposal methods (Adogu *et al.*, 2015; Yadav *et al.*, 2015).

The environmental and health consequences of poor solid waste management are well documented. Uncollected waste attracts disease vectors such as rodents and insects, contributing to cholera, typhoid, malaria, and dysentery (Adogu *et al.*, 2015; Obionu, 2007). Open dumping contaminates surface water and groundwater through leachate infiltration, while open burning releases methane, carbon dioxide, and

particulate matter that drive air pollution and greenhouse gas emissions (Hoornweg *et al.*, 1999; Medina, 2002). Clogged drainage from indiscriminate disposal further exacerbates flooding during the rains, causing property damage and loss of life (Akpen & Aondoakaa, 2009).

Several studies have examined solid waste management in Nigerian urban areas. Adogu *et al.* (2015) found that while 90% of Owerri residents were aware of waste management, open dumping (66.3%) and burning (62.4%) predominated. In Sapele, Onokohwomomo and Biose (2023) reported food and organic waste as the largest household fraction, with inadequate service coverage and vehicle shortages as major challenges. In the Jos metropolis, Akintunde *et al.* (2024) documented a wide gap between awareness (74.2%) and responsible action (30.8%), showing that knowledge alone does not translate into practice, and in the Jos slums Mailumo *et al.* (2021) found 38% of households practising open dumping and 30% disposing of waste into streams and drains. In Birnin Kebbi, Mainasara and Dodo (2024) established a significant association between poor waste management and reduced quality of life. These studies converge on a common diagnosis of weak funding, inadequate equipment, poor enforcement, and a shortage of trained personnel (Adamu *et al.*, 2023; Udoumoh *et al.*, 2023; Ukala *et al.*, 2020).

What unites almost all of this evidence is its setting: urban or peri-urban communities where a waste agency formally exists but underperforms. Far less is known about truly rural communities, where no service operates at all and the waste problem may be structurally different. Rural areas face distinct challenges, including limited access to collection services, lower levels of education and awareness, inadequate infrastructure, and weak enforcement (Vinti & Vaccari, 2022; Zerboc, 2003). The composition of rural waste also differs, with a higher proportion of agricultural and organic material (Hoornweg *et al.*, 2013). Internationally, rural solid waste management in developing countries is recognised as a neglected field, and the few empirical studies available illustrate both the problem and the opportunity: in the Waorani Nampa community of the Ecuadorian Amazon, Jaramillo *et al.* (2023) measured a per capita generation rate of 0.343 kg per inhabitant per day with a 64.2% organic fraction and designed a decentralised composting and recycling system on that basis. Comparable baseline evidence for rural Nigeria, particularly the Niger Delta, is scarce, and national reviews acknowledge that waste infrastructure is largely absent in rural areas without documenting what rural households actually do (Adamu *et al.*, 2023; Ukala *et al.*, 2020).

The present study addresses this gap by focusing on Idumuje-Unor, a rural community in Aniocha North Local Government Area, Delta State, where preliminary observation indicated no formal waste management system and disposal into bushes, gutters, and open spaces. No previous empirical study has documented waste generation, storage, collection, and disposal in this community. The study therefore aims to assess the existing solid waste management system, identify the types and composition of waste generated, evaluate household practices regarding storage, sorting, recycling, and disposal, and provide evidence-based recommendations for rural settings. The justification rests on the premise that improper waste management directly affects the health and wellbeing of rural populations; by understanding the specific practices and constraints in Idumuje-Unor, local authorities can design interventions that are culturally appropriate, economically feasible, and environmentally sustainable, contributing to the broader literature on rural waste management and supporting Sustainable Development Goals 11 and 3.

## MATERIALS AND METHODS

### Study Design

This study employed a descriptive cross-sectional survey design, combining a structured household questionnaire with direct field observation and key-informant interviews. The design was chosen because the objectives were fundamentally descriptive: to characterise current waste management practices, perceptions, and preferences at a single point in time in a community for which no baseline data existed. A cross-sectional approach is appropriate for assessing existing conditions and identifying patterns without manipulating variables (Cochran, 1963), and it is the established method for waste management studies in Nigerian settlements, permitting direct comparison with prior work in Owerri, Sapele, and Birnin Kebbi (Adogu *et al.*, 2015; Mainasara & Dodo, 2024; Onokohwomomo & Biose, 2023). The addition of observational triangulation was intended to offset the known limitations of self-reported behaviour.

## Study Area

The study was conducted in Idumuje-Unor, a rural town in Aniocha North Local Government Area of Delta State, Nigeria, lying between latitudes 6°20'01.4"N and 6°22'06.5"N and longitudes 6°25'01.4"E and 6°27'06.6"E as shown in Figure 1, about 5 km from Issele-Uku, the local government headquarters. It covers about 16 km<sup>2</sup> with an estimated population of 10,000 inhabitants across six quarters (Ime-ogbe, Okwunye, Idumu-obu, Ogbe-akwu, Atuma, and Aniofu) and is bordered by Onicha-Ugbo, Idumuje-Ugboko and Ewohinmi (Edo State), Onicha-Uku and Ugbo, and Issele-Uku. The primary economic activities are trading and farming. The community has no major river; the single stream is reserved for traditional worship and is not used for domestic supply or waste disposal. At the time of the study, no organised waste collection service was provided by the local government or any private entity, and most residents disposed of waste in nearby bushes, open spaces, or roadside drains.

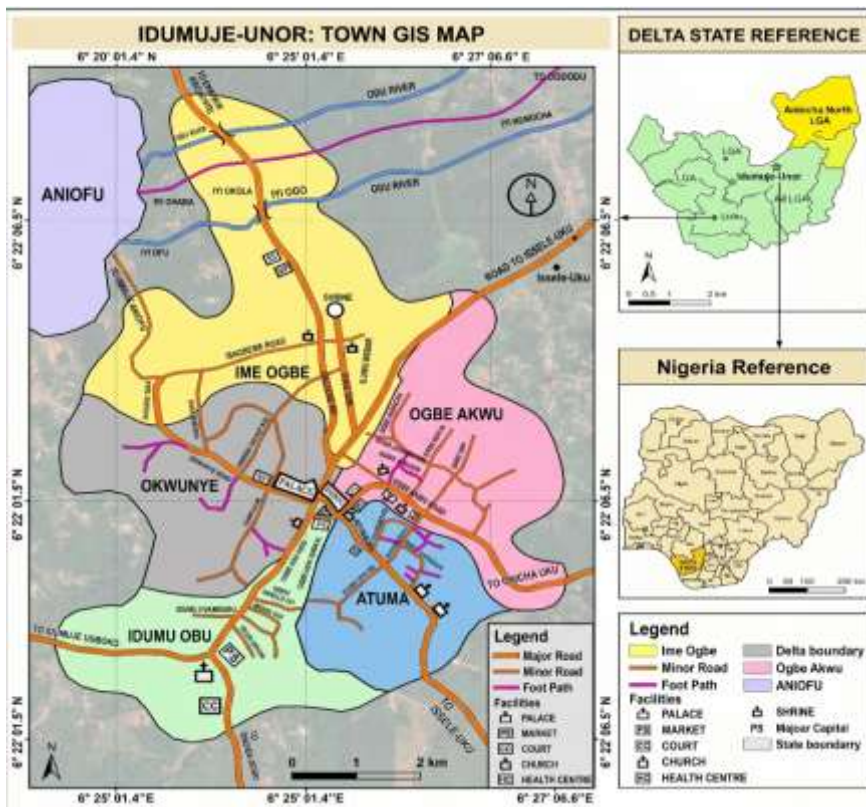


Figure 1: Road map showing Idumuje-Unor Community

## Study Population, Sampling, and Time Frame

The target population was all households in Idumuje-Unor. Because no official household figure was available from the National Population Commission or the local government, a working frame of 100 households was used for sample size determination via the Yamane (1967) formula,  $n = N / (1 + N(e)^2)$ , with  $N = 100$  and  $e = 0.05$  for a 95% level of accuracy, yielding a sample of 80 households. Simple random sampling was used to select compounds; where a compound contained more than one household, one was chosen by balloting, and the adult member (aged 18 years or older) responsible for daily waste handling was interviewed. Eighty questionnaires were distributed and 65 were properly completed and returned, a response rate of 81.25%. Field work, comprising questionnaire administration, observation of disposal points, photographic documentation, and key-informant interviews, was carried out over a two-week period in March 2026.

## Data Collection instrument and Procedures

Primary data were collected using a structured questionnaire of 18 items in three sections: (A) demographic and socio-economic characteristics (household size, occupation); (B) waste generation characteristics (type generated, composition, period of peak generation); and (C) management practices (storage containers, refuse

bin ownership, disposal point, frequency of disposal, sorting, recycling, perceived problems, and awareness needs), using multiple-choice and dichotomous questions. The draft was pretested on 10 households in the neighbouring community of Issele-Uku, and minor wording changes were made. Four research assistants resident in the local government area, fluent in English and the local Igbo/Enuani dialect, were trained for one day and administered the questionnaires face to face. Questionnaire responses were triangulated against field observation of disposal sites in each quarter and informal interviews with community elders and village heads, and discrepancies between reported and observed behaviour were recorded.

### Data Analysis and Ethical Considerations

Completed questionnaires were checked, coded, and analysed using descriptive statistics (frequencies and percentages) of the 65 valid responses. For household size, collected in grouped form, the mean and standard deviation were estimated from the grouped distribution using class midpoints of 1.5, 4.0, and an assumed 7.0 for the open upper class. No inferential tests were performed, as the study was primarily descriptive, and the categorical instrument and sample size did not support them. Permission was obtained from the traditional ruler (Obi) and community elders before data collection, and individual informed consent was obtained from each respondent after explaining the study's purpose, the voluntary nature of participation, and the confidentiality of responses; no incentives were provided.

## RESULTS

### Socio-Demographic Characteristics

Of the 65 responding households, those of three to five persons were most common (41.54%), followed by six or more persons (30.77%) and one to two persons (27.69%); the estimated mean household size was 4.23 persons (SD = 2.13). Trading was the leading occupation (36.92%), followed by farming (20.00%), teaching (18.46%), studentship (15.38%), and other occupations (9.23%), confirming the agrarian and commercial character of the community (Table 1).

Table 1. Socio-demographic characteristics of respondents (n = 65).

Variable	Category	Frequency	Percentage (%)
Household size	1-2 persons	18	27.69
	3-5 persons	27	41.54
	6 persons and above	20	30.77
Occupation	Trading	24	36.92
	Farming	13	20.00
	Teaching	12	18.46
	Student	10	15.38
	Others	6	9.23

Note. Mean household size estimated from grouped data = 4.23 persons (SD = 2.13).

### Waste Types, Composition, and Period of generation

Solid waste was the type most frequently generated (70.77%), ahead of liquid waste (23.08%) and electronic waste (6.15%). Within the solid stream, food and agricultural waste dominated (46.15%), followed by plastics

(30.77%) and paper (23.08%). Most respondents reported continuous generation throughout the year (52.31%), with festive periods (23.08%), the harvest season (13.85%), and the planting season (10.77%) cited as peaks; interviews corroborated year-round generation alongside seasonal surges of crop residues such as maize and groundnut waste (Table 2).

Table 2. Waste generation characteristics (n = 65).

Variable	Category	Frequency	Percentage (%)
<b>Waste type most generated</b>	Solid waste	46	70.77
	Liquid waste	15	23.08
	Electronic waste	4	6.15
<b>Dominant solid waste composition</b>	Food and agricultural	30	46.15
	Plastics	20	30.77
	Paper	15	23.08
<b>Period of peak generation</b>	All year round	34	52.31
	Festive period	15	23.08
	Harvest season	9	13.85
	Planting season	7	10.77

### Storage and Disposal Practices

Two-thirds of respondents (66.15%) reported storing waste in a refuse bin, while 33.85% did not. Reported storage relied on metal cans (30.77%) and plastic bags (26.15%), but the largest group (43.08%) indicated other arrangements; interviews established that for most of these households the point of storage coincided with the point of disposal, meaning waste was discarded directly into open ground as soon as it was generated. Reported disposal points were a central refuse point (43.08%), roadside drains (30.77%), bush (23.08%), and the stream (3.08%), and respondents were nearly evenly divided on whether a functional central point existed (53.85% yes, 46.15% no). Disposal frequency was irregular: 35.38% once weekly, 12.31% twice weekly, 20.00% three times weekly, and 32.31% on no fixed schedule. Field observation qualified the self-reported picture considerably; household bins, where present, were frequently unused, kitchens were often sited at the bush margin to allow immediate discard, and open dumping was documented in all quarters. No organised collection from any point in the community was observed (Table 3).

Table 3. Waste storage and disposal practices (n = 65).

Variable	Category	Frequency	Percentage (%)
<b>Stores waste in refuse bin</b>	Yes	43	66.15
	No	22	33.85
<b>Storage container</b>	Metal can	20	30.77
	Plastic bag	17	26.15

	Others (direct discard)	28	43.08
<b>Point of disposal</b>	Central refuse point	28	43.08
	Gutters	20	30.77
	Bush	15	23.08
	Stream	2	3.08
<b>Central point available</b>	Yes	35	53.85
	No	30	46.15
<b>Disposal frequency</b>	Once weekly	23	35.38
	Twice weekly	8	12.31
	Three times weekly	13	20.00
	No fixed schedule	21	32.31

### Sorting, Recycling, Perceived problems, and Preferences

Waste minimisation was weak: 61.54% did not sort their waste and 87.69% did not recycle. Among the eight respondents (12.31%) who recycled, plastics were most common (50.0%), followed by paper (37.5%) and agricultural or food waste (12.5%); this activity was informal and livelihood-driven, with traders reusing or reselling drink containers and crop residues diverted to animal feed. Respondents linked prevailing practices to tangible problems, principally odour (38.46%), flooding from waste-blocked drains (33.85%), and mosquito nuisance (18.46%). Despite the weak behaviour recorded, 73.85% considered recycling and reuse before disposal the best approach against 26.15% favouring direct disposal, and 80.00% affirmed the need for awareness programmes (Table 4).

Table 4. Minimisation behaviour, perceived problems, and preferences (n = 65).

Variable	Category	Frequency	Percentage (%)
<b>Sorts waste before disposal</b>	Yes	25	38.46
	No	40	61.54
<b>Practises recycling</b>	Yes	8	12.31
	No	57	87.69
<b>Material recycled (n = 8)</b>	Plastics	4	50.0
	Paper	3	37.5
	Agricultural and food	1	12.5
<b>Main waste-related problem</b>	Odour	25	38.46
	Flooding	22	33.85

	Mosquitoes	12	18.46
	Others	6	9.23
<b>Preferred approach</b>	Recycling and reuse	48	73.85
	Direct disposal	17	26.15
<b>Awareness programmes needed</b>	Yes	52	80.00
	No	13	20.00

### Composition of the Rural Waste Stream

The dominance of food and agricultural waste (46.15%) in Idumuje-Unor is consistent with the wider evidence on developing-country waste. Hoornweg *et al.* (1999) reported about 50% organic content in developing-country urban streams, Zurbrugg (2003) found 68 to 82% compostable waste in major Asian cities, and Ogwueleka (2009) noted that 60 to 80% of Nigerian waste is organic. The somewhat lower organic share here partly reflects the separate categorisation of agricultural residues and the diversion of some organic matter to animal feed before it enters the discard stream; combined with food waste, the organic fraction would exceed 60%, comparable to the 64.2% measured gravimetrically in the rural Ecuadorian Amazon by Jaramillo *et al.* (2023). The high organic content makes the community a strong candidate for low-technology composting (Drescher & Zurbrugg, 2006; Purkayastha, 2012). More striking is the position of plastics as the second largest component (30.77%), far above the 7.4% reported for Abuja by Abur *et al.* (2014) but echoing the plastic prevalence found in Birnin Kebbi by Mainasara and Dodo (2024). This signals that the consumption transition driven by sachet water and packaged goods has reached rural communities, and it means composting alone will not resolve disposal: a recovery channel for recyclables is also required.

### Disposal Practices and the Rural Service Vacuum

Disposal behaviour in Idumuje-Unor, where more than half of reported flows go to drains, bush, and the stream and observation showed open dumping to be even more pervasive, closely resembles patterns in disadvantaged urban settlements: open dumping by 66.3% of residents in Owerri (Adogu *et al.*, 2015), 38% open dumping and 30% stream and drain disposal in the Jos slums (Mailumo *et al.*, 2021), and 59% unauthorised disposal in Birnin Kebbi (Mainasara & Dodo, 2024). The resemblance, however, conceals a structural difference. In those urban settings, indiscriminate disposal persists despite the formal existence of state environmental agencies constrained by funding, equipment, and personnel (Onokohwomomo & Biose, 2023; Udoumoh *et al.*, 2023). In Idumuje-Unor, no service of any kind operates: there is no collection authority, no designated facility, and no enforcement presence. The community therefore represents not an underperforming system but a service vacuum, the rural condition that Vinti and Vaccari (2022) identify as typical of developing countries and that national reviews acknowledge yet rarely document (Adamu *et al.*, 2023; Ukala *et al.*, 2020). This distinction matters for policy, because remedies designed for underperforming urban agencies have no purchase where institutional infrastructure is absent altogether. The irregular disposal frequency (only 35.38% weekly; 32.31% on no fixed schedule) compounds the problem, since organic-rich waste decomposes rapidly in the humid climate, producing the odour and leachate residents reported.

### The attitude-behaviour gap and its significance

The most analytically interesting finding is the coexistence of strongly pro-environmental preferences with weakly pro-environmental behaviour: 73.85% identified recycling and reuse as best and 80.00% endorsed awareness programmes, yet 61.54% did not sort and 87.69% did not recycle. This mirrors, in a rural setting, the literacy ladder of Akintunde *et al.* (2024) for Jos, where 74.2% awareness and 82.6% positive attitudes yielded only 30.8% action, and it is consistent with Adogu *et al.* (2015), who recorded 90% awareness and 97.5% positive attitudes alongside majority open dumping. The convergence of urban and rural evidence strengthens the theoretical conclusion that awareness and attitude are necessary but insufficient for behaviour

change, with the binding constraint lying in enabling infrastructure and institutional support; this aligns with the theory of planned behaviour, in which perceived behavioural control mediates intention and action (Ajzen, 1991). It also qualifies the Environmental Kuznets Curve reasoning (Franklin & Ruth, 2012) invoked to explain waste-quality dynamics: if improvement is assumed to arrive endogenously with rising income, rural communities at the bottom of the distribution would simply be left to wait, whereas the evidence here suggests modest institutional provision can shift behaviour well before income growth does, because the willingness to act already exists. Finally, the divergence between reported bin ownership (66.15%) and observed disuse carries a methodological lesson consistent with social desirability bias: survey-based waste studies lacking observational triangulation are likely to overstate the orderliness of household practice.

### **Implications for rural waste management design**

Taken together, the findings point to a decentralised, community-based model rather than a scaled-down replica of urban municipal systems. The organic-dominant stream, agrarian livelihoods, and year-round generation all favour household and community composting, which reduces the mass requiring disposal, returns nutrients to farmland, and avoids the transport costs that make centralised systems unviable in dispersed settlements (Jaramillo *et al.*, 2023; Vinti & Vaccari, 2022). The informal recycling already practised by traders constitutes a valorisation nucleus that programmes could formalise and expand, as the informal sector underpins recovery in Nigerian cities (Onokohwomomo & Biose, 2023). The strong demand for awareness (80.00%) indicates that environmental education would find a receptive audience and is most effective when introduced early and reinforced across community institutions (Akintunde *et al.*, 2024); willingness to separate waste where a programme exists has been demonstrated in Sapele (Onokohwomomo & Biose, 2023) and Thailand (Ittiravivongs, 2012). State support remains necessary, particularly for legislation against indiscriminate dumping and for extending the reach of the state waste authority into rural local government areas, but the design centre of gravity should remain within the community.

### **LIMITATIONS OF THE STUDY**

Several limitations qualify these findings. First, a single community with 65 households describes Idumuje-Unor rather than rural Nigeria at large, although the consistency with published evidence suggests the patterns are not idiosyncratic. Second, composition was assessed by respondent perception rather than gravimetric characterisation of the kind applied by Jaramillo *et al.* (2023), which precludes estimation of per capita generation rates. Third, reliance on self-report introduced social desirability bias, made visible by the gap between reported bin use and observed disposal; reported figures should be read as upper bounds on actual practice. Fourth, the cross-sectional design captured a single period and could not quantify the seasonal agricultural surges respondents described, and the categorical instrument and sample size precluded inferential testing. Fifth, in the absence of census data the sampling frame was an approximation, which may have introduced coverage error. These limitations shade the precision of individual estimates but do not alter the central qualitative findings of a service vacuum, an organic-dominant stream, and a pronounced attitude-behaviour gap.

### **CONCLUSION**

This study set out to assess solid waste management in Idumuje-Unor, a rural Nigerian community without any formal waste service, by inventorying existing practices, profiling household characteristics, evaluating minimisation behaviour and perceived problems, and situating the rural evidence against published urban findings. The survey of 65 households, triangulated with field observation, established that the community generates a predominantly organic waste stream (46.15% food and agricultural waste) with a substantial plastic fraction (30.77%), that disposal is largely indiscriminate into bush, drains, and a stream in the absence of any collection service, that sorting (38.46%) and recycling (12.31%) are uncommon, and that residents already experience the consequences as odour, flooding, and mosquito nuisance. At the same time, the community is demonstrably ready for change, with 73.85% preferring recycling and reuse and 80.00% wanting awareness programmes.

The broader significance of these findings is that they supply rare empirical baseline evidence for rural Nigerian solid waste management and show that the rural problem is structurally distinct from the urban one: it is a vacuum of institutions rather than a failure of existing ones, and it therefore demands decentralised, community-anchored solutions. Household and community composting of the organic fraction, formalisation of existing informal recycling, designated disposal points sited away from dwellings, and structured environmental education are the leading candidates, drawing on low-technology models demonstrated in rural Ecuador and elsewhere (Jaramillo *et al.*, 2023). The findings also reinforce, from a rural vantage point, the theoretical proposition that awareness and positive attitudes do not translate into practice without enabling infrastructure.

Future research should address the limitations identified here. Gravimetric waste characterisation across wet, dry, harvest, and festive seasons would convert perceived composition into measured generation rates suitable for system design; multi-community sampling across rural local government areas and agro-ecological zones would establish the generality of the service vacuum; mixed-method designs combining surveys with systematic observation would correct for self-report bias; and intervention studies pairing environmental education with household composting and recyclable buy-back would test whether the expressed readiness for change can be converted into sustained practice. Such evidence would give policymakers a rural design template grounded in rural data rather than urban extrapolation. In the interim, collaboration among the state government, local government, and community leaders to establish a simple, low-cost, community-driven system, anchored on source separation, community composting, recyclable recovery, periodic sanitation enforcement, and sustained local-language education, offers Idumuje-Unor a realistic path from a community burdened by waste toward sustainable rural waste management.

### Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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### REFERENCES

1. Abur, B. T., Oguiche, E. E., & Duvuna, G. A. (2014). Characterization of municipal solid waste in the Federal Capital Abuja, Nigeria. *Global Journal of Science Frontier Research: H Environment & Earth Science*, 14(2), 1-7.
2. Adamu, M. T., Muhammed, K. L., Enahoro, C. I., Fatima, M., & Makama, M. S. (2023). Domestic solid waste management in Nigeria: A public health dilemma. *Life Sciences: An International Journal*, 1(1), 23-28.
3. Adogu, P. O. U., Uwakwe, K. A., Egenti, N. B., Okwuoha, A. P., & Nkwocha, I. B. (2015). Assessment of waste management practices among residents of Owerri Municipal Imo State Nigeria. *Journal of Environmental Protection*, 6(5), 446-456. <https://doi.org/10.4236/jep.2015.65043>
4. Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50(2), 179-211. [https://doi.org/10.1016/0749-5978\(91\)90020-T](https://doi.org/10.1016/0749-5978(91)90020-T)
5. Akintunde, E. A., Wahab, B., & Agbola, S. B. (2024). Environmental literacy and solid waste management in the Jos Metropolis, Nigeria. *Journal of Environment Sciences*, 23(1), 159-174.
6. Akpen, G. D., & Aondoakaa, S. C. (2009). Assessment of solid waste management in Gboko Town. *Global Journal of Environmental Sciences*, 8(2), 71-77. <https://doi.org/10.4314/gjes.v8i2.50820>
7. Cochran, W. G. (1963). *Sampling techniques* (2nd ed.). John Wiley & Sons.
8. Drescher, S., & Zurbrugg, C. (2006). *Decentralised composting: Lessons learned and future potential for sustainable waste management*. Swiss Federal Institute of Aquatic Science and Technology (EAWAG).

9. Franklin, R. S., & Ruth, M. (2012). Growing up and cleaning up: The environmental Kuznets curve redux. *Applied Geography*, 32(1), 29-39. <https://doi.org/10.1016/j.apgeog.2010.10.014>
10. Hoornweg, D., Bhada-Tata, P., & Kennedy, C. (2013). Environment: Waste production must peak this century. *Nature*, 502(7473), 615-617. <https://doi.org/10.1038/502615a>
11. Hoornweg, D., Thomas, L., & Otten, L. (1999). Composting and its applicability in developing countries (Urban Waste Management Working Paper Series No. 8). World Bank.
12. Ittiravivongs, A. (2012). Factors influencing household solid waste recycling behaviour in Thailand: An integrated perspective. *International Journal of Environmental Science and Development*, 3(5), 437-441. <https://doi.org/10.7763/IJESD.2012.V3.264>
13. Jaramillo, J., Chacha, A., Herrera-Feijoo, R. J., Peñafiel-Arcos, P., & Cazares, K. (2023). Domestic solid waste management in rural areas: Case study of the Waorani Nampa community, Ecuadorian Amazon. *Green World Journal*, 6(1), 058. <https://doi.org/10.53313/gwj61058>
14. Mailumo, A. S., Wetnwan, M. D., Wash, P. M., & Bott, D. G. (2021). Assessment of community participation in solid waste management in selected slum settlements of Jos town, Plateau State, Nigeria. *International Journal of Advanced Research in Public Policy, Social Development and Enterprise Studies*, 4(2), 115-130.
15. Mainasara, N., & Dodo, F. E. (2024). Effects of solid waste management on the quality of life of people in Birnin Kebbi metropolis. *FUDMA Journal of Earth and Environmental Sciences*, 1(2), 33-41. <https://doi.org/10.33003/jees.2024.0102.04>
16. Medina, M. (2002). Globalization and municipal solid waste management in developing countries. World Bank.
17. Obionu, C. N. (2007). Primary health care for developing countries (2nd ed.). Institute for Development Studies, University of Nigeria Enugu Campus.
18. Ogwueleka, T. C. (2009). Municipal solid waste characteristics and management in Nigeria. *Iranian Journal of Environmental Health Science & Engineering*, 6(3), 173-180.
19. Onokohwomomo, O. W., & Biose, E. (2023). Solid waste management practice and challenges in Sapele, Delta State, Nigeria. *Dutse Journal of Pure and Applied Sciences*, 9(3a), 289-302. <https://doi.org/10.4314/dujopas.v9i3a.29>
20. Purkayastha, D. (2012). Vermicomposting: A sustainable approach for solid waste management in rural areas. *International Journal of Environmental Sciences*, 2(4), 2120-2128.
21. Sridhar, M. K. C. (1996). Women in waste management [Conference paper]. Seminar on Educating Women for Sustainable Environmental Management, LHHP and British Council, Owerri, Nigeria.
22. Sridhar, M. K. C. (2006). From urban wastes to sustainable waste management in Nigeria: A case study. In M. F. A. Ivbijaro, F. Akintola, & R. U. Okechukwu (Eds.), *Sustainable environmental management in Nigeria* (pp. 337-353). Mattivi Productions.
23. Udoumoh, U. I., Ahuchaogu, I. I., & Ayotamuno, J. M. (2023). Assessment of municipal solid waste disposal and management challenges in major cities in Nigeria: A case study of Uyo, Nigeria. *IIARD International Journal of Geography & Environmental Management*, 9(5), 88-100. <https://doi.org/10.56201/ijgem.v9.no5.2023.pg88.100>
24. Ukala, D. C., Akaun, I. H. I., & Owamah, H. I. (2020). A review of solid waste management practice in Nigeria. *NIPES Journal of Science and Technology Research*, 2(3), 169-174. <https://doi.org/10.37933/nipes/2.3.2020.17>
25. Vinti, G., & Vaccari, M. (2022). Solid waste management in rural communities of developing countries: An overview of challenges and opportunities. *Clean Technologies*, 4(4), 1138-1151. <https://doi.org/10.3390/cleantechnol4040069>
26. Yadav, R., Singh, S., & Rani, S. (2015). Household waste generation and management in rural areas. *International Journal of Current Research*, 7(8), 19432-19436.
27. Yamane, T. (1967). *Statistics: An introductory analysis* (2nd ed.). Harper & Row.
28. Zerboc, O. (2003). *Urban solid waste management: Waste reduction in developing nations* [Master's thesis, Michigan Technological University].
29. Zurbrugg, C. (2003). *Solid waste management in developing countries*. Swiss Federal Institute of Aquatic Science and Technology (EAWAG).