Investigation of Domestic Solid Waste Collection and Management in Selected Residential Areas in Abuja Metropolis, Nigeria

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ABSTRACT

This study looked into home solid waste collection and management in specific residential districts in Abuja Metropolis, Nigeria. The goal was to measure waste generation patterns, evaluate collection efficiency, and compare household practices and satisfaction across various residential typologies. A cross-sectional survey design was used, with a structured questionnaire distributed to 420 households purposefully chosen from high-income (Asokoro), middle-income (Gwarinpa), and low-income (Kubwa) neighbourhoods. The results showed a hybrid collecting system dominated by private providers (31.2%), the governmental agency AEPB (26.0%), and informal collectors (25.2%). treatment quality and household satisfaction differed greatly, with high-income, gated estates obtaining more consistent treatment. Organic waste was the greatest component (40.2%), and while 62.3% of households separated waste, this was heavily influenced by residential type and service reliability. The study concludes that structural fragmentation and spatial inequalities, rather than household unwillingness, are the main constraints. It recommends a diversified service model, formal integration of the informal sector, and investment in organic waste diversion programs to improve the system's efficiency and equity.

Keywords: Domestic Solid Waste, Waste Collection, Waste Management, Waste Service Satisfaction, Abuja

INTRODUCTION

Urban centres worldwide face an increasing challenge of domestic solid waste, driven by rapid population growth, changing consumption patterns and accelerating urbanisation (Voukkali et al., 2024). Municipalities in low and middle income countries are particularly strained because waste volumes are rising faster than the capacity of collection, transfer and disposal systems; as a result, domestic waste frequently accumulates on streets, clogs drains and increases risks to public health and the urban environment (Dickson, Hastings & Smith, 2023). In Sub-Saharan Africa the combination of informal settlements, mixed residential typologies and insufficient municipal funding amplifies these problems, where collection is irregular or absent, households resort to unsafe disposal (open dumping, burning, or discharge into drainage channels), which increases vector-borne disease risk and causes local flooding and pollution (Ogwueleka, 2013; Ibimode et al., 2023). This study focuses on domestic solid waste because household waste constitutes the majority of municipal waste streams in many African capitals and because household behaviour, perception and payment practices critically shape the effectiveness of collection systems.

Abuja, Nigeria's planned federal capital, exemplifies the tensions that modern African cities face. The Federal Capital Territory (FCT) has seen rapid population growth and spatial expansion in recent decades; municipal estimates and demographic data show urban population rises that have several implications for municipal services (Dickson et al., 2023). Waste generation in Abuja has been noted to be spatially heterogeneous, as affluent districts with higher consumption patterns produce a larger proportion of packaging and non-biodegradable wastes, while lower-income areas generate proportionally more organic material (Adama, 2012; Ogwueleka, 2013; Dickson et al., 2023). The institutional responsibility for solid waste in the FCT falls largely to the Abuja Environmental Protection Board (AEPB) and area councils, but provision is increasingly mixed as public agencies, private contractors and community/estate arrangements all play roles in collection and disposal (Ibimode et al., 2023). These overlapping arrangements create variability in service coverage, frequency and quality across residential typologies, from gated estates with contracted private services to high-density

neighbourhoods with limited formal collection, and motivate a household-level investigation of performance and perceptions.

In Abuja specifically, empirical assessments report average household generation rates around 0.6kg to 0.65 kg per capita per day in sampled districts, with organic fractions often comprising a large share of the mix (Ibimode et al., 2023; Dickson et al., 2023). However, despite these studies, there is still a lack of well-sampled, questionnaire-based household evidence comparing collection performance, user satisfaction and household management practices across the wide variety of residential typologies found in the FCT. This study therefore seeks to examine the characteristics of domestic solid waste generation, collection systems, household participation and management practices in selected residential areas of Abuja metropolis, Nigeria with a view to assessing service efficiency, user satisfaction and the major constraints on reliable collection. The aims of the research are to:

i. Quantify household domestic waste generation and estimate the composition and segregation practices in Abuja households.

ii. Assess the types of collection systems in operation, their coverage and frequency, and the comparative performance of public versus private service arrangements in Abuja.

iii. Identify socio-demographic determinants of household compliance with recommended practices such as source separation.

iv. Generate evidence-based recommendations for municipal authorities, private operators and community associations to improve service delivery and promote more sustainable household waste management.

The primary research question is: "how do domestic solid waste generation, collection service characteristics and household practices vary across different residential typologies in Abuja, and what factors predict household satisfaction and compliance?" Sub-questions address differences in waste composition and per-household generation by residential type, variation in collection frequency and reliability between public and private providers, and household drivers and barriers for source separation and other waste-management behaviours.

LITERATURE REVIEW

Conceptual Review

Concepts such as "waste," "collection" and "management" are used variably across studies and policy documents (Finnveden et al., 2013). In this study, domestic solid waste (household solid waste) refers to the non-hazardous waste stream generated within residential premises from daily household activities—notably food and kitchen wastes (organics), packaging materials (plastics, paper, glass, metal), textiles, small broken household items and bulky goods that originate from family consumption and cleaning activities (Gautam et al., 2024). This household stream excludes industrial, clinical and construction wastes except where such wastes are present due to household activities (e.g., small home renovation debris).

Whereas collection is the operational stage in the waste management chain during which waste is gathered from households or communal collection points and prepared for transport (Pires et al., 2019); for measurement purposes collection covers mode (door-to-door, communal bins or transfer points), provider type (public agency, private contractor, community association or informal collector), schedule (frequency) and operational attributes such as timeliness and response to missed pickups as noted in previous literature (Oduro-Antwi, 2019; Everett, 2019).

Management, on the other hand, refers to the full socio-technical chain of generation, source-level storage and segregation, collection, transportation, treatment (including composting, recycling and waste-to-energy where applicable) and final disposal (sanitary landfill, controlled dumpsite, or informal open dumping) (Abdel-Shafy & Mansour, 2018). Additionally, this study adopts explicit performance concepts widely used in both academic and policy literatures, collection coverage, that is the proportion of households accessing formal collection

(Adedara, Taiwo & Bork, 2023); frequency which is how often pickups occur (Ola & Suleiman, 2022); timeliness which is adherence to scheduled pickups (Michael, 2024); reliability, the consistency of service over time (Cheng et al., 2021); cost, that is fees or charges faced by households and how they are paid (Alzamora & Barros, 2020), household satisfaction (users' evaluative perceptions of service quality (Abubakar et al., 2017; Puche Regaliza et al., 2020); and informal recovery, the degree to which the informal sector intervenes by collecting, sorting and selling recyclables (Ogwueleka & Naveen, 2021).

Global and Regional Evidence on Household Waste Patterns

Global analyses document rapid growth in municipal waste and persistent differences in waste composition and recovery between high- and low-income settings, creating both challenges and opportunities for household-level interventions. The World Bank's extensive synthesis "What a Waste 2.0" highlights that global municipal solid waste production is rising sharply and that Sub-Saharan Africa faces a disproportionate burden because waste generation is increasing rapidly while collection and treatment infrastructure lag behind (Kaza et al., 2018). More recent global assessments by UNEP reiterate this trajectory and estimate that without systemic changes, municipal waste will grow substantially by mid-century, with heavy financial and environmental costs concentrated in fast-urbanising regions (UNEP, 2024). In terms of composition, cross-country analyses show that low- and middle-income countries typically have a relatively large organic fraction in household waste compared with high-income countries, where packaging and other non-biodegradable fractions dominate (Rousta, Zisen & Hellwig, 2020; Banerjee & Sarkhel, 2020; Arikibe, 2025); this pattern matters for the design of interventions because a large organic fraction points to realistic options for composting and anaerobic treatment if collection systems can support source separation (World Bank, 2018; UNEP, 2024).

At the national and city level, Nigerian and Abuja-specific studies provide empirical grounding for the above generalisations. Earlier seminal household waste-weighing work in Abuja by Ogwueleka (2013) found an average daily per capita generation of about 0.634 kg and a composition dominated by organics (approximately two-thirds of the household stream) across socioeconomic groups; the study also showed that income and household characteristics affect composition and per capita quantities, with higher income households generating relatively more packaging waste (Ogwueleka, 2013). More recent questionnaire-based studies and municipal surveys in the Federal Capital Territory report similar dominance of organics and emphasise substantial shares of plastics and sachet wastes that complicate recovery (Ojiji, 2023; Dibalson et al., 2024; Michael, 2024). Seasonality also appears in urban Nigerian contexts, where comparative dumpsite analyses across Abuja councils indicate modest shifts in organic proportions between wet and dry seasons due to food consumption patterns and yard waste dynamics, a finding that suggests season should be considered when planning collection schedules and pilot composting activities (Aderoju & Dias, 2020).

Collection Models and Institutional Arrangements

The architecture of collection services varies substantially between contexts and within cities, and these differences shape both access and household experience. Broadly, four collection models are observed in Sub-Saharan African cities including Abuja, one, municipal or public collection executed directly by local environmental boards or area councils; two, contracted private collection, where individual households or estate managers hire private haulers; three, community or estate-managed systems, typical in gated or planned estates where the residents' association organises collection; and four, informal collection, where scavengers and informal collectors operate either at dump sites or as ad hoc providers in underserved neighbourhoods (Oguntoyinbo, 2012; Opoko & Oluwatayo, 2016; Olukanni & Nwafor, 2019; Adedara, Taiwo & Bork, 2023; Oladeji et al., 2024).

In Abuja, institutional responsibility is formally vested in bodies such as the Abuja Environmental Protection Board (AEPB) alongside area councils, but in practice service provision is hybrid, as public agencies, private contractors and estate managers all supply services in different parts of the metropolis, while informal recovery networks remain highly visible at dumpsites (Oyadiran & Adesina, 2014; Ita, 2021; UNIDO, 2022; Michael, 2024; Dibalson et al., 2024).

Household Participation, Behavioural Drivers and Barriers

Household behaviour is a critical mediator of the efficacy of solid waste management systems, with the participation in practices including source segregation, adherence to schedules, and payment of fees being regulated by a complex interaction of knowledge, convenience, and economic incentives. There is empirical evidence showing how environmental and public health awareness is a groundbreaking motivator of compliance. The influence of knowledge as a behavioural stimulus is supported by the fact that households with high environmental literacy and education levels are more likely to separate their sources and less likely to dispose of them improperly (Ogwueleka, 2013; Abubakar et al., 2017; Puche Regaliza et al., 2020; Umar et al., 2022).

However, without convenience, there is no awareness. According to Oduro-Antwi (2019) and Everett (2019), the physical convenience of waste disposal, which is enabled by door-to-door collection or nearby communal bins, is a decisive element in gaining the cooperation of households. On the other hand, households facing unreachable bins or unpredictable collection times logically turn to short-term, although harmful, solutions, such as burning, open dumping, or drain blocking, which exacerbate the health hazards of the population and urban flooding (Echendu, 2023). Economic factors also play a critical role; in the situation where the perceived price of privatised collection is higher than the quality of service observed, the desire to pay decreases and the use of informal disposal increases (Francisco, 2018; Alzamora & Barros, 2020).

Moreover, social context influences behaviour; positive practices can be strengthened by established social norms and mechanisms of estate-level enforcement, including penalties against illegal dumping, and lack of them contributes to apathy (Grobler, Schenck & Chitaka, 2022). Market incentives such as functional recyclables markets, which offer livelihood opportunities to informal collectors, are also directly related to household decisions to sort and sell desirable materials (Xweso, 2023). Practically, such drivers are frequently counterbalanced by barriers, the main ones in Abuja and the region in general being irregular services, a severe lack of physical infrastructure such as bins and vehicles, a lack of awareness about the advantages of segregation, and a consistently poor enforcement of regulations (Umar et al., 2022; Michael, 2024; Dibalson et al., 2024).

Theoretical Framework

This research is informed by a combined theoretical model that is based on the Systems Theory (Bertalanffy, 1968) and Social Constructionism (Berger and Luckmann, 1966). The Systems Theory which was pioneered by Bertalanffy (1968), assumes that complex phenomena are most effectively perceived as a whole, which consists of interrelated and interdependent parts. In the case of solid waste management (SWM), such a view conceptualises the urban environment as a socio-technical system in which subsystems, such as households, service providers, regulatory institutions, and the physical environment, are constantly interconnected (Bertalanffy, 1968; Iyamu, 2023). The basic principle is that a malfunction in one part may lead to spread to the whole system; an example is that the lack of adequate collection services may lead to more illegal dumping by households, and so will insufficient public awareness cancelling the advantages of a technically efficient system (Breukelman et al., 2022). Therefore, the synergistic integration of all subsystems is the key to the realisation of the best results, i.e., high collection reliability, good waste separation and a high level of satisfaction among people (Bertalanffy, 1968; Checkland, 1981).

In addition to this structural approach, there is another way of explaining meaning and behaviour through Social Constructionism. According to Berger and Luckmann (1966), reality is not a given fact but is constructed and reproduced in everyday communication, language and common understandings. This means that the concept of cleanliness, the role of waste handling, and the validity of management policies are not created on pure technical specifications but are deeply influenced by the cultural norms, expectations of the community, and personal experience (Berger and Luckmann, 1966). An instance of this is the continued occurrence of open dumping, which can be a symptom of its normalisation by the shared reality of a community instead of the mere ignorance of formal disposal methods.

In this inclusive model, household (e.g., income, education, cultural beliefs) and service factors (e.g., collection frequency, cost, reliability) are perceived as components of a bigger mechanism, the results of which are co-determined by both technical functionality and socially constructed perceptions (Iyamu, 2023). The framework

thus suggests that the successful adoption of recommended practices, such as source separation, depends not only on their technical efficiency but also on their resonance with the daily routines and perceived realities of the community (Berger & Luckmann, 1966).

Research Gaps

Despite the growing literature on municipal waste in Nigeria and insightful case studies in Abuja, several important gaps justify the present questionnaire-based comparative study. First, many rigorously measured studies of composition in Abuja, like Ogwueleka (2013), Umar, Ogwueleka & Busari (2022), Ibimode et al. (2023), and Michael (2024), have been modest in scale. For example, Ogwueleka's (2013) household weighing study covered 74 households or has focused on dumpsite sorting rather than on household perceptions and satisfaction, similar to other recent studies like Umar, Ogwueleka & Busari (2022), limiting the ability to generalise across residential typologies.

Second, there is comparatively little published research that integrates quantitative household-level measures of generation and composition with standardised attitudinal metrics (e.g., Likert-scale measures of awareness, perceived affordability and satisfaction) and then tests their multivariate relationships; most existing work remains largely descriptive. Additionally, comparative analyses across residential typologies (gated high-income estates versus middle-income planned estates versus high-density low-income neighbourhoods) using a common instrument and a sufficiently large sample are rare for the FCT, yet such contrasts are key because service models and constraints differ markedly across these typologies. Collectively these gaps argue for a rigorously sampled, questionnaire-based study that measures generation and composition proxies, standardised attitude and satisfaction scales, detailed service attributes (provider type, frequency, payment), and open responses on constraints, and that analyses the data using multivariate models to inform targeted, typology-sensitive policy interventions.

METHODOLOGY

Research Design and Approach

This study employed a cross-sectional descriptive survey design, utilising a structured questionnaire as the primary data collection instrument. This approach effectively captured household perceptions, self-reported behaviours, and challenges through a combination of quantitative (closed-ended) items and qualitative (open-ended) prompts. The questionnaire method was selected for its efficiency in gathering standardised data on waste generation, collection modalities, satisfaction, attitudes, and socio-demographic correlates across a large sample (Gangrade, 1982). While the closed-ended items enabled robust statistical analysis, the open-ended questions provided valuable contextual depth to explain emerging quantitative patterns (Humble, 2020).

Study Area and Site Selection

The research was done in the capital city of Nigeria, Abuja, which is in the Federal Capital Territory (FCT). Under the FCT Administration, the metropolis has been growing at a high rate, with an estimated population of 4.21 million in 2025 (World Population Review, 2025). The Abuja Environmental Protection Board (AEPB) has environmental services under its watch (Oyadiran and Adesina, 2014). Three neighborhoods of differing residential areas in the city (Asokoro, Gwarinpa and Kubwa) were purposely chosen to represent the existing socio-economic and infrastructural diversity of the city. It is a strategic choice that allows comparing the performance, perceptions, and limitations of waste management in the fundamentally different urban settings.
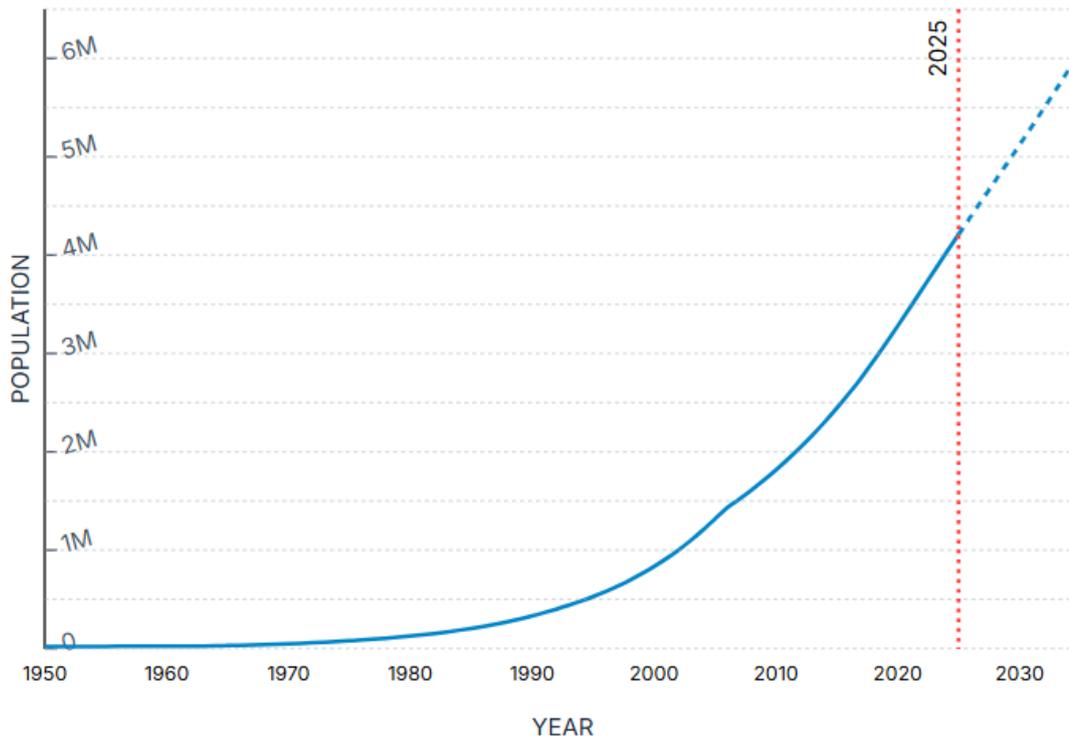
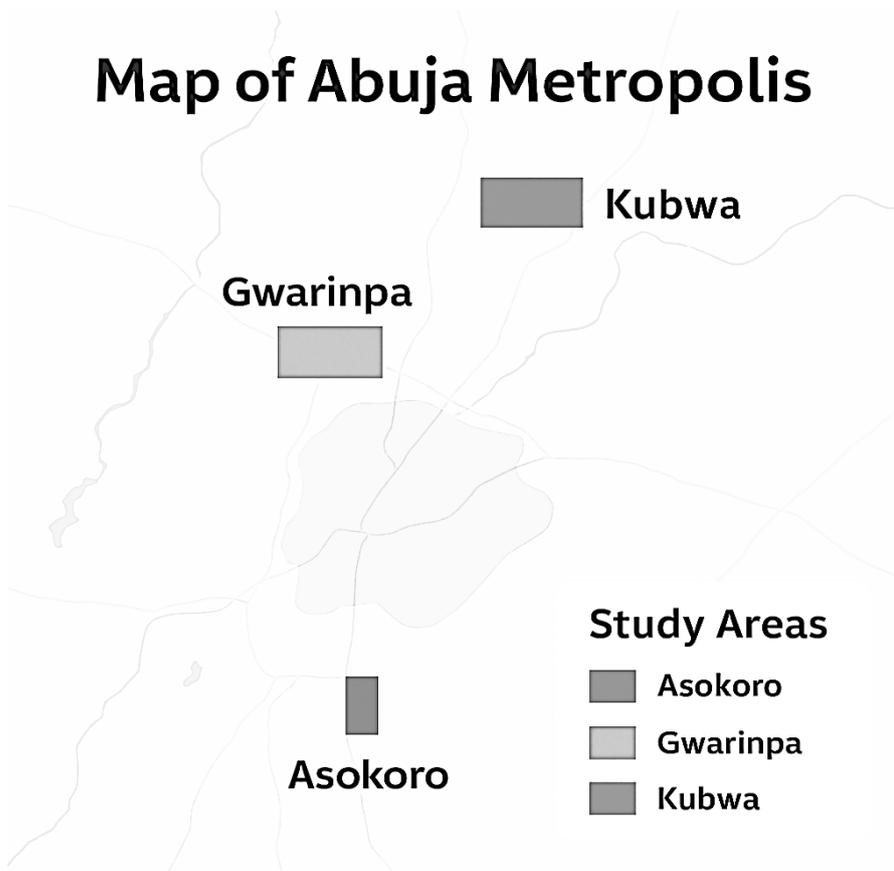Figure 3.1: Abuja Population (World Population Review, 2025)

Figure 3.2: Research Base Map of Abuja

Population and Sampling Strategy

The target population comprised all households in the selected areas. Based on the 2006 census figure of 179,674 households (Gazette, 2009; Ogwueleka, 2013) and an annual growth rate of 4.7% (World Bank, 2023), the

estimated household population for 2025 exceeds 330,000. The sample size was determined using Cochran's formula for unknown populations:

$$n_0 = \frac{(1.96)^2 \times 0.5 \times 0.5}{(0.05)^2} = 384.16$$

Rounding to 385 and anticipating a 10% non-response rate, the final target sample was 423 households, proportionally allocated across Asokoro, Gwarinpa, and Kubwa respectively to ensure robust representation within each stratum.

Questionnaire Instrument and Modules

Table 3.1: Questionnaire Sections and Description

Section	Description
Module A: Household Socio-Demographics	Items capture respondent's age, gender, education level, occupation, estimated monthly household income (banded), household size (number of members), and tenure type (owner, renter, family housing). These anchor covariates in modelling behaviour and perceptions.
Module B: Waste Generation & Composition	Households self-report average volume of waste in the last seven days (e.g., <1 bag, 1–2 bags, 3–4 bags, >4 bags). They also estimate proportion (%) of types: organic/food waste, recyclables (plastic, paper, glass, metals), sanitary/hygiene waste, bulky/disposable items. Ordinal volume data facilitate grouping; composition percentages allow comparative analysis.
Module C: Collection Services & Logistics	Questions ascertain who collects the waste (public/municipal, private contractor, estate management, informal collector), collection frequency (daily, 2–3×/week, weekly, irregular), type of method (door-to-door, communal bin, collection point), distance to nearest communal bin (meters), and ease of access (Likert scale). These capture service modality and convenience.
Module D: Cost and Payment	Households indicate whether they pay for the service (Yes/No), how much per month (currency band), mode of payment (cash to operator, check, through estate management, included in fees), and perception of affordability (Likert scale from "very affordable" to "very expensive"). This reveals financial burden and willingness to pay.
Module E: Household Practices and Attitudes	Items measure whether households separate waste at source, compost, reuse items, awareness of recycling programs, and include Likert-scale statements (1 = strongly disagree to 5 = strongly agree) on attitudes (e.g., "I believe source separation is worthwhile," "I would separate if collected separately," "I am aware of local recycling outlets").
Module F: Satisfaction and Perceived Responsiveness	A battery of Likert items (1–5) assessing household satisfaction with timeliness, cleanliness of collection, operator conduct, reliability (missed pickups), and complaint responsiveness.
Module G: Open-Ended Questions	Households are asked to name the main problems they face with waste collection and suggest improvements. These qualitative narratives provide context to quantitative findings.

The research instrument was organised into seven thematic modules as shown in Table 3.1. Prior to deployment, the questionnaire underwent pre-testing with 25 households to refine ambiguous items, improve logical flow, and enhance overall clarity.

Measurement, Reliability and Validity

The quality of measurement was evaluated with the help of internal consistency of multi-item scales (attitude and satisfaction modules) as a measure of reliability through Cronbach alpha, and the level of 0.70 was taken as acceptable. Convergent validity was tested through inter-item correlations and through scale scores and their correlation with related variables (e.g., attitude correlates with self-reported separation). The review of the instrument by experts (waste management scholars) and the pilot phase ensured face validity as well.

Data Management and Analysis Plan

The analysis of the data was carried out in systematic steps after extensive cleaning. The sample and the key variables were described using descriptive statistics (frequencies, means, standard deviations). Inferential tests consisted of Chi-square tests of categorical relationships, t-tests/ANOVA of group comparisons, and regression modelling to determine predictors of major outcomes ($p < 0.05$ level of significance). Qualitative answers were analysed thematically and multivariate analysis was carried out using composite indices (e.g., Service Reliability Index).

Ethical Considerations

The study adhered to strict ethical standards. Informed consent was obtained from all participants, who were assured of anonymity, confidentiality, and their right to withdraw without penalty. No financial compensation was provided.

FINDINGS AND DISCUSSION

Socio-Demographic Characteristics of Respondents

The sample was evenly distributed across the three residential typologies purposively selected for comparison (140 households per typology). Gender balance and an adult-skewed age distribution characterise the sample, and educational attainment is relatively high, which matters later when considering household willingness to separate and to pay. The household-size distribution yields an average household of roughly 4 persons, which is a scale that permits useful per-household inferences about weekly waste-bag counts (used here as a proxy measure for generation). Table 4.1 summarise the socio-demographic profile.

Table 4.1: Socio-Demographic Profile of Respondents

Demography	Sample	Frequency	Percent
Gender	Male	212	50.5
	Female	208	49.5
Age Group	30–39	133	31.7
	20–29	111	26.4
	40–49	90	21.4
	50–59	37	8.8
	≥60	25	6.0

	<20	24	5.7
Education	Tertiary (college/university)	151	36.0
	Secondary	109	26.0
	Postgraduate	70	16.7
	Primary	28	6.7
	No formal education	12	2.9
Occupation	Private sector employee	109	26.0
	Self-employed	108	25.7
	Civil servant	87	20.7
	Student	42	10.0
	Retired	45	10.7
	Unemployed	17	4.0
	Other	12	2.9
Residential Description	Gated estate	140	33.3
	Planned estate	140	33.3
	High-density area	140	33.3
Household Size	1	7	1.7
	2	45	10.7
	3	117	27.9
	4	126	30.0
	5	83	19.8
	6	42	10.0

Taken together, these figures in Table 4.1 indicate a typical urban-working-age sample with a meaningful portion of well-educated respondents.

Waste Generation, Composition, and Storage Practices

Household waste generation was measured using a self-reported proxy, that is the number of waste bags filled per week. The results, presented in Table 4.2, show that nearly half of the households (47.9%) generated 1-2 bags per week, while 29.3% generated 3-4 bags. The calculated average was approximately 2.31 bags per household per week.

Regarding composition, organic waste (food and kitchen waste) was identified as the dominant portion by 40.2% of households, confirming the findings of Ogwueleka (2013) and others that organics constitute the largest fraction of the household waste stream in Abuja. However, plastics were found to be a major component, being the second largest component in terms of percentage (29.5%) of households, highlighting the increasing menace of packaging and sachet waste in urban Nigeria (Dibalson et al., 2024).

Plastic bins (41.9%) were the most common storage method followed by polythene bags (31.7%). Ten percent of households reported dumping in a backyard, which is associated with poor collection services. This is corroborated by the finding that 55.7% of households reported their storage containers were "almost full" or "overflowing" by the time collection occurred, indicating a potential misalignment between generation patterns and collection frequency.

Table 4.2: Waste Generation, Composition, and Storage Practices

Waste Generation	Sample	Frequency	Percent
Weekly Waste Bags	1–2	201	47.9
	3–4	123	29.3
	<1	54	12.9
	>4	42	10.0
Largest Portion	Organic	169	40.2
	Plastic	124	29.5
	Paper	59	14.0
	Sanitary	39	9.3
	Mixed	29	6.9
Storage Method	Plastic bin	176	41.9
	Polythene bag	133	31.7
	Open container	47	11.2
	Backyard dump	43	10.2
	Other	21	5.0

Solid Waste Collection Systems and Service Access

The study revealed a hybrid and fragmented collection system, as anticipated in the literature (Ibimode et al., 2023). As shown in Table 4.3, no single provider dominates the entire metropolis. Private companies were the most frequent collector (31.2%), closely followed by the public agency AEPB (26.0%) and informal collectors (25.2%). Estate management served 10.7% of households, while 6.9% had no regular collection service. Service frequency similarly is heterogeneous, a plurality report 2–3 pickups per week, but approximately one-quarter experience irregular collection or no regular service. Door-to-door collection is the predominant method (40.7%), yet communal bins, street-corner dumps and self-burning/burying are all still common. Distance to the nearest collection point is often short, but 156 households (37.1%) are more than 100 m away, and ease-of-access scores cluster around the mid-range, indicating frequent convenience deficits.

Table 4.3: Solid Waste Collection Systems and Service Access

Waste Collection	Sample	Frequency	Percent
Who Collects Household Waste	Private company	131	31.2
	AEPB (public)	109	26.0
	Informal collector	106	25.2
	Estate management	45	10.7
	No regular collection	29	6.9
Collection Frequency	2–3 times/week	132	31.4
	Weekly	121	28.8
	Daily	55	13.1
	Irregularly	91	21.7
	Never	21	5.0
Collection Method	Door-to-door	171	40.7
	Communal bin	111	26.4
	Street corner dump	81	19.3
	Burn or bury self	57	13.6
Distance To Nearest Collection Point	<50 m	133	
	50–100 m	131	
	100–300 m	116	
	>300 m	40	

Cost of Service and Perceived Affordability

Two-thirds (66.7%) of households reported paying for waste collection services. The monthly payment structure was diverse, with the largest group (20.5%) paying ₦3,000 or more, typically associated with private or estate-managed services in high-income areas. However, the perceived affordability of these costs was middling, with a mean rating of 3.0. This suggests that cost is a moderate concern for a significant portion of the population, potentially affecting willingness to pay and compliance, as noted by Alzamora and Barros (2020).

Table 4: Cost of Service and Perceived Affordability

Waste Payment	Options	Frequency	Percent
Payment For Service	Yes	280	66.7
	No	140	33.3
Monthly Payment Bands	<1,000	59	14.0%

	1,000–1,999	58	13.8%
	2,000–2,999	77	18.3%
	≥3,000	86	20.5%
	I do not pay	140	33.3%

Household Practices, Attitudes and Recovery Behaviour

A promising 62.3% of households reported separating their waste "always" (24.0%) or "sometimes" (38.3%). Furthermore, 71.0% indicated that they engage in recycling. In contrast, composting remained a niche practice, with only 17.1% participation, despite the high organic waste fraction.

Table 4.5: Household Practices, Attitudes and Recovery Behaviour

Household Practices	Option	Frequency	Percent
Separation Behaviour	Sometimes	161	38.3
	Always	101	24.0
	Rarely	100	23.8
	Never	58	13.8
Practice	Recycle (Yes)	298	71.0
	Compost (Yes)	72	17.1

4.6 Service Satisfaction

Overall satisfaction with waste management services had a mean score of 3.51. The individual service attributes; timeliness (3.45), cleanliness after collection (3.55), and behaviour of collectors (3.51), all clustered around this moderate level, suggesting there is substantial room for improvement across the service delivery chain.

Table 4.6: Service Satisfaction

Item	N	Mean	STD
Timeliness of collection	404	3.452	1.050
Cleanliness after collection	420	3.548	1.060
Behaviour of collectors	420	3.512	1.059
Frequency satisfaction	420	3.498	1.067
Complaint response	420	3.342	1.160
Overall satisfaction	420	3.512	1.047

Table 4.7: Service Reliability Index (SRI)

Service Reliability Index	
Count	420.0

Mean	3.4468
Std	0.7459
Min	1.6667
Median	3.3333
Max	5.0

From Table 4.7, the moderate SRI suggests many households experience service that is neither clearly poor nor reliably good. From a Systems Theory standpoint, this result represents a brittle equilibrium as modest performance where institutional arrangements and infrastructure aligns, but frequent local failures where routing, asset adequacy or governance are deficient.

Inferential Analyses

Associations Between Residential Typology and Key Variables

Chi-square tests of independence were conducted to examine the relationships between residential typology and categorical variables. The results, summarised in Table 4.8, reveal highly significant associations ($p < 0.001$) for all tested variables.

Table 4.8: Selected Inferential Results

Variable	χ^2	p-value	df	Interpretation
Waste Collector	82.599	0.0000	8	Strong association; provider type varies by area.
Collection Frequency	94.186	0.0000	8	Strong association; frequency differs by typology.
Pay For Service	105.000	0.0000	2	Very strong association; payment patterns differ.
Separation Behaviour	80.365	0.0000	6	Significant association; separation varies by typology.
Recycling	19.708	0.0001	2	Significant association; recycling incidence varies.
Composting	12.471	0.0020	2	Significant association; compost uptake varies.
ANOVA (Overall Satisfaction Residential)	F = 139.668	p = 0.0000	—	Highly significant differences in satisfaction across typologies.

Table 4.8 shows reemphasised that gated estates were predominantly served by private companies and estate management, with high collection frequency, near-universal payment, and higher rates of waste separation. Whereas, planned estates showed a mix of AEPB and private providers, with moderate frequency and payment. High-density areas on the other hand relied heavily on informal collectors and AEPB, had the highest incidence of irregular or no collection, lowest payment rates, and the poorest performance in separation and composting. A one-way ANOVA was conducted to compare the effect of residential typology on overall satisfaction, and the test was highly significant, $F(2, 417) = 139.67$, $p < 0.001$. Post-hoc analyses confirmed that satisfaction in gated

estates was significantly higher than in both planned estates and high-density areas, and satisfaction in planned estates was significantly higher than in high-density areas.

Predictors of Waste Separation and Overall Satisfaction

To identify factors influencing household behaviour and perceptions, two regression models were run. A binary logistic regression was performed to ascertain the effects of household size, income, payment for service, Service Reliability Index (SRI), and residential typology on the likelihood that households separate their waste (coded as 1 for Always/Sometimes, 0 for Rarely/Never). The model was statistically significant. As shown in Table 4.9, residential typology was the strongest predictor. Holding other factors constant, households in high-density areas had significantly lower odds of separating waste compared to those in gated estates ($p < 0.001$). Household size also showed a marginally significant negative effect ($p = 0.097$).

Table 4.9: Logistic Regression Predicting Waste Separation

Variable	Coefficient	Std. Error	p-value
Intercept	2.6087	0.9135	0.004
Household Size	-0.1557	0.0939	0.097
Income	0.000001	0.00000096	0.140
Pays for Service (Yes=1)	-0.3340	0.2709	0.218
Service Reliability Index (SRI)	-0.1616	0.1964	0.411
Residential High-Density Area	-2.1418	0.4285	<0.001
Residential Planned Estate	-0.5894	0.3267	0.071

An OLS regression was used to predict Overall Satisfaction. The model was significant and explained a substantial portion of the variance. Consistent with the ANOVA, residential typology was the dominant factor. As seen in Table 4.10, households in High-Density and Planned Estates reported lower satisfaction than those in Gated Estates. Larger household size was also a small but significant negative predictor of satisfaction.

Table 4.10: OLS Regression Predicting Overall Satisfaction

Variable	Coefficient	Std. Error	p-value
Intercept	4.4477	0.2797	<0.001
Household Size	-0.0784	0.0293	0.008
Income	0.0000000476	0.0000002779	0.864
Pays for Service (Yes=1)	-0.0109	0.0860	0.899
Service Reliability Index (SRI)	0.0326	0.0616	0.597
Residential High-Density Area	-1.3869	0.1314	<0.001
Residential Planned Estate	-0.7239	0.0997	<0.001

Table 4.10 shows household size negatively predicts satisfaction, while income and paying for service are not significant once typology and SRI are included.

Thematic Analysis of Open-Ended Responses

The analysis of qualitative responses provided rich context for the quantitative findings. The dominant themes, in order of frequency, were:

Table 4.11: Thematic Analysis

Theme	Mentions	
Inadequate Infrastructure	58	Respondents cited a lack of bins, transfer stations, and functional trucks. "There are not enough public bins… no nearby transfer station; trucks take long routes and sometimes don't collect."
Irregular Collections	45	This was a pervasive complaint, directly linked to overflow and illegal dumping. "Collection is irregular; sometimes waste stays for days and smells, attracting flies."
Role of Informal Collectors	45	Their presence was acknowledged as vital for recycling but problematic. "Informal collectors arrive and pick recyclables but leave dirty waste behind."
Overflowing Bins	36	A direct consequence of irregular collection and insufficient bin capacity.
Payment and Affordability	33	Concerns were raised about the cost versus quality of service, especially in planned estates.
Environmental Hazards	15	Respondents directly linked poor waste management to clogged drains and local flooding.
Interest in Composting	18	A segment of respondents expressed willingness to compost if supported with training and space.
Open Burning	7	This was reported as a direct coping mechanism for missed collections.

The qualitative insights in Table 4.11 explain mechanistically how institutional arrangements translate into household coping behaviours and environmental externalities. Where bins and transfer infrastructure are missing and collection is irregular, households resort to burning, burning and ad-hoc dumping or paying informal collectors; where estates enforce service arrangements and absorb costs, these negative coping strategies are far less common.

DISCUSSION OF FINDINGS

The survey indicates that the domestic waste management system in Abuja is a hybrid, spatially differentiated and sub-optimal system. The findings clearly confirm the initial goal, which measures a waste stream that is largely organic (40.2) and a large and alarming proportion of plastic (29.5). The reliance on polythene bags and the high rate of almost full containers before collection shows that there are problems with storage aggravated by the irregular collection patterns.

Regarding the second goal of analysing the collecting systems, the data clearly indicate that there is a difference in service delivery between the residential typologies. The high correlations between typology, provider, frequency, and payment ($p < 0.001$) support the claim of overlapping institutional structures in accordance with Ibimode et al. (2023). Additionally, gated communities, which are serviced by private and estate providers, have

more stable, door-to-door services, whereas high-density areas, which depend on AEPB and informal collectors, are not consistent and lack access. This difference is the main reason that contributes to the high differences in overall satisfaction (F=139.67, p<0.001), which is a direct answer to the main research question regarding the diversity of service features.

The third goal regarding household behaviour discloses that 62.3 percent of households sometimes separate waste whereas 71.0 percent of households recycle, which is interesting. It challenges the notion of a purely behavioural impairment and points to the fact that the ability to participate exists. The logistic regression shows that the main barrier is not necessarily the attitude or awareness, but the contextual and systemic ones. In high-density areas, households, although they may be likely to be environmentally conscious as indicated by educational statistics, are significantly less likely to segregate garbage because a system does not always support or promote this behaviour. This is consistent with the systems theory approach (Bertalanffy, 1968; Iyamu, 2023) where the inefficiency of the collection subsystem (irregularity, lack of separate collection) directly affects the effectiveness of the household subsystem (separation).

These challenges are brought together in the qualitative data where inefficiencies in infrastructure and operational inefficiencies are found to be the main limiting factors. The presented concern with composting and the high percentage of organic waste indicate a clear opportunity to intervene. The results point to an institutional and operational limitation, and not an entirely behavioural challenge. Most households would tend to embrace more improved practices, but the tendency is discouraged by an untrustworthy, unfair, and under-financed collection system. As a result, an overhaul of the system, with a strong focus on reliable collection times, investment in the infrastructure, and the official acknowledgment of informal collectors, is necessary to achieve the potential of more sustainable and efficient waste management in Abuja.

CONCLUSION AND RECOMMENDATIONS

Conclusion

This paper concludes that the solid waste management of households in Abuja is typified by structural fragmentation and geographical imbalance, which depend directly on the type of residence. The combination of government, commercial and informal providers creates a hybrid that is defined by reliable and paid services in affluent and gated communities which is a stark contrast to the haphazard and inadequate collection in high-density and low-income neighbourhoods. The results show that there is a high tendency of the households to practice sustainable practices like separation of waste but this is undermined by the uneven service infrastructure. In turn, the main challenge is not the lack of collaboration in the household but a fundamental structural and operational lack. The way forward to a more sustainable and equitable system does not lie in the awareness campaigns, but in a decisive redesigning of collection services in order to achieve reliability, inclusivity, and the capacity to take advantage of the clearly latent potential at the household level.

Policy and Practice Recommendations

Based on the conclusive findings of this study, the following recommendations can be offered to the policymakers, municipal authorities, and service providers in the Federal Capital Territory.

For Government and Regulatory Bodies (AEPB, FCTA):

Implement a Differentiation Strategy of Services: Formalise the factual difference in the service models by creating specific strategies to each residential typology.

High-Density Areas: Prioritise public investment in infrastructure, including the strategic positioning and upkeep of communal dumpsters, as well as the creation of decentralised waste transfer stations to enhance collection efficiency. Establish a rigorous, publicly administered collecting timetable to foster confidence and dependability.

Planned Estates: Foster Public-Private Partnerships (PPPs) where AEPB provides regulatory oversight and bulk transport, while certified private operators handle door-to-door collection. Standardise service level agreements and fee structures to ensure equity and quality.

Gated Estates: Maintain the model of the private/estate-managed but increase the regulatory oversight of the AEPB to make sure that the environmental standards are achieved and informal workers are treated justly.

Formalise and Integrate the Informal Sector: Recognise the essential function of informal collectors, who cater to 25.2% of households. This can be through the formation of cooperatives, provision of safety equipment and integrating them into organised collecting and recycling systems, particularly of the profitable plastic and paper segments.

Initiate a Specialised Organic Waste Diversion Programme: Take advantage of the large proportion of organic waste (40.2) and the interest in composting. Launch community-based composting programs in specific and highly populated areas, including training, rudimentary equipment and creating a market of the compost. This reduces the trash in the landfills and creates employment opportunities that are environmentally friendly.

Introduce Extended Producer Responsibility (EPR): Introduce and enforce EPR laws on the manufacturers of plastic packaging and sachets to hold them financially and physically accountable to the end-of-life management of their products, which will help to decrease the pressure on the municipal systems..

For Service Providers (Public and Private):

Improve Operational Reliability: Enhance Operational Reliability: Work on the maintenance of published collection schedules. Use route optimisation technologies and make sure that collection vehicles are well maintained to reduce missed pickups, which are the main cause of dissatisfaction and illegal dumping.

Introduce Incentivised Separate Collection: Pilot a "separation-at-source" program in willing neighbourhoods, starting with gated and planned estates. Provide households with two clearly labelled bins (organic and residual) and ensure separate collection streams. Consider modest fee reductions for consistent participators.

Enhance Customer Communication and Feedback: Establish transparent channels for households to report missed collections, overflowing bins, and other issues. A responsive complaint mechanism, as measured in the SRI, is a key driver of perceived reliability and satisfaction.

For Households and Community Associations:

Enhance Management at the Estate Level: Residents Associations in planned and gated estates ought to leverage their collective bargaining power to secure improved service contracts with providers with performance targets such as frequency, timeliness, and waste segregation assistance.

Encourage In Estate Awareness and Norms: Organise awareness programs in communities to inform the residents about the advantages of waste separation and proper disposal. Introduce and implement by-laws on open dumping and burning in estates and use social norms to enforce the regulations.

Pilot Home-Based Composting: Houses, especially those with gardens or space, should be advised to use simple methods of home-composting their organic waste, which will decrease the amount of waste produced and improve the health of local soil.

Implementing these multi-stakeholder recommendations, Abuja can transition from its current state of fragmented and inequitable waste management towards a more efficient, sustainable, and inclusive system that matches household willingness with systemic capability.

Future Research Directions

Building on the limitations and findings of this study, future research should prioritise a longitudinal design to track waste generation trends and the impact of interventions over time. This should incorporate direct waste weighing and composition analysis to move beyond self-reported proxies. Furthermore, experimental or quasi-experimental studies are needed to rigorously evaluate the cost-effectiveness of different behaviour-change interventions, such as incentive schemes or communication strategies, on source segregation rates. Finally, a detailed cost-benefit analysis of establishing decentralised composting facilities and material recovery facilities

within the Abuja context would provide critical evidence to guide public and private investment in recycling infrastructure.

REFERENCE

1. Abdel-Shafy, H. I., & Mansour, M. S. (2018). Solid waste issue: Sources, composition, disposal, recycling, and valorization. Egyptian journal of petroleum, 27(4), 1275-1290.
2. Abubakar, I. R. (2017). Household response to inadequate sewerage and garbage collection services in Abuja, Nigeria. Journal of environmental and public health, 2017(1), 5314840.
3. Adama, O. (2012). Urban governance and spatial inequality in service delivery: a case study of solid waste management in Abuja, Nigeria. Waste Management & Research, 30(9), 991-998.
4. Adedara, M. L., Taiwo, R., & Bork, H. R. (2023, April). Municipal solid waste collection and coverage rates in Sub-Saharan African countries: A comprehensive systematic review and meta-analysis. In Waste (Vol. 1, No. 2, pp. 389-413). MDPI.
5. Aderoju, O.M., & Dias, G.A. (2020). Municipal solid waste characterization as a measure towards sustainable waste management in Abuja, Nigeria. Journal of Environmental Science and Public Health, 4(2), 43-60.
6. Alzamora, B. R., & Barros, R. T. D. V. (2020). Review of municipal waste management charging methods in different countries. Waste Management, 115, 47-55.
7. Arikibe, J. E. (2025). Municipal Solid Waste: Current Global Status and Insights into Analytical Approaches/Techniques for Metal Analysis of Incineration Residues.
8. Banerjee, S., & Sarkhel, P. (2020). Municipal solid waste management, household and local government participation: a cross country analysis. Journal of environmental planning and management, 63(2), 210-235.
9. Breukelman, H., Krikke, H., & Löhr, A. (2022). Root causes of underperforming urban waste services in developing countries: Designing a diagnostic tool, based on literature review and qualitative system dynamics. Waste Management & Research, 40(9), 1337-1355.
10. Cheng, C., Zhu, R., Thompson, R. G., & Zhang, L. (2021). Reliability analysis for multiple-stage solid waste management systems. Waste Management, 120, 650-658.
11. Cochran, W. G. (1977). Sampling Techniques (3rd ed.). John Wiley & Sons. Etikan, I., & Bala, K. (2017). Sampling and sampling methods. Biometrics & Biostatistics International Journal, 5(6), 215–217. https://doi.org/10.15406/bbij.2017.05.00149 Ogwueleka, T. C. (2013). Survey of household waste composition and quantities in Abuja, Nigeria. Resources, Conservation and Recycling, 77, 52–60. https://doi.org/10.1016/j.resconrec.2013.05.011 World Bank. (2023). Nigeria urban population growth (annual %). https://data.worldbank.org/indicator/SP.URB.GROW
12. Dibalson, A. (2024). Assessment of solid waste management practices in Abuja Municipal Area Council (AMAC). Veterinary Medicine and Public Health Journal. https://www.refaad.com/Files/VMPH/VMPH-5-1-3.pdf
13. Dickson, E. M., Hastings, A., & Smith, J. (2023). Energy production from municipal solid waste in low to middle income countries: A case study of how to build a circular economy in Abuja, Nigeria. Frontiers in Sustainability, 4, Article 1173474. https://doi.org/10.3389/frsus.2023.1173474
14. Echendu, A. J. (2023). Flooding and waste disposal practices of urban residents in Nigeria. GeoHazards, 4(4), 350-366.
15. Everett, J. W. (2019). Waste Collection and Transport. In Recovery of Materials and Energy from Urban Wastes (pp. 21-40). Springer, New York, NY.
16. Finnveden, G., Ekvall, T., Arushanyan, Y., Bisaillon, M., Henriksson, G., Östling, U. G., ... & Guath, M. (2013). Policy instruments towards a sustainable waste management. Sustainability, 5(3), 841-881.
17. Francisco, O. H. (2018). Willingness to pay for improved solid waste collection services in a commercial center in Sango, Nigeria. Universiti Putra Malaysia, Masters of Science Thesis.
18. Gangrade, K. D. (1982). Methods of data collection: Questionnaire and schedule. Journal of the Indian Law Institute, 24(4), 713-722.
19. Gautam, A. K., Pingua, N., Chandra, A., & Arya, R. K. (2024). Domestic waste management and their utilization. In From Waste to Wealth (pp. 1371-1398). Singapore: Springer Nature Singapore.

20. Gazette (2009, February 2). Legal notice on publication of 2006 census final results. Federal Republic of Nigeria Official Gazette (No. 2). https://archive.gazettes.africa/archive/ng/2009/ng-government-gazette-dated-2009-02-02-no-2.pdf

21. Geetha, V. (2025). Pollution Control Measures in Urban Waste Management. Multidisciplinary Research Area in Arts, Science & Commerce (Volume-1), 29.

22. Grobler, L., Schenck, R., & Chitaka, T. (2022). Waste management, littering and illegal dumping: A literature review. Clean cities and towns: Understanding societal behaviour in order to reduce and divert waste going to landfills, Technical Report. Bellville (South Africa): University of the Western Cape.

23. Humble, S. (2020). Quantitative analysis of questionnaires: Techniques to explore structures and relationships. Routledge.

24. Ibimode, A. A., Zhattau, V. F., Ilenwabor, J. O., Maigida, G. T., Dabis, N. D., Maton, S. M., & Dibal, J. Y. (2023). Assessment of solid waste management practices in Abuja Municipal Area Council (AMAC). International Journal of Advanced Research in Science and Technology, 12(5), 974–983. (Retrieved from ResearchGate)

25. Ita, D.R. (2021). Towards A Framework For The Adoption Of Smart Urban Waste Management System: A Case Study Of The Federal Capital Territory, Abuja.

26. Iyamu, H. O. (2023). Municipal solid waste management in low-income economies: Trialling a socio-technical assessment framework in NIgeria towards better management (Doctoral dissertation, Murdoch University).

27. Kadafa, A. A. (2017). Solid waste management practice of residents in Abuja Municipalities (Nigeria). IOSR Journal of Environmental Science, Toxicology and Food Technology, 11(2), 87-106.

28. Kaza, S., Yao, L., Bhada-Tata, P., & Van Woerden, F. (2018). What a Waste 2.0: A global snapshot of solid waste management to 2050. World Bank. https://documents.worldbank.org/en/publication/documents-reports/documentdetail/697271544470229584

29. Michael, S. (2024). Towards a Sustainable Municipal Solid Waste Management in Abuja, Nigeria: Enhancing the informal sector (Doctoral dissertation, Abertay University).

30. Morais, J., Corder, G., Golev, A., Lawson, L., & Ali, S. (2022). Global review of human waste-picking and its contribution to poverty alleviation and a circular economy. Environmental Research Letters, 17(6), 063002.

31. Oduro-Antwi, E. (2019). Collection of Municipal Solid Waste in Ghana; a case of Public-Private-Partnership in Accra Metropolitan Assembly.

32. Oguntoyinbo, O. O. (2012). Informal waste management system in Nigeria and barriers to an inclusive modern waste management system: A review. Public health, 126(5), 441-447.

33. Ogwueleka, T. (2009). Municipal solid waste characteristics and management in Nigeria. Iran Journal of Environmental Health Science & Engineering, 6, 173–180.

34. Ogwueleka, T. C. (2013). Survey of household waste composition and quantities in Abuja, Nigeria. Resources, Conservation & Recycling, 77, 52–60. https://doi.org/10.1016/j.resconrec.2013.05.011

35. Ogwueleka, T. C., & Naveen, B. P. (2021). Activities of informal recycling sector in North-Central, Nigeria. Energy Nexus, 1, 100003.

36. Ojiji, E. (2023). Towards Energy Recovery from Waste in Developing Countries: An Analysis of the Challenges, Barriers and Prospects of Waste Management in Abuja, Nigeria (Doctoral dissertation, University of Salford (United Kingdom)).

37. Ola, A. B., & Suleiman, R. A. (2022). A Comparative Analysis of the Operational Characteristics of Informal Waste Collectors: The Case of Ibadan and Abuja, Nigeria.

38. Oladeji, P. B., Oyedare, A. B., Ogunwale, T. O., Oyetola, S. O., Basiru, T. A., & Ogunrinola, O. F. (2024). Operations and Patronage of Private Waste Contractors Initiative of Solid Waste Collection in Ibadan Metropolis, Nigeria. Industrial and Domestic Waste Management, 4(1), 23-41.

39. Olukanni, D. O., & Nwafor, C. O. (2019). Public-private sector involvement in providing efficient solid waste management services in Nigeria. Recycling, 4(2), 19.

40. Opoko, A. P., & Oluwatayo, A. A. (2016). Private sector participation in domestic waste management in informal settlements in Lagos, Nigeria. Waste Management & Research, 34(12), 1217-1223.

41. Oyadiran, P., & Adesina, I. F. (2014). An Assessment Of Abuja Environmental Protection Board (Aepb) In Implementing Environmental Sanitation Policy In The Federal Capital Territory, Abuja. Conflict Resolution & Negotiation Journal, 2014(1).

42. Pires, A., Martinho, G., Rodrigues, S., & Gomes, M. I. (2019). Sustainable solid waste collection and management.

43. Puche Regaliza, J. C., Porras Alfonso, S., Jiménez Palmero, A., Aparicio Castillo, S., & Arranz Val, P. (2020). Exploring determinants of public satisfaction with urban solid waste collection services quality. Environment, Development and Sustainability, 23(7), 9927-9948.

44. Rousta, K., Zisen, L., & Hellwig, C. (2020). Household waste sorting participation in developing countries—a meta-analysis. Recycling, 5(1), 6.

45. Umar, F. Y., Ogwueleka, T. C., & Busari, A. O. (2022). Study of influencing factors of domestic solid waste management in Federal Capital Territory, Abuja. Journal of Physical Sciences, 4(2), 8–17.

46. UNEP. (2024). Global Waste Management Outlook 2024: Beyond an age of waste — Turning rubbish into a resource. United Nations Environment Programme. https://www.unep.org/resources/global-waste-management-outlook-2024

47. UNIDO. (2022). Plastic value chain in Nigeria (Project report). United Nations Industrial Development Organization. https://www.unido.org/sites/default/files/unido-publications/2022-12/Plastic-value-chain-in-Nigeria.pdf

48. Voukkali, I., Papamichael, I., Loizia, P., & Zorpas, A. A. (2024). Urbanization and solid waste production: prospects and challenges. Environmental Science and Pollution Research, 31(12), 17678-17689.

49. World Bank. (2018). What a Waste 2.0: A global snapshot of solid waste management to 2050 (Kaza, S., Yao, L., Bhada-Tata, P., & Van Woerden, F.). World Bank. https://datatopics.worldbank.org/what-a-waste/

50. World Population Review (2025). Abuja, Nigeria. https://worldpopulationreview.com/cities/nigeria/abuja

51. Xweso, M. (2023). Analysis of the livelihoods of female scrap collectors in the rural Eastern Cape of South Africa (Doctoral dissertation, University of the Western Cape).

APPENDIX

Appendix 1: Questionnaire

https://forms.gle/V4snEfi8FaHcZuAv5

INVESTIGATION OF DOMESTIC SOLID WASTE COLLECTION AND MANAGEMENT IN SELECTED RESIDENTIAL AREAS IN ABUJA, NIGERIA

Purpose: To collect household-level information on waste generation, collection services, payment, management practices and perceptions in Asokoro, Gwarinpa and Kubwa. All responses are confidential and used only for research.

Consent: I am conducting a survey on domestic solid waste for academic research. Participation is voluntary; your answers are confidential and you may stop at any time. Do you consent to take part in this interview?

☐ Yes

☐ No

SECTION 1: SOCIO-DEMOGRAPHIC CHARACTERISTICS

(Please tick/circle one option or write the answer)

1. Age:

☐ Less than 20

☐ 20–29

☐ 30–39

☐ 40–49

☐ 50–59

☐ 60 and above

2. Gender:

☐ Male

☐ Female

3. Highest level of education completed:

☐ No formal education

☐ Primary

☐ Secondary

☐ Tertiary (College/University)

☐ Postgraduate

4. Occupation (tick one):

☐ Civil servant

☐ Self-employed

☐ Private sector employee

☐ Student

☐ Unemployed

☐ Retired

☐ Other

5. Location (tick one):

☐ Asokoro

☐ Gwarinpa

☐ Kubwa

6. Which best describes your residential area?

☐ Gated estate (private management, regular services)

☐ Planned estate (moderate infrastructure, public/private collection)

☐ High-density area (limited infrastructure, irregular/informal collection)

7. Approximate monthly household income (₦):

☐ < ₦50,000

☐ ₦50,000–₦99,999

☐ ₦100,000–₦199,999

☐ ₦200,000–₦499,999

☐ ≥ ₦500,000

☐ Prefer not to answer

8. Household size (number of people living in the home): _____

9. Type of housing:

☐ Detached house

☐ Flat/apartment

☐ Bungalow

☐ Room(s) in compound

☐ Other

10. Tenure status:

☐ Owner-occupier

☐ Renter

☐ Family house

☐ Other

SECTION 2 — WASTE GENERATION & COMPOSITION

11. On average, how many standard waste bags does your household generate per week?

☐ Less than 1

☐ 1–2

☐ 3–4

☐ More than 4

12. Which of the following types of waste does your household produce? (Tick all that apply)

☐ Food/organic

☐ Plastic

☐ Paper

☐ Glass

☐ Metal

☐ Sanitary waste

☐ Other

13. Which type constitutes the largest portion of your household waste? (Tick one)

☐ Organic/food

☐ Plastic

☐ Paper

☐ Glass

☐ Sanitary

☐ Mixed/other

14. How do you usually store your household waste before collection? (Tick one)

☐ Plastic bin/bin with lid

☐ Polythene/plastic bags

☐ Open container

☐ Backyard dump

☐ Other

15. How full does your storage get before collection occurs? (Tick one)

☐ Less than half-full

☐ About half-full

☐ Almost full

☐ Overflowing

16. If storage overflows, what do you typically do? (tick all that apply)

☐ Keep until next collection

☐ Dump in open space

☐ Burn

☐ Pay an informal collector to take it

☐ Other

SECTION 3 — COLLECTION SYSTEMS & SERVICE ACCESS

17. Who collects your household waste? (Tick one)

☐ Abuja Environmental Protection Board (AEPB) / public agency

☐ Private company/contractor

☐ Estate management

☐ Informal collector/scavenger

No regular collection

18. How often is waste collected from your household or immediate vicinity? (Tick one)

☐ Daily

☐ 2–3 times per week

☐ Weekly

☐ Irregularly (no fixed schedule

☐ Never

19. What is the primary collection method used in your area? (Tick one)

☐ Door-to-door collection

☐ Communal/compound bin

☐ Street-corner collection point

☐ Household burns/buries own waste

☐ Other

20. Approximate distance from your home to the nearest collection point or communal bin:

☐ < 50 m

☐ 50–100 m

☐ 100–300 m

☐ 300 m

21. How easy is it to access the collection point? Circle one (1 = very difficult; 5 = very easy)

☐ 1

☐ 2

☐ 3

☐ 4

☐ 5

22. When collectors fail to come, how do you dispose of waste? (Tick one)

☐ Keep until next round

☐ Dump in open space

☐ Burn on site

☐ Pay informal collector

☐ Other

23. Are there visible informal collectors (scavengers/recyclable buyers) in your area?

☐ Yes

☐ No

SECTION 4: COSTS, PAYMENT & AFFORDABILITY

24. Do you (or your household) pay for waste collection services?

☐ Yes

☐ No

25. If yes, how much do you pay per month (₦)? (Tick one)

☐ < ₦1,000

☐ ₦1,000–₦1,999

☐ ₦2,000–₦2,999

☐ ≥ ₦3,000

☐ Other

26. Mode of payment (tick all that apply):

☐ Direct cash to operator

☐ Through estate management/association

☐ Local government collection point

☐ Bank transfer/mobile transfer

☐ Other

27. How would you rate the affordability of the payment? tick one (1 = very affordable; 5 = very expensive)

☐ 1

☐ 2

☐ 3

☐ 4

☐ 5

SECTION 5 — HOUSEHOLD PRACTICES, ATTITUDES & SATISFACTION

29. Do you separate waste into different categories (e.g., organics, recyclables) before disposal?

☐ Always

☐ Sometimes

☐ Rarely

☐ Never

30. Do you reuse or repurpose household items (e.g., bottles, containers)?

☐ Yes

☐ No

31. Do you compost organic waste (food scraps, yard waste) at home or within your compound?

☐ Yes

☐ No

32. Are you aware of any recycling program or facility that serves your area?

☐ Yes

☐ No

33. Please indicate how strongly you agree with the following statements (1 = Strongly disagree, 5 = Strongly agree). Circle one number per row.

Item	1	2	3	4	5
Source separation is important for a clean environment.					
I would separate my waste if collectors picked it up separately.					
Everyone in the community should pay for waste services.					
Waste management is primarily the government's responsibility.					
I am satisfied with how I personally manage my household waste.					

Please indicate your satisfaction with the listed service attributes (1 = Very dissatisfied, 5 = Very satisfied). Circle one number per row.

Item	1	2	3	4	5
Timeliness of collection					
Cleanliness of street/compound after collection					
Behaviour/professionalism of collectors					
Frequency of service					
Complaint response by authorities/operators					

Overall, how satisfied are you with waste collection in your area?

☐ 1 (Very dissatisfied)

☐ 2 (Dissatisfied)

☐ 3 (Neutral)

☐ 4 (Satisfied)

☐ 5 (Very satisfied)

SECTION 6: OPEN-ENDED QUESTIONS (Optional but appreciated)

36. What are the main challenges you face with waste collection and management in your area?

_____
_____
_____

37. Have you experienced any specific incidents related to waste (e.g., flooding due to blocked drains, health problems, fire from burning)? If yes, please describe briefly.

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38. What suggestions would you offer to improve waste management services in your community? (For authorities, operators, or community actions)

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Thank you for your time and cooperation.