Macrothink Institute™

Environmental Management and Sustainable Development
ISSN 2164-7682
2026, Vol. 15, No. 2

Influence of Socio-demographic Characteristics of Households on Plastic Waste Management Techniques in the Federal Capital Territory and Lagos State, Nigeria

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Received: May 14, 2026 Accepted: June 27, 2026 Published: July 16, 2026

doi:10.5296/emsd.v15i2.23735 URL: https://doi.org/10.5296/emsd.v15i2.23735

Abstract

The escalating crisis of plastic waste mismanagement represents a critical bottleneck for environmental governance across the Global South, particularly in Nigeria, where annual generation exceeds 2.5 million tonnes with a recovery rate of less than 10%. The structural deficiencies of waste management systems remain poorly characterised at household and community level. This study assesses the influence of socio-demographic characteristics on plastic waste management within Nigeria's two most significant urban centres: The Federal Capital Territory (FCT) and Lagos State. Adopting a robust mixed-methods research design, the study utilised a cross-sectional survey of 770 households selected via proportionate systematic sampling complemented by Key Informant Interviews (KII) involving stakeholders from government and private sectors. A multistage sampling technique was adopted. FCT and Lagos State were selected due to their high population density and recent plastic waste management initiatives. Two Area Councils in FCT and ten LGAs in Lagos State were purposively selected due to high population density, random selection (balloting) of ten wards from each of the ten study locations. A sample of 385 households each from

FCT and LS were proportionately and randomly selected amounting to 770 households. Structured questionnaires were administered to household heads or knowledgeable representatives, yielding 385 completed responses from each state. Data were analysed using descriptive statistics and chi-square tests. The findings revealed that FCT had 194 males (50.4%) and 191 females (49.6%), while the Lagos State had 197 males (51.2%) and 188 females (48.8%). Level of education was comparatively higher in FCT, where 73.5% of respondents had tertiary qualifications, compared to 55.1% in Lagos State. Respondents with secondary education constituted 17.9% (FCT) and 26.2% (Lagos State), while those with primary education accounted for 4.7% (FCT) and 12.5% (Lagos State) and no formal schooling accounted for 3.9% (FCT) and 6.2% (Lagos State). Regarding employment status, self-employment was reported by 42.6% (FCT) and 33.0% (Lagos State) of respondents, employees accounted for 44.4% (FCT) and 44.4% (Lagos State), while students constituted 13.0% (FCT) and 22.6% (Lagos State). The mean age of respondents was 35.2 (±10.3) in FCT and 35.8 (±10.3) in Lagos State, with 35 years being the most frequent. Mean household size was 4.7 (±2.9) in FCT and 4.9 (±2.7) in Lagos State, with 5-person households being the most frequent. Findings indicate that 58.2% of respondents did not segregate plastic waste from general household waste, while 41.8% reported practising separation. The most frequent source of plastic waste in FCT was food packaging (38.2%), beverages packaging (39.4%), personal care products (12.8%), others (5.5%) and electronic device packages (4.1%); while in Lagos State, food packaging (39.5%), beverages packaging (37.0%), personal care products (14.2%), others (4.4%), and electronic device packages (4.9%). The dominant Plastic Waste Management Techniques (PWMT) used by households in the FCT were recycling (51.7%), open dumping (27.4%), waste-to-energy (8.8%), burning (7.2%), and biodegradation (4.9%); while in Lagos State, recycling (51.0%), open dumping (28.1%), waste-to-energy (6.9%), burning (8.4%), and biodegradation (5.6%) were used. Chi-square analysis revealed a statistically significant relationship between gender and burning ($p = 0.009$), and between occupation and open dumping ($p = 0.017$). These findings underscore the need for targeted, socio-demographically informed interventions to improve plastic waste practices. Policy efforts should not just prioritise public education campaigns, but infrastructural investment in plastic waste systems, and regulatory frameworks that account for socio-demographic heterogeneity in urban Nigerian contexts.

Keywords: Plastic waste, Plastic waste management techniques, Socio-demographic characteristics, Lagos State, Federal Capital Territory

1. Introduction

Due to their adaptability, strength, affordability, and light weight, plastics were recognised as revolutionary materials in the 20th century. However, in the 21st century, they have transformed into one of the most difficult environmental problems facing humanity (Nayanathara & Ratnayake, 2024). Global plastics production has increased at an extraordinary rate since synthetic polymers were commercialised after World War II, approaching 400 million tonnes annually (UNEP, 2024; Evode et al., 2021). Given their exceptional qualities such as durability, low cost, and flexibility in manufacturing, plastics are used extensively for single-use packaging (Ezeudu et al., 2024; Shen et al., 2020). However,

there is a pressing need to reduce unsustainable use and disposal that contaminate the environment. Only a small portion of this enormous amount is successfully recycled; an estimate of over 70% of plastic waste worldwide is dumped in landfills or carelessly discharged into the environment (Pereyra-Camacho & Pardo, 2024).

Plastic pollution on land and in water is seriously harming the environment and posing health concerns to people worldwide. Notably, it is responsible for more than 1.1 million animal and seabird deaths per year (Xanthos & Walker, 2017), endangers the marine ecosystem (Dumbili & Henderson, 2020), jeopardises global food security (Zhang et al., 2020), and is related to a number of health issues in humans and animals. Studies by Barbosa et al. (2020) and Zhu et al. (2020) have found the presence of microplastics in the human diet. However, while there is no consensus among scientists on the actual scope of effects associated with human exposure to microplastics (Prata et al., 2020), available evidence suggests that the ingestion or inhalation of microplastics could lead to inflammation and immune system response (Hwang et al., 2019), reproductive health challenges (Rist et al., 2018) as well as cancer (Prata et al., 2020). Adopted in 2015, the Sustainable Development Goals (SDGs) of the United Nations acknowledged that the present patterns of plastic production and waste are incompatible with the vision of a healthy world and inclusive prosperity. The cross-cutting effects of plastic pollution touch on no fewer than twelve of the seventeen goals, including clean water and sanitation (SDG 6), good health and wellbeing (SDG 3), sustainable cities and communities (SDG 11), climate action (SDG 13), and responsible consumption and production (SDG 12), even though SDG Target 14.1 specifically mentions plastic debris (Walker et al., 2021; UNDP, 2024).

With an estimated 2.5 million tonnes of plastic waste produced yearly and less than 12% recycled, Nigeria is ranked ninth in the world for plastic pollution (Yalwayi et al., 2022). Dumbili & Henderson (2020) recommended that Nigerian society adopt culturally relevant solutions to the problem of plastic pollution rather than depending on top-down approaches that might not work locally. Due to rapid urbanisation, population growth exceeding 200 million, a consumption structure heavily dependent on single-use packaging, and persistent underinvestment in formal waste management infrastructure, Nigeria is one of the top ten global producers of improperly managed plastic waste (Ezeudu et al., 2024; Dumbili & Henderson, 2020). Nigeria's plastic waste problem is more than just an environmental annoyance; it is a systemic development emergency that is interfering with urban drainage systems, contaminating water sources, causing disease burdens in low-income communities, and impeding the country's formal commitment to the SDG targets (Olaoti, 2024; Anabaraonye et al., 2023).

The Federal Capital Territory (FCT) and Lagos State constitute two of the most consequential theaters of Nigeria's plastic waste challenge, yet they present contrasting governance contexts, demographic profiles, and infrastructural capacities that make their comparative study particularly instructive. Lagos, the commercial capital of Nigeria and among the five largest cities in Africa, with a metropolitan population conservatively estimated at over 22 million, generates an estimated 870,000 tonnes of plastic waste annually, making it the single largest plastic waste producing sub-national jurisdiction in the country (Olaoti, 2024). The scale and

density of Lagos's plastic pollution crisis are reflected in its blocked drainage systems, recurrent catastrophic flooding, contamination of the Lagos Lagoon and adjacent Atlantic coastline, and pervasive presence of microplastics in water and food sources.

The difficulties of the Federal Capital Territory are different but equally urgent. The Abuja Environmental Protection Board (AEPB), a specialised environmental regulating organization, and a relatively more structured spatial layout are two advantages of Abuja as Nigeria's administrative capital (Obiadi et al., 2019). However, conditions of significant plastic waste accumulation in both formal and satellite communities have been created by rapid immigration, the growth of informal settlements on the outskirts of the planned city, and inadequate waste management infrastructure (Obiadi et al., 2019). Twenty-five locally fabricated Reverse Vending Machines (RVMs) were installed in strategic locations throughout Abuja as part of a historic 2024 initiative led by the United Nations Industrial Development Organization (UNIDO) in collaboration with the AEPB. This represents a major technological advancement in the FCT's infrastructure for collecting and recycling plastic waste (UNIDO, 2024). Despite these initiatives, there is still a dearth of thorough empirical profiling of plastic waste management strategies used in FCT homes and communities in the peer-reviewed literature.

Much of the day-to-day plastic waste management burden in Nigerian cities is shouldered by informal sector actors (itinerant waste pickers), aggregators, and recyclers who operate outside formal regulatory frameworks and with limited access to markets, social protection, or capital (Ogwueleka & Naveen, 2021). When they do exist, formal waste management systems are plagued by irregular collection schedules, poor waste segregation at the source, the predominance of open dumpsites, and a nearly insignificant contribution from advanced treatment technologies like chemical recycling, pyrolysis, and waste-to-energy conversion (Ezeudu et al., 2024; Kibria et al., 2023).

Despite the increasing amount of research on plastic pollution in Nigeria, there are still a lot of empirical gaps, especially when it comes to the systematic identification and characterisation of plastic waste management strategies being used in Lagos State and the Federal Capital Territory. Previous research has tended to concentrate on waste characterisation and composition analyses, health impact assessments, or comprehensive policy reviews at the national level without providing thorough, community-level inventories of the actual management strategies in use, encompassing both formal mechanisms (kerbside collection, organised recycling, sanitary landfilling) and informal practices (open burning, open dumping, itinerant waste picking, communal transfer points) (Olaoti, 2024; Kibria et al., 2023). This gap is particularly consequential given that effective policy design requires precise knowledge of the existing management landscape, its coverage, limitations, and potential for upgrading.

However, there are still few empirical studies in the peer-reviewed literature that particularly describe technique-level practices and their socio-demographic correlations in the Lagos and FCT contexts. That gap is directly addressed in this work by identifying the methods currently in use for managing plastic waste and how they affect socio-demographic variables. Thus, the objective of this study is to assess the influence of socio-demographic characteristics on plastic waste management techniques in Lagos State and the Federal Capital Territory.

2. Methods

2.1 Study Area

The study was carried out in the Federal Capital Territory and Lagos State, located in the North-Central and Southwest regions of Nigeria respectively, as shown in Figure 1. The Federal Capital Territory is currently made up of six Area Councils, namely: Abaji, Abuja Municipal Area Council (AMAC), Bwari, Gwagwalada, Kuje and Kwali (Ayileka and Kalgo, 2001), while Lagos State is situated in the southwest of Nigeria. There are twenty local government areas (LGAs) in the state.

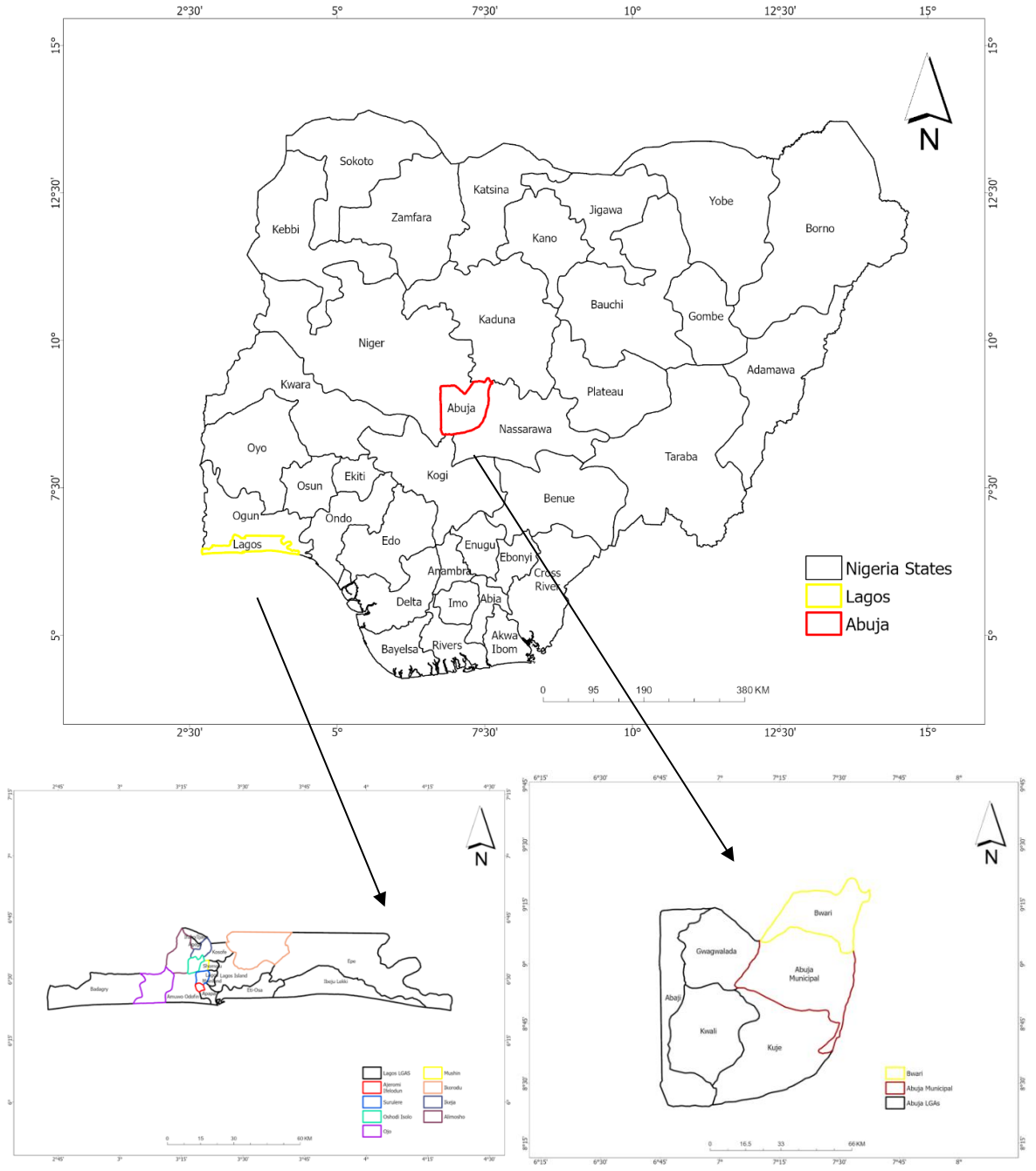

Figure 1. Map of Nigeria and the study area

2.2 Research Design

This study adopted a cross-sectional mixed-methods research design by collecting primary data. Quantitative and qualitative research methodologies were utilized for gathering and analysing data. Fieldwork included a questionnaire survey for households and Key Informant Interviews (KII) with stakeholders. The mixed-methods approach was selected on the grounds of credibility, contextualisation, and complementarity (Greene et al., 1989; Bryman, 2006; Schoonenboom & Johnson, 2017): quantitative data provided the statistical basis for testing hypothesised associations between socio-demographic variables and plastic waste management techniques, while qualitative data from KII contextualised and enriched the interpretation of the quantitative data within the operational realities of waste governance in Federal Capital Territory and Lagos State.

2.3 Sample Size and Sampling Frame

The sampling size for this study was determined using Cochran's formula. To have an equal ratio of population in both states, Abuja Municipal (AMAC), and Bwari area councils with 1,203,165, and 355,346 populations respectively were selected in FCT while Ajeromi-Ifelodun, Alimosho, Kosofe, Mushin, Oshodi-Isolo, Ojo, Ikorodu, Surulere, Agege, and Ifako-Ijaye LGAs with 1,017,500, 1,953,500, 1,010,800, 935,400, 931,300, 901,800, 781,500, 744,400, 683,600, and 633,200 populations respectively were selected in Lagos State according to Nigeria Bureau of Statistics Estimated Projection 2022 (Brinkhoff, 2022). Using the Cochran's sample size formula with finite population correction

$$n = \frac{\left[Z^2 * \frac{p(1-p)}{e^2}\right]}{\left[1 + \left(Z^2 * \frac{p(1-p)}{e^2 N}\right)\right]}.$$

Where: 'n' is the required sample size,

'N' is the population size,

'e' is margin of error 5% (standard value of 0.05)

'p' population proportion at 0.5

'z' the number of standard deviations a given proportion is away from the mean (desired confidence level—95% [1.96]) and

'1' is the constant value.

n (FCT)= 1,203,165 + 355,346 = 1,558,511

$$n\ (FCT) = \frac{\left[(1.96)^2 * \frac{0.5(1-0.5)}{(0.5)^2}\right]}{\left[1 + (1.96)^2 * \frac{0.5(1-0.5)}{(0.5)^2} * 1{,}558{,}511\right]}$$

n= 385

n (Lagos)= 1,017,500 + 1,953,500 + 1,010,800 + 935,400 + 931,300 + 901,800 + 781,500 + 744,400 + 683,600 + 633,200 = 9,593,000

$$n\ (Lagos) = \frac{\left[(1.96)^2 * \frac{0.5(1-0.5)}{(0.5)^2}\right]}{\left[1 + (1.96)^2 * \frac{0.5(1-0.5)}{(0.5)^2} * 9{,}593{,}000\right]}$$

n= 385

Thus, the questionnaire was distributed to 385 households in each state. This results in a total of 770 questionnaires distributed across the two states. A proportionate sampling was used to distribute the questionnaires as follows

Table 1. Study Location and Sample Size

	FCT	Lagos	Total
	AMAC = 297	Ajeromi-Ifelodun = 41	
	Bwari = 88	Alimosho = 78	
		Kosofe = 41	
		Mushin = 38	
		Oshodi-Isolo = 37	
		Ojo = 36	
		Ikorodu = 31	
		Surulere = 30	
		Agege = 27	
		Ifako-Ijaye = 26	
Total	385	385	770

2.4 Sampling Procedure

A multistage sampling method was used. The Federal Capital Territory and Lagos state were selected based on the study (high population density) and recent events such as the ban on single-use plastics and the use of reverse vending machines. Within the states, purposive sampling was used to select two Area Councils in FCT and eight Local Government Areas (LGAs) in Lagos State due to population density. Within the selected area councils and LGAs, ten (10) wards were randomly selected through balloting from each selected study locations and households within these wards were chosen through proportionate and random sampling. Structured questionnaires were administered to selected heads of households, as they are responsible for household decision-making. In cases where the head of household is not available, another household member who is knowledgeable about the household activities was interviewed to ensure adequate representation and minimize non-response bias. Out of the 770 households that responded to the survey, 385 households completed the questionnaire in each state. From each household, one member was requested to respond to the survey. Using a proportionate sampling method as shown in table 1, the questionnaire was distributed equally in both states.

To complement and buttress quantitative data, qualitative data were gathered using a structured Key Informant Interview (KII), which were conducted with a purposive sampling of key stakeholders. These included two senior staff members from Lagos State Waste Management Authority (LAWMA) & Abuja Environmental Protection Board (AEPB), an official from Waste Picker Association of Nigeria (WAPAN), and plastic collectors for

insights into the practices regarding plastic waste management operations in the study area. These participants were chosen for their specialized knowledge and practical involvement in plastic waste management in Lagos State and FCT.

2.5 Survey Method and Content

The quantitative data used in this study were generated through structured questions prepared and presented using KoboToolbox and administered to respondents within the study area. Prior to full deployment, the instrument was pre-tested with 30 respondents drawn from Kuje LGA of FCT. This pre-test assessed the clarity of item wording, the adequacy of response options, and the appropriateness of the digital administration format. Feedback from the pre-test was used to revise ambiguous items, standardise response categories, and adjust the sequencing of questions to improve logical flow. The qualitative component of the study was evaluated using trustworthiness criteria rather than internal consistency measures. Credibility, dependability, confirmability, and transferability were enhanced through expert validation, triangulation, and systematic documentation of the research procedures (Lincoln & Guba, 1985).

Data collection was conducted between April 15, 2025 and July 4, 2025. A three-step approach was used in data collection:

1. *The creation of the data collection form:*

The data collection instrument was designed using KoboToolbox. An account and the form containing the survey questions was created and configured to capture relevant variables in line with the objectives of the study. The questionnaire was reviewed and refined where necessary before deployment. The digital form had 28 fields such as date/time stamps, socio-demographic characteristic, and other key variables required for the study on plastic waste management practices. The structure of the form provided flexibility with both open-ended and closed-ended questions to capture detailed responses from participants. The flexibility provided by the survey ensured that respondents could input text where necessary, while dropdown lists were also made available.

2. *Administration of the questionnaire:*

The questionnaire was administered electronically using mobile devices. Data were collected through an interviewer-administered approach, where enumerators were trained on how to collect data, and responses were entered directly into the KoboToolbox platform. The data and information collected were securely stored and not made publicly accessible during and after the data collection process. The platform supported both offline and online data collection, allowing responses to be recorded without internet access and synchronized to the server once connectivity was available.

3. *The transfer and management of collected data:*

The responses to the survey were automatically saved and stored on the Kobo Toolbox server. The platform allows direct export of collected data into spreadsheet formats for further processing and analysis. The datasets containing the responses were downloaded,

cross-checked and subsequently analyzed using statistical software such as SPSS.

2.6 Analytical Framework and Hypothesis

Data were analysed using SPSS Statistics Version 27. Firstly, descriptive statistics (including frequencies, percentages, means, and standard deviations) were computed to characterise the socio-demographic profile of respondents and the distribution of plastic waste management practices and technique awareness across the study area. Next, chi-square tests of independence (χ^2) were performed to examine bivariate associations between the three socio-demographic independent variables (gender, educational attainment, occupational status) and the five plastic waste management technique related dependent variables (recycling, burning, open dumping, biodegradation, and waste-to-energy). The significance threshold was set at $p < 0.05$ (two-tailed). In the third stage, KII transcripts were subjected to thematic analysis following the six-phase framework of Braun and Clarke (2006): familiarisation, initial coding, theme generation, theme review, theme definition, and reporting.

The study tested the following directional hypothesis:

H_0: There is no significant relationship between socio-demographic characteristics and plastic waste management techniques

H_1: There is a significant relationship between socio-demographic characteristics and plastic waste management techniques

3. Results and Discussion

3.1 Socio-demographic Characteristics

The socio-demographic characteristics of respondents are important in this study because demographics often influence the patterns of plastic consumption, disposal behaviour, level of awareness and use of waste management. Variables including age, sex, education, occupation, and household size are particularly relevant in explaining the differences in plastic use, disposal preference, and levels of engagement in plastic waste management. These characteristics offer an analytical basis for interpreting behavioural patterns observed in the study and for assessing how well the sample reflects the broader population in the Federal Capital Territory and Lagos State.

Table 2 reveals that the study had 194 (50.4%) male and 191 (49.6%) female in FCT, while 197 (51.2%) male and 188 (48.8%) female in Lagos State, but overall, there were 391 (50.8%) male and 379 (49.2%) female. The marginal male predominance is consistent with the methodological decision to target household heads as primary respondents, a role disproportionately occupied by men in the Nigerian socio-cultural context (Oladipupo et al., 2024). This finding is corroborated by Oladipupo et al. (2024) who reported 51.0% male and 49.0% female and also with a study by Lawal (2026) that had 51.9% male and 48.1% female.

The study also revealed that in FCT, 283 (73.5%) of the respondents had tertiary education, 69 (17.9%) had secondary education, 18 (4.7%) had primary education and 15 (3.9%) had no

formal education, while in Lagos State, 212 (55.1%) of the respondents had tertiary education, 101 (26.2%) had secondary education, 48 (12.5%) had primary education and 24 (6.2%) had no formal education. In total, there were 495 (64.3%) with tertiary education, 170 (22.1%) with secondary education, 66 (8.6%) with primary education and 39 (5.0%) with no formal education. The higher concentration of tertiary educated respondents in FCT is attributable to the city's character as Nigeria's administrative capital, which has attracted a disproportionate share of graduate level civil servants, professionals, and technocrats (Obiadi et al., 2019), while Lagos State reflects the state's position as Nigeria's foremost commercial and industrial centre, attracting a diverse workforce comprising professionals, entrepreneurs, and skilled employees.

Lagos hosts a large concentration of higher educational institutions, corporate organisations, financial institutions, and industrial establishments, which contribute to a relatively educated population structure (Adeosun et al., 2023). These findings agree with Oladipupo et al. (2024). In their findings, respondents with no formal education (none) were 5.0%, those with primary education were 6.0%, those with secondary education were 30.0%, those with university were 54.0%, and those with Master and above were 3.0%. In contrast, Lawal (2026) had 19.6% with no formal education, 13.9% with Primary education, 43.3% with secondary education, 16.6% with post-secondary education, University with 6.5% and do not know with 0.1%.

Also, 50 (13.0%) and 87 (22.6%) of the respondents revealed that they were students, while 164 (42.6%) and 127 (33.0%) revealed that they were self-employed, and 171 (44.4%) and 171 (44.4%) revealed that they were employees in FCT and Lagos State respectively. In total, the findings had 137 (17.8%) student, 291 (37.8%) self-employed and 342 (44.4%) employees. In contrast to these findings, Oladipupo et al. (2024) revealed that students were 64.0%, Government employees were 11.0%, unemployed were 28.0% and self-employed were 7.0%.

The average age for each location was 35.2 (±10.3) and 35.8 (±10.3) in FCT and Lagos State respectively, while the total average age for both state is 35.5 (±11.2). The age that occurred more was 35years in both States. The average number of persons in a household is 4.7 (±2.9) and 4.9 (±2.7) in FCT and Lagos State respectively, while the total average number of persons in a household in both states is 4.8 (±2.8). Most household had 5 persons in their households.

Table 2. Socio-demographic characteristics of households

Item	Description	FCT	Lagos	Total
Gender	Male	194 (50.4)	197 (51.2)	391 (50.8)
	Female	191 (49.6)	188 (48.8)	379 (49.2)
Education	Tertiary	283 (73.5)	212 (55.1)	495 (64.3)
	Secondary	69 (17.9)	101 (26.2)	170 (22.1)
	Primary	18 (4.7)	48 (12.5)	66 (8.6)
	No formal education	15 (3.9)	24 (6.2)	39 (5.0)
Occupation	Employee	171 (44.4)	171 (44.4)	342 (44.4)
	Self employed	164 (42.6)	127 (33.0)	291 (37.8)
	Student	50 (13.0)	87 (22.6)	137 (17.8)
Age	Average	35.2	35.8	35.5
	St. deviation	10.3	10.3	11.2
	Mode	35.0	35.0	35.0
No of persons in household	Average	4.7	4.9	4.8
	St. deviation	2.9	2.7	2.8
	Mode	5	5	5

Note: Figures in parentheses are percentages
Source: Field work, 2025

3.2 Plastic Waste Management Techniques

This section discusses the plastic waste management techniques identified in the Federal Capital Territory (FCT) and Lagos State. The increasing generation of plastic waste resulting from urbanization, population growth, and the widespread consumption of packaged products has intensified concerns regarding environmental sustainability and effective waste management practices. The identification of existing plastic waste management techniques is essential for understanding households' disposal behaviours and evaluating the effectiveness of current waste management practices

The findings presented in Table 3 reveal that majority of respondents across both study areas demonstrated awareness of at least one plastic waste management technique, with 252 (65.5%) of FCT households and 277 (71.9%) of Lagos State households affirming such awareness, yielding a combined total of 529 (68.7%). These results are consistent with the broader trajectory of environmental consciousness among urban Nigerian populations, which has been gradually shaped by government-led policy interventions and civil society advocacy over the past decade. Nigeria's National Policy on Plastic Waste Management (2020), which provides a framework for plastic reduction, recycling, and extended producer responsibility, has been credited with stimulating some degree of public awareness about waste management options. Nevertheless, the finding that approximately one-third of respondents in the FCT 133 (34.5%) and more than a quarter in Lagos 108 (28.1%), giving a sum of 241(31.3%) remained unaware of any plastic waste management technique is a matter of considerable concern, particularly given the magnitude of the plastic waste crisis in these metropolitan centres.

The higher awareness levels recorded in Lagos State relative to the FCT may be attributable to the more intensive waste management campaigns and institutional frameworks operational in Lagos. The Lagos Waste Management Authority (LAWMA), which had registered over 50

recyclers under the Lagos Recycle Initiative as of March 2021, has been instrumental in promoting public engagement with formal recycling systems (UNIDO, 2022). Conversely, waste management governance in the FCT operates under a more fragmented institutional structure, with responsibilities shared across the Abuja Environmental Protection Board (AEPB) and the Abuja Municipal Area Council, a dynamic that has historically impeded coherent public education efforts (Obidimma & Azubuike, 2023). These structural differences may explain the observed inter-city variation in awareness levels.

These findings are broadly consistent with evidence from Hanoi, Vietnam, where Nguyen et al. (2015) reported moderate to high household awareness of waste separation and recycling programmes following sustained communication campaigns and institutional support. However, the Hanoi study also demonstrated that awareness levels do not automatically translate into active participation in waste management practices, with convenience, availability of collection facilities, and institutional support emerging as stronger determinants of actual behaviour than awareness alone.

The dominant plastic waste management techniques used were recycling (51.7%), open dumping (27.4%), waste-to-energy (8.8%), burning (7.2%), and biodegradation (4.9%); while in Lagos State, recycling (51.0%), open dumping (28.1%), waste-to-energy (6.9%), burning (8.4%), and biodegradation (5.6%) were used. The total findings for both locations are 395 (51.3%) for recycling, 213 (27.7%) for open dumping, 60 (7.8%) for burning, 61 (7.9%) waste-to-energy, and 41 (5.3%) for biodegradation. Recycling and waste to energy were found by Ekanem et al. (2024) to be a promising management strategy for Nigeria's plastic waste. According to Babayemi et al. (2019), 80% of Nigeria's plastic waste ends up in landfills, with only 12% being recycled. Aikowe (2021) suggested that the rate of recycling in Nigeria does not match the speed at which plastics are being generated. According to Adebayo et al., (2024), 67.0% of respondents in the Ilorin metropolitan were using recycling, whilst 33.0% are not. All facts imply that recycling and open dumping are the dominant management strategies of plastic waste in FCT, Lagos State and Nigeria as a whole.

The findings are consistent with international evidence from Vietnam, where Nguyen et al. (2015) found that household knowledge and usage was concentrated on conventional waste management practices such as recycling and waste separation, while knowledge of advanced treatment technologies remained limited. Similarly, a study in Malaysia by Ramayah et al. (2012) reported that public practice was highest for recycling programmes because these initiatives were directly promoted through community campaigns and educational interventions, whereas awareness and use of technologically advanced waste treatment options was relatively low. These studies suggest that public practice tends to be greatest for waste management techniques that are visible, accessible, and directly integrated into everyday household activities.

However, recycling and open dumping are being highly recognized from the findings of this study and it agrees with the 2020 National Policy on Plastic Waste Management in Nigeria. By focusing on waste hierarchy, the policy encourages a circular economy. It made recycling a priority and specifically limited the amount of plastic waste that could be dumped in

landfills. The policy sets some aims to recycle 50% of all plastic waste by 2030, develop a countrywide recycling target for sectors, municipalities, cities and states, reviewed every 5-10 years starting from 2020 and standardize minimum thickness for single-use plastics to increase recyclability. By 2025, open dumping and dumpsites will be replaced by controlled dumpsites or sanitary landfills; starting in 2021, recyclables should not be disposed of in landfills; instead, waste should be converted into energy. Additionally, as a link between recycling and landfills, the policy promoted waste-to-energy, particularly for non-recyclables, contaminated plastics, and multi-layered plastics.

The observed difference between reported practices and awareness of plastic waste management techniques indicates that a lack of explicit understanding does not always mean that households are not using these techniques. Instead, without necessarily identifying them as official plastic waste management procedures, households may select waste management techniques based on their accessibility, convenience, current community practices, or availability of collection services. As a result, behavioural practice and self-reported awareness might not always match. This result is consistent with research showing that contextual elements including infrastructure, accessibility, convenience, and prevalent social norms affect waste management behaviour in addition to knowledge. Etim (2024) reported a gap between awareness and actual waste management practices, concluding that awareness alone does not guarantee behavioural adoption because practice is constrained by factors such as infrastructure, willingness, and convenience.

The Key Informant Interview with government officials, plastic waste collectors and waste pickers provided important qualitative insight into identifying the techniques used in plastic waste management in FCT and Lagos State. Their expertise buttressed the findings gotten from the quantitative data.

Question: What are the current practices regarding plastic waste management in your State?

> *In the Federal Capital Territory (FCT), plastic waste management is predominantly limited to basic recycling and disposal at dumpsites. Waste segregation at source is generally minimal or absent, resulting in mixed waste streams. Most plastic waste is either collected by waste aggregators or transported to dumpsites through formal waste collection systems. Although the informal sector, particularly waste pickers, has historically played a significant role in plastic waste management, their activities have been prohibited within the Federal Capital City (FCC) due to safety and operational concerns arising from previous incidents. Nevertheless, waste pickers remain active at designated dumpsites, where they recover recyclable plastics and sell them to aggregators. These aggregators serve as intermediaries between waste recovery and recycling facilities. The recycling process in the FCT commonly involves the collection, sorting, washing, baling, crushing, and pelletizing of plastic materials. These activities are undertaken by recycling companies registered with the Abuja Environmental Protection Board. In addition, several recycling facilities are located along the Zuba and Kaduna Road, some of which fall within the*

administrative boundaries of the FCT and contribute to the processing of recovered plastic waste.

Are you saying there is no biodegradation, burning or waste-to-energy in FCT?

Yes, there are currently no operational biodegradation, burning, or waste-to-energy in FCT. Research has shown that waste composition and a certain quantity of daily waste is required when converting waste to energy or burning to generate an expected calorific value. With 20% of FCC's waste stream being plastic and 60% organic, this is not possible on a daily basis to generate a certain amount of energy. Also, there is a segregation problem, if all waste is sorted at source, FCT and investors will be able to draft a plan on the amount of plastic needed to have any of these techniques available seamlessly.

KII/MALE/AEPB/JUNE, 2025

In Lagos state, Lagos State Waste Management Authority (LAWMA) started with sensitisation across the state to encourage people to sort their waste from the point of generation, and through this people are coming up with recycling businesses where this plastic waste is being collected from the household level. So, we are partnering with different organisation to come up with an initiative to ensure that plastics are taken off through community engagement. We have community recycling, estate recycling, school recycling, and market recycling initiatives. We also deploy bins in public places for plastic waste collection. Also, there are people who engage in upcycling.

KII/FEMALE/LAWMA/MAY, 2025

At Givo Africa, we collect, sort, shred and recycle. We shred and granulate plastics and send them to Lagos where they are recycled.

KII/MALE/GIVO/JULY, 2025

Chanja Jatti is a recycling company, so we process our plastics into bales, flakes or pellet. We collect plastics and process them into secondary raw materials that manufacturing industry can use for their production.

KII/FEMALE/CHANJA JATTI/JULY, 2025

In FCT, recycling is being carried out although most of the collectors carry out baling, pelleting, crushing but a few of them recycle. While in Lagos, recycling is common and there a few people who carry out waste to energy. Biodegradation is still an upcoming technique in Nigeria.

KII/MALE/WASTE PICKER ASSOCIATION/FCT /JUNE, 2025

Table 3. Plastic waste management techniques

Item	Description	FCT	Lagos State	Total
Are you aware of any plastic waste management technique?	Yes	252 (65.5)	277 (71.9)	529 (68.7)
	No	133 (34.5)	108 (28.1)	241 (31.3)
What plastic waste management technique do you use?	Recycling	199 (51.7)	196 (51.0)	395 (51.3)
	Burning	28 (7.3)	32 (8.4)	60 (7.8)
	Open dumping	105 (27.3)	108 (28.1)	213 (27.7)
	Biodegradation	19 (4.9)	22 (5.6)	41 (5.3)
	Waste to Energy	34 (8.8)	27 (6.9)	61 (7.9)

Note: Figures in parentheses are percentages
Source: Field work, 2025

3.3 Plastic Separation, Sources, and Collection

Table 4 provides data on plastic waste separation from general waste. Out of 770 respondents, 448 (58.2%) do not separate their plastic waste from general waste whereas 322 (41.8%) do separate their waste. In FCT, 169 (43.9%) of the respondents do separate their waste while in Lagos State, 153 (39.7%) of the respondents do separate their waste. This aligns with a study by Olusunmade (2019) where 81.2% of respondents in Makurdi, Benue state, do not separate their plastic waste from other waste streams for a variety of reasons, including behavior, norm, and ignorance.

A report by World Bank (2024) also corroborates with the study by demonstrating that there was no segregation at source in Lagos state from general waste and this is as a result of lack of awareness. These structural explanations are particularly important in the context of this study, where 68.7% of respondents demonstrated awareness of at least one plastic waste management technique, yet 58.2% did not practise source separation. This gap between awareness and behaviour suggests that knowledge alone is insufficient to drive sustainable waste management practices in the absence of enabling infrastructure, accessible collection systems, and supportive institutional arrangements.

Similarly, Adebayo et al., (2024) indicated in their study in Ilorin Metropolis, 55.1% do not sort their plastic waste from the general waste while 44.9% did. Source separation, or the segregation of waste at the point of generation, is widely regarded as a critical precondition for effective recycling and resource recovery, and its absence constitutes a major structural barrier to formal waste management systems (Kihila et al., 2021). Orevaoghene & Abam (2023) posit that a well-planned waste reuse, recycling, and recovery programmes could reduce the total waste stream by up to 65%; however, such efficiency gains are contingent on upstream source separation practices that remain largely unrealised in the Nigerian context.

The findings are consistent with evidence from Hanoi, Vietnam, where household participation in waste separation remained relatively low despite growing awareness of environmental issues. Nguyen et al. (2015) found that convenience, availability of collection facilities, and institutional support were stronger determinants of source separation behaviour than environmental awareness alone. Similarly, research conducted in Malaysia reported that although residents demonstrated positive attitudes towards recycling, actual participation in

waste segregation programmes remained limited due to infrastructural and logistical barriers (Ramayah et al., 2012).

However, the findings contrast with experiences in several developed countries where source separation has become a routine household practice due to the availability of colour-coded collection systems, mandatory segregation policies, economic incentives, and sustained environmental education programmes. For example, studies from Germany and South Korea have reported household participation rates exceeding 70% as a result of comprehensive waste management frameworks and strong regulatory enforcement (OECD, 2022). The comparatively lower participation rate observed in the FCT and Lagos State therefore highlights the need for institutional reforms that prioritise household segregation, improve collection infrastructure, and strengthen public engagement in waste management programmes.

Table 4 reveals that vast majority of the participants cited food packaging as the most frequent source of plastic waste 147 (38.2%) and 152 (39.5%), followed by beverages packaging 153 (39.5%) and 142 (37.0%), then personal care products 49 (12.8%) and 55 (14.2%), then others 20 (5.5%) and 17 (4.4%), and electronic device packages 16 (4.1%) and 19 (4.9%) in FCT and Lagos state respectively. The overall findings for the study area are 299 (38.8%) for food packaging, 296 (38.3%) for beverages, 104 (13.5%) for personal care products, 35 (4.5%) for electronic device packages and 37 (4.9%) for others. The results indicate that food packages and beverages (bottle, sachet water, nylons) are the dominant sources of plastic waste among households in the study area.

These results are consistent with a Deep Research report on packaging and plastic waste in Nigeria (2025). It highlights that Beverages (non-alcoholic) and alcoholic, food and dairy products, detergents and home/personal care are the major companies with high packaging footprints. The findings are also consistent with Ezeudu et al. (2024) who revealed that packaging is the dominant use of plastics and in fact 54% of all plastic consumption in Nigeria is used in packaging such as polyethylene (PE) and polyethylene terephthalate (PET). The near-ubiquitous identification of food and beverage packaging as primary waste sources underscores the structural embeddedness of plastic in everyday consumption habits, a challenge that cannot be resolved through awareness campaigns alone but necessitates producer responsibility frameworks and regulatory interventions targeting the upstream plastic value chain. Similarly, personal care items, electronics, and other sources showed significantly lower values, indicating their comparatively small contribution, in contrast to the findings.

These findings are consistent with international evidence indicating that food and beverage packaging constitutes the largest component of plastic waste generated by households. For example, the United Nations Environment Programme reported that packaging accounts for approximately 36% of global plastic production, with a substantial proportion used for single-use food and beverage applications (UNEP, 2023). Similarly, the Organisation for Economic Co-operation and Development observed that plastic packaging represents the largest source of plastic waste worldwide because of its short product life cycle and high

disposal rate (OECD, 2022).

Similarly, 152 (39.5%) and 165 (42.9%) responded that their waste gets collected by either private or government with a total of 317 (41.2%) in both states responded that their waste gets collected by either private or government services. The findings are consistent with evidence from other developing countries where formal waste collection coverage remains limited despite increasing urbanisation. According to the World Bank, waste collection coverage in many low- and middle-income countries is often below 50% in peri-urban and underserved communities, resulting in widespread reliance on informal disposal methods (Kaza et al., 2018). However, the findings contrast with those reported in many developed countries, where waste collection services are nearly universal. For example, member countries of the Organisation for Economic Co-operation and Development generally report collection coverage exceeding 90%, supported by well-established waste management infrastructure, effective regulatory systems, and sustained public investment (OECD, 2022).

Where collection happens, 27 (7.0%) and 17 (4.4%) responded that their plastic waste is collected daily, 77(20.0%) and 85 (22.1%) responded weekly, 54 (14.0%) and 57 (14.8%) responded bi-weekly, 37 (9.6%) and 40 (10.4%) responded monthly, and 190 (49.4%) and 186 (48.3%) responded not at all in FCT and Lagos State respectively. While the overall findings revealed that 44 (5.7%) of the respondents' plastic waste are collected daily while 111 (14.4%) are collected bi-weekly.162 (21.0%) of the respondents indicated that their plastic waste is collected weekly, 77 (10.0%) are collected monthly and 376 (48.8%) are not collected.

Table 4. Plastic waste separation, sources and collection

Item	Description	FCT	Lagos State	Total
Separation at source	Yes	169 (43.9)	153 (39.7)	322 (41.8)
	No	216 (56.1)	232 (60.3)	448 (58.2)
Sources of plastic waste	Food packaging	147 (38.2)	152 (39.5)	299 (38.8)
	Beverage packaging	153 (39.4)	142 (37.0)	296 (38.3)
	Personal care products	49 (12.8)	55 (14.2)	104 (13.5)
	Electronic device packages	16 (4.1)	19 (4.9)	35 (4.5)
	Others	20 (5.5)	17 (4.4)	37 (4.9)
Are your plastic waste collected by private or government agency	Yes	152 (39.5)	165 (42.9)	317 (41.2)
	No	233 (60.5)	220 (57.1)	453 (58.8)
Plastic waste collection	Daily	27 (7.0)	17 (4.4)	44 (5.7)
	Weekly	77 (20.0)	85 (22.1)	162 (21.0)
	Bi-weekly	54 (14.0)	57 (14.8)	111(14.4)
	Monthly	37 (9.6)	40 (10.4)	77 (10.0)

Note: Figures in parentheses are percentages
Source: Field work, 2025

3.4 Chi-square Result of the Hypotheses

Table 5 reveals the chi-square result of the null hypotheses that there is no significant relationship between socio-demographic characteristic (gender, education and occupation) and plastic waste management techniques (recycling, burning, open dumping, biodegradation

and waste-to-energy) and the alternative hypotheses that there is a significant relationship between socio-demographic characteristic and plastic waste management techniques in FCT and Lagos State. The null hypotheses are largely supported by the finding of this study with chi-square result that shows there is no significant relationship with gender or education ($p > 0.05$). On the other hand, the alternative hypotheses are supported between gender and burning ($p = 0.009$) as well as between occupation and open dumping ($p = 0.017$)

The findings from Table 5 show that there is no significant relationship between most plastic waste management techniques with gender or education. This aligns with Ogwueleka (2009) who reported that waste management practices in Nigeria cities are driven more by infrastructural availability and socioeconomic conditions than educational level. World Bank (2025) also stated that behavioral and structural assessment can emphasize systemic failures such as an inadequate number of collection trucks, overflowing localized skips, and missing recycling facilities serve as the primary bottlenecks to effective waste management, rendering individual educational awareness secondary. Also, Adeolu et al. (2014) observed that despite moderate literacy levels among students in Oyo State, improper disposal method such as open dumping and burning remained prevalent. It means that education alone does not translate environmentally sustainable behaviour.

However, burning of plastic waste shows a significant relationship with gender ($p = 0.009$). This suggests that gender influences decisions regarding plastic waste disposal, implying that male and female respondents differ in their likelihood of adopting burning as a plastic waste management technique. Although the findings revealed that male respondents were more likely to adopt burning than their female counterparts, this difference may reflect variations in environmental awareness, risk perception, and household waste management responsibilities. Men have generally been reported to exhibit lower levels of environmental concern and are less likely to engage in pro-environmental behaviours than women, making them relatively more willing to adopt convenient but environmentally harmful waste disposal methods such as open burning (Chan et al., 2019; Li et al., 2022). In many households, men may also prioritize the rapid removal of accumulated waste over the potential environmental and health consequences associated with burning. Conversely, women tend to demonstrate greater concern for environmental quality and health risks and are more likely to adopt environmentally responsible waste management practices because of their traditional role in managing household sanitation and family well-being (Echavarren, 2023). Conversely, men may be more inclined to adopt burning because of its convenience and effectiveness in reducing waste volume. The finding highlights the importance of incorporating gender-sensitive approaches into waste management policies and environmental education programmes to address differences in environmental attitudes and behaviours, thereby promoting the adoption of more sustainable plastic waste management practices (Li et al., 2022).

In addition, table 5 reveals that open dumping disposal shows a significant relationship with occupation ($p = 0.017$), occupation significantly influences the likelihood of using open dumpings for plastic waste disposal. This can be compared with Abila and Kantola (2013) emphasized that occupational status often reflects income level, job security, work location,

and access to municipal waste service. Individuals engaged in informal or low-income occupations are more likely to rely on open dumpings due to cost constraints and limited access to regulated waste disposal systems. The significance of this relationship is determined by economic drivers than personal attributes like education. Ezeudu et al. (2024) found that occupation and income significantly influence disposal methods, while education had limited impact on recycling behaviour due to weak supporting systems. Similarly, UNEP (2018) on Africa waste management outlook highlights that open dumping and burning remain dominant waste disposal methods across Africa cities particularly occupational groups involved in informal settlements and non-regulated economic activities. The role of occupation in open dumping usage underscores the persistence of environmentally harmful practices due to inadequate municipal waste services in both FCT and Lagos State.

Waste-to-energy (WtE) technique adoption was shown to be significantly related with occupation ($p = 0.004$), suggesting that respondents' occupation history affects their propensity to embrace WtE practices. Compared to people in informal jobs, those in formal work might have better access to information, technical know-how, and awareness of contemporary waste management methods. The informal sector, which concentrates more on collecting and recycling for short-term financial gains, dominates waste recovery operations in Nigeria, whereas WtE technologies are still constrained by insufficient infrastructure, technical capability, and funding (Afon, 2012). This implies that awareness of and involvement in advanced waste management systems can be influenced by differences in occupation.

Similar patterns in which vocational background affects public acceptance and involvement in waste-to-energy efforts have been documented internationally. According to studies, people who are more exposed to technical advancements and have a higher level of environmental literacy are more likely to support WtE projects because they are more aware of the financial and environmental advantages of energy recovery (Nubi et al., 2021). WtE has been more widely accepted in nations like Sweden, Denmark, and Germany thanks to strong institutional backing, skilled labour development, and public education (Kørnøv et al., 2016; Sanhi & Rosenlund, 2024; Weber et al., 2020). In order to increase knowledge and uptake of waste-to-energy technologies, Nigeria needs capacity-building initiatives and occupation-specific awareness campaigns, as demonstrated by the substantial association found in this study.

Table 5. Chi-Square test result of the hypotheses between socio-demographic characteristics and plastic waste management techniques in FCT and Lagos

Plastic Waste Management Techniques	Gender	Education	Occupation
Recycling	0.948	0.558	0.748
Burning	0.009***	0.131	0.642
Open dumping	0.255	0.158	0.017**
Biodegradation	0.401	0.895	0.118
Waste-to-Energy	0.770	0.329	0.004***

*Note: ** means significant at 5%; *** means significant at 1%*

4. Conclusion

This study provides important insights into household plastic waste management practices in the Federal Capital Territory and Lagos State, revealing that sustainable plastic waste management remains constrained by systemic and institutional challenges despite relative levels of public use. The findings show that source separation is not yet widely practised, while household plastic waste continues to be dominated by single-use food packaging and beverage packaging, reflecting changing consumption patterns and the growing pressure placed on municipal waste management systems. Although respondents demonstrated awareness and use of conventional waste management techniques, knowledge and adoption of more advanced technologies remained limited, largely because such technologies are either unavailable or inadequately developed within the study areas.

The study further demonstrates that household plastic waste management behaviour is influenced not only by individual socio-demographic characteristics but also by the availability of enabling infrastructure and institutional support. The lack of a significant relationship between educational attainment and most waste management techniques suggests that improving environmental knowledge alone is unlikely to achieve substantial behavioural change where reliable waste collection services and appropriate treatment facilities are lacking. Instead, strengthening waste management systems, expanding collection infrastructure, and improving access to sustainable waste treatment options are likely to have a greater impact on household waste management practices.

Furthermore, the significant associations between selected socio-demographic characteristics and specific waste management practices highlight the need for interventions that are responsive to differences in household behaviour and access to resources. Overall, the study demonstrates that achieving sustainable plastic waste management in Nigeria requires an integrated approach that combines infrastructure development, effective policy implementation, technological investment, producer responsibility, and sustained public engagement. Such an approach would not only improve household plastic waste management but also contribute to environmental protection, resource efficiency, and the country's transition towards a circular economy.

The study recommends strengthening household waste collection infrastructure and promoting source separation through improved service delivery. Greater investment should also be directed towards advanced plastic waste treatment technologies. Without systematic segregation at the point of generation, advanced treatment technologies envisaged under the National Policy on Plastic Waste Management (2020) are unlikely to achieve operational efficiency, given their dependence on consistent and adequately sorted waste streams. Consequently, strengthening collection infrastructure, enforcing segregation regulations, and expanding public participation in waste management programmes will be essential for achieving sustainable plastic waste governance and advancing environmental sustainability objectives in Nigeria.

Acknowledgments

Not applicable

Author contributions

Mayowa Bernice Oke was responsible for drafting the manuscript and data collection. Olawale Emmanuel Olayide revised it. All authors read and approved the final manuscript.

Funding

Not applicable

Competing interests

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.

Informed consent

Obtained.

Ethics approval

The Publication Ethics Committee of the Macrothink Institute.

The journal's policies adhere to the Core Practices established by the Committee on Publication Ethics (COPE).

Provenance and peer review

Not commissioned; externally double-blind peer reviewed.

Data availability statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

Data sharing statement

No additional data are available.

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