JOURNAL OF SCIENCE TECHNOLOGY AND EDUCATION 14(3), SEPTEMBER, 2026
E-ISSN: 3093-0898, PRINT ISSN: 2277-0011; Journal homepage: www.atbufstejoste.com



Household Solid Waste Practices and Determinants of Source Segregation in Yola North Local Government Area, Adamawa State, Nigeria

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ABSTRACT

This study examined household solid waste practices and the determinants of source segregation in Yola North Local Government Area (LGA), Adamawa State, Nigeria. A descriptive cross-sectional mixed-methods design was used, combining a structured survey of 250 households across six wards with 12 key-informant interviews and field observations. Quantitative data collected between June and August 2025 were analysed in IBM SPSS Statistics version 27 using descriptive statistics, chi-square tests, Pearson correlation and binary logistic regression; interview data were analysed thematically. Mean household waste generation was estimated at 8.60 kg per week. Organic/food waste accounted for 52.0% of the reported waste stream, followed by plastics (21.1%), paper/cardboard (13.6%) and glass/metal/cans (8.0%). Half of respondents (50.4%) reported no source segregation, 31.2% segregated occasionally and 18.4% did so regularly. Only 6.0% used multiple containers deliberately separated by waste type. The most frequently reported barriers were lack of segregation bins (79.2%), absence of separate local-government collection (72.8%), distrust that separated waste would be appropriately managed (71.2%) and limited practical knowledge (58.8%). Education was reported to be associated with segregation behaviour ($\chi^2 = 12.84$; reported $p = 0.002$), while monthly household income correlated positively with segregation frequency ($r = 0.47$). In the multivariable model, access to segregation containers was the strongest reported predictor (odds ratio = 3.08), followed by education (2.44), income (2.04) and trust in the local-government collection system (1.98). Interview findings highlighted institutional under-resourcing, weak service reliability and declining participation when awareness activities were not supported by infrastructure. The findings indicate that household willingness alone is insufficient: practical segregation requires containers, reliable separate collection, public education and credible institutional commitment. An infrastructure-first, community-based approach is recommended for Yola North.

ARTICLE INFO
Article History
Received: May, 2026
Received in revised form: May, 2026
Accepted: July, 2026
Published online: September, 2026

KEYWORDS
Household Solid Waste; Source Segregation; Waste Management; Household Behaviour; Yola North; Nigeria

INTRODUCTION

Rapid urbanisation, population growth and changing consumption patterns have increased the volume and complexity of municipal solid waste generated in many low- and middle-income countries. Where collection systems, treatment facilities and institutional capacity do not expand at a comparable rate, households and local authorities often rely on mixed-waste storage, open dumping and burning. These practices reduce opportunities for material recovery and can contribute to blocked drainage,

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environmental pollution and public-health risks (Hoornweg and Bhada-Tata, 2012; Wilson et al., 2015; World Bank, 2018).

Household source segregation—the separation of waste into different material streams at the point of generation—is an important upstream component of integrated solid waste management. Separating biodegradable waste, recyclable materials and residual waste can improve the quality of recovered materials, support composting and recycling, and reduce the quantity of mixed waste requiring final disposal (Tchobanoglous and Kreith, 2002; UNEP, 2015). However, segregation depends not only on environmental awareness but also on the availability of containers, convenient collection arrangements, household resources and confidence that separated materials will remain separate after collection (Barr and Gilg, 2005; Miafodzyeva and Brandt, 2013).

In Nigeria, municipal solid waste management remains constrained by inadequate infrastructure, limited finance, uneven service coverage and weak implementation of policy. Studies of Nigerian cities have documented the challenges of waste generation, collection, recovery and disposal, while also showing the importance of household participation and institutional arrangements (Agunwamba, 1998; Ogwueleka, 2009; Babayemi and Dauda, 2019). Evidence from Ilorin and other urban settings similarly identifies household practices and service conditions as important dimensions of waste management performance (Oyelaran and Afolabi, 2018).

Yola North LGA, which includes the urban Jimeta area and serves as an administrative and commercial centre of Adamawa State, faces increasing pressure on its household waste management system. The project underpinning this article describes mixed-waste disposal, open dumping and burning, and limited formal collection capacity. Despite the relevance of source segregation to reducing the mixed waste stream, locally specific empirical evidence on household practices and the factors associated with segregation has been limited.

The study was guided by complementary behavioural and institutional perspectives. The Theory of Planned Behaviour emphasises attitudes, subjective norms and perceived behavioural control in shaping intentions and behaviour (Ajzen, 1991). Social Cognitive Theory highlights reciprocal relationships among personal factors, behaviour and the surrounding environment (Bandura, 1986), while institutional perspectives draw attention to the influence of rules, organisational capacity and service credibility on collective practices (North, 1990; DiMaggio and Powell, 1983). Together, these perspectives suggest that household segregation is shaped by both individual capacity and the practical conditions created by local waste services. This article therefore assesses household waste generation and composition, describes storage and segregation practices, examines awareness and perceived barriers, and analyses socio-economic, behavioural and service-related factors associated with source segregation in Yola North LGA.

MATERIALS AND METHODS

Study area

The study was conducted in Yola North Local Government Area, Adamawa State, north-eastern Nigeria. The study covered six wards: Doubeli, Karewa, Kofare, Luggere, Nasarawo and Bole-Yolde-Pate. These wards were selected to represent a range of residential and service-access conditions within the LGA. Yola North contains densely settled residential and commercial neighbourhoods, and household waste management is undertaken within a context of uneven collection access and constrained municipal resources.

Study design and sampling

A descriptive cross-sectional survey design was adopted and supplemented with qualitative interviews and field observations. The household was the unit of analysis. A total of 250 households were selected across the six wards using stratified random sampling, with ward-level

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allocation intended to reflect the distribution of households. Systematic random sampling was then used to select households within wards. All 250 administered questionnaires were retrieved and considered suitable for analysis, giving a reported response rate of 100%.

Data collection instruments and procedure

Primary data were collected between June and August 2025. A structured household questionnaire captured respondent socio-demographic characteristics, estimated household waste generation and composition, storage and disposal practices, knowledge and attitudes towards source segregation, and perceived barriers and enabling conditions. The questionnaire was administered in English and relevant local languages by trained research assistants. A semi-structured interview guide was used for 12 purposively selected key informants, including local-government environmental officers, state environmental officers, community leaders, community-based organisation representatives and an informal waste picker. A field-observation checklist was used to document visible waste-management conditions in public spaces.

Validity, reliability and ethics

Content validity was assessed by three academic experts in environmental management and two senior environmental officers. The questionnaire was pilot-tested with 25 households in Rumde Ward, which was excluded from the main sample. The ten attitudinal items produced a Cronbach's alpha coefficient of 0.81. Ethical clearance was obtained from the Abubakar Tafawa Balewa University Faculty of Environmental Technology Research Ethics Committee (reference ATBU/FET/EMT/EC/2025/012). Informed consent was obtained from participants, and questionnaire and interview records were anonymised.

Data analysis

Quantitative data were analysed using IBM SPSS Statistics version 27. Frequencies, percentages, means and standard deviations were used to summarise respondent characteristics and household waste practices. Chi-square tests of independence were used for categorical associations, and Pearson product-moment correlations were used to assess relationships between continuous or ordered measures. Binary logistic regression was used to examine predictors of source segregation, coded as 1 for regular or occasional segregation and 0 for no segregation. Statistical tests were assessed at $\alpha = 0.05$. Interview transcripts were analysed thematically using the framework approach described by Ritchie and Spencer (1994), involving familiarisation, indexing, charting and interpretation.

RESULTS

Socio-demographic characteristics

The survey included 250 respondents. Males represented 55.2% and females 44.8%. Almost half (48.4%) were aged 31–50 years. Most respondents were married (72.8%). Secondary education was the most common educational category (35.6%), while 24.0% had tertiary education and 17.2% had no formal education. Monthly household income was below ₦60,000 for 68.0% of respondents. Households of four to six persons were most common (51.2%); the reported mean household size was 5.8 persons.

Household waste generation and composition

Mean household waste generation was estimated at 8.60 kg per week (standard deviation 3.14). Organic/food waste accounted for 4.47 kg per household per week (52.0%), followed by plastics at 1.81 kg (21.1%), paper/cardboard at 1.17 kg (13.6%), and glass/metal/cans at 0.69 kg (8.0%). Textile/leather and other miscellaneous materials each contributed 2.7%. The predominance of biodegradable material indicates a substantial potential feedstock for household or community composting, provided that organic waste can be kept separate from other fractions.

Household storage and segregation practices

Discardable plastic bags were the most frequently reported storage method (42.8%),

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followed by a single reusable bin or container for mixed waste (33.6%). Multiple containers without separation by waste type were reported by 12.4%, while only 6.0% used multiple containers deliberately segregated by type. A further 5.2% reported keeping waste in an open pile within the compound. In terms of actual segregation behaviour, 50.4% reported no segregation, 31.2% segregated occasionally and 18.4% practised regular segregation. Thus, although 49.6% reported at least occasional separation, consistent practice remained uncommon.

Awareness and attitudes

Although 59.2% had heard the term 'source segregation', only 48.4% reported knowing its purpose and 38.8% could correctly identify recyclable waste. Awareness of a local waste segregation programme was low (17.2%), and only 24.4% had received waste-related education during the preceding two years. Attitudinal responses showed conditional willingness to participate: the statement 'I would segregate my waste if proper bins were provided' had the highest mean score (4.11/5; standard deviation 0.82). Respondents also tended to agree that government should provide bins before households are expected to segregate (mean 3.87). Trust that the LGA would collect segregated waste separately was low (mean 2.18).

Barriers to source segregation

The most frequently cited barrier was lack of segregation containers or bins (79.2%). This was followed by absence of separate collection by the LGA (72.8%), distrust that government would appropriately use segregated waste (71.2%), limited knowledge of how to segregate (58.8%), lack of time or convenience (48.8%), low income constraining the purchase of additional bins (47.2%), lack of perceived personal benefit (41.2%) and unsupportive community or cultural norms (34.8%). Multiple responses were permitted.

Statistical relationships and regression results

Education level was reported as significantly associated with segregation practice (χ^2 = 12.84; reported p = 0.002). The cross-tabulation showed a gradient in regular segregation, from 7.0% among respondents with no formal education to 35.0% among those with tertiary education. Monthly income was positively correlated with segregation frequency (r = 0.47; reported p < 0.001). Awareness score (r = 0.53), pro-segregation attitude score (r = 0.61) and household size with weekly waste generation (r = 0.68) were also positively correlated; distance to the collection point was negatively correlated with compliance (r = −0.44).

The binary logistic regression model classified 74.8% of cases correctly, with a reported Nagelkerke R^2 of 0.47 and Hosmer–Lemeshow p = 0.71. Access to a segregation container was the strongest reported predictor (odds ratio [OR] = 3.08; p < 0.001). Other significant predictors were education at secondary level or above (OR = 2.44; p = 0.002), monthly income above ₦60,000 (OR = 2.04; p = 0.003), trust in the LGA collection system (OR = 1.98; p = 0.002), pro-segregation attitude (OR = 1.72; p < 0.001) and awareness score (OR = 1.53; p = 0.001).

Qualitative findings

Key-informant interviews provided context for the household survey. Environmental officers described inadequate operational resources, including a reduction in the number of functional collection trucks and limited maintenance funding. State-level officers highlighted a gap between policy requirements and the capacity to monitor and enforce compliance. Community leaders and community-based organisations reported that awareness activities often produced short-lived participation when households did not see bins or reliable separate collection. An informal waste picker described the hazards of sorting mixed waste and the potential livelihood benefits of receiving pre-sorted recyclable materials. Across interviews, the recurring themes were institutional under-

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resourcing, weak service reliability, low public awareness, limited infrastructure, and the need for sustained community engagement.

Table 1. Socio-demographic characteristics of respondents (n = 250)

Characteristic	Category	N	%
Gender	Male	138	55.2
	Female	112	44.8
Age	18–30 years	72	28.8
	31–50 years	121	48.4
	Above 50 years	57	22.8
Education	No formal education	43	17.2
	Primary	58	23.2
	Secondary	89	35.6
	Tertiary	60	24.0
Monthly income	Below ₦30,000	78	31.2
	₦30,001–₦60,000	92	36.8
	₦60,001–₦100,000	54	21.6
	Above ₦100,000	26	10.4
Household size	1–3 persons	47	18.8
	4–6 persons	128	51.2
	7–10 persons	62	24.8
	Above 10 persons	13	5.2

Source: Field survey, 2025; SPSS analysis where indicated.

Table 2. Mean household waste composition (kg per household per week)

Waste fraction	Mean (kg/week)	SD	Composition (%)
Organic/food	4.47	1.82	52.0
Plastics	1.81	0.91	21.1
Paper/cardboard	1.17	0.72	13.6
Glass/metal/cans	0.69	0.55	8.0
Textile/leather	0.23	0.31	2.7
Other/miscellaneous	0.23	0.29	2.7
Total	8.60	3.14	100.0

Source: Field survey, 2025; SPSS analysis where indicated.

Table 3. Household storage and source segregation practices

Measure	Category	N	%
Storage	Discardable plastic bags	107	42.8
	Single reusable mixed-waste container	84	33.6
	Multiple containers, not segregated	31	12.4
	Multiple containers, segregated by type	15	6.0
	Open pile in compound	13	5.2
Segregation	Regular	46	18.4
	Occasional	78	31.2
	None	126	50.4

Source: Field survey, 2025; SPSS analysis where indicated.

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Table 4. Awareness and reported barriers to source segregation

Indicator / barrier	N	%
Heard the term source segregation	148	59.2
Knows its purpose	121	48.4
Can identify recyclable waste	97	38.8
Aware of a local segregation programme	43	17.2
Received waste education in past two years	61	24.4
Lack of segregation bins	198	79.2
No separate LGA collection	182	72.8
Distrust of government use of segregated waste	178	71.2
Limited knowledge of how to segregate	147	58.8
Lack of time/convenience	122	48.8
Low income to purchase extra bins	118	47.2
No perceived personal benefit	103	41.2
Unsupportive community/cultural norms	87	34.8

Source: Field survey, 2025; SPSS analysis where indicated.

Table 5. Binary logistic regression predictors of source segregation

Predictor	B	SE	Wald	P	OR
Education (secondary or above)	0.893	0.287	9.68	0.002	2.44
Income above ₦60,000	0.712	0.241	8.73	0.003	2.04
Pro-segregation attitude	0.541	0.118	21.06	<0.001	1.72
Awareness score	0.428	0.134	10.21	0.001	1.53
Access to segregation container	1.124	0.312	12.99	<0.001	3.08
Trust in LGA collection system	0.683	0.221	9.55	0.002	1.98
Constant	−4.211	0.876	23.12	<0.001	0.015

Source: Field survey, 2025; SPSS analysis where indicated.

Model diagnostics:
Nagelkerke R^2 = 0.47; Hosmer–Lemeshow p = 0.71; overall classification accuracy = 74.8%. The dependent variable was coded 1 = regular/occasional segregation and 0 = no segregation.

DISCUSSION OF FINDINGS

The findings show that household waste management in Yola North is characterised by a high share of biodegradable material, widespread mixed-waste storage and low regular source segregation. The organic fraction (52.0%) is consistent with the broad pattern reported in studies of waste composition in developing-country cities, where food and other biodegradable materials often form a substantial part of the municipal waste stream (Hoornweg and Bhada-Tata, 2012; Miezah et al., 2015). This composition presents an opportunity for decentralised composting and other biological treatment options, but only if organic materials are separated before they become contaminated by mixed refuse.

The low prevalence of regular segregation (18.4%) is consistent with the wider evidence that household recycling and segregation depend on a combination of motivation and practical opportunity. Research applying the Theory of Planned Behaviour to recycling has shown that attitudes and perceived control are relevant to behaviour (Tonglet et al., 2004), while studies of household recycling identify convenience, habits and access to facilities as important determinants (Knussen and Yule, 2008; Miafodzyeva and Brandt, 2013). In Yola North, the gap between the proportion who had heard of source segregation and the smaller proportion able to identify recyclable materials

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suggests that general familiarity has not translated into practical knowledge.

The strongest reported barrier was the absence of suitable segregation containers, and access to containers was also the strongest predictor in the logistic regression model (OR = 3.08). The high mean score for willingness to segregate if bins were provided (4.11/5) reinforces the importance of opportunity and perceived behavioural control. This finding is consistent with evidence that recycling intentions and behaviour are constrained when facilities are unavailable or inconvenient (Chen and Tung, 2010; Timlett and Williams, 2008). Awareness campaigns alone are therefore unlikely to produce sustained behaviour change if households are not equipped to separate waste and if collection services continue to mix the separated fractions.

Institutional trust emerged as another important factor. Respondents expressed low confidence that the LGA would collect separated waste separately, and trust in the collection system remained a significant predictor in the regression model (OR = 1.98). This result is substantively important: household participation may be undermined if residents believe that the effort of separating waste will be cancelled out when all materials are recombined during collection. Reliable separate collection, transparent communication about the destination of each fraction and visible feedback on recovery outcomes are therefore central to rebuilding confidence.

Socio-economic differences also mattered. Education was associated with segregation practice, and income correlated positively with segregation frequency. Higher educational attainment may improve knowledge and the ability to interpret environmental information, while higher income may make it easier to obtain additional containers or pay for collection services. However, the findings also show that education and income operate within a wider service environment: even respondents with positive attitudes may be unable or unwilling to segregate where infrastructure and separate collection are absent. This is consistent with the value–action gap described in environmental behaviour research (Blake, 1999; Barr and Gilg, 2005).

The qualitative evidence supports an integrated explanation. Municipal officers described resource and enforcement constraints; community organisations described declining participation when campaigns were not accompanied by service improvements; and informal recyclers identified potential economic value in receiving pre-sorted materials. These perspectives suggest that a workable programme should connect household-level separation to downstream collection, composting and recycling markets. Inclusion of informal waste workers in organised recovery arrangements may improve material recovery while reducing the need for workers to sort hazardous mixed waste (Medina, 2005; Nzeadibe and Ajaero, 2019).

Policy and practical implications

First, the LGA and state environmental authorities should pilot a household container programme that provides clearly labelled receptacles for at least organic, recyclable and residual waste. The high organic fraction supports prioritising a separate biodegradable stream, with community composting or other appropriate treatment evaluated locally. Second, separate collection must be introduced alongside container distribution. Collection schedules and vehicles should preserve separation, and households should receive clear information about collection days and the destination of each waste stream. A visible and reliable service is likely to strengthen trust and reduce the perceived futility of household effort.

Third, public education should focus on practical skills rather than terminology alone. Demonstrations should show how to distinguish organic, recyclable and residual materials, how to store them safely and how to prepare them for collection. Communication should be delivered through ward leaders, community associations, schools, local radio and other channels suited to the different literacy levels in the study population. Fourth, the LGA should establish partnerships with registered informal recyclers, community-based organisations and recycling aggregators. A

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transparent arrangement for purchasing or collecting separated plastics, paper, metals and glass could provide a tangible incentive for households and support local livelihoods.

Finally, implementation should be monitored through ward-level indicators, including the proportion of households supplied with containers, the proportion practising regular segregation, collection reliability, contamination of separated streams, quantities of organic waste composted and recyclable materials recovered. Results should be reported publicly to strengthen accountability.

Limitations of the Study

This study is cross-sectional and therefore identifies associations rather than causal effects. Waste quantities and segregation behaviour were largely self-reported, creating potential recall and social-desirability bias; direct weighing of household waste was not undertaken. The study covered six of the ten wards in Yola North, and its findings may not fully represent the remaining wards. The qualitative component involved 12 key informants and did not include private-sector waste contractors. The results should therefore be interpreted within the geographical, temporal and methodological boundaries of the study. Future work should incorporate repeated seasonal measurements, direct waste characterisation, and follow-up evaluation of a household segregation pilot.

CONCLUSION

Households in Yola North generate an estimated mean of 8.60 kg of solid waste per week, of which organic/food waste forms 52.0%. Yet regular source segregation is practised by only 18.4% of respondents, while half report no segregation. The principal constraints are not limited to awareness: lack of containers, absence of separate collection and low trust in the local-government system are prominent barriers. Access to segregation containers was the strongest reported predictor of segregation behaviour, while education, income, attitudes, awareness and institutional trust were also associated with participation.

Improving household source segregation in Yola North therefore requires a coordinated system rather than isolated awareness campaigns. Container provision, reliable separate collection, practical education, community partnerships and transparent institutional performance should be implemented together. Such an approach can improve the quality of recoverable materials, create opportunities for composting and recycling, and support more sustainable household waste management in Yola North and comparable secondary cities in Nigeria.

Declarations

Ethics approval and consent to participate.

Ethical clearance was obtained from the Abubakar Tafawa Balewa University Faculty of Environmental Technology Research Ethics Committee (ATBU/FET/EMT/EC/2025/012). Informed consent was obtained from all participants.

Funding.

The underlying research was supported by the researcher's personal and family resources; no external grant funding was reported.

Competing interests

The author declares no known competing financial interests or personal relationships that could have appeared to influence the work.

Data availability.

The data supporting the findings are available from the corresponding author upon reasonable request, subject to applicable confidentiality and ethics requirements.

Author contributions.

Princewill Iliya Usmana: conceptualisation, methodology, investigation, data curation, formal analysis, writing—original draft, and writing—review and editing.

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REFERENCES

Abarca-Guerrero, L., Maas, G., Hogland, W., 2013. Solid waste management challenges for cities in developing countries. Waste Manag. 33(1), 220–232.

Agunwamba, J.C., 1998. Solid waste management in Nigeria: problems and issues. Environ. Manage. 22(6), 849–856.

Ajzen, I., 1991. The theory of planned behavior. Organ. Behav. Hum. Decis. Process. 50(2), 179–211.

Bandura, A., 1986. Social Foundations of Thought and Action: A Social Cognitive Theory. Prentice-Hall, Englewood Cliffs, NJ.

Babayemi, J.O., Dauda, K.T., 2019. Evaluation of solid waste generation, categories, and disposal options in developing countries: a case study of Nigeria. J. Appl. Sci. Environ. Manage. 13(3), 83–88.

Barr, S., Gilg, A.W., 2005. Conceptualizing and analyzing household attitudes and actions to a growing environmental problem: development and application of a framework to guide local waste policy. Appl. Geogr. 25(3), 226–247.

Blake, J., 1999. Overcoming the 'value-action gap' in environmental policy: tensions between national policy and local experience. Local Environ. 4(3), 257–278.

Chen, M.F., Tung, P.J., 2010. The moderating effect of perceived lack of facilities on consumers' recycling intentions. Environ. Behav. 42(6), 824–844.

DiMaggio, P.J., Powell, W.W., 1983. The iron cage revisited: institutional isomorphism and collective rationality in organizational fields. Am. Sociol. Rev. 48(2), 147–160.

Hoornweg, D., Bhada-Tata, P., 2012. What a Waste: A Global Review of Solid Waste Management. World Bank, Washington, DC.

Knussen, C., Yule, F., 2008. 'I'm not in the habit of recycling': the role of habitual behavior in the disposal of household waste. Environ. Behav. 40(5), 683–702.

Medina, M., 2005. Serving the unserved: informal refuse collection in Mexican cities. Waste Manag. Res. 23(5), 390–397.

Miafodzyeva, S., Brandt, N., 2013. Recycling behaviour among householders: synthesising determinants via a meta-analysis. Waste Biomass Valorization 4(2), 221–235.

Miezah, K., Obiri-Danso, K., Kádár, Z., Fei-Baffoe, B., Mensah, M.Y., 2015. Municipal solid waste characterization and quantification as a measure towards effective waste management in Ghana. Waste Manag. 46, 15–27.

North, D.C., 1990. Institutions, Institutional Change and Economic Performance. Cambridge University Press, Cambridge.

Nzeadibe, T.C., Ajaero, C.K., 2019. Assessment of the informal sector in solid waste management in Nigeria: evidence from waste recycling enterprises in Enugu Urban. The Environmentalist 29(4), 437–445.

Ogwueleka, T.C., 2009. Municipal solid waste characteristics and management in Nigeria. Iran. J. Environ. Health Sci. Eng. 6(3), 173–180.

Oyelaran, O.A., Afolabi, O.T., 2018. Assessment of household solid waste management practices in Ilorin metropolis, Nigeria. J. Appl. Sci. Environ. Manage. 22(8), 1317–1322.

Ritchie, J., Spencer, L., 1994. Qualitative data analysis for applied policy research. In: Bryman, A., Burgess, R.G. (Eds.), Analysing Qualitative Data. Routledge, London, pp. 173–194.

Tchobanoglous, G., Kreith, F. (Eds.), 2002. Handbook of Solid Waste Management, second ed. McGraw-Hill, New York.

Timlett, R.E., Williams, I.D., 2008. Public participation and recycling performance in England: a comparison of tools for behaviour change. Resour. Conserv. Recycl. 52(4), 622–634.

Tonglet, M., Phillips, P.S., Read, A.D., 2004. Using the theory of planned behaviour to investigate the determinants of recycling behaviour in Brixworth, UK. Resour. *Conserv. Recycl. 41*(3), 191–214.

United Nations Environment Programme (UNEP), 2015. Global Waste Management Outlook. UNEP, Nairobi.

Wilson, D.C., Rodic, L., Modak, P., Soos, R., Carpintero, A., Velis, K., Iyer, M., Simonett, O., 2015. Global Waste Management Outlook. UNEP and International Solid Waste Association, Nairobi.

World Bank, 2018. What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050. World Bank Group, Washington, DC.

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