

ORIGINAL RESEARCH ARTICLE

Municipal Solid Waste Management Practices and the Feasibility of Integrated Solid Waste Management in Bakoteh, Kanifing Municipal Council, The Gambia

Chinenye Agnes Ariwaodo*  and Ebrima Bojang 

School of Agriculture and Environmental Sciences, University of The Gambia

DOI: [https://doi.org/10.70851/jfines.2026.3\(4\).245.256](https://doi.org/10.70851/jfines.2026.3(4).245.256)

ABSTRACT

This study assessed municipal solid waste management (MSWM) practices in the Bakoteh community within the Kanifing Municipal Council (KMC), The Gambia, focusing on waste generation patterns, household disposal methods, community perceptions, and the feasibility of Integrated Solid Waste Management (ISWM). A descriptive cross-sectional design was employed using a structured questionnaire administered to a probability-sampled population of 100 respondents. Instrument reliability was confirmed via pilot testing ($\alpha=0.81$). Data were analyzed using descriptive statistics, Cramer's V, and Chi-square (χ^2) tests of independence using exact Monte Carlo diagnostics to account for sparse cell distributions. Results show that recyclable materials (55%) and organic waste (30%) were identified by respondents as the most frequently observed waste types in their immediate environment. Half of the households (50%) rely on municipal waste collection services, while substantial proportions engage in open dumping (20%) and open burning (10%), highlighting critical service coverage gaps. Awareness of ISWM was moderate (55%). Regarding perceived feasibility, 60% of respondents selected “feasible,” while 25% selected “very feasible.” Inferential analysis revealed that familiarity with ISWM was significantly associated with occupation ($\chi^2=10.52$, $df=3$, $p = 0.015$, $V=0.324$), with civil servants showing higher awareness due to formal institutional exposure. All other socio-demographic cross-tabulations—including education level, age, marital status, and nationality—showed no statistically significant associations ($p > 0.05$), demonstrating that waste management challenges in Bakoteh are structural and community-wide rather than driven by individual socio-demographic profiles. The study concludes that transitioning to ISWM—supported by improved municipal infrastructure, source segregation, policy enforcement, and inclusive community engagement—is essential for sustainable waste management in Bakoteh, KMC.

Article history

Received:
07 July 2026

Revised:
11 September
2026

Accepted:
30 September
2026

Keywords

Solid Waste
Management,
ISWM
Feasibility,
Waste
Perception,
Urban
Sustainability,
Bakoteh, The
Gambia

*Corresponding author:

Email: agnes@utg.edu.gm (Chinenye Agnes Ariwaodo)

Peer review under responsibility of Journal of Food Innovation, Nutrition, and Environmental Sciences.

A Publication of EcoScribe Publishers company Limited,
Uganda. www.ecoscribepublishers.com

All the articles published by [Journal of Food Innovation, Nutrition, and Environmental Sciences](#) are licensed under a [Creative Commons Attribution 4.0 International \(CC-BY\) License](#) Based on a work at <https://jfines.org>



1.0 Introduction

Waste generation is an inevitable outcome of industrialization, urbanization, and economic development, driven by population growth, rising incomes, and changing consumption patterns (Kaza et al., 2018; Gir et al., 2010). Globally, the volume of municipal solid waste (MSW) has increased at an unprecedented rate, with estimates indicating a rise from 2.01 billion tonnes in 2016 to 3.40 billion tonnes by 2050, particularly in low- and middle-income countries (World Bank, 2018). This rapid escalation poses significant environmental, social, and economic challenges, especially in regions where waste management infrastructure and institutional capacity remain underdeveloped.

In sub-Saharan Africa, the challenge of municipal solid waste management (MSWM) is further compounded by rapid urban population growth and unplanned urban expansion. Cities in the region often struggle to provide adequate waste collection, transportation, and disposal services, resulting in inefficient and unsustainable waste management systems (Guerrero et al., 2013; Kaza et al., 2018). Consequently, waste accumulation in urban environments has become a major concern, contributing to environmental degradation and increased public health risks.

In The Gambia, urbanization has significantly intensified the complexity of MSWM. The country's urban population reached approximately 1,727,830 in 2022, reflecting a steady upward trend (O'Neill, 2022). This demographic shift has led to increased waste generation, placing considerable strain on existing waste management systems. Urban centers such as Bakoteh, in Kanifing Municipal Council (KMC), part of the Greater Banjul Area, are particularly affected, as they experience high population density and rapid spatial expansion.

A major concern within Bakoteh, KMC is the persistence of unsustainable waste disposal practices, notably open dumping and open burning as shown in Figure 1. These practices have serious environmental and public health implications, including air and water pollution, greenhouse gas emissions, and the spread of disease vectors (Ferronato & Torretta, 2019; Sankoh et al., 2016). Poor waste management has been linked to increased incidences of respiratory infections, gastrointestinal diseases, and other environmentally related health conditions, particularly in densely populated urban communities. The persistence of these challenges can be attributed to several systemic and institutional constraints, including inadequate funding, weak governance structures,

limited technical capacity, and insufficient waste collection coverage (Kaza et al., 2018; Wilson et al., 2021). Rapid urbanization further exacerbates these issues by increasing waste volumes beyond the capacity of existing systems. In response, many cities rely heavily on the informal waste sector, which plays a critical role in recycling and material recovery but often operates under unsafe and unregulated conditions (Gutberlet, 2021).

In recent years, Integrated Solid Waste Management (ISWM) has emerged as a comprehensive and sustainable approach to addressing MSWM challenges. ISWM promotes the coordinated management of waste across multiple streams, including municipal, industrial, healthcare, and agricultural waste, while emphasizing stakeholder participation, environmental protection, and resource efficiency (Wilson et al., 2015). Central to this approach is the 3R principle (reduce, reuse, and recycle), which aligns with the broader concept of a circular economy aimed at minimizing waste and maximizing resource recovery (Geissdoerfer et al., 2017).

Despite its potential, the implementation of ISWM in developing countries remains constrained by socio-economic, behavioral, and institutional barriers. Empirical studies indicate that although awareness of proper waste management practices may be relatively high, actual participation is often limited due to inadequate infrastructure, weak policy enforcement, and low levels of community engagement (Bamberg & Möser, 2007; Wilson et al., 2021). These challenges highlight the need for context-specific research that integrates technical, social, and governance dimensions of waste management.

Against this backdrop, this study examines municipal solid waste management practices in the Bakoteh community within the Kanifing Municipal Council (Bakoteh, KMC), The Gambia, with particular emphasis on community perceptions, participation, and the feasibility of ISWM. Specifically, the study aims to: Identify the types of waste encountered by residents in Bakoteh; Examine the perceived impacts of poor waste management on the local community; and assess the feasibility of Integrated Solid Waste Management (ISWM) in Bakoteh, KMC.

By providing empirical evidence on these issues, the study contributes to the growing body of literature on sustainable waste management in sub-Saharan Africa and offers policy-relevant insights for improving MSWM systems in The Gambia.



Fig. 1. Bad Waste management Practices in Bakoteh dumping site, Bakoteh, KMC

2. MATERIALS AND METHODS

2.1 Description of the Study Area

This study was conducted in Bakoteh, a district within the Kanifing Municipal Council (KMC) in The Gambia. Bakoteh, KMC is part of the Greater Banjul Area, which represents the most densely populated and rapidly urbanizing region in the

country. Bakoteh is geographically located at latitude 13° 25' 48" N and longitude 16° 41' 53" W, the Map of Bakoteh is presented in Figure 2.

The area has experienced significant population growth due to rural–urban migration, largely driven by economic opportunities in nearby urban centers such as Serekunda and Banjul. This rapid urban expansion has contributed to increasing pressure on municipal services, particularly solid waste management systems.



Fig. 2. Geographical Map of Bakoteh, Kanifing Municipal Council.

2.2 Population of the Study Area

The population of Bakoteh was estimated at approximately 16,924 people, within a national population of about 1,882,450 (Gambia Bureau of Statistics [GBOS], 2013). Given ongoing urbanization trends, the population is expected to increase, which has implications for waste generation and management in the area.

To determine sample size for an unknown or large population, Cochran's (1977) formula was applied:

$$n_0 = Z^2 p(1 - p)/d^2$$

Where:

$Z = 1.96$ (corresponding to a 95% confidence level)

$p = 0.50$ (assumed proportion for maximum variability)

$d = 0.10$ (margin of error of 10%)

$$n_0 = (1.96)^2 \times (0.50)(0.50)/(0.10)^2 = 3.8416 \times 0.25/0.01 = 96.04$$

To account for potential non-response, missing data, or incomplete returns, a non-response adjustment factor ($R = 0.04$) was applied:

$$N = n_0/(1 - R) = 96.04/(1 - 0.04) = 96.04/0.96 = 100.04 \approx 100$$

Thus, the final adjusted sample size was $n = 100$ respondents.

A systematic random sampling strategy was implemented across Bakoteh. The community was divided into four geographic quadrants. Using local municipal street maps as the sampling frame, every k -th household ($k = 5$) along designated transect routes was selected. Within each household, one adult resident (≥ 18 years) residing in the area for at least six months was eligible for inclusion. The target sample captured key occupational groups across the local economy (civil servants, traders, processors, and private professionals). Out of 105 households approached, 100 completed the interview, yielding an effective response rate of 95.2%. Non-responding households ($n = 5$) were replaced using predefined adjacent household rules.

2.3 Research Design and Data Collection Instruments

A descriptive cross-sectional survey design was employed. Data were gathered using a structured questionnaire administered via face-to-face interviews. The instrument comprised four sections:

The structured questionnaire comprised 24 items split into four modules: Module A (Socio-demographics; 6 items), Module B (Waste generation observation and disposal behaviors; 5 nominal items), Module C (Perceived community and health impacts; 5 items scored on 5-point Likert scales ranging from 1 = Strongly Disagree to 5 = Strongly Agree), and Module D (ISWM awareness, perceived feasibility, and participation barriers; 8 items).

Field observations were conducted concurrently to contextualize self-reported disposal behaviors.

2.4 Instrument Validation and Reliability Testing

Composite perception index scores were computed by summing scale items within constructs. Scale reliability for multi-item perception constructs (ISWM Feasibility and Environmental Risk Impact) yielded a Cronbach's alpha of $\alpha=0.81$, confirming strong internal consistency across items prior to aggregation.

Content and face validity were established through expert evaluation by faculty members in the School of Agriculture and Environmental Sciences at the University of The Gambia. A pilot study was conducted prior to formal data collection with 15 non-sampled respondents in adjacent Manjai Kunda community. Composite perception index scores were computed by summing scale items within constructs. Scale reliability for multi-item perception constructs (ISWM Feasibility and Environmental Risk Impact) yielded a Cronbach's alpha of $\alpha=0.81$, confirming strong internal consistency across items prior to aggregation, which exceeds the standard threshold of 0.70 (DeVellis, 2016).

2.5 Statistical Analysis and Diagnostics

Data were audited, coded, and analyzed using IBM SPSS Statistics (Version 26)

Descriptive Statistics: Absolute frequencies (n) and relative percentages (%) were calculated for socio-demographic features, disposal methods, and ISWM perceptions.

Inferential Statistics: Cross-tabulations were constructed to assess relationships between socio-demographic independent variables and waste management dependent variables.

To test independence, Pearson's Chi-square (χ^2) test was conducted at a significance level of $\alpha=0.05$. For contingency tables with cells having expected counts less than 5 ($E_{ij}<5$), exact Monte Carlo significance tests (10,000 sampled tables; 99% confidence interval) were computed to prevent Type I errors. Effect sizes for categorical associations were measured using Cramer's V, interpreted as: small (≈ 0.10), medium (≈ 0.30), and large (≥ 0.50).

2.6 Ethical Considerations

This study protocol received ethical approval from the School of Agriculture and Environmental Science, Research and ethics Review Committee of the University of The Gambia. Participation was voluntary, and written informed consent was obtained from all participants prior to questionnaire

administration. Confidentiality and anonymity were strictly maintained by anonymizing all identification markers.

3. RESULTS AND DISCUSSION

3.1 Socio-demographic characteristics

The socio-demographic profile of respondents provides essential contextual grounding for interpreting household waste generation rates, disposal behaviors, and community readiness for Integrated Solid Waste Management (ISWM) in Bakoteh, KMC (Table 1).

The age distribution indicates a strong concentration within economically active cohorts: 44% of respondents were aged 40–49, 28% were 30–39, 17% were 20–29, and 11% were 50 years or older. The overwhelming representation (89%) of adults under 50 years highlights a demographic baseline characterized by higher daily consumption rates and higher operational volume of domestic waste stream generation (Kaza et al., 2018).

Regarding marital status, 85% of respondents were married, reflecting a predominance of multi-member, household-based living arrangements. Family structure and household density are established drivers of waste stream volume, as larger cohabitation units consistently generate greater cumulative quantities of domestic solid waste (Ogwueleka, 2009).

Educational attainment across the sample was varied: 35% completed secondary education, 25% primary education, 20% non-formal Arabic/Madarassa education, and 10% attained tertiary-level qualification, alongside 10% with no formal education. Although formal education is frequently linked to increased environmental literacy and pro-environmental attitudes (Bamberg & Möser, 2007), these empirical findings suggest that educational awareness alone is insufficient to drive sustainable disposal practices when structural municipal infrastructure is lacking or inaccessible (Guerrero et al., 2013).

Occupational profiles were dominated by informal commercial actors, specifically processors (40%) and traders (30%), followed by private sector professionals (17%) and civil servants (13%). The heavy presence of informal commercial activities within residential spaces directly correlates with elevated baseline generation of organic material, secondary packaging, and single-use plastic waste (Wilson et al., 2015).

Finally, nationality metrics indicate that 85% of respondents were Gambian nationals and 15% were non-Gambians, illustrating a predominantly localized demographic frame with stable long-term residency in Bakoteh.

Table 1: Demographic Data of Respondents (n=100)

Socio-Demographic Variable	Category	Frequency (n)	Percentage (%)
Age Group (Years)	20–29	17	17.0
	30–39	28	28.0
	40–49	44	44.0
	50 and above	11	11.0
Marital Status	Married	85	85.0

Socio-Demographic Variable	Category	Frequency (n)	Percentage (%)
Education Level	Single / Other	15	15.0
	No Formal Education	10	10.0
	Primary Education	25	25.0
	Secondary Education	35	35.0
	Tertiary Education	10	10.0
	Arabic / Madarassa	20	20.0
Primary Occupation	Processors	40	40.0
	Traders	30	30.0
	Private Professionals	17	17.0
	Civil Servants	13	13.0
Nationality	Gambian	85	85.0
	Non-Gambian	15	15.0

Note: n=100. No missing values or item non-responses were recorded across the socio-demographic variables (0%missing data)

3.2 Types of Waste Generated, Disposal Methods, and Perception of Waste

3.2.1 Types of Waste Generated (TWE)

When asked to identify the predominant type of waste visually observed in their immediate surroundings, 55% of respondents identified recyclable materials (plastics, paper, glass, metals), 30% noted organic waste, 10% cited e-waste, and 5% reported hazardous waste. This is shown in Plate 1a

This pattern reflects a shift toward an urbanized waste profile, characterized by increased consumption of packaged goods. While studies in developing countries often report organic waste as dominant (Kaza et al., 2018; Ogwueleka, 2009), the higher proportion of recyclables in Bakoteh, KMC suggests changing consumption patterns associated with urbanization.

The dominance of recyclable materials presents opportunities for resource recovery and recycling initiatives, although the absence of structured systems limits this potential (Wilson et al., 2015).

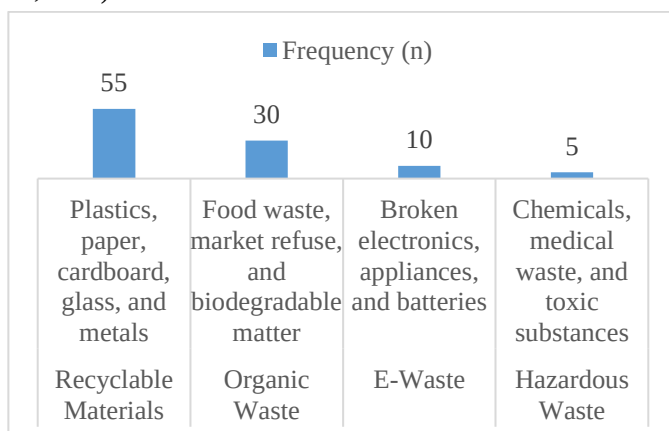


Plate 1a: Types of Waste Encountered in Bakoteh (n=100)

3.2.2 Household Waste Disposal Methods (HWDM)

As shown in Plate 1b, participants responded that 50% of households rely on municipal waste collection services, while

20% practice open dumping, 15% use private collectors, 10% burn waste, and only 5% engage in composting.

The coexistence of formal and informal disposal methods highlights the fragmented nature of waste management systems in Bakoteh, KMC. Similar patterns have been observed in many developing urban areas where inadequate service coverage forces residents to adopt alternative disposal practices (Guerrero et al., 2013).

Open dumping and burning pose serious environmental and health risks, including air pollution, water contamination, and disease transmission (Ferronato & Torretta, 2019; Sankoh et al., 2016).

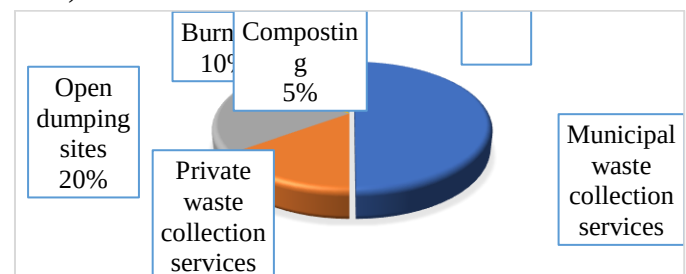


Plate 1b: Household Waste Disposal Methods

3.2.3 Waste as a Serious Problem (WSP)

An overwhelming 95% of respondents strongly agreed, and 5% agreed, that waste is becoming a serious problem in the community (Plate 1c). Respondents reported visible waste accumulation in public spaces and irregular waste collection.

This high level of concern reflects widespread awareness of waste-related challenges, consistent with findings that urban residents often recognize waste as a critical environmental issue (Bamberg & Möser, 2007).

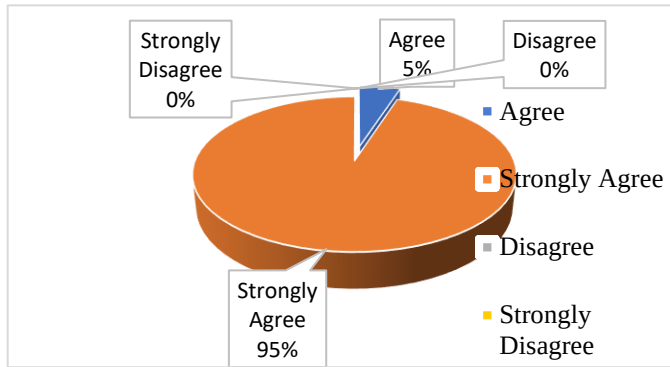


Plate 1c: Community's Perception of Waste Growth towards a threatening level

3.3 Consequences of Poor Waste Management

The findings (Plate 2) reveal that 100% of respondents reported experiencing problems associated with poor waste management.

The most commonly reported impacts include:

Health and well-being (45%)

Environmental health issues (30%)

Personal comfort and safety (15%)

Social and community impacts (10%)

Poor waste management contributes to the proliferation of disease vectors such as mosquitoes and rodents, increasing the risk of vector-borne diseases and infections (Sarkodie & Owusu, 2020). Open burning further contributes to respiratory illnesses due to air pollution (Ezeah & Roberts, 2017).

Additionally, improper waste disposal leads to blocked drainage systems, resulting in flooding and environmental contamination, particularly during rainy seasons (Schübeler et al., 2016). These findings align with studies linking poor waste management to both environmental degradation and public health risks (Guerrero et al., 2013; Kaza et al., 2018).

3.4 Applicability and feasibility of ISWM in Bakoteh, KMC

The findings from this study in plate 3 indicate a moderate level of awareness of Integrated Solid Waste Management (ISWM) among residents of Kanifing Municipal Council (Bakoteh, KMC). Slightly more than half of the respondents (55%) reported being familiar with the concept of ISWM, while a substantial proportion (45%) indicated no prior knowledge of it. This suggests that although awareness of modern waste management approaches is emerging within the community, there remains a significant knowledge gap that could hinder effective implementation.

Despite this moderate level of awareness, perceptions of the feasibility of ISWM implementation were generally positive. A majority of respondents expressed confidence in the

applicability of ISWM, with 60% indicating that it is feasible and an additional 25% considering it very feasible. However, a smaller proportion of respondents expressed skepticism, with 20% perceiving it as not feasible and 5% remaining uncertain. Overall, these findings reflect a cautious optimism among residents regarding the adoption of more sustainable waste management systems in Bakoteh, KMC.

Respondents were permitted to select multiple applicable responses regarding the perceived feasibility of ISWM; respondents emphasized the importance of efficient waste collection and transportation systems, which accounted for 30% of responses. Public awareness and education programs were also highlighted (25%), underscoring the role of community engagement in achieving sustainable waste management. Other important components included waste segregation at the source (15%), recycling and composting initiatives (10%), and the establishment of strong policy and regulatory frameworks (10%). These priorities are consistent with the fundamental principles of ISWM, which advocate for integrated, participatory, and resource-efficient waste management systems (Wilson et al., 2015).

However, the study also revealed several significant barriers that could impede the successful implementation of ISWM in Bakoteh, KMC. The most prominent challenge identified was the lack of funding and resources, cited by 50% of respondents. Limited public awareness and participation were also major constraints (25%), alongside weak policy enforcement (15%). Technological limitations (3%) and cultural resistance to change (7%) were identified as additional, though less dominant, barriers. These findings are consistent with existing literature, which identifies financial, institutional, and socio-cultural constraints as key challenges to effective waste management in developing countries (Guerrero et al., 2013; Katusiimeh et al., 2017).

Encouragingly, the study found a high level of willingness among residents to participate in waste management initiatives, with 75% of respondents expressing readiness to engage in activities such as recycling programs and community clean-up campaigns. This strong willingness indicates significant potential for community-driven approaches to waste management. Furthermore, respondents identified several anticipated benefits of ISWM implementation, including reduced environmental pollution (50%), improved public health (35%), cleaner communities (10%), and enhanced resource recovery (5%). These expected outcomes align with global evidence on the benefits of integrated waste management systems (Moya et al., 2017).

3.5 Cross-tabulation and inferential analysis

The cross-tabulation and Chi-square analyses were conducted to examine the relationships or dependence between socio-demographic characteristics and key variables related to waste generation, perception, and management practices in Bakoteh, KMC, the Gambia the result is shown in Table 2.

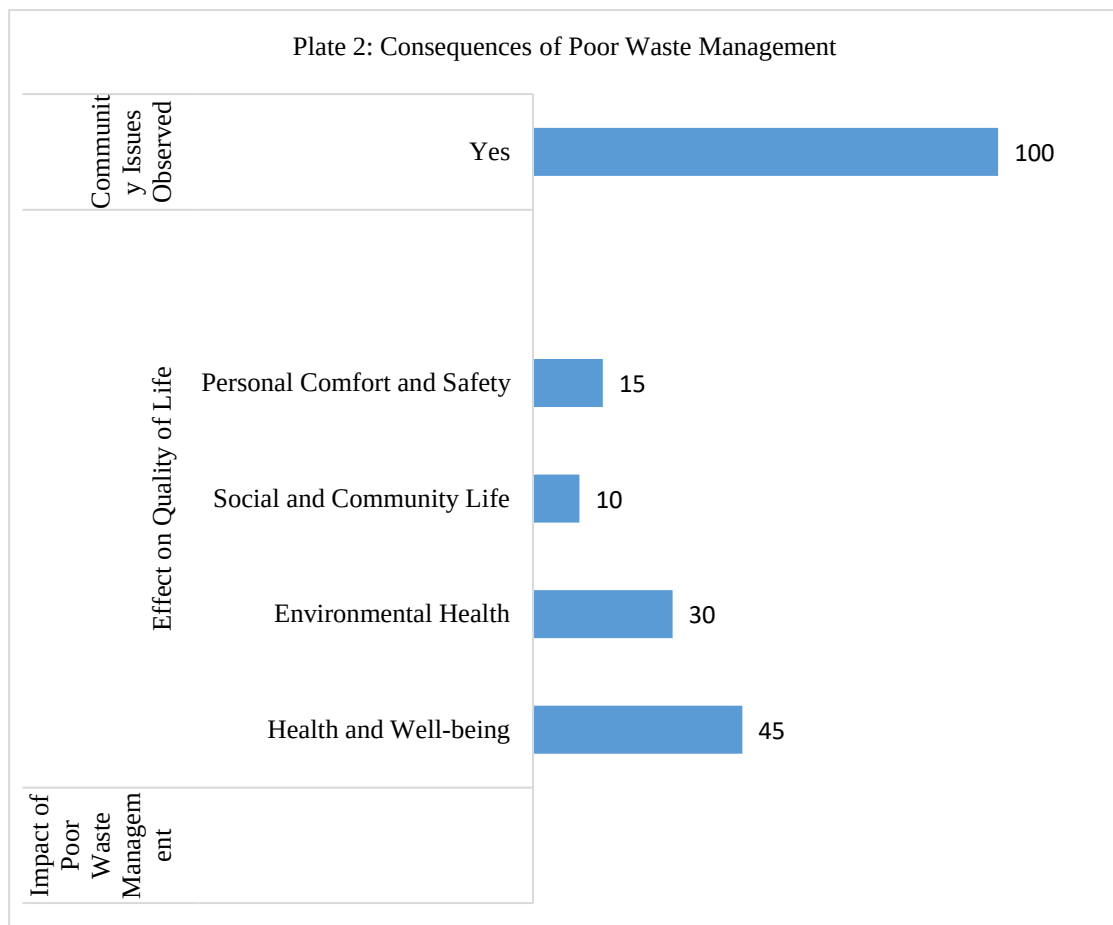


Plate 2: consequences of poor waste management

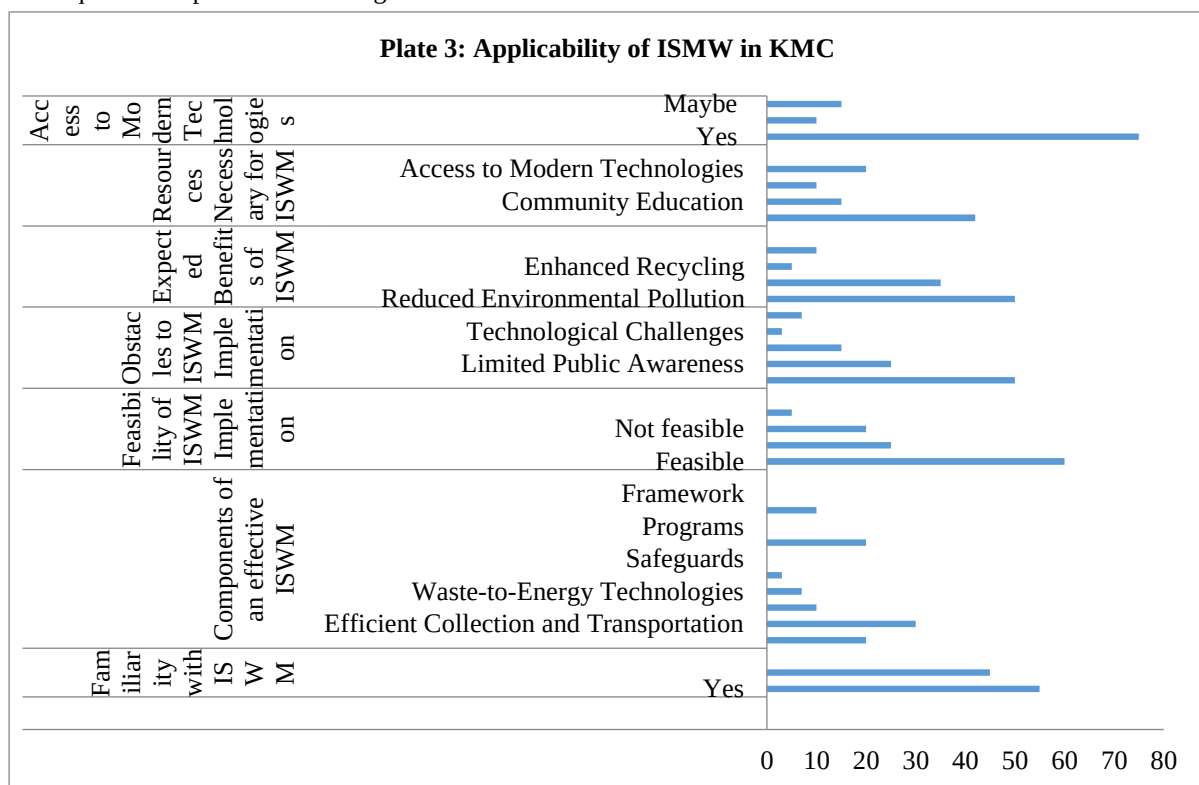


Plate 3: Applicability and feasibility of ISWM in Bakoteh, KMC

Table 2: Summary of Chi-Square Tests of Independence (n=100)

Hypothesis / Variable Cross-Tabulation	Pearson χ^2	df	Monte Carlo p-value	Cramer's V	Statistical Decision
Education vs. Waste Types Observed	2.87	12	0.996	0.098	Not Significant
Occupation vs. Waste Types Observed	3.45	9	0.944	0.107	Not Significant
Age vs. Perceived Waste Impact	4.12	9	0.903	0.117	Not Significant
Education vs. Perception of Waste Severity	3.78	12	0.987	0.112	Not Significant
Occupation vs. Familiarity with ISWM	10.52	3	0.015*	0.324	Statistically Significant
Education vs. Perceived ISWM Feasibility	4.97	12	0.960	0.129	Not Significant
Nationality vs. Perceived ISWM Obstacles	3.89	4	0.421	0.197	Not Significant

The analysis of the relationship between education level and types of waste encountered as shown in table 2 revealed no statistically significant association ($\chi^2=2.87$, $df=12$, $p = 0.996$). Across all educational categories, recyclable materials (55%) were the most frequently encountered waste type, followed by organic waste (30%). This finding suggests that waste composition in Bakoteh, KMC is largely influenced by broader consumption patterns rather than educational attainment. Similar observations have been reported by Cheshire and Magrath (2009) and Ogwueleka (2009), who noted that recyclable waste often dominates municipal waste streams due to increased reliance on packaged goods, regardless of socio-demographic characteristics. The absence of a significant relationship implies that waste reduction and recycling interventions should be designed at the community level rather than targeting specific educational groups.

Similarly, the cross-tabulation between occupation and types of waste generated showed no statistically significant relationship ($\chi^2=3.45$, $df=9$, $p = 0.944$). This indicates that waste generation patterns are relatively uniform across different occupational groups (civil servants, traders, processors, and private professionals). The finding reflects a broader, community-wide pattern of waste production, consistent with studies in other urban African settings where consumption behavior, rather than occupation, drives waste composition (Cheshire & Magrath, 2009; Ogwueleka, 2009).

The relationship between age and perceived impacts of poor waste management was also found to be statistically insignificant ($\chi^2=4.12$, $df=9$, $p = 0.903$). Respondents across all age groups consistently identified health and well-being (45%) and environmental health (30%) as the most affected areas. This suggests a shared understanding of the consequences of poor waste management, irrespective of age. These findings align with previous studies indicating that inadequate waste management contributes to environmental degradation and increased incidence of vector-borne diseases across all population groups (Guerrero et al., 2013; Kaza et al., 2018).

In examining marital status and perception of waste as a community issue, all respondents (100%)—comprising both single ($n=15$) and married ($n=85$) individuals—reported awareness of problems associated with poor waste management. This unanimous response highlights a universal recognition of waste-related challenges within the community, reinforcing the

argument that waste management issues are widespread and highly visible in urban environments (Guerrero et al., 2013).

Further analysis of the relationship between education level and perception of waste showed no statistically significant association ($\chi^2=3.78$, $df=12$, $p = 0.987$). Respondents across all educational levels perceived waste as a serious problem, suggesting that awareness of waste-related issues is broadly shared within the community. This finding supports the notion that environmental concerns related to waste are not confined to more educated groups but are experienced and recognized across the entire population.

However, a different pattern emerged in the analysis of occupation and familiarity with ISWM, where a statistically significant relationship was observed ($\chi^2=10.52$, $df=3$, $p = 0.015$, $V=0.324$). Civil servants were found to be more familiar with ISWM compared to other occupational groups. This may be attributed to their greater exposure to formal institutional frameworks, policy discussions, and environmental programs, as also reported by Adewumi and Babatunde (2020). This finding suggests that institutional exposure plays an important role in shaping awareness of modern waste management approaches.

The analysis of education level and perceived feasibility of ISWM showed no statistically significant association ($\chi^2=4.97$, $df=12$, $p = 0.960$), indicating that support for ISWM implementation is relatively consistent across educational groups. This suggests that perceptions of ISWM feasibility are influenced more by shared community experiences and challenges than by differences in educational attainment. Similar findings have been reported in other African municipalities, where public support for improved waste management systems tends to be widespread (Guerrero et al., 2013).

Likewise, the relationship between nationality and perceived obstacles to ISWM implementation was not statistically significant ($\chi^2=3.89$, $df=4$, $p = 0.421$). Both Gambian ($n=85$) and non-Gambian ($n=15$) respondents identified similar barriers, particularly lack of funding and resources (50%), limited public awareness (25%), and weak policy enforcement (15%). This indicates that challenges to effective waste management are structural in nature and are experienced uniformly across different population groups regardless of citizenship status.

Finally, the cross-tabulation between age and willingness to participate in waste management initiatives revealed no statistically significant association ($\chi^2=4.11$, $df=3$, $p = 0.250$). Respondents across all age groups demonstrated a generally high willingness to engage in community-based waste management programs (75% overall willingness). This finding is consistent with Mgheni et al. (2021), who emphasized the critical role of community participation in achieving sustainable waste management outcomes.

Overall, the inferential analysis indicates that most waste management challenges and perceptions in Bakoteh, KMC are not strongly influenced by socio-demographic characteristics, but are instead shared across the entire community. This underscores the need for inclusive, community-wide interventions that address systemic issues such as infrastructure, policy enforcement, and public awareness, rather than narrowly targeted demographic approaches.

4.0 DISCUSSION

This study examined municipal solid waste management (MSWM) practices in Bakoteh, KMC, with particular focus on waste generation patterns, disposal methods, community perceptions, and the feasibility of Integrated Solid Waste Management (ISWM). The findings reveal important insights into the structural, behavioral, and institutional dynamics shaping waste management in rapidly urbanizing environments.

4.1 Waste Generation Patterns in Bakoteh, KMC

The results indicate that recyclable materials constitute the largest proportion of waste generated in Bakoteh, KMC, followed by organic waste, while electronic and hazardous wastes occur less frequently. This pattern reflects a transition in waste composition associated with urbanization and changing consumption patterns. In many developing countries, municipal waste streams have traditionally been dominated by organic waste; however, increasing urbanization and the proliferation of packaged goods have led to a growing share of recyclable materials such as plastics, paper, and metals (Kaza et al., 2018; Wilson et al., 2015).

The predominance of recyclable waste in this study suggests a shift toward a more urbanized waste profile, driven by market integration and lifestyle changes. Similar findings have been reported by Ogwueleka (2009), who observed that urban households increasingly generate higher volumes of packaging waste due to modern consumption habits. This trend presents both a challenge and an opportunity. On one hand, the accumulation of non-biodegradable waste contributes to environmental degradation; on the other hand, it provides a significant opportunity for resource recovery through recycling initiatives (Wilson et al., 2015).

Although e-waste and hazardous waste represent a smaller proportion of the waste stream, their environmental significance cannot be overlooked. Improper disposal of these waste types can release toxic substances into the environment, posing risks to human health and ecosystems (Ferronato & Torretta, 2019). This underscores the need for specialized waste management systems capable of handling such materials.

4.2 Waste Disposal Practices and System Inefficiencies

The study reveals that while municipal waste collection services are utilized by a significant proportion of households, a considerable number of residents still rely on informal disposal methods such as open dumping and burning. This coexistence of formal and informal waste management practices reflects the fragmented nature of waste management systems in Bakoteh, KMC.

The persistence of informal disposal methods is largely attributable to inadequate service coverage, irregular waste collection, and limited infrastructure. Guerrero et al. (2013) argue that inefficiencies in waste collection systems are a defining characteristic of many cities in low- and middle-income countries, where rapid urban growth often outpaces the capacity of municipal services. Similarly, Zurbrügg et al. (2018) highlight that open dumping remains a common practice in many African cities due to the lack of accessible and reliable waste management services.

Open dumping and burning have serious environmental and public health implications. These practices contribute to soil and water contamination, air pollution, and the proliferation of disease vectors (Sankoh et al., 2016; Ferronato & Torretta, 2019). The findings of this study, therefore, reinforce the argument that improving waste collection efficiency is a critical step toward reducing reliance on unsafe disposal methods.

4.3 Community Perception and Awareness of Waste Management

The study found that an overwhelming majority of respondents perceive waste as a serious and growing problem in Bakoteh, KMC. This high level of awareness reflects the visible and immediate impacts of poor waste management, such as waste accumulation in public spaces, blocked drainage systems, and unpleasant living conditions.

Interestingly, the cross-tabulation analysis revealed that this perception is consistent across all socio-demographic groups, with no significant differences based on education, age, or occupation. This suggests that awareness of waste-related issues is driven more by lived experience than by formal education. Bamberg and Möser (2007) note that while education can influence environmental attitudes, direct exposure to environmental problems often plays a more significant role in shaping perceptions and behaviors.

The widespread recognition of waste as a serious issue is a positive indicator, as it suggests a readiness among residents to support improved waste management initiatives. However, awareness alone is insufficient to drive behavioral change in the absence of enabling infrastructure and institutional support (Guerrero et al., 2013).

4.4 Consequences of Poor Waste Management

The findings demonstrate that poor waste management has significant implications for both public health and environmental quality in Bakoteh, KMC. Respondents identified health and well-being, as well as environmental health, as the most affected aspects of their lives.

Poorly managed waste creates favorable conditions for the proliferation of disease vectors such as mosquitoes and rodents, increasing the risk of vector-borne diseases (Sarkodie & Owusu, 2020). Additionally, the practice of open burning contributes to air pollution and respiratory illnesses (Ezeah & Roberts, 2017). The blockage of drainage systems by improperly disposed waste further exacerbates flooding, particularly during the rainy season, leading to additional health and environmental risks (Schübeler et al., 2016).

These findings are consistent with existing literature, which highlights the strong link between inadequate waste management and adverse health outcomes in urban areas (Kaza et al., 2018; Guerrero et al., 2013). The universal acknowledgment of these impacts among respondents underscores the severity of the problem and the urgency of intervention.

4.5 Feasibility and Applicability of ISWM in Bakoteh, KMC

The study reveals a generally positive perception of the feasibility of ISWM in Bakoteh, KMC, with the majority of respondents expressing confidence in its implementation. This reflects a recognition of the need for more sustainable and integrated approaches to waste management.

ISWM emphasizes the integration of waste reduction, reuse, recycling, and proper disposal within a coordinated framework (Wilson et al., 2015). The components identified by respondents—such as efficient collection systems, public awareness, and waste segregation—align closely with these principles, suggesting that community expectations are consistent with established best practices.

However, the implementation of ISWM in Bakoteh, KMC faces several challenges, particularly in terms of funding, public awareness, and policy enforcement. Financial constraints remain the most significant barrier, as municipalities often lack the resources required to invest in infrastructure and technology (Guerrero et al., 2013). Weak institutional capacity and limited enforcement of existing regulations further undermine the effectiveness of waste management systems (Katusiimeh et al., 2017).

Despite these challenges, the high level of willingness among respondents to participate in waste management initiatives presents a valuable opportunity for community-based approaches. Public participation has been identified as a key determinant of success in ISWM systems, particularly in developing countries (Mgheni et al., 2021).

4.6 Socio-Demographic Dynamics and Systemic Implications

One of the most significant findings of this study is the lack of statistically significant relationships between most socio-demographic variables and waste management practices. This suggests that waste management challenges in Bakoteh, KMC are not driven by individual characteristics but are instead shaped by broader systemic factors.

This finding challenges the assumption that improving education or targeting specific demographic groups will

automatically lead to better waste management outcomes. Instead, it supports the argument that effective waste management requires system-wide interventions, including improved infrastructure, stronger policy enforcement, and institutional reforms (Wilson et al., 2021).

The only exception was the significant relationship between occupation and familiarity with ISWM, with civil servants demonstrating higher awareness. This highlights the role of institutional exposure in shaping knowledge of waste management practices and suggests the need for broader public education initiatives.

4.7 Implications for Policy and Practice

The findings of this study have important implications for waste management policy and practice in Bakoteh, KMC. First, the dominance of recyclable and organic waste highlights the potential for implementing recycling and composting programs as part of an integrated waste management strategy. Second, the persistence of informal disposal methods underscores the need to improve waste collection infrastructure and service delivery.

Furthermore, the high level of community awareness and willingness to participate provides a strong foundation for the development of community-based waste management initiatives. However, these efforts must be supported by adequate funding, effective policy enforcement, and institutional capacity building.

Overall, the study reinforces the need for a transition toward ISWM as a sustainable solution to waste management challenges in Bakoteh, KMC. Such an approach requires the integration of technical, social, and institutional components to ensure long-term effectiveness and sustainability.

Conclusion

The study demonstrates that municipal solid waste management in Bakoteh, Kanifing Municipal Council, is characterized by a combination of increasing recyclable and organic waste generation, incomplete municipal collection coverage, and continued reliance on environmentally unsafe disposal practices. Recyclable materials constituted the most frequently reported waste category, followed by organic waste, indicating substantial potential for material recovery, recycling, and composting. However, the persistence of open dumping and open burning reflects deficiencies in collection coverage, waste-handling infrastructure, and organized recovery systems. These practices have important environmental and public-health implications, particularly through pollution, blockage of drainage systems, proliferation of disease vectors, and deterioration of community environmental quality. The near-universal perception of waste as a serious community problem further demonstrates that inadequate solid waste management is a visible and widely experienced concern in Bakoteh.

The findings further indicate that Integrated Solid Waste Management represents a potentially applicable approach for improving waste management in Bakoteh. Although familiarity with ISWM was moderate, most respondents considered its implementation feasible, and 75% expressed willingness to participate in activities such as recycling and community clean-up programmes. The inferential analysis showed that most

waste-management perceptions and practices were not significantly associated with socio-demographic characteristics, suggesting that the prevailing challenges are predominantly structural and community-wide rather than confined to particular population groups. The significant association between occupation and familiarity with ISWM nevertheless indicates that exposure to institutional information may influence awareness. Overall, sustainable improvement in municipal solid waste management in Bakoteh will require an integrated approach that simultaneously strengthens collection services, promotes waste segregation and resource recovery, improves public awareness, reinforces institutional and regulatory capacity, and facilitates meaningful community participation.

Recommendations

Based on the findings, Kanifing Municipal Council should progressively develop and implement an Integrated Solid Waste Management system that prioritizes reliable household waste collection, segregation at source, recycling, composting, and environmentally sound final disposal. Particular attention should be given to improving collection frequency and geographical coverage, providing appropriate waste-storage and collection infrastructure, and reducing open dumping and open burning. Given the predominance of recyclable and organic materials in the reported waste stream, separate collection systems for recyclables and biodegradable waste should be introduced and linked to locally appropriate recycling and composting initiatives. Partnerships involving municipal authorities, private waste-service providers, informal waste collectors, community organization, and other relevant stakeholders could strengthen material recovery while improving operational efficiency and creating livelihood opportunities. Adequate financing, technical capacity, and appropriate technologies should accompany these interventions, rather than introducing technologies that cannot be sustainably operated under local resource conditions.

In addition, sustained community education and participatory waste-management programmes should be established to translate the existing high level of concern about waste into consistent household practices. Public education should emphasize source segregation, reduction and reuse of waste, safe disposal practices, recycling, composting, and the environmental and health consequences of open dumping and burning. Because most socio-demographic variables were not significantly associated with waste-management perceptions or practices, these interventions should be implemented broadly across the community rather than being restricted to particular educational, age, or nationality groups. Municipal authorities should also strengthen enforcement of existing waste-management regulations, establish clear responsibilities among implementing institutions, and create practical mechanisms for community participation in planning and monitoring waste services. Future research should complement the present perception-based survey with direct waste-characterisation studies, larger and more geographically representative samples, and economic and operational assessments of proposed ISWM options to determine their technical, financial, and environmental sustainability before full-scale implementation.

CONFLICT OF INTEREST

Authors declare no conflict of interest

Ariwaodo and Bojang (2026)

FUNDING

The study did not receive any form of funding

DATA AVAILABILITY

The data is available from corresponding authors upon reasonable request

AUTHOR CONTRIBUTIONS.

CAA: Conceptualization of the study; development of the research methodology and questionnaire; literature review; data collection and field supervision; data curation and statistical analysis; interpretation of results; preparation and drafting of the original manuscript; critical revision of the manuscript; and overall coordination of the study; **E B:** Contribution to study conceptualization and methodology; field data collection and community engagement; data organization and validation; contribution to data analysis and interpretation; review of relevant literature; critical review and editing of the manuscript; and approval of the final version for publication. **Both authors:** Both authors contributed to the interpretation of findings, critically reviewed the manuscript for important intellectual content, approved the final version of the manuscript, and agreed to be accountable for all aspects of the work.

REFERENCES

- Adewumi, J. R., & Babatunde, A. O. (2020). Awareness and practice of municipal solid waste management in urban Nigeria. *Journal of Environmental Management in Developing Countries*, 11(2), 142–155.
- Bamberg, S., & Möser, G. (2007). Twenty years after Hines: A meta-analysis of psycho-social determinants of pro-environmental behavior. *Journal of Environmental Psychology*, 27(1), 14–25. <https://doi.org/10.1016/j.jenvp.2006.12.002>
- Cheshire, L., & Magrath, P. (2009). Household waste recycling: The role of socio-demographic factors. *Environment and Planning A: Economy and Space*, 41(6), 1410–1425.
- Cochran, W. G. (1977). *Sampling techniques* (3rd ed.). John Wiley & Sons.
- DeVellis, R. F. (2016). *Scale development: Theory and applications* (4th ed.). SAGE Publications.
- Ezeah, C., & Roberts, C. L. (2017). Analysis of barriers and success factors affecting the adoption of sustainable management of municipal solid waste in Nigeria. *Journal of Environmental Management*, 189, 95–101.
- Ferronato, N., & Torretta, V. (2019). Waste mismanagement in developing countries: A review of global issues. *International Journal of Environmental Research and Public Health*, 16(6), Article 1060. <https://doi.org/10.3390/ijerph16061060>
- Gambia Bureau of Statistics. (2013). *Population and housing census report*. Government of The Gambia.
- Geissdoerfer, M., Savaget, P., Bocken, N. M. P., & Hultink, E. J. (2017). The circular economy: A new sustainability paradigm. *Journal of Cleaner Production*, 143, 757–768. <https://doi.org/10.1016/j.jclepro.2016.12.048>

- Gir, R., Singh, A. K., & Ross, K. (2010). Waste generation and urbanization dynamics in developing countries. *Journal of Urban Environmental Management*, 14(2), 115–128.
- Guerrero, L. A., Maas, G., & Hogland, W. (2013). Solid waste management challenges for cities in developing countries. *Waste Management*, 33(1), 220–232. <https://doi.org/10.1016/j.wasman.2012.09.008>
- Gutberlet, J. (2021). Waste pickers and the circular economy: Inclusion and empowerment. *Sustainability*, 13(3), Article 1235.
- Katusiimeh, M. W., Burger, K., & Mol, A. P. J. (2017). Informal waste management and its implications for sustainability in Kampala, Uganda. *Habitat International*, 64, 1–9.
- 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 Publications. <https://doi.org/10.1596/978-1-4648-1329-0>
- Mgheni, M. S., Mbuligwe, S. E., & Kassenga, G. R. (2021). Public awareness, attitudes, and community engagement in municipal waste management: Insights from East African urban communities. *Environmental Challenges*, 4, Article 100112.
- Moya, D., Aldás, C., López, G., & Kaparaju, P. (2017). Municipal solid waste as a valuable renewable energy resource: A worldwide opportunity of energy recovery by using waste-to-energy technologies. *Energy Procedia*, 134, 286–295. <https://doi.org/10.1016/j.egypro.2017.09.618>
- Ogwueleka, T. C. (2009). Municipal solid waste characteristics and management in Nigeria. *Iranian Journal of Environmental Health Science & Engineering*, 6(3), 173–180.
- O'Neill, A. (2022). *Urban population in The Gambia from 2010 to 2022*. Statista. <https://www.statista.com>
- Sankoh, F. P., Yan, X., & Tran, Q. (2016). Environmental and health impact of solid waste disposal in developing cities: A case study of Granville Brook dumpsite, Freetown, Sierra Leone. *Journal of Environmental Protection*, 7(5), 665–670.
- Sarkodie, S. A., & Owusu, P. A. (2020). Impact of waste mismanagement on health outcomes: Evidence from developing countries. *Science of The Total Environment*, 706, Article 135998.
- Schübeler, P., Wehrle, K., & Christen, J. (2016). *Conceptual framework for municipal solid waste management in low-income countries*. UNDP/World Bank.
- Wilson, D. C., Rodic, L., Modak, P., Soos, R., Carpintero, A., Velis, C., Iyer, M., & Simonett, O. (2021). *Global waste management outlook 2021*. United Nations Environment Programme.
- Wilson, D. C., Velis, C., & Cheeseman, C. (2015). Role of informal sector recycling in waste management in developing countries. *Habitat International*, 30(4), 797–808. <https://doi.org/10.1016/j.habitatint.2005.09.005>
- Zurbrugg, C., Gfrerer, M., Ashadi, H., Brenner, W., & Küper, D. (2018). Determinants of sustainability in solid waste management—The Gianyar Waste Recovery Project in Indonesia. *Waste Management*, 24(5), 455–464.