



Evaluation of Waste Collection (Adamu, S. A. 2026) DOI: <https://doi.org/10.59479/jiaheri.v2i1.137>

Evaluation of Waste Collection, Disposal, Recycling, and Policy Effectiveness in Abuja Metropolis, Nigeria

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Abstract

This paper evaluates waste collection, disposal, recycling, and policy enforcement within Abuja Metropolis. A sample of 394 respondents was surveyed using structured questionnaires. Data analysis using descriptive statistics and inferential tests revealed that collection systems are functional in urban districts but poor in outskirts. Data were collected from structured questionnaires and analysed using both descriptive and inferential statistics. Descriptive statistics profiled respondents' demographics and summarized their perceptions and practices regarding waste management. Inferential analysis employed one-sample t-tests to test six hypotheses at the 0.05 significance level. Findings revealed that while general awareness of waste management is high, detailed knowledge of recycling, segregation, and composting remains low. The study recommends improved education, community sensitization, and stakeholder collaboration to enhance public participation in sustainable waste management. Recycling and policy enforcement are weak due to infrastructure and funding gaps. The study suggests modernizing waste collection, enforcing waste laws, and establishing recycling centers.

Keywords: Evaluation, Waste Collection, Disposal, Recycling, Policy Effectiveness, Abuja, Nigeria

Introduction

Rapid economic development and related industrialization have led to increased urbanization and sizes of cities, as well as changing consumption habits (Dong, et al., 2022). The consequences of these, with associated population growth, have been phenomenal increase in the amount of all sorts of wastes generated globally. Solid wastes are particularly large in volume and variety for these reasons (Dehghani, et al., 2021). Solid wastes can be defined as useless, unwanted or discarded materials that arise from man's activities (domestic, commercial, industrial, agricultural, institutional and construction/demolition) in the human environment and are not free flowing (Aziz, et al., 2022). Prompt and proper handling (or management) of these wastes is absolutely necessary to minimize its negative environmental impacts and significant risks to public health (Singh, et al., 2024).

Unfortunately, this process has continued to pose the greatest challenges the world over, more seriously in cities and other urban settlements, especially where these are not planned. Management of solid waste is a global issue resulting in varying degrees of successes and also posing varying challenges, depending on several factors, including level of development (Khan, et al., 2022). In developed countries, cities continue to generate staggering amounts of municipal



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solid waste (MSW); but because there are established solid waste management systems in place, the challenges posed by these wastes are minimal and less stressful (Valavanidis, 2023). For instance, the USA generated 243 million tons of Municipal Solid Waste in 2009 alone, which showed the average person produced 1.9kg of waste per day. However, recycling levels only increased by 0.4% between 2008 and 2009.

Statement of the problem

The problems and challenges of solid waste management in cities in Africa and other developing countries of the world are very visible and not amenable to cover-ups or management pretensions. The situation clearly exposes the pathetic state and hopelessness of the institutional arrangements put in place for solid waste management in most urban areas of countries in sub-Saharan Africa, including Nigeria. Generally, waste generation rates range from 0.66kg/capita/day in urban areas to 0.44kg/capita/day in rural areas in Nigeria, as opposed to 0.7 1.8 kg/cap/day in developed countries In Lagos alone with a population of 9.1 million people (2006 census), over 4 million tons of municipal solid waste are generated annually, translating to about 1.1kg/capita/day (Abdulfatah, 2023).

Aims and objectives of the Study

The main aim of this study is Waste Collection, Disposal, Recycling, and Policy Effectiveness in Abuja Metropolis, Nigeria, identifying areas for improvement and potential solution. The specific

Specific objectives include:

1. To examine the solid waste collection method in Abuja metropolis
2. To explore the waste disposal method used in Abuja metropolis
3. To explore waste management policies and regulation which help reduce municipal waste in Abuja metropolis

Research Questions

1. What is the waste collection methods available in Abuja metropolis?
2. What are the various waste disposal methods used in Abuja metropolis?
3. How does waste management policies and regulation which help reduce municipal waste in Abuja metropolis?

Hypotheses postulation

Ho3: The waste collection methods available in Abuja metropolis will not be significant high.

Ho4: The waste disposal method used in Abuja metropolis will not be significant high.

Ho5: Waste recycling practices will not significantly help to reduce municipal waste in Abuja metropolis

Significance of the Study

Although a lot of study has been done on the issue of solid waste in FCT, Abuja metropolis, nevertheless this study wants to demonstrate an aspect of understanding that a lot of the strategies used by FCT can be adopted by some parts of FCT and other states of the federation to keep a clean and good environment, as this will go a long way in control of a lot of sickness, diseases and clogging of water ways which eventually lead to flooding. It is enough to put structures in place



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to maintain waste, it will require some level of supervision and maintenance and also as you swing the structure into action think of sustainability.

Literature review

Solid Wastes Definitions and Classifications

American Public Works Association (1975) defined solid waste as useless unwanted or discarded material with insufficient liquid content to be free flowing. Because of its ‘sticky’ nature, therefore, solid waste has the quality of accumulating, and physically insulting the environment, if not well managed (Muthuraman, & Ramaswamy, 2019). It is this propensity that sets solid waste apart from other forms of waste. Thus, it has been established that even in the smallest villages, solid waste management is generally accepted as a major aspect of the indigenous community organisation and traditional home management (Goswami, 2022). Hopskinville (1976) explained that solid wastes are residuals from homes, businesses and institutions, and referred to it as trash garbage, rubbish, refuse, discards and throwaways that enter a local system for collection and disposal (Jana, et al., 2024). Feacham et al (1976) explained that solid waste can be classified in different ways. The first is the division of solid wastes or refuse into two broad groups; domestic and industrial solid waste. Secondly, simple system that recognizes three categories of solid wastes namely animals, vegetables and minerals (Hardoy, et al., 2024).

Table 1.2: Solid Waste Classification

CLASSIFICATION OF SOLID WASTES	DESCRIPTION	SOURCES
Food waste (garbage)	Wastes from the preparation, cooking, and serving of food. Market refuse, waste from the handling, storage, and sale of produce and meats and vegetable combustible (primary organic) paper, cardboard, cartons	Households, institutions and commercial such as hotels, stores, restaurants, markets, etc.
Rubbish	wood, boxes, plastics, rags, cloth, bedding, leather, rubber, grass, leaves, yard trimmings Non-combustible (primary inorganic) metals, tin cans, metal foils dirt, stones, bricks, ceramics, crockery, glass bottles, other mineral refuse	Households, institutions and commercial such as hotels, stores, restaurants, markets, etc.
Ashes and Residues	Residue from fires used for cooking and for heating buildings, cinders, clinkers, thermal power plants	households, industries etc
Bulky waste	Large auto parts, tyres, stoves, refrigerators, others large appliances, furniture, large crates, trees, branches, palm fronds, stumps, foliage	Auto repair shops, households etc.



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Street waste	Street sweepings, dirt, leaves, catch basin dirt, animal droppings, contents of litter receptacles	Streets, sidewalks, alleys, vacant lots, etc.
Dead animals	Small animals: cats, dogs, poultry etc. Large animals: horses, cows etc	Poulties, cattle ranches, households etc
Construction & demolition Waste	Lumber, roofing, and sheathing scraps, crop residues, rubble, broken concrete, plaster, conduit pipe, wire, insulation etc.	Construction and demolition sites, remodelling, repairing sites
Industrial waste & sludge	Solid wastes resulting from industry processes and manufacturing operations, such as food processing wastes, boiler house cinders, wood, plastic and metal scraps and shaving, etc. Effluent treatment plant sludge of industries and sewage treatment plant sludge, coarse screening, grit & septic tank	Factories, power plants, treatment Plants, etc.
Hazardous wastes	Hazardous wastes: pathological waste, explosives, radioactive material, toxic waste etc	Households, hospitals, institution, Stores, industry, etc.
Households, hospitals, institution, stores, industry, etc.	Tree-trimmings, leaves, waste from parks and gardens, etc.	Parks, gardens, roadside trees, etc.

Source: (Sylvester, & Ikudayisi, 2021)

Waste collection method

With growing urbanization and consumption, waste generation has reached unprecedented levels. According to Singh et al. (2025), most developing nations face a “transitional phase” in municipal solid waste (MSW) collection, characterized by a mix of traditional and modern methods. Efficient collection methods are critical not only for waste reduction but also for recycling, energy recovery, and reducing environmental and public health impacts. Traditionally, waste collection involves curbside pickup, community bins, and landfilling. These methods are labour-intensive, often inefficient, and contribute to environmental degradation if not properly managed (Rengerla & Angamuthu, 2025). While cost-effective for small-scale applications, traditional systems struggle to cope with the volume and complexity of modern waste streams. Internet of Things (IoT)-based systems have revolutionized collection efficiency. Labaran (2025) describes a pilot project in Kano, Nigeria, where smart bins equipped with sensors notified municipal workers when bins reached capacity. This real-time monitoring reduced overflow and optimized collection routes. Furthermore, Shaikh and Ali (2025) propose a model integrating AI with GPS and traffic data to optimize waste collection routes in urban India. The system reduces fuel consumption, traffic congestion, and operational costs. AI also aids in predicting waste generation patterns based on historical data and urban activities. Although still experimental,



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automated waste collectors have emerged, especially in industrial zones. Firozjaee et al. (2025) report the use of autonomous vehicles in Iran's biowaste sectors for collecting animal waste, enhancing hygiene and reducing manual labour.

4 Waste disposal methods

Waste disposal has become one of the most pressing challenges of modern society due to the exponential increase in waste generated from urbanization, industrialization, and population growth. From landfilling and incineration to smart technologies and circular economy practices, the methods for managing waste have evolved significantly in recent years.

Sanitary landfilling remains a dominant method of waste disposal, particularly in countries where space and infrastructure for alternative methods are limited. These landfills are engineered with liners, leachate management systems, and gas recovery technologies to reduce environmental impact (Kumar, 2021). Despite improvements, landfills continue to pose significant environmental risks such as groundwater contamination and methane emissions. Leachate and landfill fires are especially problematic, highlighting the need for improved landfill management techniques and regular monitoring systems. Innovative practices like landfill mining and reuse for energy recovery or recreational purposes are emerging but remain underutilized in many regions (Samreen et al., 2024).

Research Method

Research Design

A descriptive cross-sectional design was adopted to assess residents' awareness and knowledge of MSWM.

Area of the Study

The study area, Abuja Metropolis, is Nigeria's Federal Capital Territory with a population exceeding 3 million.

Population of the Study

The population comprised households, shop owners, and waste workers across six districts of Abuja.

Sampling Technique and Sample Size

A stratified random sampling method was used. Using Yamane's formula, a sample of 394 respondents was drawn.

Instrument for Data Collection

Structured questionnaires were used to measure awareness, knowledge, and perception of waste management.

Validity and Reliability

The questionnaire was validated by experts, and a reliability coefficient of 0.82 was obtained using Cronbach's Alpha.



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Method of Data Analysis

Data were analyzed using descriptive (mean, SD) and inferential statistics (t-test). Graphs were used for visualization.

Results and Discussion

Demographic Characteristics of Respondents

This section presents the demographic features of the respondents, including gender, age, religion, and parents’ educational background.

Table 4.1: Distribution on Socio-demographic characteristics of the respondents

Socio-demographic characteristics	Frequency	Percent
Gender		
Male	258	65.5
Female	136	34.5
Age		
18-24 years	90	22.8
25-34 years	75	19.0
35-44 years	121	30.7
45-54 years	62	15.7
55-64 years	31	7.9
65 years or above	15	3.8
Marital Status		
Single	152	38.6
Married	182	46.2
Divorced	30	7.6
Widow	30	7.6
Highest Qualification		
Primary	15	3.8
SSCE	137	34.8
B.sc/B.Ed.	151	38.3
PGDE	45	11.4
Masters	46	11.7
Occupation		



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Employed(full-time)	196	49.7
employed(part-time)	15	3.8
unemployed	15	3.8
Self employed	108	27.4
Student	30	7.6
Monthly Income		
Below # 20,000	35	8.9
#20,000-#50,000	93	23.6
#50,001-#100,000	49	12.4
#100,001-#200,000	70	17.8
above # 200,000	147	37.3
Household		
1-2	62	15.7
3-4	151	38.3
5-6	76	19.3
7 or more	105	26.6
Residential area		
Urban	272	69.0
Suburban	60	15.2
Rural	62	15.7
Type of housing		
Apartment/Flat	212	53.8
Detached House	122	31.0
Semi Detached house	60	15.2
Others	24	6.2
Access to Waste collection services		
Yes	289	73.4
No	45	11.4
Sometimes	60	15.2
Dispose of waste		
Curb side collection by waste management	168	73.4
Private Contractor	196	11.4
Self-Disposal	30	15.2
Municipal solid waste management practices		
very Informed	166	42.1
Somewhat Informed	183	46.4
Not informed at all	45	11.4
Waste gets collected		
Daily	76	19.3
twice a week	228	57.9
once a week	60	15.2



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Less frequently	30	7.6
Waste management services		
very satisfied	91	23.1
Satisfied	182	46.2
Neutral	60	15.2
Dissatisfied	45	11.4
very Dissatisfied	16	4.1
Total	394	100%

The table 1 above showed the sex distribution of the respondents. Sociodemographic status indicators: The sample population has a majority of male respondents (65.5%), while females constitute 34.5%. This gender gap shows that male opinions may be more prominently represented in the study, potentially impacting findings where gender-specific roles effect waste management habits or household decision-making processes.

Inferential Statistics

The waste collection methods available in Abuja metropolis will not be significant high.

In testing the third null hypothesis, the variable of the waste collection methods available in Abuja metropolis, measured by 10 items. The respondents’ scores on the scale were summed-up. For the waste collection methods available in Abuja metropolis to be considered significantly positive among the respondent, the scores made on the whole scale should be significantly higher/greater that 30 (which is the midpoint between strongly agree and strongly disagree). This implies 3 X 10, the number of items measuring the construct. This null hypothesis was tested with a one-sample t-test) otherwise called population t-test). The results are presented in Table 4.2

Table 4.2 One sample t-test analysis of between the waste collection methods available in Abuja metropolis

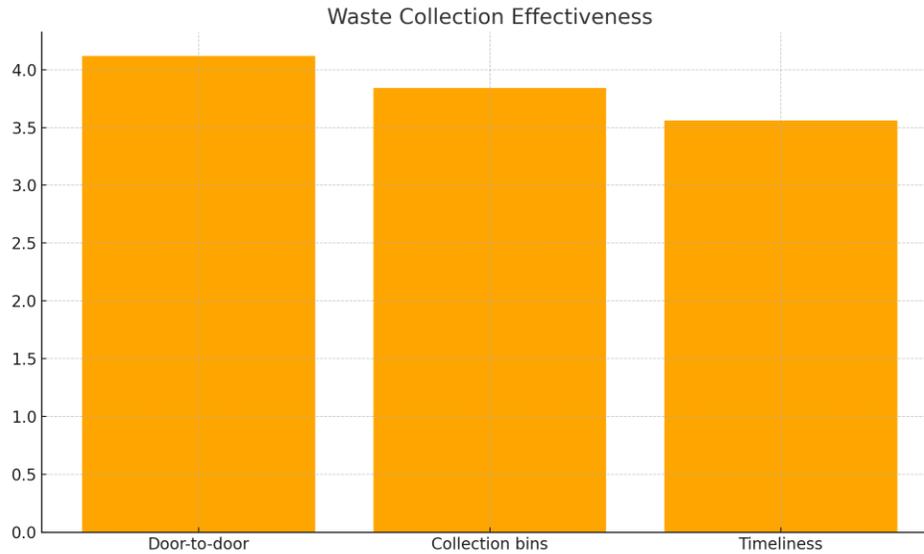
Variable	Sample Mean	Sample SD	Ref. Mean	T	Sig	Remark
The waste collection methods available in Abuja metropolis	31.36	9.90	30	2.73	< .006	NS

Source: Field work, 2024

A look at the results indicated a statistically significant the waste collection methods available in Abuja metropolis, Nigeria. (M=31.36, SD=9.90), t (394) = 2.73, P >.006. The magnitude of difference in the mean (mean difference =7.55), 95% CL: 0.38 to 2.34) was large (eta squared = 0.52). With these results the third null hypothesis is hereby supported and hence accepted. This implies that the waste collection methods available in Abuja metropolis, Nigeria is not effective and efficient enough.



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Waste disposal method used in Abuja metropolis will not be significant high.

In testing the fourth null hypothesis, the variable is waste disposal method used in Abuja metropolis measured by 10 items. The respondents’ scores on the scale were summed-up. For the disposal factors to be considered significantly high among the respondents, the scores made on the whole scale should be significantly higher/greater than 18 (which is the midpoint between strongly agree and strongly disagree). This implies 3 X 6, the number of items measuring the construct. This null hypothesis was tested with a one-sample t-test (otherwise called population t-test). The results are presented in Table 4.3.

Table 4.3 Population t-test analysis of the waste disposal method used in Abuja metropolis

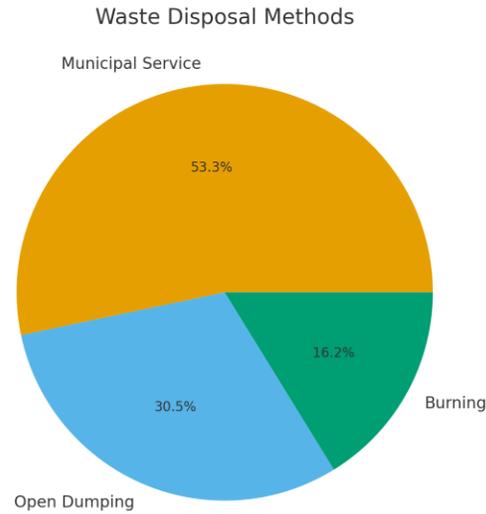
Variable	Sample Mean	Sample SD	Ref. Mean	T	Sig	Remark
The waste disposal method used in Abuja metropolis	31.54	8.85	30	3.46	< .001	Sig.

Source: Field work, 2024

A look at the results indicated that the waste disposal method used in Abuja metropolis, Nigeria. (M=31.54, SD=8.85), $t(394) = 3.46$, $P < .001$. The magnitude of difference in the mean (mean difference = 1.66), 95% CL: 0.67 to 2.42) was large (eta squared = 0.52). With these results the fourth null hypothesis is hereby not supported and hence rejected for the alternative. This implies that the waste disposal method used in Abuja metropolis is statistically and significantly positive among the waste disposal method used in Abuja metropolis



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Waste recycling practices will not significantly help to reduce municipal waste in Abuja metropolis

In testing the fifth null hypothesis, the variable of interest is Waste recycling practices and reduce municipal waste in Abuja, measured by 10 items. The respondents' scores on the scale were summed-up. For Waste recycling practices help to reduce municipal waste in Abuja metropolis among respondents to be considered significantly high, the scores made on the whole scale should be significantly higher/greater than 30 (which is the midpoint between strongly agree and strongly disagree). This implies 3 X 10, the number of items measuring the construct. This null hypothesis was tested with a one-sample t-test (otherwise called population t-test). The results are presented in Table 4.4.

Table 4.4 Population t-test analysis of Waste recycling practices helps to reduce municipal waste in Abuja metropolis

Variable	Sample Mean	Sample SD	Ref. Mean	T	Sig	Remark
Waste recycling practices to reduce municipal waste in Abuja metropolis	30.26	9.76	30	0.531	< .595	NS.

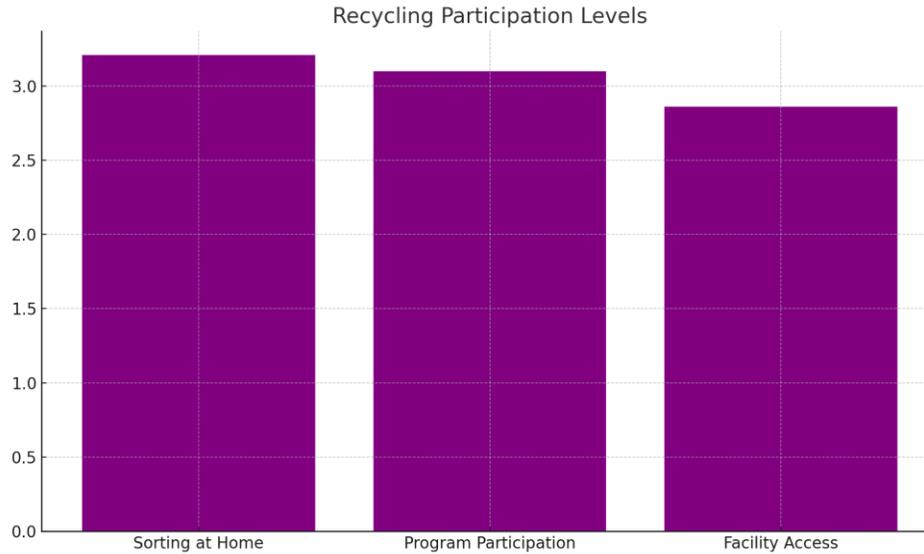
Source: Field work, 2024

Table 4.15 clearly indicated a statistically significant high Waste recycling practices will not significantly help to reduce municipal waste in Abuja metropolis (M=30.26, SD=9.76), $t(394) = 0.531, P < .595$. The magnitude of difference in the mean (mean difference = 1.95), 95% CL: 2.66 to 4.15) was very large (eta squared = 0.51). With these results the fifth null hypothesis is hereby



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supported. This implies that Waste recycling practices will not significantly help to reduce municipal waste in Abuja metropolis



The results indicate moderate efficiency in waste collection and poor recycling participation

Conclusion

The study concludes that, despite widespread awareness of solid waste management in Abuja Metropolis, a critical gap persists between knowledge and effective, sustainable practices. Waste collection and disposal systems operate but struggle with inconsistency, environmental concerns, and insufficient infrastructure that undermine their efficiency. Recycling, vital for sustainable management and conservation, remains limited due to infrastructure gaps and low engagement.

Current policies and regulations are not well enforced and lack strong support, limiting their ability to change waste management behaviour or drive innovation. Informal waste actors, crucial for recycling and material recovery, remain outside official management, which weakens the system's resilience and inclusiveness.

The findings suggest that addressing Abuja's solid waste management challenges requires coordinated interventions in policy, institutions, infrastructure, technology, and community engagement. Involving all stakeholder's government, private sector, informal workers, and the public is essential to create a sustainable, equitable, and effective waste management system.

Recommendations

Based on the findings and conclusions, the following recommendations are proposed to improve municipal solid waste management in Abuja Metropolis:



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1. Targeted campaigns outlining environmental and health impacts of improper waste disposal and this campaign should focus on educational programs have to cover hazardous waste, recycling benefits, and citizens' reporting obligations.
2. Waste collection services' frequency and availability need to be improved, implementing environmentally friendly techniques.
3. Recycling centers, materials recovery facilities, and composting facilities must receive more investment.
4. Create firm enforcement, performance metrics, and incentives for compliance and innovation.
5. Public-private partnership to create and introduce technologies in waste-to-energy.
6. Behavioral barriers and drivers to segregation of waste and recycling particularly.
7. Innovative technology solutions can help increase efficiency and reduce operational costs.

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