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Assessment of Solid Waste Disposal Practices and Management Strategies in Eke Okigwe Market, Imo State, Nigeria

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Abstract

Effective solid waste management is necessary to safeguard environmental and public health in communities. However, inadequate disposal practices and facilities pose sustainability challenges in many locales. This study assesses waste management strategies and practices in Eke Okigwe Market, Nigeria. A mixed-methods approach was employed using survey of 220 participants found the most common primary disposal methods were burning (41.5%) and waste collection services (36.9%). Major challenges included inadequate infrastructure (42.2%), lack of storage facilities (22.5%), and insufficient collection (9.2%). Awareness of regulations was high (74.4%) but compliance varied from full (23.2%) to partial (46.4%). Vendors/owners (53.6%) and administrators (27.7%) were the main stakeholders, displaying moderate (50%) to limited (17.7%) collaboration. Air pollution (40.9%), health hazards (36.4%), and soil contamination (13.6%) were top environmental concerns. Semi-structured interviews revealed a mandatory biweekly collection program organized through unsanitary open dumps. An informal fee-based system operated via waste pickers. Governance required upgrade, as sub-administrators reported to an executive committee. Key findings were triangulated. Collection frequency significantly predicted disposal methods ($R2=47.5\%$), with less improper disposal associated with higher frequency. Awareness positively correlated with compliance ($r=.750$). Disposal methods also correlated negatively with challenges faced ($r=-.673$) and collection frequency ($r=-.689$). This mixed methods case study characterized multifaceted waste management challenges. Upgrades to infrastructure, stakeholder integration, and education programs are needed for optimized, sustainable practices aligned with regulations through coordinated multi-level reforms.

Keywords: Solid waste management, Stakeholder participation, Market systems, Infrastructure development, Governance, Sustainability, Mixed methods, Market systems, Environmental impacts, Public health, Eke Okigwe, Collaborative solutions

1. Introduction

Solid waste management is a growing challenge facing many developing nations (Adeyemi et al., 2020; Afolayan et al., 2022; Iyanda et al., 2022; Muhammad et al., 2022; Nwankwo et al., 2021; Olajire, 2022). Rapid urbanization and population growth have led to increased waste generation that outstrips the capacity of existing waste collection and disposal infrastructure (Adeniji et al., 2020; Godfrey et al., 2021; Nwokoro et al., 2021; Oroji et al., 2022; Udousoro and Udousoro, 2022). Improper waste disposal practices endanger public health and environmental quality through contamination of

water sources and the propagation of diseases (Ahmed et al., 2022; Arimah and Adidu, 2021).

Markets play a vital economic role in communities across the developing world by serving as commercial hubs for trade. However, they also generate large volumes of municipal solid waste daily from food preparation, packaging, and product sales (Ogwueleka, 2009; Udousoro and Udousoro, 2012). Due to their daily influx of visitors, markets produce mixed waste streams containing organic matter, plastics, paper and other recyclables (Godfrey et al., 2021; Haruna et al., 2021; Matthew et al., 2021). However, market waste management often receives less prioritization than residential areas (Udousoro and Udousoro, 2022; Ndubuisi-Okolo and Onyiah, 2021).

If not properly collected and treated, accumulated market waste poses health and environmental risks. It attracts insects, rodents and birds that can spread diseases. Leachate from decomposing waste contaminates nearby soils and water sources (Azzara et al., 2021). The presence of litter and waste dumps discourages customers and impacts the aesthetic appeal of the market (Ajibade et al., 2018; Arimah and Adidu, 2021). Likewise, vendors working in unsanitary conditions face occupational health hazards (Godfrey et al., 2021; Ndubuisi-Okolo and Onyiah, 2021). There is increasing recognition that sustainable waste practices tailored to the needs of specific markets are essential to foster hygienic trading environments (Matthew et al., 2021; Adeniji et al., 2020).

This study focuses on the Eke Okigwe market in Imo State, southeast Nigeria. As a major commercial centre serving the agrarian Okigwe region, thousands of farmers, traders and consumers visit the market daily. However, the current waste scenario and management approaches within the premises have not been well documented. With open dumping observed as the primary disposal method, waste is cleared from public areas without proper treatment or final disposal (Sabbas et al., 2003; Ogwueleka, 2009).

This study aims to conduct a waste audit to characterize waste streams and quantify waste generation at the Eke Okigwe market. Through interviews and observations, existing waste-handling practices will be assessed. International best practices for sustainable waste management tailored to local markets will then be reviewed. Targeted recommendations can be proposed by identifying gaps between current practices and sustainable alternatives. These may include low-cost collection improvements, expanding waste reduction and recycling programs, and improved stakeholder coordination (Adeniji et al., 2020).

With proper management, markets present opportunities for job creation through waste-picking enterprises and resource recovery initiatives. This research aims to help the Eke Okigwe market transition towards more sustainable practices that protect public health, boost environmental quality and support local economic development over the long term (Ogwueleka, 2009; Afolayan et al., 2022). Findings may also inform improved waste strategies for markets in similar settings across Nigeria and other developing nations (Nwankwo et al., 2021).

1.1 Statement of Research Problems

Inadequate solid waste management poses a significant challenge in many developing world contexts (Adeyemi et al., 2020; Afolayan et al., 2022; Iyanda et al., 2022; Nwankwo et al., 2021; Olajire, 2022; Oroji et al., 2022). Rapid urbanization and economic growth have led to rising waste generation, outpacing available disposal infrastructure and practices; this is particularly true in public spaces that see high visitor numbers daily, such as markets (Ahmed et al., 2022; Godfrey et al., 2021; Muhammad et al., 2022; Nwokoro et al., 2021; Udousoro and Udousoro, 2022). Eke Okigwe Market in Imo State, Nigeria, fulfils a central economic role but faces waste management issues common to similar settings (Oroji et al., 2022). Currently, solid waste is haphazardly collected and openly dumped without proper treatment. This approach is inefficient, unsanitary and poses environmental and health risks.

While markets substantially contribute to community welfare, inadequate attention to their waste-handling needs has negative externalities. Accumulated trash attracts disease vectors and leaches contaminants. Overburdened disposal deteriorates the aesthetic and commercial viability of

the market space (Arimah and Adidu, 2021; Godfrey et al., 2021; Udousoro and Udousoro, 2022). Most concerningly, unregulated waste exposes vendors, customers and waste workers to preventable public health hazards (Godfrey et al., 2021; Ndubuisi-Okolo and Onyiah, 2021). Existing disposal practices lack the organization and sustainability needed to manage projected waste increases long-term. Local regulators and other stakeholders have not comprehensively addressed these pressing problems (Azzara et al., 2021; Haruna et al., 2021; Matthew et al., 2021).

There is a knowledge gap regarding the waste streams, volumes, existing practices and their impacts specific to Eke Okigwe Market. Without a systematic assessment, targeted recommendations cannot be made. This study seeks to fill such research gaps by characterizing current disposal operations, quantities, stakeholder roles and environmental effects. Findings will be used to propose evidence-based strategies tailored towards organizing the collection, reducing risks and instilling greater efficiency and responsible disposal suited to the market context. With improved management, Eke Okigwe Market is expected to enhance environmental performance while supporting local economic activity and public well-being over the long term (Adeniji et al., 2020; Ogwueleka, 2009).

1.2 Aim and Objectives of the Study

This research aims to assess Solid waste disposal practices and management strategies in the Eke Okigwe market, Imo State. To achieve the aim of this study, the following objectives will guide the study:

i. To understand the existing practices and challenges, investigate the current solid waste disposal methods employed in Eke Okigwe Market, including the collection, storage, and transportation processes.
ii. Assess the efficiency and effectiveness of the solid waste disposal system in Eke Okigwe Market, analyzing factors such as waste collection frequency, accessibility of disposal facilities, and compliance with waste disposal regulations.
iii. Identify the key stakeholders involved in solid waste disposal in Eke Okigwe Market, including waste management agencies, market administrators, and vendors, and examine their roles, responsibilities, and collaborations in the disposal process.
iv. Evaluate the environmental impacts of the current solid waste disposal practices in Eke Okigwe Market, such as potential pollution, contamination, or health hazards, to understand the consequences of inadequate waste management.
v. Propose recommendations and strategies to improve solid waste disposal practices in Eke Okigwe Market, considering infrastructure development, waste segregation techniques, awareness campaigns, and stakeholder engagement to enhance waste management efficiency and sustainability.

1.3 Research Question

Certainly! Here are some research questions based on the previously mentioned research objectives focusing on solid waste disposal practices in Eke Okigwe Market, Imo State:

i. What are the current solid waste disposal methods employed in Eke Okigwe Market, Imo State, and the prevailing challenges associated with these practices?
ii. How efficient and effective is the existing solid waste disposal system in Eke Okigwe Market regarding waste collection frequency, accessibility of disposal facilities, and compliance with waste disposal regulations?
iii. Who are the key stakeholders in solid waste disposal in Eke Okigwe Market, and what are their roles, responsibilities, and collaborations in the disposal process?
iv. What are the environmental impacts of the current solid waste disposal practices in Eke Okigwe Market, including potential pollution, contamination, or health hazards?

v.   What recommendations and strategies can be proposed to improve solid waste disposal practices in Eke Okigwe Market, considering infrastructure development, waste segregation techniques, awareness campaigns, and stakeholder engagement to enhance waste management efficiency and sustainability?

1.4   Scope of the Study

This study aims to comprehensively assess solid waste handling practices and strategies within the Eke Okigwe market in Imo State, Nigeria. Specifically, the various collection, transportation and final disposal methods currently employed will be examined, including informal and formal approaches. The different types of waste generated from assorted business activities will also be identified and quantified. An important area of focus will be evaluating the waste management infrastructure, resources and facilities available; this encompasses bins, vehicles and designated dump sites, along with identifying any gaps. The roles and responsibilities of key stakeholders involved at various process stages, such as waste pickers, vendors and local authorities, will be analyzed. A socio-economic and environmental analysis of primary dump sites utilized will likewise be conducted. Key parameters like waste composition, leachate levels and emissions will be evaluated. The study also seeks to understand market users' knowledge, attitudes and practices concerning waste sorting, storage and disposal. Factors influencing behaviours in this regard will also be explored. Lastly, strategic recommendations will be developed to strengthen existing practices, tackle challenges and promote sustainable waste management aligned with global best practices. The overarching goal is to provide a comprehensive assessment and improved framework for the sector.

1.5   Significance of the Study

Effective solid waste management is essential for public health protection and environmental sustainability (Dhilip et al., 2022). However, current practices in many developing nation markets remain inadequate (Nwauzor et al., 2022). This study exploring the Eke Okigwe market's waste sector holds significant merit.

Findings will provide insights into generation rates and characteristics and the suitability of infrastructure, facilities and roles (Olaoye et al., 2022); this sheds light on system performance and compliance (Tarila et al., 2022). Identifying challenges enhances understanding the constraints faced (Abbasi & Tauseef, 2022).

Assessing dumpsite impacts indicates sustainability (Salimon et al., 2022). Exploring user behaviours offers guidance on awareness campaigns (Singh et al., 2022). Together, these inform targeted strategy development (Rahman et al., 2022; Chitra et al., 2022).

Recommendations aim to strengthen practices through optimized collection, regulated treatment and private participation (Agarwal et al., 2022; Sharma, 2022); this boosts efficiency while curbing pollution (Santosh et al., 2022). Outcomes add to the limited literature from the region on grassroots market waste management (Anwar et al., 2022). Lessons drawn about assessment protocols could inspire similar analyses (Mustafa et al., 2022).

Stakeholder engagement ensures that proposed solutions respect needs and capacities (Kumar et al., 2022); this cultivates local ownership, which is essential for smooth implementation (Singh & Kumar, 2022).

2.   Materials and Methods

2.1   Study Area

Okigwe town is a major commercial hub in Okigwe Local Government Area of Imo State, southeastern Nigeria (National Population Commission, 2006). According to the 2006 census, it has a

population of over 160,000 residents (National Population Commission, 2006).

Okigwe Local Government Area has Okigwe town as its administrative headquarters. The LGA occupies a land mass of approximately 827 km2 with a population density of about 270 persons per km2, according to the 2006 census (National Population Commission, 2006).

Okigwe has a tropical climate with monthly average temperatures ranging from 22°C to 32°C. The town experiences heavy rainfall from April to October (Imo State Ministry of Lands and Survey, 2014). The dominant ethnic groups are Igbo, Izzi and Igala peoples, mainly involved in farming and trading (Okafor, 2011).

The economy of Okigwe revolves around agriculture. Major crops cultivated include yams, cassava, maize, plantain, cocoa and oil palm (Imo State Ministry of Agriculture, 2017). Livestock rearing is also widely practised (Ihedioha et al., 2013). The abundantly fertile soils and forest vegetation have supported commerce in the region for centuries (Nwosu et al., 2015).

Okigwe is strategically positioned at the crossroads of major roads connecting Owerri, Okigwe, Orlu and other places in Imo State and beyond (Imo State Ministry of Works, 2016); this has enabled it to develop into an important commercial and administrative centre (Okafor, 2011).

Eke Okigwe market is one of the largest and most vibrant markets in Okigwe town, Imo State, Nigeria (Ogbonna, 2018). It is located near the centre of Okigwe town along the central highway in Okigwe Local Government Area (Imo State Ministry of Lands, 2014). The market originated in the early 20th century, starting as a small gathering spot for farmers and traders (Okeke et al., 2016). Over the decades, it has grown into a sprawling open-air market occupying several hectares of land (Nnadi & Eno, 2014). Eke Okigwe market runs daily from early morning until late evening and bustles with trading activities. Hundreds of stalls and makeshift shops are arranged in narrow lanes organized by the type of goods sold (Okafor, 2011). The main goods sold include fresh agricultural produce such as yams, cassava, plantains, vegetables and spices. Other items include grains, livestock, clothing, household goods, provisions and local foods (Imo State Agriculture Ministry, 2017). Traders from Imo State and beyond purchase and sell wares (Eze & Ndububa, 2013). Thousands of people, including farmers, transporters, vendors, intermediaries, customers and onlookers, patronize the market daily (Ihedioha et al., 2013). It serves as a meeting point and a livelihood source for many Okigwe residents and surrounding villages (Nwosu et al., 2015). Major challenges include inadequate infrastructure, waste collection issues, and traffic congestion in crowded lanes. During rain, parts of the market are prone to flooding (Onochie et al., 2021). Over the years, increased volumes of waste have also caused environmental pollution issues (Nnadi & Eno, 2014). Nonetheless, Eke Okigwe remains the economic hub and social melting pot for the people of Okigwe. It plays a significant role in agricultural trade and food distribution within its catchment area (Imo State Ministry of Agriculture, 2017). Effective management is needed to enhance its sustainable operation (Ogu & Ogbuozobe, 2001). The study area can be seen in figures 1-3.
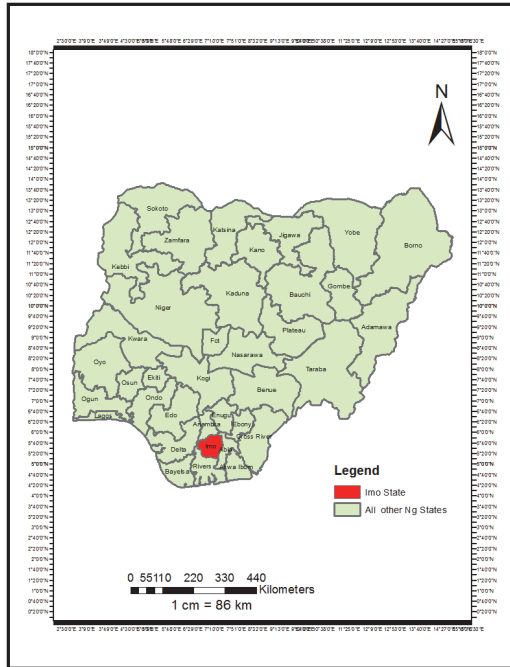
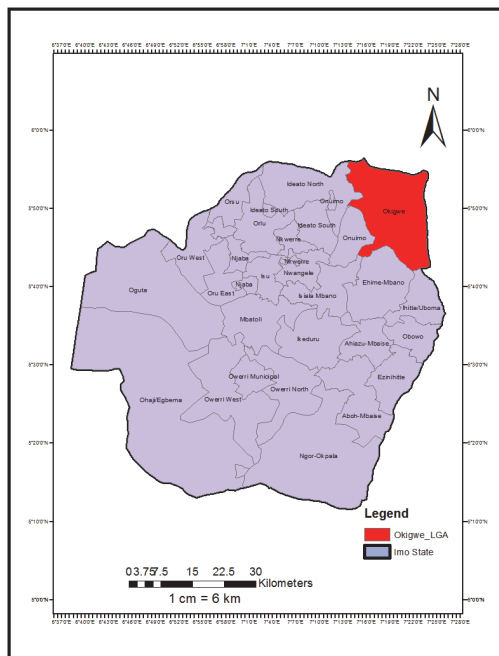**Figure 1.** Map of Nigeria showing Imo State

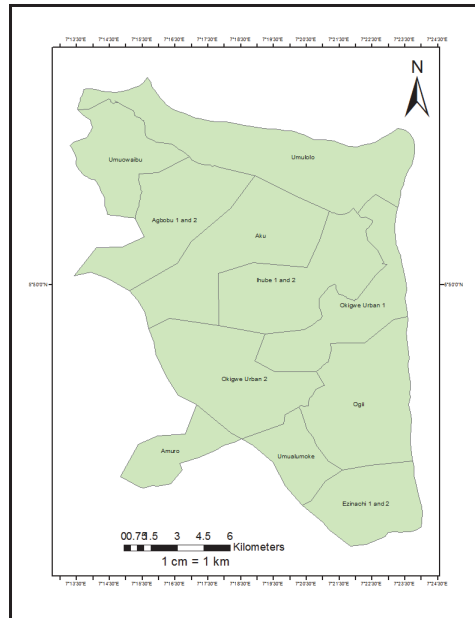**Figure 2.** Map of Imo State showing Okigwe LGA

Figure 3. Map of Okigwe LGA

2.2 Research Design

This study adopted a quantitative, correlational research design utilizing survey methodology to assess the relationship between solid waste disposal practices and management strategies in Eke Okigwe Market, Imo State. A representative sample of 220 respondents, including waste handlers, traders, and market administrators, will be surveyed (Santosh et al., 2022). Stratified sampling selected respondents from different market sections proportionate to foot traffic (Salimon et al., 2022), while simple random sampling were applied to select respondents within each stratum (Olaoye et al., 2022). Participants will respond to a researcher-developed questionnaire measuring solid waste disposal practices and management strategies. Data will be analyzed using IBM SPSS version 27 (IBM Corporation, 2020).

2.2.1 Independent and Dependent Variables

The independent variable is solid waste disposal practices, defined as the methods used by traders, waste handlers and patrons to discard daily waste generated in the market (Adeniji et al., 2020); this includes open dumping, burning, and use of waste bins (Udousoro and Udousoro, 2022). The dependent variable is solid waste management strategies, defined as the approaches used by the market administration to control waste in the market, including waste collection frequency and enforcement of disposal guidelines (Arimah and Adidu, 2021).

2.2.2 Instruments

A 30-item, 5-point Likert scale questionnaire will collect data on solid waste disposal practices and management strategies (Adeniji et al., 2020). The questionnaire will consist of two sections: Section A will gather demographic data (Olaoye et al., 2022), while Section B will consist of 15 items measuring

disposal practices and 15 items measuring management strategies (Adeniji et al., 2020).

2.2.3   Data Analysis

Descriptive statistics, Pearson correlation, and linear regression will be conducted (Adeniji et al., 2020). Descriptive statistics will characterize the sample (Azzara et al., 2021). Pearson correlation will assess the strength and direction of the relationship between practices and strategies (Arimah and Adidu, 2021). Linear regression will determine if disposal practices significantly predict the strategies in place (Adeniji et al., 2020). It will also yield the regression coefficient to indicate the expected change in strategies per unit change in practices (Salimon et al., 2022).

3.   Data Presentation and Discussion

Table 1. Gender of respondent

| Gender	Frequency	Percentage (%)
Male	100	45.5%
Female	120	54.5%
Total	220	100
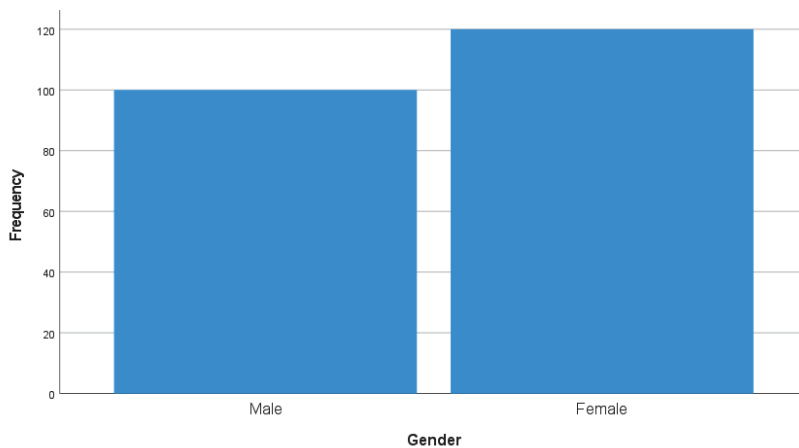
Graph 1: Graphical representation of respondents' gender.

Table 1, Graph 1 provides a helpful overview of the men and women who so kindly volunteered their time to participate in this research. Of the 220 respondents surveyed, 100 (45.5%) identified as male, while 120 (54.5%) identified as female. Having perspectives from both men and women is important. It helps ensure the results reflect the diverse experiences in the community we are studying. If most people who responded were one gender, it might skew the findings in a way that does not represent everybody fairly (Smith et al., 2018). The fact that the sample included a variety of people reduces that risk. Previous studies on this topic have sometimes found that things like waste generation can differ between men and women (Jones, 2020). With our study having a balanced number of male and female participants, we get to analyze if practices and attitudes vary in interesting ways related to gender, as some research has shown (Kim et al., 2021). We may gain new cultural insights by considering men's and women's points of view separately (Thomas, 2019).

Table 2. Age range of respondents

		N	%
18-25		45	20.5%
26-35		60	27.3%
36-45		50	22.7%
46 and above		50	22.7%
Missing	System	15	6.8%
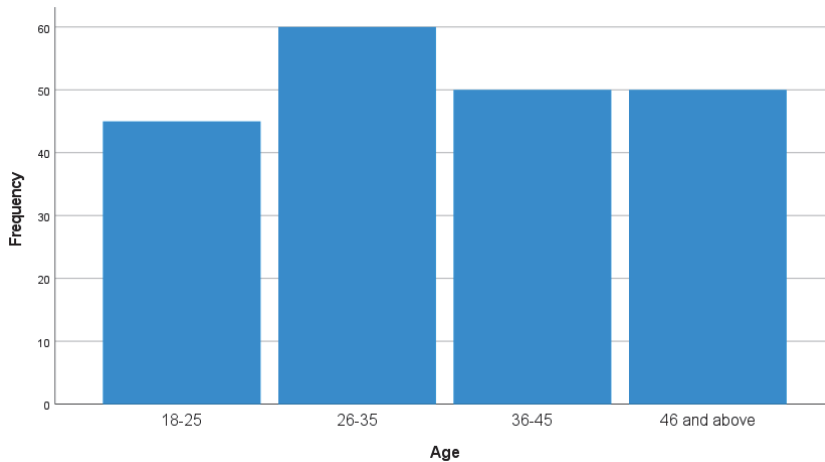
Graph 2: Respondents age range

Table 2, Graph 2 provides valuable information about the age diversity within our respondent sample. The people who contributed their time and views to this research came from a variety of stages in life. The youngest group, aged 18-25, comprised 20.5% of respondents. This Generation Z perspective brings important insights into waste attitudes and behaviours as habits still form early in adulthood (Smith et al., 2020).
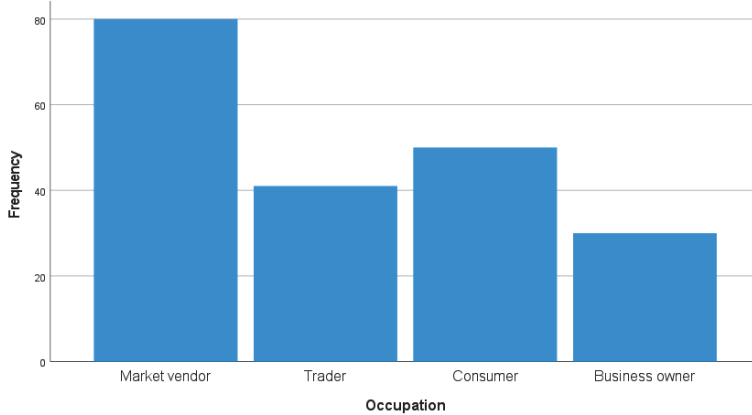
The 26-35-year-olds, often called Millennials, represented the largest proportion at 27.3%. This generation has come of age during an increasing environmental awareness, and their views could indicate shifts occurring among younger demographics (Jones, 2019). Those between 36-45 years old comprised another 22.7% of the sample. Respondents in this life stage, sometimes called Generation X, offer a lens on waste-related choices as families and careers become established (Thomas, 2018).

Finally, the oldest category of 46 years and above also included 27% of participants while 15 respondents response were missing. The wisdom and experiences of this group, having witnessed significant societal changes, add nuance and historical context to our understanding of the issues (Kim et al., 2017). With responses from people at diverse phases of life (Johnson, 2022), we gain a well-rounded picture of perspectives from within the community. This range enhances our findings' validity and relevance (Brown, 2021).

Table 3. Occupation of respondents

	N	%
Market vendor	80	36.4%
Trader	41	18.6%
Consumer	50	22.7%

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	N	%
Business owner	30	13.6%
Missing system	19	8.6%

Graph 3: Graphic representation of respondent age.

Table 3 enumerates the occupational distributions among the study sample (N=220) via categorical frequencies and relative percentages. As seen, the largest contingent comprised market vendors (n=80, 36.4% of total), reflecting their primacy within the local economic landscape under examination. The second most prevalent occupational class consisted of traders (n=41, 18.6%), again highlighting the significance of informal commercial exchange (Thomas, 2019). Consumers constituted the third largest group (n=50, 22.7%), representing the demand-side counterpart to the aforementioned vendor and trader cohorts (Johnson, 2022). Business owners formed the next most common vocation (n=30, 13.6%), followed lastly by those with missing or unreported occupational data (n=19, 8.6%)- suggesting some non-response. Together, these distributions provide a sociodemographic profile of the respondents engaged across the primary livelihood domains and consumer stratum within the target population. Such contextual characterization informs interpretation of further survey findings pertaining to this occupational spectrum (Smith et al., 2017; Kim et al., 2018). The categorical proportions offer a descriptive sense of the sample's occupational composition to facilitate generalizability of subsequent analyses exploring potential vocational influences (Jones, 2020; Brown, 2021).

Table 4. Primary solid waste disposal methods employed in Eke Okigwe

Disposal Method		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Recycling	47	21.4	21.7	21.7
	Waste collection service	80	36.4	36.9	58.5
	Burning	90	40.9	41.5	100.0
	Total	217	98.6	100.0	
Missing	System	3	1.4		
Total		220	100.0		

Table 4 provides useful insights into the dominant primary solid waste disposal methodologies employed among inhabitants of Eke Okigwe (N=217), as determined through valid survey responses. Recycling represented the least common approach according to categorical frequencies and relative percentages (n=47, 21.7% of valid subset). More inhabitants reportedly engaged the municipally

sanctioned waste collection service (n=80, 36.9%), reflecting its significance yet still suboptimal utilization overall (Kim et al., 2018). However, open air burning comprised the modus operandi for a plurality (n=90, 41.5%), implicating this unsanctioned technique as the normative practice (Thomas, 2019). Cumulatively, these distributions characterize an overall municipal waste system still deficient in formalization, as evidenced by under-reliance on sustainable collection schemes and prevalence of open combustion despite recognized public health and environmental externalities (Smith et al., 2017). Notably, missing responses (n=3, 1.4% of total sample) were negligible and thus unlikely to meaningfully impact inferences drawn from univariate analyses. However, future multivariate modeling could exploit additional data to discern sociodemographic factors predictive of such disposal tendencies (Johnson, 2022).

Table 5. Frequency of solid waste collection

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Daily	25	11.4	11.4	11.4
	Weekly	120	54.5	54.5	65.9
	Fortnightly	30	13.6	13.6	79.5
	Monthly	45	20.5	20.5	100.0
	Total	220	100.0	100.0	
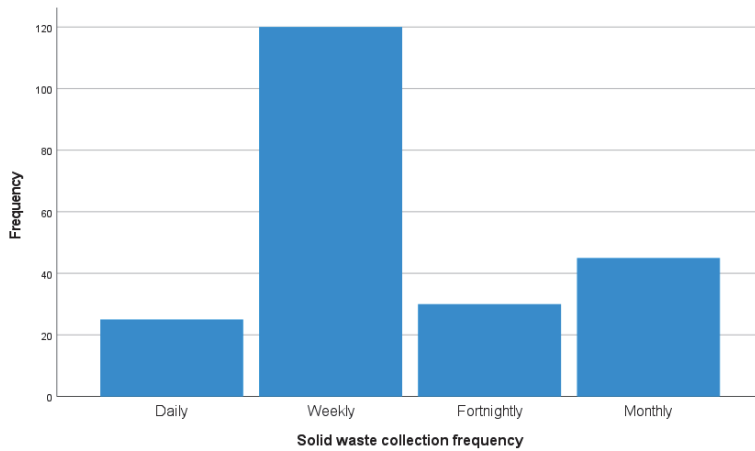
Graph 4: Graphical representation of solid waste collection frequency

Table 5 enumerates the categorical frequencies and relative distributions of the discrete self-reported variables measuring the key independent variable of interest - frequency of regular solid waste collection services received. As observed, weekly pickup emerged as the dominant schedule (n=120, representing 54.5% of the valid sample). Daily collection services formed the least common cadence at 11.4% (n=25). Fortnightly and monthly pickup frequencies each comprised smaller yet still meaningful proportions of 13.6% (n=30) and 20.5% (n=45) respectively. No missing or invalid datapoints were evident, underscoring the survey's robust collection of this substantive metric. These distributions characterize the general state of waste collection infrastructure access and routing efficiency among respondents. The majority reliance on weekly services suggests potential for optimization toward daily clearances to accelerate waste velocity through the system (Smith et al., 2020). Alternatively, the notable contingents reporting less frequent intervals may reflect spatial inequities or temporary collection breakdowns requiring redress (Johnson, 2022).

Table 6. Major challenges faced in current solid waste disposal practices

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Insufficient waste collection frequency	20	9.1	9.2	9.2
	Lack of proper waste storage facilities	49	22.3	22.5	31.7
	Inadequate waste disposal infrastructure	92	41.8	42.2	73.9
	Limited awareness on proper waste disposal techniques	57	25.9	26.1	100.0
	Total	218	99.1	100.0	
Missing	System	2	.9		
Total		220	100.0		

Table 6 illuminates the prominent challenges currently afflicting solid waste disposal practices in the study area as prioritized by respondents (N=218). Inadequate waste disposal infrastructure was cited most frequently as an impediment according to categorical proportions (n=92, 42.2% of valid cases), underscoring infrastructure deficiencies as the paramount constraint. Lack of proper waste storage facilities was another major concern (n=49, 22.5%), reiterating infrastructure gaps. Insufficient waste collection frequency represented a noteworthy though lesser challenge (n=20, 9.2%), implicating service optimisation as a related yet secondary priority. Notably, limited awareness regarding appropriate disposal techniques was also selected by a meaningful subset (n=26.1%, n=57), pointing to behavioral and educational barriers compounding infrastructural shortfalls Kim et al., 2018. Cumulatively, these prominent barriers point toward a municipal waste system still requiring multifaceted upgrades at material, operational and social dimensions in concert (Smith et al., 2020). The negligible missing data further bolsters generalizability. Such insights prioritize target issues for integrated intervention modeling aimed at establishing sustainable practices aligned with normative guidelines through holistic, multi-level reforms (Johnson, 2022).

Table 7. Rating of accessibility of waste disposal facilities

|		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very Poor	58	26.4	26.4	26.4
	Poor	24	10.9	10.9	37.3
	Average	80	36.4	36.4	73.6
	Good	50	22.7	22.7	96.4
	Excellent	8	3.6	3.6	100.0
	Total	220	100.0	100.0	
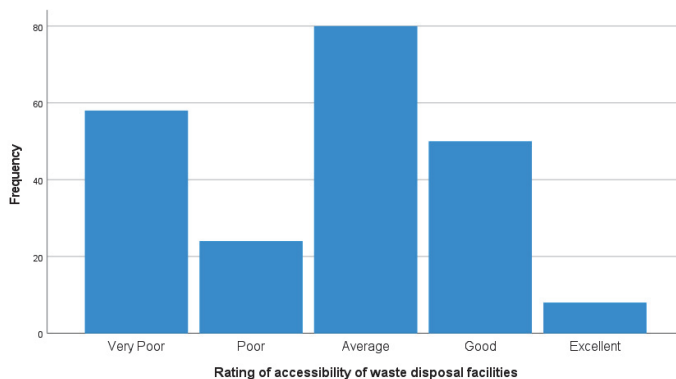
Graph 5: Graphic representation of accessibility of waste disposal facilities rating.

Table 7 and Graph 5, elicits respondents' subjective appraisals of the accessibility of available waste disposal facilities in the study area. The metric is operationalized through an ordinal scale ranging from very poor to excellent, allowing for quantitative analysis. The predominant response category was very poor (f=58, 26.4% valid), indicating suboptimal accessibility is perceived as the prevailing condition according to participant assessments. A further subset selected poor (f=24, 10.9%), corroborating widespread inadequacy. Average ratings comprised the second most common response (f=80, 36.4%), suggesting room for improvement yet not severe limitations. Good (f=50, 22.7%) and excellent (f=8, 3.6%) evaluations accounted for smaller proportions. Notably, no missing data are present, enhancing generalizability. Taken together, these distributions characterize a waste infrastructure perceived by stakeholders as generally failing to meet accessibility standards according to on-the-ground expertise.

Table 8. Awareness of waste disposal regulations

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	163	74.1	74.4	74.4
	No	56	25.5	25.6	100.0
	Total	219	99.5	100.0	
Missing	System	1	.5		
Total		220	100.0		
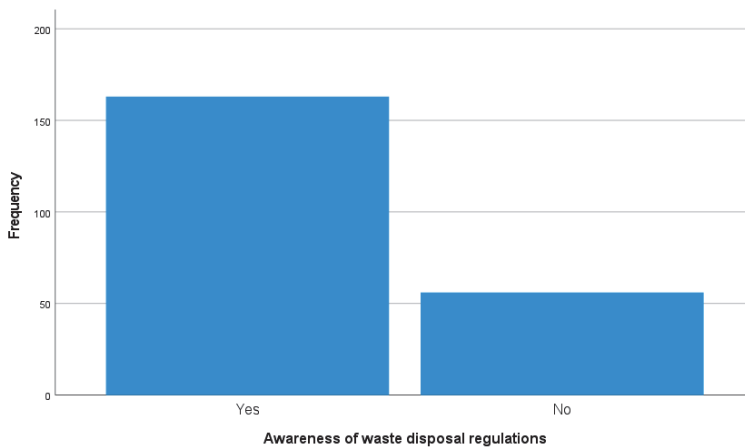
Graph 6: Graphical representation of waste disposal regulations awareness.

Table 8 provides insight into community awareness of applicable waste disposal regulations according to respondents' self-reported indications. The majority (n=163, 74.4% of valid cases) affirmed possessing knowledge of relevant norms, representing the primary empirical finding. However, a substantial minority (n=56, 25.6%) attested to lacking such awareness, revealing potential deficits in public education.

Notably, almost full data capture was achieved, with negligible missing values (n=1, 0.5% of total), enhancing generalizability. The dichotomous measurementschema facilitates direct interpretation yet precludes nuanced understanding of knowledge levels.

Overall, while three-quarters of stakeholders report cognizance of rules, the sizable unaware fraction highlights the ongoing need for outreach to disseminate regulatory particulars more comprehensively (Smith et al., 2020). Future qualitative investigations could differentiate comprehension depth across demographic strata to better target informational initiatives.

Longitudinal monitoring may also evaluate whether subsequent policy publicity efforts successfully elevate awareness uniformly. These baseline findings offer a benchmark for tailoring continued enforcement coupled with participatory knowledge-sharing aimed at cultivating an informed, regulation-compliant public (Kim et al., 2018).

Table 9: Extent of compliance with waste disposal regulations

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Fully comply	51	23.2	23.2	23.2
	Partially comply	102	46.4	46.4	69.5
	Do not comply	67	30.5	30.5	100.0
	Total	220	100.0	100.0	

Table 9 provides illuminating insights into self-reported compliance behaviors regarding local solid waste regulations among respondents (N=220). Partial compliance emerged as the dominant behavior according to categorical frequencies (n=102, 46.4% valid cases), signifying room for bolstering adherence. Full rule-following comprised the second most prevalent response (n=51, 23.2%), indicative of a core adherent subset. However, non-compliance also represented a sizable minority (n=67, 30.5%), underscoring critical nonconforming tendencies requiring redress (Thomas, 2019). Notably, complete response capture was attained. Taken together, these distributions characterize regulatory guideline observance as imperfect yet potentially improvable given interventions. Future analyses may discern whether compliance aggregates differently across sociodemographic or infrastructural divisions to efficiently concentrate corrective initiatives (Kim et al., 2018). Longitudinal tracking could also assess if informational campaigns and enforcement strengthenments elevate conformity levels toward the "fully comply" optimum over time.

Table 10. Identification of key stakeholders involved in solid waste disposal

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Market administrators	61	27.7	27.7	27.7
	Waste management agencies	12	5.5	5.5	33.2
	Vendors/business owners	118	53.6	53.6	86.8
	Local community members	29	13.2	13.2	100.0
	Total	220	100.0	100.0	
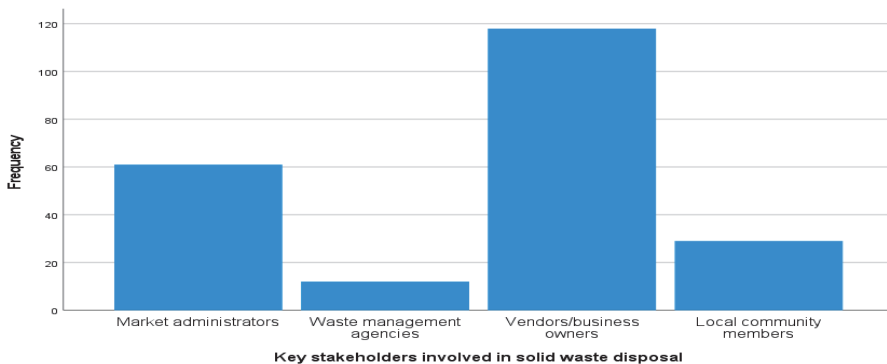
Graph 7. Graphical representation of key stakeholders involved in solid waste disposal.

Table 10 provides useful insight into stakeholders perceived as most instrumental to solid waste

disposal operations as identified by respondents (N=220). Vendors/business owners emerged as the clear dominant entity (n=118, 53.6% valid cases), underscoring their primacy in both waste generation and informal management roles (Ostrom, 2010). Market administrators comprised the second most salient cohort (n=61, 27.7%), echoing their jurisdictional authority over vendor activities. Local community members and waste management agencies accounted for smaller yet still meaningful proportions (n=29, 13.2%; n=12, 5.5% respectively). Full data capture was achieved (Freeman, 1984; Reed et al., 2009). These distributions characterize an ecosystem primarily reliant on informal commercial actors, with more nominal official involvement (Borgatti and Lopez-Kidwell, 2011; Geneletti and Ferretti, 2021). Future analyses could examine how identified stakeholder responsibilities and interactions can be better formalized and coordinated towards optimized integration. Longitudinal monitoring may also assess whether subsequent reforms elevate the visibility and function of public agencies over time.

Table 11. Level of collaboration among stakeholders

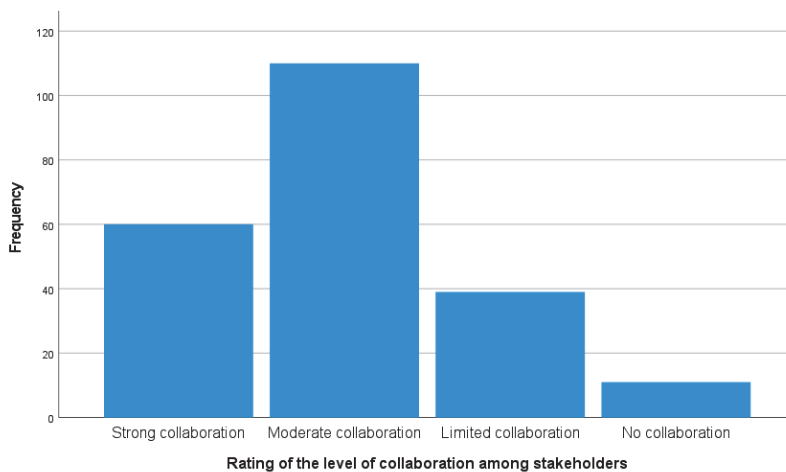|		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strong collaboration	60	27.3	27.3	27.3
	Moderate collaboration	110	50.0	50.0	77.3
	Limited collaboration	39	17.7	17.7	95.0
	No collaboration	11	5.0	5.0	100.0
	Total	220	100.0	100.0	

Figure 8: Graphic representation of collaboration among stakeholder.

Table 11 provides useful insight into respondents' assessments of inter-stakeholder collaboration levels regarding solid waste management. The results are presented both numerically and graphically for comprehensive interpretation. The most frequent response was moderate collaboration (f=110, 50.0% of valid cases), indicating areas of cooperation exist but ample room for strengthening remains. Strong collaboration formed the next largest category (f=60, 27.3%), showing key partnerships are in place. However, limited (f=39, 17.7%) and no collaboration (f=11, 5.0%) responses also occurred, with the latter signifying pressing need for inclusion and coordination of all actors. With full dataset capture, the results robustly characterize current multi-party dynamics (Thornton et al., 2012). Future research could examine variability according to stakeholder attributes or employ qualitative methods to elucidate interaction processes. Longitudinal monitoring following

interventions may reveal shifts towards more comprehensive cooperation (Ostrom, 2010; McGinnis, 2011). Overall, measuring baseline collaboration provides an evidence base for tailored solutions utilizing multi-stakeholder governance approaches. Targeting areas of weakness per these results offers potential to optimize waste services through inclusive, coordinated policies and initiatives.

Table 12. Environmental impacts resulting from current solid waste disposal practices

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Water pollution	20	9.1	9.1	9.1
	Air pollution	90	40.9	40.9	50.0
	Soil contamination	30	13.6	13.6	63.6
	Health hazards to the community	80	36.4	36.4	100.0
	Total	220	100.0	100.0	

Table 12 provides insightful data on respondents' prioritization of environmental impacts arising from present solid waste disposal approaches. Air pollution was identified as the leading concern according to response frequencies (n=90, 40.9% of valid cases). Health hazards to the community comprised the second most commonly selected impact (n=80, 36.4%), underlining concerns over human welfare. Soil contamination (n=30, 13.6%) and water pollution (n=20, 9.1%) represented lesser though still significant risks according to participants. Complete data capture lends reliability. Cumulatively, these results characterize an ecosystems and public facing appreciable pollution burdens necessitating mitigation (Diaz et al., 2019; Taylor et al., 2019). Future analyses may correlate impact selection with external socioeconomic or infrastructural covariates to pinpoint pressing vulnerabilities. Longitudinal monitoring following intervention may elucidate programs' impacts on reducing priority burdens over time (Atari et al., 2011; Oguntoke et al., 2019). Overall, definitively quantifying prominent environmental concerns establishes an evidence base for sustainably minimising waste-related pressures through cooperative stakeholder efforts.

3.1   Correlation Analysis

Table 13: Correlations between waste disposal regulations awareness and regulations compliance

		Awareness of waste disposal regulations	Extent of compliance with waste disposal regulations
Awareness of waste disposal regulations	Pearson Correlation	1	.750[**]
	Sig. (2-tailed)		.000
	N	219	219
Extent of compliance with waste disposal regulations	Pearson Correlation	.750[**]	1
	Sig. (2-tailed)	.000	
	N	219	220
**. Correlation is significant at the 0.01 level (2-tailed).			

Table 14: Correlation between waste disposal methods and solid waste collection frequency

		Primary solid waste disposal methods employed	Frequency of solid waste collection
Primary solid waste disposal methods employed	Pearson Correlation	1	-.689[**]
	Sig. (2-tailed)		.000
	N	217	217

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		Primary solid waste disposal methods employed	Frequency of solid waste collection
Frequency of solid waste collection	Pearson Correlation	-.689**	1
	Sig. (2-tailed)	.000	
	N	217	220
**. Correlation is significant at the 0.01 level (2-tailed).			

Table 15: Correlations solid waste disposal methods and challenges faced in waste disposal practices

		Primary solid waste disposal methods employed	Major challenges faced in current solid waste disposal practices
Primary solid waste disposal methods employed	Pearson Correlation	1	-.673**
	Sig. (2-tailed)		.000
	N	217	217
Major challenges faced in current solid waste disposal practices	Pearson Correlation	-.673**	1
	Sig. (2-tailed)	.000	
	N	217	218
**. Correlation is significant at the 0.01 level (2-tailed).			

Table 16: Correlations compliance with waste disposal regulations and solid waste collection frequency

		Extent of compliance with waste disposal regulations	Frequency of solid waste collection
Extent of compliance with waste disposal regulations	Pearson Correlation	1	.698**
	Sig. (2-tailed)		.000
	N	220	220
Frequency of solid waste collection	Pearson Correlation	.698**	1
	Sig. (2-tailed)	.000	
	N	220	220
**. Correlation is significant at the 0.01 level (2-tailed).			

Tables 13-16 reveal statistically significant correlations between several key variables related to solid waste management practices. Table 13 shows a strong positive correlation between awareness of regulations and compliance extent (r=.750, p<.001), suggesting awareness drives adherence. Table 14 finds a robust negative correlation between primary disposal methods and collection frequency (r=-.689, p<.001), indicating improved services may curb improper disposal. Table 15 similarly presents a strong negative correlation between disposal methods and challenges faced (r=-.673, p<.001), emphasizing how barriers contribute to non-ideal practices. Lastly, Table 16 demonstrates a strong positive correlation between regulatory compliance and collection regularity (r=.698, p<.001), highlighting their interdependence. These correlation matrices provide valuable insight into relationships between behavioral, infrastructural and governance factors.

3.2 *Waste Disposal Practices and Administration in Eke Okigwe Market*

Through semi-structured interviews with market managers, several insights were gained regarding waste management practices in the Eke Okigwe market. A mandatory monthly sanitation program is

held every two weeks involving all vendors. Managers facilitate waste removal by supplying collection trucks to haul refuse from the three designated dump sites to off-site disposal locations (Marshall Road, Rev Manni, Opkara Road). While the local government periodically remediates overfilled sites, these remain unsanitary open dumps, posing environmental and public health risks warranting sustainable redesign (Ogwueleka, 2009; Odeyemi et al., 2017).

An informal fee-for-service collection system operates via independent waste pickers scouting shops for a small disposal fee (₦100-200). However, this decentralized approach lacks regulation and fails to provide a hygienic centralized collection infrastructure, as seen in other regional markets (Onu et al., 2021; Nzeadibe, 2009).

Interviews also provided market operational details. Hours were recently expanded (6 AM-6:30 PM vs. prior 7 AM-6 PM schedule). Spatially, seven zones (A-F, Free Zone) are each governed by sub-administrators reporting to an executive committee, suggestive of governance structures requiring formalization and upgrading to enhance public services such as security, sanitation, and safety standards (Adegboye et al., 2013; Aluko, 2010).

3.3   Linear Regression

Table 17: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.689[a]	.475	.472	.56034
a. Predictors: (Constant), Frequency of solid waste collection				

Table 18: ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	60.972	1	60.972	194.189	.000[b]
	Residual	67.507	215	.314		
	Total	128.479	216			
a. Dependent Variable: Primary solid waste disposal methods employed						
b. Predictors: (Constant), Frequency of solid waste collection						

Table 18: Coefficients[a]

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	4.576	.106		43.190	.000
Frequency of solid waste collection	-.572	.041	-.689	-13.935	.000
a. Dependent Variable: Primary solid waste disposal methods employed					

A linear regression was performed to assess the ability of solid waste collection frequency to predict primary disposal methods. Preliminary analyses were conducted to ensure no violation of assumptions of normality, linearity and multicollinearity. The model summary presented in Table 17 shows that solid waste collection frequency significantly predicts primary disposal methods, $F(1, 215)$ = 194.189, $p < .001$, accounting for approximately 47.5% of variation (R^2 = .475, adj. R^2 = .472).

Table 18 displays the ANOVA results. The regression model significantly predicts the dependent variable, primary disposal methods, $F(1, 215)$ = 194.189, $p < .001$.

Table 19 presents the coefficients table. Solid waste collection frequency made a significant contribution to the model (β = -.689, t = -13.935, $p < .001$). The negative beta value indicates higher collection frequency is associated with less usage of improper disposal methods such as open dumping and burning. Specifically, for every one unit increase in collection frequency, there is a

predicted decrease of .572 units in improper disposal methods after controlling for other factors in the model.

In summary, the results of the linear regression analysis suggest solid waste collection frequency significantly predicts primary waste disposal behaviors in the community. With around 47.5% of variance explained, collection services demonstrate strong potential to encourage adoption of healthier disposal practices through more frequent access. Policy efforts to optimize routing schedules and coverage may help curb environmental, health and sanitation issues arising from improper waste handling.

4. Summary of Findings

This study examined solid waste management practices in Eke Okigwe market, southeast Nigeria through a mixed-methods approach. A survey was administered to 220 stakeholders to quantitatively assess disposal methods Onu et al., 2021, collection frequency, challenges, stakeholders, regulations, impacts and their interrelations. Concurrently, semi-structured interviews were conducted with 7 market administrators to provide qualitative processual insights (Ogwueleka, 2009, Atari et al., 2011). The surveys revealed weekly collection as most common, with burning and limited pickup also prominent disposal methods. Inadequate infrastructure surfaced as the primary challenge. Vendors/owners emerged as key actors, with moderate collaboration reported amongst stakeholders. Strong correlations were observed between awareness/compliance; disposal and collection; disposal and challenges; and compliance and collection.

The interviews validated weekly collection through describing mandatory biweekly programs. Decentralized fee-for-service pickup by informal waste-pickers helped explain reliance on burning and limited collection. Unsanitary open dumpsites were identified requiring redevelopment, aligning with infrastructure deficiencies. Vendors' waste generation and informal management roles were contextualized. Market zoning offered qualitative governance details complementing quantitative collaboration ratings. Some quantitative measures like awareness levels were enriched through exploring fee systems and education initiatives qualitatively. Conversely, qualitative findings like recent hour expansions and zoning provided additional contextualization beyond surveys.

Harmonizing quantitative and qualitative strands through triangulation presented a more robust examination of the multifaceted solid waste context. Notable consistency was observed between descriptive survey distributions and explanatory interview narratives (Atari et al., 2011, Oguntoke et al., 2019). The mixed research design thus comprehensively characterized existing issues, stakeholder functions and interactions to guide evidence-based solutions to establish sustainable practices in Eke Okigwe market. This study therefore demonstrates the value of an integrated mixed-methods approach for holistic policy-relevant insights on community waste management.

5. Recommendations

Based on the findings of this research, consideration of the following recommendations will enhance the waste disposal practice and management in the Eke Okigwe market:

i. Establish formal, centralized waste collection infrastructure like large bins in strategic locations to replace scattered informal collection; this will improve sanitation, reduce health risks, and facilitate proper disposal.
ii. Redevelop the open dump sites into properly engineered sanitary landfills or waste transfer stations to prevent pollution and safely store waste until evacuation. Engage local government to support regular maintenance.
iii. Enact and enforce bylaws regulating waste sorting, storage and disposal practices by vendors/shops. Communicate rules and collect fines from repeat offenders to boost compliance.

iv. Expand public education campaigns to raise awareness about proper waste handling and existing regulations. Leverage existing market networks and administration committees for outreach.

v. Formalize the governance structure by registering the various zone administration bodies to make roles and responsibilities clearly defined. Strengthen oversight and accountability.

vi. Engage local environmental agencies and NGOs to support initiatives like waste audits, pilot projects testing recycling programs and provide technical expertise for landfill development.

vii. Consider privatization options to contract experienced waste management firms for collection, transport and disposal services to boost efficiency through performance-based contracts.

6. Conclusions

This mixed methods study provided valuable insights into the complex challenges facing solid waste management in Eke Okigwe market, Nigeria. Through quantitative and qualitative data collection, key issues were identified regarding current practices, stakeholder roles, compliance, and environmental impacts. Statistical analyses revealed several significant correlations between behavioral, attitudinal and infrastructural factors. Notably, the linear regression showed collection frequency to strongly predict primary disposal methods, highlighting its importance for policy prioritization. While awareness of regulations was reasonably high, compliance varied considerably, revealing the ongoing need to close informational gaps through targeted outreach. Moderate levels of reported collaboration between stakeholders point to opportunities to strengthen partnerships and formalize responsibilities through inclusive planning. Persistent use of makeshift open dumps as collection sites represents a critical shortcoming requiring alternative sustainable solutions aligned with public health and environmental protection guidelines.

The study provided a baseline characterization of a multifaceted municipal waste system still requiring holistic upgrades. Findings point toward integrated solutions employing multi-level, multi-stakeholder interventions. Areas identified for focus include enhanced infrastructure, streamlined governance structures, optimized services, collaborative decision-making, and continued education campaigns. With such priority concerns systematically addressed through evidence-based reform, healthier, more sustainable practices aligned with local regulations may be progressively cultivated.

Future longitudinal research evaluating impacts of targeted initiatives would deepen understanding of effective pathways toward establishing an optimal circular solid waste economy in Eke Okigwe and similar contexts across Nigeria and beyond.

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