

Evaluating Solid Waste and its Management in Akiama-Abalamabie Communities of Bonny Island in Rivers State.

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ABSTRACT

Solid waste management (SWM) is a critical environmental and public health concern in developing regions such as Bonny Island, Rivers State. Rapid urbanization, population growth, and industrial activities in the Akiama–Abalamabie communities have intensified waste generation. This study evaluates the quantity, composition, and management practices of solid waste, as well as community awareness and participation in waste management, using a survey of 140 respondents. Results show that organic waste constitutes the largest proportion of the waste stream (45%), followed by plastics (25%), paper (15%), metals and glass (10%), and other materials (5%). The survey revealed that 64.3% of respondents dispose of waste by open dumping, 17.9% by burning, 10.7% via municipal collection, and only 7.1% engage in recycling or reuse. While 85.7% of respondents are aware of the types of waste generated and 78.6% recognize the environmental and health risks, improper disposal remains prevalent. Additionally, 67.9% of respondents expressed willingness to participate in community recycling programs, indicating potential for intervention. The study recommends adopting integrated solid waste management (ISWM), community education, policy enforcement, recycling initiatives, and infrastructural improvements to enhance sustainability and public health.

Keywords: Solid waste, Waste management, Environmental pollution, Akiama–Abalamabie, Bonny Island, Rivers State

INTRODUCTION

Solid waste is any unwanted, underused, overused discarded material; including trash, garbage and refuse. Resource Conversion and Recovery Act Resource of 1976, defines solid waste as any garbage or refuse, sludge from waste water treatment plant, water supply treatment plant, or air pollution control facility and other discarded materials, resulting from industrial, commercial, mining and agricultural operations and from community activities [1, 2]. Solid waste management is critical environmental and public health issue faced by cities and towns worldwide. Solid waste generated from households, commercial, institutional, and industrial activities is a growing environmental concern. Improper handling contributes to pollution, water contamination, and the spread of vector-borne diseases [3,4]. Relevant literature indicates that solid waste management in Nigeria faces several challenges; ranging from inadequate infrastructure, insufficient funding, poor waste segregation practices, lack of public awareness. Various studies highlighted that waste disposal is often carried out without considering the environmental and health consequences.

In Bonny Local Government of Rivers State, Nigeria; inefficient waste management has seemingly implicated unsanitary conditions, environmental degradation, and health hazards.

Bonny Island, a major oil and gas hub in Rivers State, generates significant household and industrial waste in the Akiama–Abalamabie communities. Residents rely mainly on informal disposal methods, including open dumping and burning, with minimal recycling. This study assesses waste generation, management practices, community awareness, and potential solutions, using data from 140 respondents.

Global and Regional Perspectives

Integrated Solid Waste Management (ISWM) is widely applied in developed countries, combining waste reduction, segregation, recycling, composting, energy recovery, and sanitary landfills [5,6].

In Nigeria, urban centers including Bonny Island face rapid waste accumulation, irregular collection, and minimal recycling, leading to environmental and public health challenges [7,8].

Health and Environmental Impacts

Improper disposal causes soil and water contamination, air pollution from burning, and vector-borne diseases malaria, cholera, diarrheal infections [9,10].

MATERIALS AND METHODS

Study Area

The study was conducted in the Akiama–Abalamabie communities of Bonny Island, Rivers State, a residential and commercial hub with limited municipal waste infrastructure. Akiama and Abalamabie communities of Bonny Local Government area among the 49 communities in Bonny Island. Bonny Local Government is a small local government in land mass; 645.60 km² and size; 215 - 343.9 square kilometer, but rich in petroleum resources. It is an ancient Kingdom, with terminals towards Trans-Atlantic; hence forest areas are converted to settlements with an estimated population of 309,200 people as of year 2022. [11] Until recently, it was accessible by air and water. The Bonny Island axis of Niger Delta, Nigeria is one of the most industrialized belts of Nigeria. It can be said to be a Mini-Nigeria with the indigenes being Ibani tribe, Igbo and others as non-indigenous residents.

Akiama: Also called Okoloama, located on the mainland of Bonny Island, covering residential and community areas with significant population growth due to proximity to oil and gas industrial activities. The area is relatively flat, with a low elevation of around 3.05meter above sea level.

Abalamabie: It is listed as one of the village communities comprising the hinterland of the Kingdom of Bonny, rapidly growing in development and population as a coastal community in the Niger Delta with high density of mangrove swamps and light rainforest vegetation [12].

Data Collection

Survey design: The questionnaire is based on Akiama and Abalamabie Communities which is made up more than 8 villages, but due to the short duration, of the study, it was confined to seven villages in the Bonny Local government.

The total of two hundred (200), questionnaires were distributed via stratified random sampling in and around the selected villages respectively which included Akiama community, Akiama Village, Akiama Road, Abalamabie Road, Simidia, George Tolofari Close, Coconut Estate and Oguede. One hundred and forty (140), responses (sample size), were obtained and used for analysis.

Questionnaire Topics:

1. Types and quantity of waste generated
2. Disposal practices
3. Awareness of health and environmental impacts
4. Willingness to participate in recycling programs

Interviews: Conducted with municipal waste authorities to supplement survey data.

Direct Measurement: Selected households' waste was quantified over 7 days.

Statistical Tools

- Descriptive statistics: frequency, percentage, mean, standard deviation
- Cross-tabulation: association between education, age, and disposal practices
- Graphical representation: pie charts and bar graphs

RESULTS AND DISCUSSION

Based on a survey of 140 respondents regarding solid waste management (SWM), in Akiama-Abalamabie, the findings suggest that the demographic profile, educational level and occupation influenced the respondent awareness and practices, with specific characteristics that influence waste disposal practices as shown in Table 1.

Table 1: Demographic Profile of Respondents (n = 140)

Demographic Variable	Category	Frequency	Percentage (%)
Gender	Male	80	57.1
	Female	60	42.9
Age (years)	18–30	40	28.6
	31–50	70	50.0
	51+	30	21.4
Marital Status	Single	50	35.7
	Married	80	57.1
	Widowed/Divorced	10	7.2
Educational Status	No formal education	10	7.1
	Primary	40	28.6
	Secondary	60	42.9
	Tertiary	30	21.4
Occupational Status	Farming	30	21.4

	Trading/Business	40	28.6
	Public/Private Employment	50	35.7
	Unemployed/Other	20	14.3

Gender: Distribution of respondents shows a slightly higher percentage of males (57.1%) than females (42.9%). This is attributed to voluntary response bias, as male participants indicated more interest in the study.

Age: The majority of respondents are aged 31–50 (50%), married (57.1%), and have secondary education (42.9%). This indicates that a large portion of the respondents are in their active working age, married and at least possess a secondary level education, making them more potentially more adaptable to waste segregation and recycling practices. 57.1% married respondents as against 35.7% single category proved that households generate high volume of solid waste and may indicate willingness to regulated disposal measures of the government, that is the National Environmental Standards and Regulations Enforcement Agency (NESREA) [13].

Occupational Status: Most respondents are engaged in public/private employment (35.7%), followed by trading/business (28.6%), with underemployed and others (14.3%), as least. This could be attributed to higher awareness and educational level of the public/private employment category. The responses of the trading and business operators signify that of the informal sector.

Table 2: Waste Generation Awareness

Response	Frequency	Percentage (%)
Yes	120	85.7
No	20	14.3

Based on the result in Table 2 above, the high awareness of types of waste generated and the management approach as a result of increased global educational efforts. In spite of the level of awareness that high, solid waste management remains a critical global challenge especially in densely populated, rapid urbanizing and industrialized area such as Akiama-Abalamabie Communities, due to gap between knowledge and action, inadequate infrastructure and economic constraints there is a seemingly low compliance to standard waste management practices observed by local authorities.

Table 3: Waste Disposal Practices

Disposal Method	Frequency	Percentage (%)
Open dumping	90	64.3
Burning	25	17.9

Municipal collection	15	10.7
Recycling / Reuse	10	7.1

Table 3 indicate that Open dumping (64,3%), is dominant, as it is characterized by availability of space, cheap and low or no technological solutions. Municipal waste collection in Bonny Local Government, with reference to the covered area is irregular, and formal recycling is minimal. This may be due to inadequate modern infrastructure, rapid and unplanned urban growth.

Table 4: Awareness of Health and Environmental Impacts

Response	Frequency	Percentage (%)
Yes	110	78.6
No	30	21.4

Table 4 show that most respondents understand the risks of poor solid waste management and disposal practices, but practices do not always align with awareness. Deliberate management policies; reducing, reusing and recycling to minimize landfill reliance, strict regulations and advanced sustainable technologies to proffer as solutions.

Table 5: Willingness to Participate in Recycling Programs

Response	Frequency	Percentage (%)
Yes	95	67.9
No	45	32.1

Table 5 provides a strong proof that majority of respondents (67.9%) are willing to participate in recycling programs if available, suggesting potential for community-based interventions.

Table 6: Waste Composition (Direct Measurement)

Waste Type	Average Daily Proportion (%)	Observations
Organic	45	Food/garden waste dominates
Plastics	25	Mostly packaging materials

Paper	15	Newspapers, cardboard
Metals & Glass	10	Bottles, cans, scrap metal
Others	5	Textiles, e-waste

Correlation Analysis

Example: Education vs proper disposal practices

Education Level	Proper Disposal (%)
None	0
Primary	10
Secondary	15
Tertiary	40

Observation: Positive correlation ($r \approx 0.65$), indicating education strongly influences proper disposal.

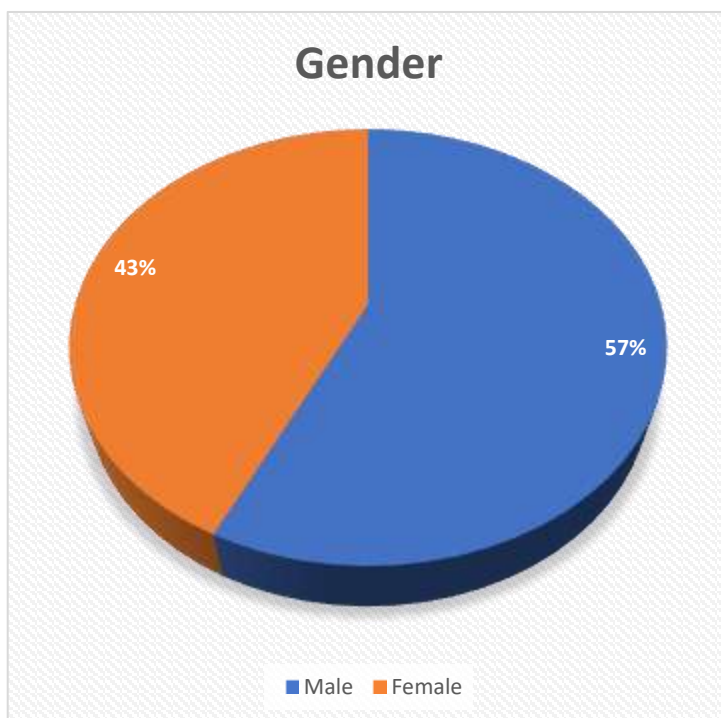


Fig. 1. Chart of Male Verses Female respondents

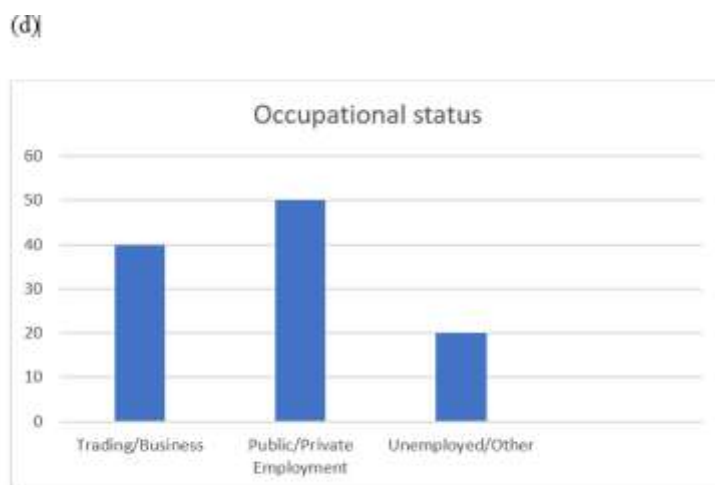
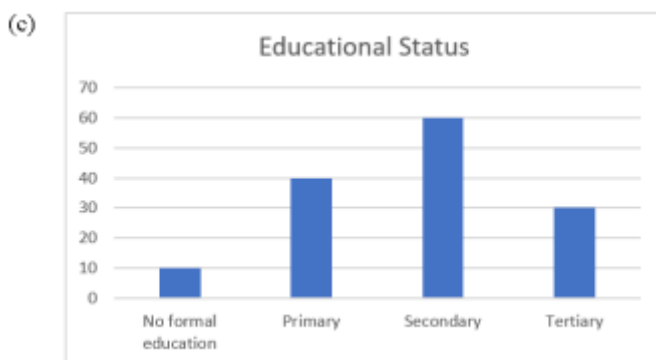
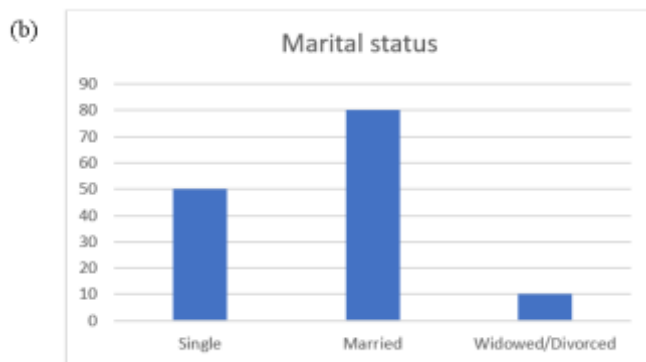
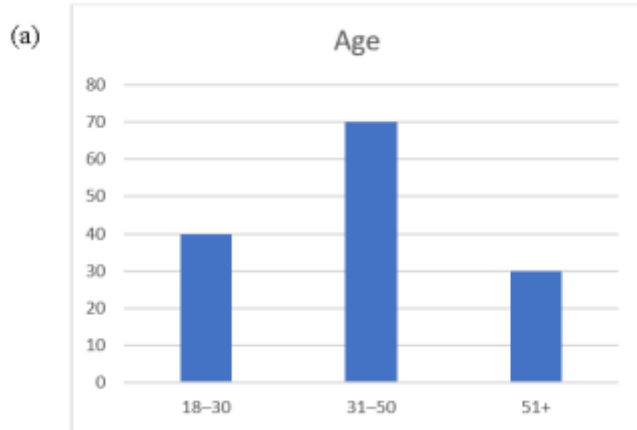


Fig. 2. Charts of: Age, Marital status, Educational status, and Occupational status.

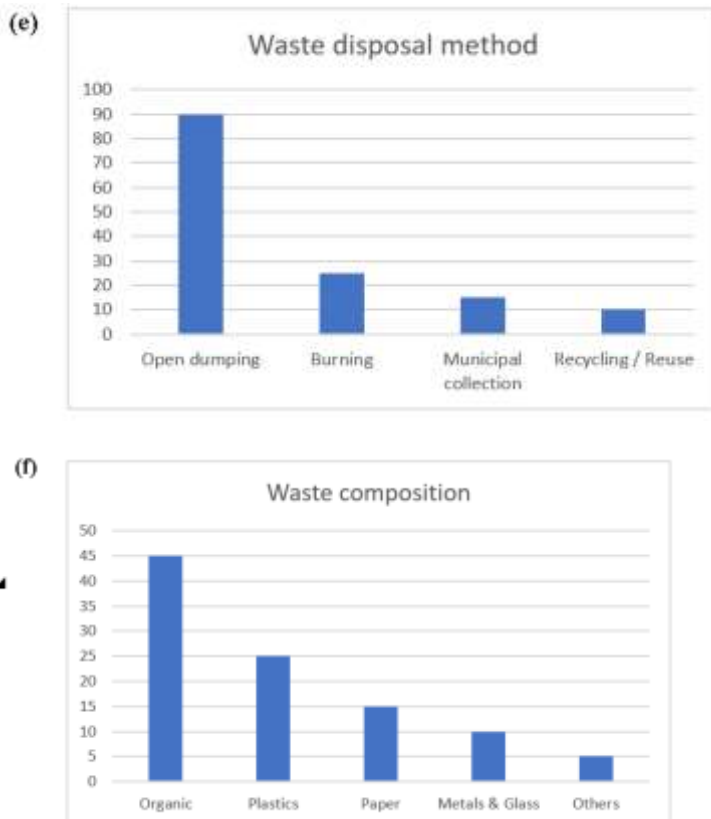


Fig. 3. Chart of waste disposal and waste composition

From the results, there is observed a significantly high awareness, as 85.7% of the respondents know types of waste, but 64.3% still practice open dumping, indicating low compliance level to municipal collection and recycling or reuse (10.7% and 7.1%), of solid waste generated respectively. Efforts to ameliorate the unhealthy trend has to be geared toward strong enforcement and regulatory framework, waste prevention: recycling and reuse of solid waste products.

Proper waste management increases with education and availability of municipal collection strategies, and infrastructural influence. Sweden has developed a world-leading solid waste management infrastructure that converts nearly 99% of waste to useful resources, with less than 1% of its household waste ending up in landfills, made possible by strict legislation, strong circular economy model and high public participation impact. Models and plants are designed with advanced technologies for converting household waste-to-energy [14].

The findings show that community engagement opportunity supports solid waste management. 67.9% of the respondents willing to participate in recycling programs, supports the obvious need for integrated solid waste management (ISWM), implementation.

Waste Composition that showed high organic waste suggests potential for composting, anaerobic digestion could tap for production of biogas, which serves as clean fuel for public transportation, bio-fertilizers producible via these waste products. Plastics that amounted to 25% per day, require recycling programs to reducing fossil reliance and enhancing safe chemical methods for recycling and reuse.

RECOMMENDATIONS

Integrated Solid Waste Management (ISWM): Source segregation, composting, recycling, and sanitary landfills and other types of waste management techniques should be advanced from the top to the bottom stakeholders. The latest overarching benefit of Sweden Integrated Solid Waste Management (ISWM), for instance is its evolution into a highly profitable self-sustaining circular economy that employs over 200,000 people and accounts for about 4% of the country's GDP. Less than 1% of Sweden's trash goes to landfills. In

Bonny Local Government Area, there is an increasing aware of solid waste segregation, sorting for accumulation for recycling of metal scraps, plastics and glass.

Policy Enforcement: Penalties for illegal dumping; incentives for proper disposal. Communities and villages, Local Government authority in Bonny should deliberately enact and enforce polices that support Integrated Solid Waste Management. Source segregation, Composting and Recycling cooperatives should be formed and supported by all tiers of Government.

Public Awareness Campaigns and Community Sensitization: The first target are households with lower education levels. The effect of low public awareness on solid waste management campaigns has remained a major setback. Like political campaigns, aggressive advocacies, providing that would promote wealth-for-innovational-waste reuse, can be championed by government. Annual budgetary resources should be sustained for the awareness drive. Community Chiefs, youth leaders, women groups and all residence in Akiama-Abalamabie must collaborate and be sensitized on health impacts of indiscriminate dumping in local waterways and settlements.

Private Sector Participation: Local Government Authorities must champion the partnership to ensure a coordinated waste hierarchy. Models for prevention of solid waste accumulation, recovery, promoting recycling enterprises and waste-to-energy initiatives has to be developed and strategically sustained.

Infrastructure Development: Deliberate effort to procure collection trucks, bins, recycling centers, and composting units has to be sustained. Decentralized collection and elevated resource recovery, community-level composting, material recovery and localized anaerobic digestion as proposed.

Continuous Monitoring: Community surveys should be employed to track changes in waste management behavior. Technological sensors - GIS Spatial Mapping is recommended due to the rapid refuse build-ups, overflow and poor disposal of waste. Sensor-based waste management can proactively mitigate pollution and protect public health for Abalamabie due to its rapid infrastructural integration into Bonny town, and vulnerability to costal environmental challenges.

CONCLUSION

The survey of 140 respondents demonstrates that although awareness of solid waste types and environmental risks is high, improper disposal practices remain prevalent. Education, infrastructure, and community participation are critical to improving waste management in Akiama-Abalamabie. Adoption of integrated waste management strategies combined with policy enforcement and public engagement can significantly reduce environmental and health risks.

Knowledge of organic waste and mitigation techniques would significantly reduce greenhouse gases such as methane, that is a primary driver of near-term global warming and possesses environmental and health impact.

Further research would be to design a community-specific circular economy waste-to-wealth framework.

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