

## Drivers and Characterization of Solid Wastes in Open Air Markets of Sub Sahara City of Ibadan, Nigeria

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### Abstract

The operation of Open Air markets in traditional Sub Sahara African cities are often driven by factors and with certain waste characterization which require a good understanding to reduce the menace the waste may pose. This study examined the drivers of waste generation in open air markets in Ibadan, a Sub Sahara African city and the composition. A case study research design was adopted; while systematic sampling techniques was used to determine the sample size. From a sample frame of 54 markets observed, 5 markets were selected based on location in the local government (Urban and less urban), volume of trade, and years of existence. A total of 350 traders were randomly selected based on trade type and were administered questionnaire to extract information on their trade location, goods type, type of waste generated and knowledge of waste disposal method. The data were analyzed and the result revealed that Fruits and Vegetable vendors formed 26.3% of traders in the markets, Meat and Fish has 23.7%, Raw food 22.3%, Processed food 14.6%, Herbal 14.4% and Textile with 9.4%. The result also showed that the population of the type of traders dictated the volume of waste generated. The analysis on waste management practices showed that 50% of traders used Dust bin while 45.1% carry out open burning of dry wastes. It was also revealed that population of the traders was the greatest drivers of waste generated with 100% weight while method of packaging of goods, availability of disposal facilities, and nearness of traders to waste skips carried 45% weight each. It was recommended that waste management authorities should pay more attention to the operation of Open air markets in Ibadan City since it generates 50% of total waste in the city; more provision of waste skip Bins and more hands be engaged to provide regular collection of wastes away from the trading sites by either the government or private waste companies.

**Word counts:** 319

**Keywords:** Solids Wastes, Open Air markets, Waste Characterization, Sub Sahara City

### 1.0. Introduction

Urbanization as a process involves human agglomeration in multi functional settlements; and it is usually from less developed areas to a more developed ones (Mabogunje,1981). This process generates interaction of people, goods, services and necessary infrastructure for sustainable development.

Urban structure is compartmentalized into different sectors: the Central Business District (CBD), light industrial zone, heavy industrial zone, and the outer agricultural zone (Burdett, 2018). In traditional cities of Sub sahara Africa, Open Air market is one of the oldest and fundamental types of commercial activities. This is defined by actual interaction of the buyers and the sellers in open areas to exchange goods and services. The continuous daily exchange of goods through trading generates wastes which constitute the goods' leftovers and bad ones. These wastes required a complex and methodological waste management process that must be carefully collected and disposed to prevent environmental management problems. The markets supply fresh fruits, handcrafted goods, textiles, plastics and paper packaging bags, and slaughtered animals and birds.

Wastes are unwanted or unsuitable items that are thrown away after their initial usage. It was noted that over 2.01 billion tonnes of wastes are generated globally which could rise to 3.8 billion by 2050. (World Bank, 2016). In Nigeria, about 32 million tonnes of waste is generated annually, out of which 20 30% is collected and recycled (Bakare, 2016). A breakdown of waste generation on state by state basis revealed that Lagos state generates highest volume (5.5 million tonnes) while Oyo state generates 1.6 million tonnes annually (Businessday NG, 2024)

This paper examines the drivers and characterization of solid wastes in Open Air markets of Sub Sahara city of Ibadan, Nigeria with the view to identifying the composition, disposal process and the potential effects on the market environment.

## 2.0. Review of Literature and Theories

### 2.1. Solid Waste Generation and Management

Solid wastes can be described as any discarded or unwanted materials which may include various items such as paper, plastics, glass and food waste (IDR Environmental Services, 2025). Wastes are generated when there is unneeded residue of a good which is left over for disposal and be thrown away. The primary types of solid wastes are organic waste, recyclable waste, and hazardous waste. Each of these types impacts on the human environment. (reel, 2023). Waste is a daily word used to describe material that are meant to be discarded and disposed. It starts from discarded wrappers of breakfast foods, electronic gathering dust in homes and it becomes an intrinsic part of modern living.

Wastes are generated from industries, commerce (i.e trading), households, and agriculture practice or farming. Wastes are required to be reduced in the society to conserve the limited natural resources, mitigate pollution of the environment and promote sustainability of the environment. It was observed that the characteristics, volume and composition of waste generated differs from country to country and from rural to urban divide (Slideshare.net, 2025). A functional waste management system should involve an examination of the composition of the generated waste, on site handling and storage, collection method, and transfer and transportation of the wastes material to the dump sites for further processing. The quantity of waste generated are usually measured in kilogram using Load Count Analysis or Weight Volume Analysis. The generation and management of wastes in Nigeria is growing to disturbing level since the World Bank submitted that solid waste generation in Nigeria will rise from the current 32 million tonnes to 107 million annually in 2050 (Earth.Org, 2023). It was also observed that 30% of the waste generated is efficiently collected and disposed of as a result of lack of waste management practices or urban households in low income neighbourhoods. This resulted to dumping of the wastes in illegal makeshift land fills, improper incinerators abandoned at highways, road islands, street corners and eventually end up in open drains and streams (Earth.Org, 2023).

**Plate 1.** Waste dumps in typical local neighbourhood in Ibadan, Nigeria



Source: Authors' Field work, 2025

**Plate 2.** Waste disposal in Odo Ona neighbourhood in Ibadan city, Nigeria



**Source.** Authors' Field work, 2025.

## 2.2. Drivers of Waste Generation

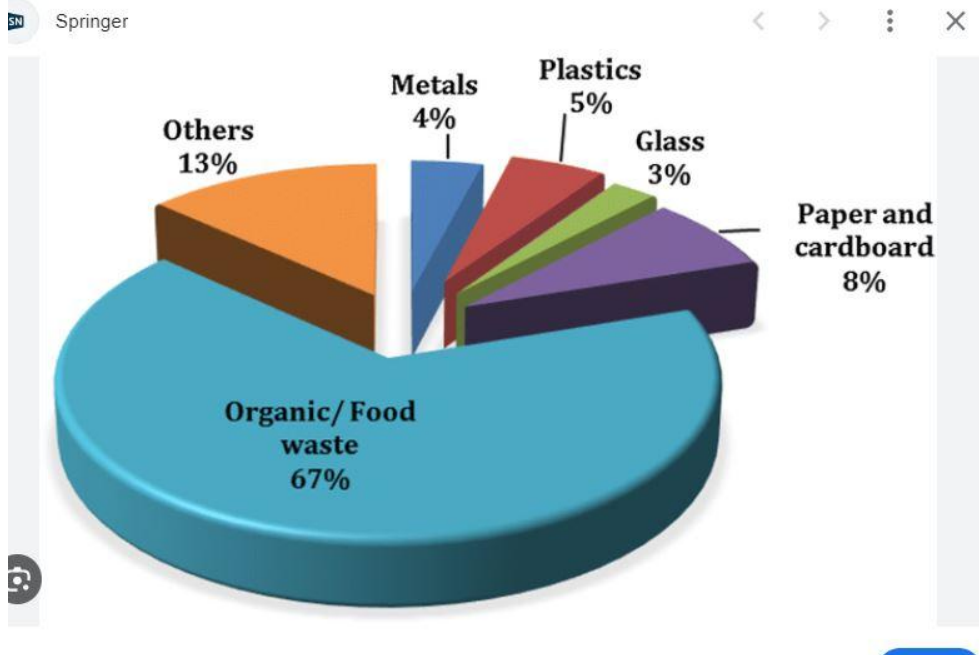
It is important to examine the factors that drive waste generation in a community of people or settlements. Drivers are the active and innate factors driving the generation of waste in a location of human interaction. The primary drivers of waste generation may include rapid urbanization, population growth, rising economic power, culture of the people, and lack of waste infrastructure. Another opinion noted that fundamental drivers of waste generation to include: consumption pattern, production and packaging of goods, and disposal facilities available to the consumers (Pollution/Sustainability Directory, 2025). It was observed that in some societies, there is strong desire generated by advertisements and social perception to consume new goods which often fuel demand for “new” products. People are psyched to believe that happiness and success are linked to acquisition of material things. This belief system drives unsustainable consumption habits both at the individual and larger economic levels. Another noticeable driving factors are inefficient production and packaging processes, lack of environmental awareness and education and systemic factor arising from lack of sound environmental policy and implementation, and linear economic model of ‘take>make>dispose (Pollution/Sustainability Directory, 2025). In another opinion waste generation is driven by concentration of population due to urbanization and migration, change in economic status and life style, location of disposal sites or Bins, seasons with respect to harvest of crops (Ramachandran, 2009)

## 2.3. Characterization of Waste Generation

The design and execution of adequate solid waste management require a precise understanding of the amount and rate of solid waste produced in a particular location. This offers data on the equipment, manpower, and financial resources needed for garbage collection and transportation, design suitable waste reduction method, and determine the present and future requirements for solid waste disposal recycling for environmental management. The physical composition of a waste stream is the quantity of various material types present in that stream. The physical composition of solid waste varies widely depending on a number of factors amongst which are: economic level of the people, demographic composition, nature of trade, business season, management strategy and the recycling process put in place (Chukukula et al, 2024). It was noted that solid waste generation in Nigeria comprised of food residue (46.16%), inorganic material (20.63%), glass and metal took (5%), plastic 18.65%, of the annual waste generation (Mokuolu, 2021). Research findings by ScienceDirect characterized Municipal waste into food waste (67%), metals (4%), plastics (5%), glass (3%), paper (8%) and others constituting 13%. (ScienceDirect, 2015). A further examination of the collection of Pie chats in figure 1 revealed that there is no absolute consensus about the

percentage volume of municipal waste composition among researchers. However, there is relative agreement on the components of the wastes generated but there is no consensus on the percentage of composition subject to the particular area of study.

**Figure. 1**



The characterization of solid wastes is therefore carried out to assist in the management and recycling process which include size reduction and waste minimization (Sharma, 2025). He noted that characterization of solid wastes helps in planning of how to reduce waste, set up recycling programs and find ways to conserve fund and resources. He also noted that in India, waste grows by leaps and bounds and India alone generates 7.2 million tonnes of hazardous wastes every year coupled with very low collection for all India cities. Wastes was also classified into Municipal wastes, Agricultural wastes, Bio medical wastes, Industrial wastes and E wastes. Environmental Protection Agency submitted four characteristics of hazardous wastes based on reactions to the environment which are Ignitability, Corrosivity, Reactivity and Toxicity (EPA, 2025)

Wastes are also classified and characterized by source of the waste. These may include: Household Hazardous Wastes, Construction and Demolition Debris, Industrial and Commercial Waste, Hazardous Waste Lamps, Regulated Medical Wastes, Used Electronic Equipment, Used Oil, and Waste Tyres (New York State, Department of Environmental Conservation, 2024).

The examination of the submission of the aforementioned authors in waste characterization and composition gave a general grouping of municipal solid wastes in the cities or countries of their study. None of them attempted to identify the composition of wastes in open markets particular in indigenous cities like Ibadan, Nigeria of Sub sahara Africa. The open market operation in the study areas is known majorly for low and medium income traders who sell fruits and vegetables, agricultural goods, light textiles, small processed foods, and cooked foods. This will be discussed in details in another section.

#### 2.4. Environmental Impact of Solid Wastes

Solid wastes have varying impacts on the immediate and distant environment of the communities that host the waste dumps. The wrong disposal of solid wastes contaminates ground water by the leachate generated by waste dumps, surface water contamination, bad odour production, pests and rodents' production, disturbance and inconvenience by winds blown litters in and around waste dumps, gathering of birds who may want to feast on the dumps which may disturb flight of Aircrafts, emergence of wild fires, erosion, occurrence of epidemics and acidity to the surrounding soil (Sharma, 2025). Environmental Protection Agency identified four effects of wastes on the environment and the objects consisting therein. These are ignitability, corrosivity, reactivity and toxicity (EPA, 2025)

Poor waste management and control affects the lives of the people living in the immediate and nearer environment. There is the likelihood of pollution of the water source through open dumping of refuse, air pollution through burning of wastes and release of poisonous gases, soil pollution and damage of the top soil layer, noise pollution during movement of refuse collection vehicles and traffic inhibition during collection of wastes from the deposit areas (Yogalakshmi, 2025). It was noted that multi level failure of waste management in low income neighbourhoods in Nigeria has direct correlation on the environmental health of the people. This is manifested from the waste dumps being a fertile land for breeding of mosquitoes, rodents and other vector carrying germs and diseases. WHO (2021) reported in her 2021 World Malaria Report that Nigeria remains the most malaria endemic country in the world, having 27% of cases out of which 32% of all deaths are caused by malaria.

### 2.5. The Study Area and the Concept of Open-Air Market

An open-air market is a public market place held for outdoors, often in the streets, squares or parks, where various vendors sell goods like fresh produce, crafts and prepared foods from temporary stalls or stables, fostering community interaction and supporting local businesses. It can be daily, weekly, or bi weekly days operated.

Ibadan in the annals of history is the capital of the old western region and the capital of the present Oyo state. It is the most populous city in Southwest Sub sahara Africa. It has a population of 4.3 million and consist of eleven local governments with five within the metropolis and six in the outer parts of the region.

**Figure 2:** The Map of Ibadan showing important Settlements



The genesis of Ibadan market system (oja) was born of military necessity, solidifying the town's initial identity as an agrarian city highly reliant on massive production (Alabi, 2021; Balogun, 2025). The massive economic output was historically sustained by the extensive use of slave labour across all sectors: farming, blacksmithing and commerce. Iba-Oluyole and Olupoyi, two of Ibadan's greatest warriors, established Oja'ba Market in 1830. The market began with the sale of melon (Egusi), which was carried by vendors from Oyo-Ile and put on display for sale at Olupoyi's residential entrance. The market grew as more food products were introduced throughout time, such as pepper, tomatoes, and yam flour (Elubo). Farmers from the Ibadan suburbs, including Omi-Adio, Olodo, Egbede, Ihori, Igangan, and others, were drawn to the market as vendors. They brought food products to purchase and sell. Various residents of Ilesha, Abeokuta, Ijebu, and other places come to purchase food for their local communities. For commodities, the market has a peak season. For instance, the market sees a surge in the purchase and sale of food products from June to December. However, the market relies on other marketplaces, such as Shasa and Oje, for commodity sales and purchases from January to May. The Oja'ba market is open day and night, with an organic development pattern and an on-street trading distribution structure.

**Plate 1.** An Overview of Oja'ba Market's On-Street Trading



**Source:** Authors' Field work, 2026

Great Ibadan warriors Dele Solu, Jubilikenke, Ajeja, and Ojo Ibadan created Oje in 1860. The "Igi-Etun" tree, which grew large and eventually offered shade for people to unwind, gave rise to the market. People who were lounging beneath the large tree had something to eat as a woman was selling bean cake (Akara) beneath it.

With some additional activity, this location eventually developed into a major marketplace for purchases and sales. Today, this location is known as Ayunre-Oje. People from many locations, including Ilorin, Iseyin, Saki, Okeho, and others, come to this well-known market to buy and trade weaving supplies (Aso-Ofi).

The market is divided into three categories: Oje-Eleso (fruits), Oje-Alata (pepper, tomato, etc.), and Oje-Olofi (weaving fabric). While Oje-Alata, Oje-Eleso, and other culinary items happen every day, Oje-Olofi takes place every seventeenth day, or sixteen days apart. The researcher's data indicates that the Oje market is both daily and periodic in character. The Oje market's distribution style is street trade, and its growth is organic.

**Plate2.** An Overview of Ayunre tree where Oje Market Originated



**Source:** Authors' Field work, 2026

The characterization of goods sold in the open markets in Ibadan is carried out by using the type of goods sold delineate the market into sections. For example in Oje market, the type of goods sold was used to sectionalized the market to make location and purchase of goods easy for the people. This is presented in the table 1.

**Table 1:** Delineation of Oje Market into Sections

S/N	Type of goods sold	Local Name for the Section
1	Fruits (Eleso)	Oje Eleso
2	Pepper, Tomato	Oje Alata
3	Weaving Fabric	Oje Olofi
4	Herbs	Oje Alagbo
5	Raw foods (yam, cassava flour, Gari etc)	Oje Olounje Tutu

**Source:** Authors' Field work, 2025

The Table1 showed the local identification system and area identification of the Yorubas in Ibadan as an indigenous African city.

The city's commercial infrastructure was highly sophisticated, featuring major central metropolitan wholesale markets like Oja'ba and Orita-merin located near the Oba palace. This commercial power institutionalized the influence of the Iyalode, or female chief, whose economic clout was so significant that, for insta military leadership, promoting stability in a state otherwise founded entirely on expansion and conquest.

**Plate 3. An Overview of the Items Sold at Oja'ba Market on the Access Road**



**Source:** Authors' Field work, 2026

The sustained development of Ibadan into a massive metropolitan hub is intrinsically associated with the market system's dynamism and the symbiotic relationship it engineered between the city and its surrounding rural productive base. The urban area relied heavily on the rural areas for food, raw materials, and labour, maintaining a robust cultural affinity through the customary land tenure system, which encouraged the periodic movement of people between the city's compounds and the outlying villages (Alabi, 2021). The spatial distribution of markets follows a density pattern correlated with population size and historical commercial significance (Wojuade, 2020).

**Table 2.** Open-air markets in Ibadan Region and Market Density

Local Area	Government	Market Category	Principal Identified	Markets	Market Density
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Ibadan North	Metropolitan / Core	Bodija, Gate, Sango, Mokola, Sabo, Agbowo	13 Markets
Ibadan South-West	Metropolitan / Core	Agbeni, Ogunpa, Oja'ba, Aleshinloye, Challenge, Ayeye	13 Markets
Ibadan South-East	Metropolitan / Core	Oja-oba, Orita-aperin, Bode, Molete, Owode	11 Markets
Ibadan North-West	Metropolitan / Core	Dugbe, Ifeleye, Agbaje, Ayeye	10 Markets
Ibadan North-East	Metropolitan / Core	Oje, Araromi, Agugu, Irefin, Bashorun	7 Markets
Akinyele	Peri-Urban	Moniya, Ojoo, Sasa, Akingbile, Ijaiye	Variable (Periodic)
Ido	Peri-Urban	Apete, Omi-Adio, Bakatari	Variable (Periodic)
Egbeda	Peri-Urban	New Gbagi (Bola Ige), Alakia, Egbeda	High
Oluyole	Peri-Urban	Orita-Challenge, Idi-Ayunre, Podo	Expanding
Ona-Ara	Peri-Urban	Akanran (Aare-Alasa), Olunloyo, Badeku	Rural-Urban Supply

**Source:** Authors field work, 2025.

From the table 2, Ibadan with her Eleven local governments has 54 markets some of which are periodical and others regular daily markets with open air trading pattern and lock up shops.

**Plate 4:** Open Air Trading in Odo Ona Market, Ibadan, Oluyole Local Government



**Source:** Authors' Field work 2026.

**Plate 5.** Open Air Trading at Sasa Market, Akinyele Local Government



Source: Authors' Field work, 2026

## 2.6. Theoretical Framework

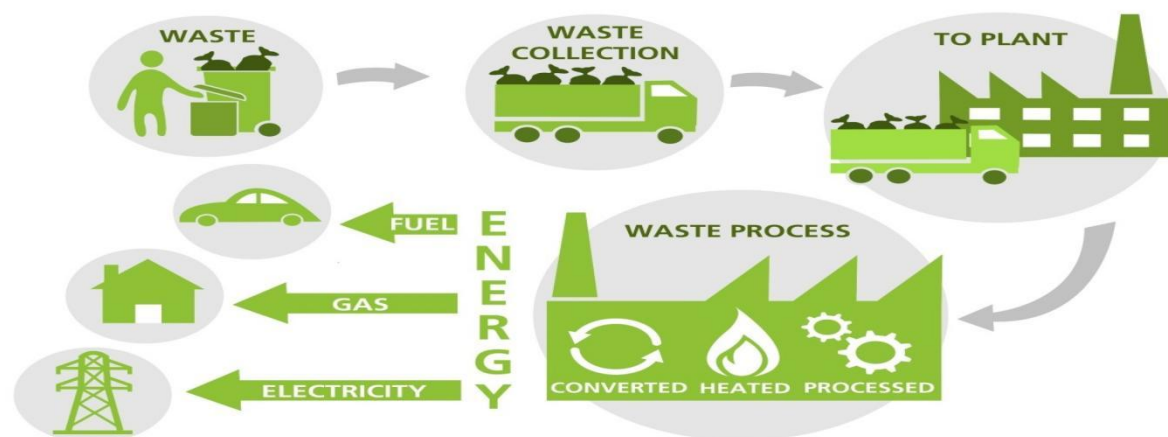
This study is anchored on two theories to locate it in the body of knowledge. This is discussed one after the other.

### Sustainable Waste Management Model

This model posits that waste management is sustainable when allows reduction in volume, reuses and recycling of the wastes to minimize environmental impact, improve public health and create economic opportunities. This is called 3Rs of Reduce, Reuse and Recycle (Waste Mission, 2024). The sustainable waste management concept involves reducing the amount of waste generated, reusing the waste where possible, recycling what can be reused, selling what we can, and disposing of what is left. Sustainable waste management necessitates four steps which are collection of waste, sorting and processing, recovery of materials or energy and recycling into new products. Sustainable waste management mitigates environmental problems such as carbon emission and cleaner environment. Sustainable waste management also allows for conservation of natural resources through recycling of waste material to produce goods for other consumption. Sustainable waste management produces economic benefit by creating jobs and reduction of costs of raw material (Waste Mission, 2024).

The concept of Circular Economy is complementary to sustainable waste management. The principle of circular economy in waste management revolves around the process of eliminating waste of the wastes, reduction in environmental pollution, reuse of waste products and materials and restoring nature. Zero waste initiatives can be put into action through decrease in consumption, encourage reuse, setting up of recycling and composting programmes and redesign and repackaging of products (Lettieri, 2020).

Figure 3. Waste Recycling Process



### Urban Governance

This concept posits that urban governance is the complex, continuous process through which the public, private and civil society actors interact and cooperate to plan, finance and manage urban problems (Avis, 2016). It describes how the government whether local, regional and national and the other stakeholders decide to plan, finance and manage urban areas. It is a system that requires a continuous process of negotiation and contestation over the allocation of social and material resources. Urban governance involves a series of actors and institutions relating among each other to determine issues in the management of cities (UN Habitat, 2010, 2015). Urban governance is based on four principles. These are Purpose, People, Process and Performance (4Ps). There are certain issues in urban governance that may impact on the effectiveness such as funding, fragmentation and duplication of functions, non participatory and corrupt administrative structure (Jiboye, 2011). Cities and urban areas face series of challenges that need to be studied and evolve solutions within a specific geographic and socio economic context. These include rapid population growth, inadequate infrastructure, housing shortages, traffic congestion, waste management, environmental degradation and climate change (Ecoholics).

### 3.0. Methodology

This study employed the case study method using both quantitative and qualitative technique to gather necessary information about the observed variables. The population for the study are the traders of the Open Air markets and the goods they trade with. A total of 54 market centers existed in the eleven local governments in Ibadan and 5 markets were systematically selected. This is as shown in Table 2. The selected markets were based on certain factors such as year of existence, nature of openness in the operation of trades, high rate of daily waste generation, and location within the eleven local governments comprising Ibadan region. Bodija market was picked from Ibadan North Local Government, Oje market from Ibadan North East Local Government, Adelabu Adegoke market, Orita Challenge from Ibadan South Esat Local Government, Sasa market from Akinyele Local Government and Odo Ona market from Oluyole Local Government (both were picked to represent sub urban local governments).

Stratified sampling technique was used to determine the number of respondents from the traders; and factors such as location in the markets, type of goods they are trading, years of existence in the market and gender were considered. A total of 350 traders were selected and administered questionnaire as distributed across the five markets selected. This means that 70 traders were allocated to each market and were grouped based on convenience and uniformity of trading pattern. The selection in each group was random and were subsequently administered questionnaire. Information requested covered their year of operation, type goods being sold, gender, type of waste generated from their trading activities, mode of disposal, frequency of disposal, knowledge of environmental education, knowledge of government waste management agency activities and cost of disposing the waste per week. Also, the effects of waste garbage on their health.

The data collected were analyzed using Charts, Tables, Pearson correlation matrix, and both Binary and Linear regression to predict waste separation behaviour of the traders in the Open Air markets studied.

#### 4.0. Results and Discussion

##### 4.1 Trade Type and Waste Produced in the Markets

Table 4.2 shows the distribution of trade types and the associated trash categories produced in each of the markets that were examined. The wastes types are broadly characterized into Organic and Inorganic wastes. The organic comprised of Vegetables, Fruits, and spoiled food wastes. The inorganic comprised plastics, tins, papers, rags, and planks. This is further presented in Table 4.2.

**Table 4.2:** Waste Composition in the Selected Markets

Markets	Organic Waste (%)	Inorganic Waste (%)	Primary Waste Types
Sasa	82.5	17.5	Vegetables, Fruits, Food Waste.
Oje	77.5	22.5	Beef, Fish, Food Waste.
Bodija	75.0	25.0	Damaged Items, Food Waste.
Orita	70.0	30.0	Food Waste, Plastics.
Odo Ona	67.5	32.5	Food Waste, Plastics.

**Source:** Oyo State Waste Management Authority, 2026.

##### 4.3: Waste Management Practices by Traders

Table 4.3 presents the waste management practices that traders in the research region reported adopting, with an emphasis on waste separation, waste disposal techniques, waste management expertise, and access to waste disposal services.

Regarding methods of waste disposal, the table indicated that the use of dust bins is the most commonly reported practice, with 175 traders representing 50.0% of the respondents. This is followed closely by open burning of dry waste, reported by 158 traders (45.1%). In contrast, only a small proportion of traders, 17 individuals (4.9%), reported engaging in recycling activities.

With respect to waste collection services, Table 4.3 reveals that 177 traders (50.6%) reported having no access to any formal waste collection service, while 173 traders (49.4%) indicated that they are served by the State Government. This shows a nearly even split between those with and without organized waste collection support.

In terms of waste separation practices, the table shows that only 49 traders (14.0%) reported that they separate their waste before disposal, whereas a large majority of 301 traders (86.0%) do not practice waste separation. Concerning knowledge of waste management, Table 4.3 indicates that 179 traders (51.1%) reported having knowledge of waste management, while 171 traders (48.9%) indicated that they do not. This suggests that awareness of waste management issues is almost evenly distributed among the respondents.

**Table 4.3:** Waste Management Practices by Traders

Variable	Category	Frequency (n)	Percentage (%)
<b>Method of Waste Disposal</b>	Dust bins	175	50.0
	Open burning of dry waste	158	45.1
	Recycling	17	4.9
<b>Waste Collection Service</b>	State Government	177	50.6
	None	173	49.4
<b>Waste Separation Practice</b>	Yes	49	14.0
	No	301	86.0

**Table 4.4:** Drivers of Waste Generation in the open markets

SN	Drivers of Waste Generated	Weight of the factors in total waste generated
1	Population Growth of the traders	100%
2	Culture of waste disposal	25%
3	Method of packaging of goods	45%
4	Disposal facilities available	45%
5	Consumption pattern	25%
6	Poor environmental education	30%
7	Location of disposal site/ Bin	45%

**Source:** Authors' Field work, 2026

Table 4.4 showed the contribution of the drivers of waste generation to the volume of waste generated. The volume of waste increases as the number of trader's population in the market increases at 100%. Also, other factors have their varying weight as drivers of waste generated in the market, although it is depended on the type of trade. The method of packaging the goods, availability of disposal facilities and nearness of traders to disposal site have 45% weight each as drivers of waste generation.

#### 5.0. Recommendation and Conclusion

The analysis of the data informed that more attention be paid on the Open Air markets in Ibadan since they trade in food related goods and formed 50% of waste generated in the city. There should be provision of Skip Bins nearer to the traders supported with frequent collection of the wastes to prevent accumulation and decomposition on waste heaps.

The issue of waste recycling should be given attention to convert the food waste fertilizer for agricultural use. to This may pose environmental risks such as air and water pollution, disease spread, multiplication of rodent population and so on.

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