SOLID WASTE MANAGEMENT PRACTICES IN SAPELE TOWNSHIP IN DELTA STATE

Endurance Obatavwe ORHOTAIRE

UNIVERSITY OF BENIN
BENIN CITY

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Endurance Obatavwe ORHOTAIRE

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B.Sc Health Education (Port Harcourt)

A RESEARCH PROPOSAL PRESENTED TO THE DEPARTMENT OF HEALTH, SAFETY AND ENVIRONMENTAL EDUCATION, FACULTY OF EDUCATION, IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTERS DEGREE (M.Sc) IN ENVIRONMENTAL AND SAFETY EDUCATION OF THE UNIVERSITY OF BENIN, BENIN CITY, EDO STATE.

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CERTIFICATION

We, the undersigned, certify that this work was carried out by Endurance Obatavwe ORHOTAIRE in the Department of Health, Safety and Environmental Education, Faculty of Education, University of Benin.

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Prof. (Mrs) U. Igbudu Date
(Project Supervisor)

_____ _____

Dr. (Mrs.) O. H. Obasuyi Date
(Ag. Head of Department)

DEDICATION

This work is dedicated to God Almighty.

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ABSTRACT

This study examines the solid waste management practices in Sapele, the challenges hindering effective waste management, the role of the local government, and residents' attitudes toward waste disposal.

A descriptive survey research design was adopted, allowing for data collection from a representative sample without manipulation. The study population comprised residents aged 18 to 65 years who are directly involved in waste generation, collection, disposal, and management. A total of 490 respondents participated in the study, and data were collected using a self-structured questionnaire. The analysis was conducted using mean and standard deviation.

Findings indicate that while waste collection services are available, unsustainable practices such as illegal dumping and open burning persist. A significant gap exists in waste segregation, recycling, and composting due to inadequate public awareness, poor infrastructure, and weak enforcement of waste regulations. The local government plays a vital role in waste management; however, challenges such as insufficient waste bins, ineffective penalties, and limited funding hinder progress. Despite these challenges, residents exhibit a positive attitude toward waste management, recognizing its importance and expressing willingness to participate in community clean-up efforts and pay for waste collection services. The study recommends a multi-faceted approach to improving waste management in Sapele, including increased investment in infrastructure, stricter enforcement of waste disposal regulations, expansion of recycling programs, and intensified public awareness campaigns. Strengthening collaboration between government agencies, private waste management firms, and local communities is essential to developing a more sustainable and efficient waste management system. These findings have significant implications for environmental and safety education, highlighting the need for integrating waste management strategies into school curricula, fostering community-based environmental programs, and promoting sustainable waste management practices for long-term environmental sustainability.

CHAPTER ONE

INTRODUCTION

Background to the Study

Waste is any unwanted or discarded material that results from human or animal activity on the planet. Solid waste is a broad categorized waste that includes garbage, commercial and industrial waste, waste from construction and demolition projects, waste from dead animals and abandoned vehicles, food scraps, plastics, bottles, polythene material (such as nylon bags), metallic objects, waste from furniture and wood products, paper, and some other unclassified wastes (Joseph *et al,* 2016). Solid waste by its nature is the most generated forms of waste that needs proper management for health promotion, well-being and environmental purity. Waste management according to Joseph *et al* (2016) is the systematic management of waste generation, storage, segregation, collection, transportation and disposal.

The management of solid waste has emerged as a critical issue in urban centers worldwide due to rapid population growth, industrialization, and increased consumption. As cities expand, the volume of waste generated increases significantly, placing immense pressure on solid waste management systems and threatening environmental and public health. Effective solid waste management is essential for sustainable urban development, requiring coordinated actions across various sectors and the cooperation of local communities.

Solid waste disposal sites are found both within and on the outskirts of developing urban cities. With increase in the global population and the rising demand for food and other essentials, there has been a rise in the amount of solid waste being generated daily by each household (Foday *et al.,* 2013). This solid waste is ultimately thrown into municipal disposal sites and due to poor and ineffective management, the dumpsites turn to sources of environmental and health hazards to people living in the vicinity of such dumps.

The management of solid waste in urban areas has increasingly become a focal point for public health and environmental sustainability, particularly in the context of rapid urbanization. Sapele Township in Delta State, Nigeria, is experiencing significant growth, leading to a corresponding increase in waste generation. This scenario necessitates effective waste management practices to mitigate adverse environmental impacts and enhance public health. Poor waste disposal practices, combined with limited government support, have led to environmental degradation, pollution of water sources, and an increased risk of diseases among residents. Studies by Nnamani and Odoh (2021) on waste management in Nigerian cities emphasize that addressing these issues requires a comprehensive approach that considers the socio-economic and environmental conditions of each area.

Waste management practices encompass various activities, including waste collection, transportation, treatment, and disposal. In Sapele, these practices are influenced by a mix of formal and informal systems. As highlighted by Joseph et al. (2018), many urban areas in Nigeria rely heavily on informal waste collectors due

to the inadequacy of formal services. In Sapele, the existing waste management system often struggles to cope with the volume of waste generated, leading to improper disposal methods such as open dumping and burning. Moreover, there is a lack of organized waste collection routes and schedules, which further complicates waste management efforts. Understanding the current practices will shed light on the operational frameworks in place and inform necessary improvements to enhance efficiency.

Proper waste management is essential for protecting the environment and public health. Ineffective waste management practices can lead to significant environmental issues, including soil and water contamination, air pollution, and loss of biodiversity. As noted by Okoli et al. (2020), improper disposal methods such as open dumping can result in the leaching of hazardous materials into the soil and groundwater, posing risks to human health and ecosystems.

Solid waste management (SWM) is a critical challenge confronting urban and rural areas worldwide, particularly in developing countries. As urbanization and population growth intensify, the generation of solid waste increases, often outpacing the capacity of local governments to effectively manage it. This situation is particularly evident in Nigeria, where inadequate waste management practices contribute to environmental degradation, public health issues, and socio-economic challenges (Omobola, 2020). Sapele, a township in Delta State, is no exception to these challenges. As a rapidly growing urban area, Sapele faces significant issues in managing its solid waste. The township generates various types of waste, including

residential, commercial, and industrial waste, which, if improperly managed, can lead to pollution, flooding, and the spread of diseases. Despite the existence of regulatory frameworks and institutions mandated to handle waste management, the effectiveness of these measures remains questionable. Issues such as insufficient funding, lack of infrastructure, inadequate public awareness, and poor enforcement of policies exacerbate the problem.

Effective solid waste management in Sapele is crucial for environmental sustainability, public health, and urban aesthetics. However, achieving this goal requires a comprehensive understanding of the current practices, challenges, and potential solutions. Previous studies in similar contexts highlight the importance of integrating community participation, adopting modern waste management technologies, and enhancing institutional capacity to address waste management issues (Okoli et al, 2020). These insights underscore the need to evaluate Sapele's waste management practices to identify gaps and propose evidence-based interventions. This study focuses on assessing the existing solid waste management practices in Sapele Township and identifying barriers to effective waste management. By doing so, the research aims to contribute to the development of sustainable strategies for improving waste management in Sapele and similar urban areas in Nigeria.

Local governments play a critical role in solid waste management, as they are the closest governmental tier to the people and are primarily responsible for maintaining a clean and healthy environment. Effective solid waste management encompasses the generation,

storage, segregation, collection, transportation, treatment, and disposal of waste in a manner that protects human health and the environment. According to Suleiman and Audu (2023), poorly managed solid waste can lead to severe environmental and health issues, including pollution, disease outbreaks, and ecosystem degradation.

Statement of the Problem

Solid waste management (SWM) has become a pressing issue in many developing countries, including Nigeria, where urban areas are grappling with the rapid generation of waste and limited capacity for effective disposal. In Sapele Township, Delta State, ineffective waste management practices have resulted in environmental and public health concerns. Poor waste disposal methods, such as open dumping and burning, contribute to land, air, and water pollution, threatening ecosystems and human well-being (Ogwueleka, 2009).

The township's waste management challenges are compounded by inadequate infrastructure, insufficient funding, and limited awareness of proper waste management practices among residents. The lack of well-structured waste collection systems and recycling initiatives further exacerbates the problem, leading to the accumulation of waste in public spaces, clogged drainage systems, and increased vulnerability to flooding during the rainy season (Babayemi & Dauda, 2009). Additionally, weak enforcement of environmental policies and the absence of effective stakeholder collaboration hinder the sustainable management of solid waste in the area (Adewumi et al., 2005).

Despite existing government efforts and policies aimed at addressing waste management issues, the situation in Sapele remains critical. This underscores the need for an in-depth investigation into the current SWM practices, identifying gaps in infrastructure, governance, and public participation. Without urgent interventions, the persistent waste management crisis in Sapele may escalate, posing greater risks to environmental sustainability and public health.

Research Questions

The following research questions was raised to guide the study.

1. What are the solid waste management practices in Sapele Delta State?
2. What are the challenges of solid waste management practices in Sapele Delta state?
3. What are the roles played by local government agency to enhance solid waste management in Sapele Delta State?
4. What is the disposition of Sapele residents toward waste management practices?

Purpose of the Study

The purpose of the study was to examine the management of solid waste in Sapele, Delta State. Specifically, the study:

1. Investigated the solid waste management practices in Sapele Delta State.
2. Find out the challenges to effective management practices in Sapele Delta State.

3. Examine the roles played by local government agency in of solid waste management in Sapele Delta State.
4. Assess the disposition of Sapele residents toward waste management practices.

Significance of the Study

The importance of this study cannot be under estimated. The study will be significant to the populace of Sapele Town, environmental and health workers, town planners, waste management authorities, policy makers, among others with the intent of reviewing the overall waste problem and waste management system of the Sapele Township. To the residents, the findings of the study will provide information that will enable them understand the need to properly managed their solid waste generated domestically and industrially to protect human health and the environment. It will enable them to gain insight to the problems that likely emanate from poor solid waste management in a town.

To environmental and health workers, the study will help them to sit up to their role of monitoring the residents' attitude towards solid waste management to help minimized its negative impact on the environment and human health.

To town planners, the finding of the study will enable them to restrategise and resencitized the public on the need to adhered strictly to town planning and environmental laws while doing construction work that may generate solid waste and block channels.

To waste management authorities, the study will be useful to them by making them realized the implication of their waste management strategies and that of the

residents on the health and well-being of the individuals and the environment as well sought to either adopt new solid waste management strategies or improve on their methods for health benefits.

To policy makers, the findings of the study will enable to them see the need for making necessary environmental and waste management laws or re-emphsized on strict compliance of existing environmental waste management policies to protect the health of individuals and the environment.

To future researchers, the findings of the study will serve as basis of comparison to previous and subsequent researchers' result in this area of knowledge. It will as well serve as literature materials to future researchers who will carry out further studies in this field or area of knowledge.

On the whole, information, findings and conclusion from the study will serve as basis of decision making or reference point to environmental planner, solid waste management agencies, government and concerned individual when handling solid waste management issues.

Scope and Delimitation of the Study

This study focuses on the management of solid waste in Sapele Township, Delta State. The scope is delimited to residents of Sapele Township aged between 18 and 65 years, ensuring that the study captures perspectives and practices from adults actively involved in or impacted by waste management activities.

Definition of Terms

The following terms will be operationally defined in this study

Waste - waste are materials people would want to deposal of even if payment is required for the disposal it is of no value to them.

Waste Management- waste management is way of collection, removal, processing, and disposing materials considered as waste which are generally generated by human activities. In the simplest terms, it can be seen as the collection, transportation, and disposal of garbage, sewage, and other waste products.

Township – Is a municipal area that comprises of smaller villages or quarter.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

This chapter presents Review of Related Literature. It was discussed under the following sub-headings.

- Theoretical Framework
- Concepts of Wastes and Solid Wastes
- Concept of Solid Waste Management
- Methods of Solid Wastes Management Practices in Nigeria
- Challenges of Solid Wastes Management in Developing Countries
- Education and Awareness on Solid Waste Management
- Role of Local Government in Enhancing Solid Waste Management
- Review of Empirical Studies
- Summary of Reviewed Related Literature

Theoretical Framework

The theoretical framework of this study is hinged on the Health Belief Model (HBM), developed in the 1950s by social psychologists Godfrey Hochbaum, Irwin M. Rosenstock, and Howard Leventhal. The HBM was originally developed to explain why individuals often fail to adopt health-promoting behaviors despite being aware of potential health risks.

The Health Belief Model posits that individuals' health-related behaviors are primarily influenced by their beliefs about health conditions, the perceived benefits and barriers to action, and the perceived severity and susceptibility to health threats.

In this framework, key components that shape health behaviors include perceived susceptibility (belief about the likelihood of developing a condition), perceived severity (belief about the seriousness of the condition), perceived benefits (belief in the effectiveness of advised action to reduce risk), and perceived barriers (factors that inhibit taking the advised action).

There are six main components of the health belief model. They are perceived barriers, cues to action and self-efficacy. The health belief model has been used for decades to help produce behaviour changes interventions. HBM can be helpful for designing strategies to help promote healthy behaviour and to improve the prevention and treatments of health conditions.

Perceived Severity

The probability that a person will change their health behaviour to avoid the consequence depends on how serious they believe the consequence will be. The severity of an illness can have a major impact on health outcomes.

Perceived Susceptibility

People will not change their health behaviour unless they believe that they are at risk, perceived susceptibility to illness is an important prediction of preventive health behaviours.

Perceived Benefits

It is difficult to convince people to change their behaviour if there is not something in it for them. People do not want to give something they enjoy if they do not also get something in return.

Perceived Barriers

One of the major reason people do not change their health behaviour is that they think doing so is going to be hard or difficult. Changing health behaviours can require effort, money and time. Commonly perceived barriers include: amount of effort needed, danger, discomfort, expenses, inconveniences, social consequences. Sometimes, it is not just a matter of physical difficulty but social difficulty as well.

Cues to Action

One of the best things about the health belief model is how realistically it frames people's behaviour. It recognizes the fact that sometimes wanting to change a health behaviour is not enough to actually make someone do it. Cues to action are external events that prompt a desire to make a health change, something like seeing a condom poster on a train, to have a relative die of cancer. Cue to action help move someone from wanting to make a health change to actually making the change.

Self-Efficacy

Self-efficacy looks at a person's belief in their ability to make a health related change. Faith in your ability to do something has an enormous impact on your

actual ability to do it. Finding ways to improve individual self-efficacy can have a positive impact on health related behaviour.

The HBM has been widely used and tested in public health research to understand and promote health behaviors, as seen in recent studies by Johnson and Kane (2018) on waste management practices and by Carter et al. (2021) on environmental health behaviors. These authors have adopted HBM in exploring how health perceptions influence people's engagement in environmentally friendly practices, including waste reduction and recycling efforts.

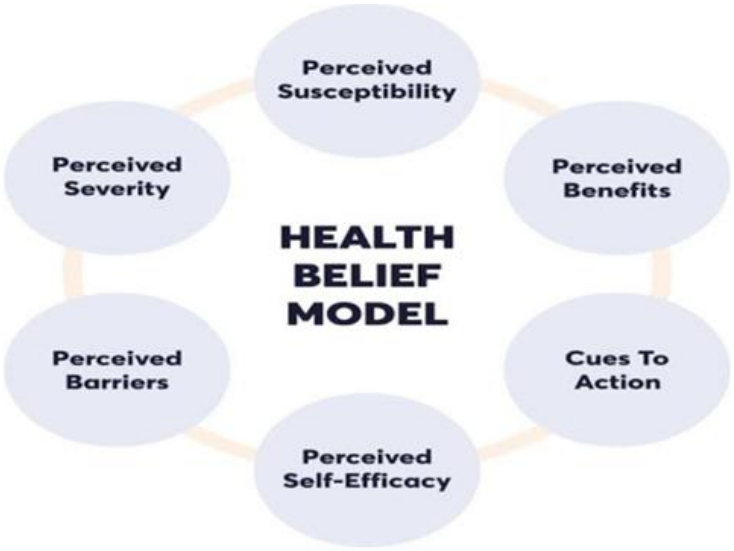

Fig 1: Health belief Model

(Source: Rosenstock, I. M**.** (1950s).

Relevance and Application of the HBM to Waste Management in Sapele Township:

The Health Belief Model is relevant to this study on solid waste management in Sapele Township as it provides insights into the behavioral factors that impact waste disposal practices among residents. By applying the HBM, this study can explore how individuals' perceptions about waste-related health risks influence their waste disposal behaviors. For instance, residents who perceive a high risk of illness from poor waste management (perceived susceptibility) and understand the severity of health outcomes associated with improper solid waste disposal (perceived severity) may be more motivated to engage in proper solid waste management behaviors, such as waste segregation and regular disposal.

Moreover, the HBM's focus on perceived benefits and barriers can help identify why some residents may be resistant to adopting recommended waste management practices. If residents believe that proper solid waste management will benefit their health and community (perceived benefit) and they feel confident in their ability to follow these practices (self-efficacy), they are more likely to participate in effective solid waste management. Conversely, perceived barriers such as inadequate facilities, financial constraints, or lack of awareness can hinder positive waste management behaviors.

Application of the Health Belief Model (HBM) to the Study

The Health Belief Model (HBM) is a psychological framework used to explain and predict health-related behaviors by focusing on individuals' perceptions of health threats and the benefits of taking preventive actions. This model can be applied to the study of solid waste management practices in Sapele Township as follows:

1. **Perceived Susceptibility**

   Residents' perception of their vulnerability to health problems caused by poor waste management, such as waterborne diseases, respiratory issues, or vector-borne illnesses, could influence their willingness to adopt proper waste disposal practices. The study can examine whether residents believe they are at risk due to the current state of solid waste management in their community.

2. **Perceived Severity**

   The perception of the seriousness of health and environmental consequences from improper waste disposal, such as flooding, pollution, and disease outbreaks, is a critical factor. Residents who recognize these potential severe outcomes are more likely to participate in effective waste management practices.

3. **Perceived Benefits**

   Understanding the benefits of proper waste management, such as a cleaner environment, reduced health risks, and improved quality of life, can motivate residents to engage in appropriate behaviors like recycling and proper waste disposal. The study can explore how these perceived benefits influence residents' actions.

4. **Perceived Barriers**

Barriers such as lack of access to waste disposal facilities, high costs, or time constraints can hinder proper waste management practices. The study can identify these barriers and assess their impact on the adoption of waste management strategies in Sapele.

5. **Cues to Action**

External factors, such as awareness campaigns, educational programs, or government enforcement, can serve as triggers for residents to take action. The study can evaluate the effectiveness of existing cues to action in promoting better waste management practices.

6. **Self-Efficacy**

The confidence of residents in their ability to engage in proper waste management practices, such as segregating waste, composting, or recycling, is crucial. The study can investigate the level of self-efficacy among residents and its role in improving solid waste management behaviors.

By applying the HBM, the study can provide insights into the psychological and behavioral factors that influence waste management practices in Sapele, offering a foundation for targeted interventions to improve environmental health outcomes.

Concepts of Wastes and Solid Wastes

According to the Basel Convention, '"Wastes' are substance or objects, which are disposed off or are intended to be disposed off or are required to be disposed off by the provisions of national law" (Basel Convention 1989). "Wastes are materials that

are not prime products (that is products produced for the market) for which the initial user has no further use in terms of his/her own purposes of production, transformation or consumption, and of which he/she wants to dispose.

Wastes may be generated during the extraction of raw materials, the processing of raw materials into intermediate and final products, the consumption of final products, and other human activities. Residuals recycled or reused at the place of generation are excluded (United Nation Statistics Division, 1997)."Under the Waste Framework Directive, the European Union defines waste as "an object the holder discards, intends to discard or is required to discard."

Waste according to Sridhar, (2017) is defined as any matter which has no further use, based on the composition, e.g. garbage, trash, junks, domestics or ashes. It may be domestic, nonhazardous, hazardous or infectious. On another literature, Polprasert (1996) classified solid wastes generated from human activities include those from residential, commercial, street sweepings, institutional, and industrial categories. Omar, Hossain & Parvin (2018) viewed waste as unwanted remains, residues discarded and material or by products which are no longer required by the initial user. These materials are by-products of human activities such as process of preparation, manufacture, packing, repacking, unpacking, construction, renovation of structures and mining operations.

Types of Waste

There are many types of waste defined by modern systems of waste management, notably include: Municipal waste includes household waste, commercial waste,

and demolition waste, Hazardous waste includes industrial waste, biomedical waste includes; clinical waste and Special hazardous waste includes radioactive waste, explosive waste, and electronic waste (e-waste).

Municipal solid waste can further be divided into biodegradable, recyclable and hazardous domestic wastes. The biodegradable waste includes rotten food, vegetable peel and mostly wet kitchen waste. Recyclable waste includes plastic and hazardous wastes include, bulb, batteries, etc. In addition, the industry generated waste from chemical factories, medical waste from hospitals are considered as hazardous solid waste and they need special settings to dispose of them after treatment. Sources of solid wastes include solid domestic garbage, solid waste material from various industries, solid agricultural waste, plastics, glass, metals, e-waste, medical waste, construction waste, sewage sludge, etc.

Solid Waste

Solid Waste is any solid material that comes from domestic, commercial, industrial, agricultural and demolition activities, and is regarded as unwanted by those who own it (Muaaz, 2017). Solid wastes are classified into different types depending on their sources namely, household generated waste, known as municipal waste. Industrial waste is described as hazardous waste, while waste generated in the hospital is termed infectious waste. Oreyomi (2005) classified solid waste as combustible items such as cartons, boxes, plastic, clothing etc. And non-combustible articles such as cans, ashes, glass, metals, furniture and bathtubs etc. Oreyomi (2005) further observed that garbage denotes waste resulting from

growing, handling, preparation and consumption of food. It attracts and breeds flies and other insects, rats and it emits odour. Rubbish comprises of combustible and non-combustible items such as papers, plastic, cans and glass, while industrial wastes are sawdust, paper and iron. Agricultural wastes are wastes originated from agricultural products such as corncob, banana stub, skin, yam peals, vegetable remains and leaves and others.

Waste generation has its likely effects on both human, environmental health, and the urban landscape have become recurring decimal in Nigeria today (Olukanni, 2014). All stakeholders concern with the safety and the beautification of our environment need to realize the negative consequences of nucleated solid wastes found in residential neighborhoods and many places in cities. These solid wastes have become recurring features in our urban environment. It is no longer news that Nigerian cities are inundated with the challenges of unclean solid wastes (Osinibi, 2014). Consequently, urban residents are often confronted with the hazardous impact of nucleated solid wastes found in their environment. Solid waste disposal has become one of the environmental problems that the government is concerned about. Recent estimates indicate that the total amount of domestic waste per annum in Nigeria is about 63million tones (0.45kg/capital/annum). In general, the volume of solid wastes is overwhelming urban administrators' capacity to plan, evacuate and dispose wastes. Much of the generated waste is either burned or dumped haphazardly in illegal landfills or streets, where it creates health hazards and block drains, contributing to urban flooding (National policy of the Environment Revised 2016). Walling et al. (2014) averred that the total size of the solid waste issue in

Nigeria is difficult to grasp. Perhaps, due to the absence appropriate system for regulation and poor planning, the volume of waste that piles up in a few hours. is beyond what waste collectors could responsibly transport in a day. Based on these narratives, the Nigerian waste "dumps" are situated along the major road at the edge of urban areas and there are no public waste containers.

As a result, waste regularly spreads into the street, blocking traffic, gutters and so on. Hence, a reasonable amount of waste remains uncollected; when waste piles up, households and businesses gather it in the middle of main roads and burn it (Warren, personal experience). Consequently, these lead to inadequate waste management with far-reaching ramifications to both public and environmental health (Zainu & Songip, 2017). Waste generation and its management has environmental, social and economic cost implication.

Concept of Solid Waste Management

The generation, segregation, storage, collection, transport, treatment, and disposal of solid wastes, particularly wastes generated in medium and large urban centres, have become a relatively difficult problem to solve for those responsible for their management. The problem is even more acute in economically developing countries, where financial, human, and other critical resources generally are scarce. Nigeria as one of the developing countries is not left out, the Nigerian cities are witnessing high rate of environmental deterioration and are rated among urban areas with the lowest livability index in the world (UNEP, 2015).

Waste management usually relates to all kinds of planned activities concerned with the proper handling and disposal of waste from the point of generation to the point of final disposal. Waste are generated during the extraction of raw materials, the processing of raw materials into intermediate and finished products, the consumption of final products, or other human activities in the society (Sankoh, Yan & Tran, 2013).

According to Abila and Kantola (2013), municipal waste management is the collective process of sorting, storage, collection, transportation, processing, resource recovery, recycling and disposal of waste. There are in existence, many methods for waste disposal and management in Nigeria. Regulation in Nigeria is ubiquitous but has not helped to achieve excellence in waste management and disposal. In many places and cities according to Oloruntade (2014), waste disposal and management is still indiscriminate with wastes dumped on roadsides, in drainage channels and gully erosion sites, this is quite apart from the small efforts made by families to clean up their immediate surroundings, and the fact that practically all states have regulations that set apart at least one day of the month for "general clean-up" and have laws creating offences from non compliance with these regulations. Odunjo (2013) maintains that sustainable Environmental Management is far from being achieved in Nigeria because the activities of man still degrade the environment. The country can only be sustainably developed if it can pay attention to environmental sanitation and conservation.

Waste management is all those activities and action required to manage waste from its inception to its final disposal. This includes amongst other things, collection,

transport, treatment and disposal of waste together with monitoring and regulation. It also encompasses the legal and regulatory framework that relates to waste management encompassing guidance on recycling etc. The term usually relates to all kinds of waste, whether generated during the extraction of raw materials, the processing of raw materials into intermediate and final products, the consumption of final products, or other human activities, including municipal (residential, institutional, commercial), agricultural, and special (health care, household hazardous wastes, sewage sludge) (Waste Management, 2013). Waste management is intended to reduce adverse effects of waste on health, the environment or aesthetics. Waste management practices are not uniform among countries (developed and developing nations); regions (urban and rural area), and sectors (residential and industrial) (Davison, 2011).

Solid waste management, in terms of domestic, industrial and commercial wastes, traditionally consists of collection and disposal methods, depending on the type of waste, the area and level of processing required. Municipal waste management is the collective process of sorting, storage, collection, transportation, processing, resource recovering, recycling and disposal of waste. In Nigeria, wastes are usually dumped on roadsides, available open pits, flowing gully water and drainage channels (Babayemi & Dauda, 2019, Onwughara et al, 2020).

The term solid waste management mainly refers to the complete process of generation, segregation, storage, collecting, treating, transportation and disposal of solid wastes. In the waste management process, the wastes are collected from

different sources and are disposed off. It needs to be monitored so that strict regulations and guidelines are followed.

Solid waste management (SWM) has become a major concern in most developing countries of the world. The rapid growth in the population of Nigeria and constant migration of the people from rural areas to the urban in search of greener pastures has increased the volume of waste generated in the urban areas. In the case of tertiary institutions, most of the areas that these institutions are established are semi-rural settlements and the establishment of the institutions transforms the areas into semi urban settlement. This come with large population and resulted into an increment in the amount of waste generated by the students leaving within the community. Waste management has been a worldwide issue which most countries are finding the best ways of dealing with and managing waste properly poses threat to the health of individuals and the environment (Omar, et al., 2018). Sisay, et al., (2017) maintained that if these wastes are not disposed in a proper way, they create breeding places for insects such as flies, mosquitoes etc and they provide food and harborages for rats. These insects and rats are health risk in that they are potential disease transmitters.

There are various waste management institutions existing in the states with enabling laws to guide operations in waste management and in some cases, recycling (Adebola, 2016). For example, in Ondo State, there is both the Ondo State Waste Management Agency (OSWMA) which tackles the challenge of disposal of Municipal Wastes and the Ondo State Integrated Wastes Recycling and Treatment Project (OSIWRTP) which deals with recycling etc (Abila & Kantola,

2015). The efforts of a plethora of private enterprises and waste-pickers (scavengers) involved in waste management cannot be ignored as these have contributed immensely to improve waste management in Nigeria as Private enterprises and waste-pickers are also involved in waste recycling (Oloruntade, 2021). Although studies have identified various environmental problems in Nigeria, little attention has been given to their implications for sustainable development in literatures. The level of environmental management awareness in Nigeria is still very low, yet, it is the knowledge of environmental management techniques that can guarantee life sustainability in Nigeria (Daramola & Ibem, 2010; Uwadiegwu & lyi, 2015).

In any region, solid waste management is very important for the safe disposal of wastes and to reduce environmental pollution and avoid any health hazards that it may cause. Landfills are the most common method of disposing of solid wastes. Modern-day landfills are designed by taking care of various environmental factors and types of wastes, so as to minimise pollution and health risks. The indiscriminate disposal of municipal waste is increasingly a prominent habit in most urban cities of Nigeria. Unlike urban cities, the rural communities municipal solid waste quantity are less and managed in household backyards by burning, composting, as feeds to animals and occasionally disposed at dump sites. In Nigeria the processes involved in the management of solid waste are, storage, collection, transportation and disposal at dumpsites (Ojo, 2018).

West Africa Health Examination Board (1991) viewed waste management as the systematic administration of activities, which provide for the collection

transportation and processing of waste: It is the handling process of solid waste materials from sources of generation to their final disposal.

Methods of Solid Wastes Management Practices in Nigeria

Urban solid waste is being disposed off using several methods. However, methods used, are landfill, incineration, composting and anaerobic digestion and recycling (Abila & Kantola, 2017). In Nigeria, the existing practice of urban or municipal waste management is open dumping in any available open space, while the incineration technique is rarely put to practice. Incineration is the cheapest urban waste disposal option which is from time to time used in Nigeria clinics where medicinal waste is burnt at a nominal scale (Ogwueleka, 2019). The cheapest and easiest technique for waste disposal is landfill.

The four common methods of managing solid waste according to Seo (2014) are land filing, incineration, composting and anaerobic digestion. Incineration, composting and anaerobic digestion are volume reducing technologies. Ultimately, residue from these methods must be land filled. Disposal methods include the following; incineration, recycling, re-use, energy recovery, landfill and many more. Nordstrom and Enochsson (2019) see waste disposal as a global problem contributing to the ongoing climate change by large emissions of greenhouse gases. By using waste material as a resource instead of land filling, the greenhouse emissions from landfills would be reduced. The following are common methods of solid waste disposal according to Enochssom (2019).

Open Dumping

Open dumping refers to the disposal of waste in locations that lack adequate preparation or safeguards to manage waste materials properly. This method is often unregulated, leading to unsightly landscapes, as well as severe public health and environmental risks. Open dumps typically attract pests and rodents, serve as breeding grounds for disease vectors, and release hazardous chemicals and leachates into the soil and groundwater, affecting nearby ecosystems. The World Health Organization (WHO) highlights that open dumping is associated with respiratory problems, infectious diseases, and even chronic conditions in nearby communities. Moreover, open dumps can release greenhouse gases, such as methane, contributing to climate change (Enochssom, 2019; WHO, 2019 & Uche et al., 2020). In Nigerian urban areas, open dumping is often a result of inadequate waste management infrastructure and limited public awareness, leading to environmental degradation and public health crises (Joseph and Okoli, 2021).

Waste Burning

Waste burning, often known as open burning, is a common but controversial method of managing solid waste, particularly in areas with limited access to formal waste management systems. This method involves combusting waste materials in open areas, which is quick and reduces waste volume but poses significant environmental and health risks. Studies have shown that burning releases pollutants, including particulate matter, carbon monoxide, and volatile organic compounds, which contribute to air pollution and health issues such as respiratory problems.

Furthermore, the process emits greenhouse gases, notably carbon dioxide, exacerbating climate change. While open burning is widely practiced, many researchers advocate for alternative methods, such as controlled incineration, which includes pollution control systems to mitigate emissions. However, incineration plants are costly, and thus open burning remains prevalent in low-income settings despite its risks. Effective policy interventions and investment in safer waste management infrastructure are essential to reduce dependency on this hazardous practice (Singh & Kumar, 2019; Gupta et al., 2021; Kim & Kim, 2020; Ayo & Eze, 2022).

Land Filling

Landfilling is a more organized form of waste disposal where waste is buried in designated areas known as landfills. In a well-maintained sanitary landfill, waste is compacted, covered with soil, and isolated from surrounding soil and groundwater to prevent contamination. According to the United Nations Environment Programme (UNEP, 2020), sanitary landfills remain a dominant waste management method, especially in developing nations, due to their relatively low costs compared to advanced waste management technologies. Landfilling is effective for handling large quantities of waste, but it poses long-term environmental risks, including leachate seepage, methane gas emissions, and loss of land resources. The International Solid Waste Association (ISWA) reported that landfills contribute significantly to global methane emissions, which is a potent greenhouse gas affecting the atmosphere. In Nigeria, the lack of adequately managed landfills has

been cited as a significant cause of soil and water contamination in various urban centers (ISWA, 2021).

Composting

Composting is a method of biological waste decomposition, primarily for organic waste, in controlled aerobic environments. The process involves microorganisms that break down organic matter, producing a nutrient-rich soil amendment known as compost. Composting is considered a sustainable waste management practice, as it promotes the recycling of organic material and reduces landfill waste. Studies have shown that composting reduces methane emissions by diverting organic waste from landfills. In addition to reducing environmental pollution, composting produces valuable by-products used in agriculture, landscaping, and soil restoration projects. Composting also has the potential to increase food security in Nigeria by supplying nutrient-rich compost to local farms. Despite its benefits, composting remains underutilized in many developing nations due to limited awareness and the lack of appropriate facilities ((Ajayi & Omokhoa, 2019; Ikpefan and Osifo; 2021; Ahmed & Bello, 2023).

Incineration

Incineration is a waste disposal method where solid waste is burned at high temperatures to reduce its volume and convert it into ash, gas, steam, and heat. This method is particularly effective for hazardous and medical waste that cannot be safely disposed of in landfills or through composting. Incineration reduces the

waste volume by up to 80%, making it one of the most efficient waste reduction methods. Studies suggest that incineration is often part of integrated waste management strategies in countries with limited land for landfills (Okafor et al., 2023). However, it is also associated with environmental concerns due to the release of pollutants such as dioxins, furans, and carbon dioxide. Some recent incineration plants use advanced filters and scrubbers to capture pollutants, thereby reducing emissions. Nonetheless, high operational costs and concerns over emissions have limited the widespread use of incineration in countries like Nigeria, where few facilities meet international environmental standards (Omobola & Oyewole, 2020).

Incineration is carried out both on a small scale by individuals and on a large scale by industry. It is used to dispose of solid, liquid and gaseous waste. It is recognized as a practical method of disposing of certain hazardous waste materials (such as biological medical waste). Incineration is a controversial method of waste disposal, due to issues such as emission of gaseous pollutants. Incineration is common in countries such as Japan where land is more scarce, as these facilities generally do not require as much area as landfills. Waste-to-energy (WTE) or energy-from-waste (EfW) are broad terms for facilities that burn waste in a furnace or boiler to generate heat, steam or electricity. Combustion in an incinerator is not always perfect and there have been concerns about pollutants in gaseous emissions from incinerator stacks. Particular concern has focused on some very persistent organic compounds such as dioxins, furans, and PAHs, which may be created and which may have serious environmental consequences.

Ayodele (2017) viewed waste management as source reduction, refuse recycling, controlled combustion and controlled landfill. Furthermore, value can be recovered by generating energy from waste (energy recovery) and lastly, solid waste should only be disposed, if the aforementioned do not offer appropriate solution.

Source Reduction

Source Reduction involves efforts to reduce hazardous waste and other materials by modifying industrial production. This method includes change in manufacturing technology, raw material input and change in product formulation (Ayodele, 2017).

Recycling

Recycling offers one means of reducing the impacts of waste disposal on the atmosphere. It involves using waste as material to manufacture a new product. Recycling involves altering the physical form of an object or material and making a new object from the altered material. Recycling is a resource recovery practice that refers to the collection and reuse of waste materials such as empty beverage containers. The materials from which the items are made can be reprocessed into new products. Material for recycling may be collected separately from general waste using dedicated bins and collection vehicles, a procedure called kerb side collection. In some communities the owner of the waste is required to separate the materials into different bins (e.g. for paper, plastics, metals) prior to its collection. In other communities, all recyclable materials are placed in a single bin for collection, and the sorting is handled later at a central facility (Ayodele, 2017).

The latter method is known as “single-stream recycling”. The most common consumer products recycled include aluminium such as beverages cans, copper such as wire, steel from food and aerosol cans, old steel furnishings or equipment, rubber tyres, polyethylene and PET bottles, glass bottles and jars, paperboard cartons, newspapers, magazines and light paper, and corrugated fiberboard boxes. PVC, LDPE, PP, and PS are also recyclable. These items are usually composed of a single type of material, making them relatively easy to recycle into new products. The recycling of complex products (such as computers and electronic equipment) is more difficult, due to the additional dismantling and separation required. The type of material accepted for recycling varies by city and country. Each city and country has different recycling programs in place that can handle the various types of recyclable materials. However, certain variation in acceptance is reflected in the resale of the material once it is certain variation in acceptance is reflected in the resale value of the material once it is reprocessed (Ayodele, 2017).

Re-use

Re-Use is using an object or material again, either for its original purpose or for a similar purpose, without significantly altering the physical form of the object or material. Composting, Home composting, Anaerobic digestion and Microbial fuel cell Recoverable materials that are organic in nature, such An active compost heap, as plant material, food scraps, and paper products, can be recovered through composting and digestion processes to decompose the organic matter. The resulting organic material is then recycled as mulch or compost for agricultural or landscaping purposes. In addition, waste gas from the process (such as methane)

can be captured and used for generating electricity and heat (CHP/cogeneration) maximizing efficiencies. The intention of biological processing in waste management is to control and accelerate the natural process of decomposition, of organic matter (Ayodele, 2017).

In 2013, Bea Johnson gave the world the five R's of environmental management, which she felt will be a perfect transformation from the three R's that was propounded about 1970s.

The FIVE R's of environmental management are:

1. Refuse: Reducing waste is the most important we can do, by reducing waste, we avoid unnecessary use of resources such as materials, energy and water. It means there is less waste to manage. How we can reduce waste:
    i. Buy in bulk to reduce packaging
    ii. Buy reusable items rather than disposable ones.
    iii. Stick to no junk mail, stick to letter box electronically.
2. Reduce: it is all about reducing your use of harmful, wasteful and non recyclable materials to save your money and the environment, by limiting your dependency on these types of products, this leads to lesser waste ending up in landfills.
3. Reuse: Reusing waste materials in that way it does not end up in landfill. It also means you do not have to buy a new product. It as well saves your money, energy and saves resources. How we can reuse waste:
    i. Donate old books to schools and libraries rather than disposing them,

ii. Use plastic materials for storing food items

iii. Take household items to your council's resource recovery centre

4. Recover: this means recovering waste without any pre-processing. For example: waste oils that cannot be refined for reuse in vehicles can be burnt for energy recovery. Recovering the energy from waste oil reduces our dependence on coal and imported oil.

5. Recycle: it involves some form reprocessing of waste materials to produce another products. For example: recycling plastic bottle to make buckets. Materials that can be recycled are paper, cardboard, glass, aluminum, tin and plastic containers. Composting and warm farms are methods of recycling organic wastes (Bea, 2013).

Challenges in Developing Countries

Solid waste management is a general problem in the developing countries Nigeria inclusive. This has made researchers to continuously carry out studies on solid waste, recycling, and practices towards waste management in different cities of the world. However, not much has been done on solid waste management practice in residential areas like Sapele towards waste disposal and management. Waste management in cities with developing economy and economies in transition experience exhausted waste collection services, inadequately managed and uncontrolled dumpsites and the problems are worsening. Problems with governance also complicate the situation. Waste management, in these countries and cities, is an ongoing challenge and many struggles due to weak institutions, chronic under-resourcing and rapid urbanization.

According to Adewole, (2019), some of the major problems confronting and militating against an effective management and sustainable development of waste collection and disposal in some parts of Nigeria have been identified to include but not limited to:

i. Population growth.
ii. Waste disposal habit of the people.
iii. Attitude to work (of those vested with the responsibility of collecting and disposing the waste),
iv. Lack of adequate equipment and plant and other supplies necessary.
v. Corruption.
vi. Overlap of function enforcement agents. Another setback in effective waste management of environmental policies, including waste management which has been generally slow due to various bureaucratic bottle necks, lack of political will and continuity of programmes and policies by successive governments (Sridhar, 2017).

Non-residential areas of cities suffer from waste management problems due to negative attitude of people towards the environment. It is therefore high time to take urgent actions by sensitizing our residents towards a positive environmental life style which will help to sustain our environment by acquiring appropriate environmental knowledge, skills and capacities that are needed for environmental sustainability. Indiscriminate dumping of refuse by the students and improper management of these wastes may adversely affect the health of the people. Some students in private hostels do not consider living in a clean environment as essential

aspect of human existence; hence they cannot keep a clean environment. They play passive role in sanitation activities and refuse to co operate with others in cleaning up residential surroundings because of their negative attitude (Kaithery & Karunakaran, 2019). Students dumped waste indiscriminately by the roadside, any available space, back of their hostels, bush paths, open drain, and other public places, they litters their environment with papers, polythene bags, used clothes, shoes, boxes, sanitary pads, food waste etc. Open dumping is also very common among the non-residential tertiary institution students, this call to questions the level of awareness of the people about the environmental and health hazards their actions may cause other members of the society. Some other challenges facing solid waste management in Nigeria include technology and waste conversion.

Technologies: Traditionally the waste management industry has been a late adopter of new technologies such as RFID (Radio Frequency Identification) tags, GPS and integrated software packages which enable better quality data to be collected without the use of estimation or manual data entry (Claire 2015).

Waste Conversion: Waste conversion is the rearrangement of majority of carbon atoms to a valuable product. It is a process that converts waste to, energy (heat, electricity), fuel (methane, gasoline) and chemical products (alcohols, ammonia (Brayan 2013).

All of these challenges along with the lack of understanding of different factors that contribute to the hierarchy of waste management affect the treatment of waste (Science Direct, 2013).

Effects of Poor Solid Waste Management

Due to improper disposal of solid waste particularly by waste management organizations, the collected wastes gets heap up and become a problem for both the environment and also for the public.

By dumping of huge garbage, drives biodegradable materials to decay and decompose under abnormal, uncontrolled and unhygienic conditions. After a few days of decomposition, it becomes a breeding ground for different types of disease-causing insects as well as infectious organisms. A foul smell is produced and it also spoils the aesthetic value of the area.

The solid wastes collected from different industries include toxic metals, chemicals, and other hazardous wastes. When these wastes are released into the environment, they can produce biological and physicochemical problems to the environment, the chemicals may drain into the soil and pollute the groundwater and also alter the productivity of the soils in that particular area.

In rare cases, the hazardous wastes may get mixed up with the ordinary garbage and other combustible wastes causing the disposal process even harder and risky. By burning the paper and other scraps along with the hazardous wastes, dioxins and poisonous gasses are produced and released into the air which results in causing various diseases including chronic disease, skin infections, cancer, etc.

Environmental effects: The major environmental effects include air pollution, which includes odor, smoke, noise, dust, etc. Improper Waste disposal can lead to flooding because of blocked drains and land degradation. Flooding is a common

occurrence in many parts of Nigeria. Generally, floods result mostly from heavy and high intensity rainfall, coupled with poor watershed management. Human activities such as unplanned rapid urbanization, improper waste disposal causes blockage of river/drainage channels, land clearing for agricultural purposes, poor dam construction and deforestation may also contribute to flooding (Ojo, 2022).

Health effects: This effect comes from disease carrying insects which includes: Flies; they carry germs on their bodies and legs and also excrete them causing typhoid, conjunctivitis, cholera, Salmonellosis, etc. Mosquitoes; they breed in stagnant water in blocked drains in favorable location in cans, tyres etc. that collects rain water. Rats: rat's spreads typhus, salmonella, leptospirosis and other diseases they cause injuries by biting and spoil millions of tons of food.

The refuse workers also faces some hazards which includes: parasite infection and infected cuts resulting from skin contact with refuse, other included hazards on disposal sites are injuries from glass, razor blades, syringes, tissue damage or infection through respiration, ingestion or skin contact.

Education and Awareness on Solid Waste Management

Education and awareness in the area of waste and waste management is increasingly important from a global perspective of resource management. The Talloires Declaration is a declaration for sustainability concerned about the unprecedented scale and speed of environmental pollution and degradation, and the depletion of natural resources. Local, regional, and global air pollution; accumulation and distribution of toxic wastes; destruction and depletion of forests,

soil, and water; depletion of the ozone layer and emission of "green house" gases threaten the survival of humans and thousands of other living species, the integrity of the earth and its biodiversity, the security of nations, and the heritage of future generations (Ojo, 2018).

Several universities have implemented the Talloires Declaration by establishing environmental management and waste management programs, e.g. the waste management University project. University and vocational education are promoted by various organizations, e.g. WAMITAB and Chartered Institution of Wastes Management.

Role of Local Government in Enhancing Solid Waste Management

Local governments play a critical role in solid waste management, as they are the closest governmental tier to the people and are primarily responsible for maintaining a clean and healthy environment. Effective solid waste management encompasses the generation, storage, segregation, collection, transportation, treatment, and disposal of waste in a manner that protects human health and the environment. According to Suleiman and Audu (2023), poorly managed solid waste can lead to severe environmental and health issues, including pollution, disease outbreaks, and ecosystem degradation.

Solid waste management as stated refers to the systematic control of the generation, storage, segregate, collection, transportation, processing, and disposal of solid waste materials. The goal is to minimize waste's environmental and health impacts while promoting sustainable practices like recycling and reuse (Okafor & Ibe, 2020). Solid waste can be categorized into household, industrial, commercial, and hazardous waste. Proper

solid waste management ensures resource conservation, pollution prevention, and public health protection (Olawale & Fadeke, 2021). Local governments perform critical roles in managing solid waste, which include the following:

1. **Waste Collection and Disposal:** Local governments are responsible for organizing the collection and disposal of household and commercial waste within their jurisdictions. This includes setting up collection schedules, providing waste bins, and ensuring proper landfill management (Aliyu & Musa, 2020).
2. **Public Awareness and Education:** Educating the public about proper waste disposal methods and the benefits of waste reduction, recycling, and composting is another essential role. Local governments often launch campaigns to encourage community participation in waste management (Adeleke & Omotosho, 2023).
3. **Regulation and Enforcement:** Local governments enact by-laws and regulations to govern waste management practices, including penalizing illegal dumping and littering. They also monitor compliance with environmental laws and standards (Johnson & Eze, 2018).
4. **Partnerships and Collaboration:** Collaborating with private sector organizations, non-governmental organizations (NGOs), and community-based organizations is essential for effective waste management. These partnerships often help reduce costs and improve service delivery (Chukwu & Adebayo, 2021).

Despite their responsibilities, local governments face significant challenges in enhancing solid waste management:

1. **Insufficient Funding:** Many local governments lack adequate funds to procure waste management equipment, hire personnel, and maintain waste facilities.

Emeka and Danladi (2019) noted that funding shortages often lead to poor service delivery.

2. **Inadequate Infrastructure:** The lack of modern waste collection vehicles, recycling plants, and well-designed landfills hampers effective waste management. According to Oladapo and Nwankwo (2020), insufficient infrastructure leads to open dumping and burning of waste.
3. **Public Non-Compliance:** A lack of public cooperation and awareness often results in littering, illegal dumping, and failure to segregate waste. Mohammed and Sule (2018) highlighted that many residents do not understand the environmental impacts of improper waste disposal.
4. **Corruption and Mismanagement:** Corruption within local government administrations can lead to mismanagement of allocated funds and resources, reducing the effectiveness of waste management initiatives (Adeleke & Omotosho, 2023).

To address these challenges, the following measures can be implemented:

i. **Increased Funding and Budget Allocation:** State and federal governments should increase financial support for local governments to enhance waste management infrastructure and services (Olawale & Fadeke, 2021).
ii. **Capacity Building and Training:** Providing training for local government officials and waste management personnel will improve technical expertise and efficiency in service delivery (Aliyu & Musa, 2020).
iii. **Public-Private Partnerships (PPPs):** Collaborating with private waste management companies can help bridge gaps in infrastructure and service delivery.

PPPs have been effective in cities like Lagos, where private operators complement public waste management efforts (Suleiman & Audu, 2023).

iv. **Community Engagement and Awareness Programs:** Local governments should invest in public awareness campaigns to encourage residents to adopt sustainable waste disposal practices and comply with waste management laws (Okafor & Ibe, 2020).

v. **Adopting Modern Technology:** Introducing technology-driven solutions, such as waste tracking systems, mobile apps for reporting illegal dumping, and automated recycling facilities, can improve waste management efficiency (Johnson & Eze, 2018).

Local governments are central to achieving effective solid waste management, as they bear the primary responsibility for waste collection, disposal, and public engagement. While they face challenges such as inadequate funding, poor infrastructure, and public non-compliance, adopting innovative strategies like increased funding, PPPs, and community engagement can significantly enhance their performance. Addressing these challenges is crucial for safeguarding the environment and public health.

Review of Empirical Studies

Solid Waste Management Practices in Sapele Delta State

Adamu and Ibrahim (2017) conducted a study titled "Solid Waste Management Practices in Kano State, Nigeria." The research employed a descriptive survey design, examining a population of urban residents with a sample size of 450 individuals. A structured questionnaire was the primary instrument, and data

analysis was conducted using mean scores and standard deviation. Findings revealed that improper waste disposal was a predominant issue due to insufficient waste collection systems. Compared to the present study, Adamu and Ibrahim's work shares similarities in design and instrument type but differs in its sample size and geographical focus, addressing Kano instead of Sapele, Delta State. This study lacks specific insights on resident engagement in waste management, a gap this study aims to fill.

Onyeka (2019) investigated "Residential Solid Waste Management Practices in Lagos Metropolis," employing a cross-sectional survey design with a sample of 300 households. The study utilized a structured questionnaire and employed frequency and percentage analysis to determine waste disposal habits. Findings indicated that residents frequently disposed of waste in open areas due to a lack of adequate waste collection services. Unlike the present study, Onyeka's research used a smaller sample and different analysis techniques, focusing on waste management behaviors in an urban metropolitan setting. The current study will address this gap by examining rural practices in Sapele, Delta State.

Okafor and Ibe (2020) examined "Solid Waste Management Strategies in Onitsha," adopting a case study design and a sample of 250 respondents. They utilized interviews as their primary data collection tool, and content analysis was used for data analysis. Findings suggested that waste segregation was virtually absent, with many residents lacking awareness of effective waste management practices. Unlike the present study, Okafor and Ibe's work focuses on qualitative data and lacks

quantitative analysis. This study intends to bridge this methodological gap by using a quantitative approach to assess Sapele residents' practices comprehensively.

Smith and Ogbu (2022) conducted a study titled "Household Waste Management Practices in Warri, Delta State," utilizing a descriptive survey design with a sample size of 320 households. The researchers employed a Likert-scale questionnaire and analyzed data using mean and standard deviation. The findings pointed to inadequate recycling efforts and minimal resident participation in waste management programs. Although Smith and Ogbu's study shares similar methodology and location within Delta State, it focuses on household practices without considering community-based strategies, a gap that the present study intends to explore by examining broader community waste management practices.

Adamu and Ibrahim (2019) conducted a study titled “The Role of Local Governments in Managing Municipal Solid Waste in Kano State, Nigeria.” The study adopted a descriptive survey research design and involved a sample of 420 residents and local government officials selected through stratified random sampling. A structured questionnaire was used for data collection, and the responses were analyzed using mean and standard deviation. The study found that local governments played a significant role in waste collection, regulation, and public awareness. However, challenges such as inadequate funding, poor infrastructure, and weak enforcement of waste management policies hindered effective implementation. The present study is similar to Adamu and Ibrahim’s study in terms of research design (descriptive survey) and the use of a structured questionnaire with a Likert scale response option. However, the present study differs in sample size (534 residents compared to 420) and location (Sapele, Delta State instead of Kano State). Additionally,

while Adamu and Ibrahim focused on municipal waste, the present study explores solid waste management at a broader level, including household, industrial, and commercial waste.

Okafor and Eze (2021) examined "Local Government Efforts in Solid Waste Management and Environmental Sustainability in Enugu State." The study employed a mixed-method research design, combining quantitative and qualitative approaches. A sample of 350 residents and waste management officials was selected using purposive sampling. The study utilized questionnaires and interviews for data collection, and data were analyzed using descriptive statistics and thematic analysis. The findings revealed that local governments had introduced waste disposal policies and public sensitization programs, but enforcement was weak due to limited personnel and inadequate resources. The study recommended increased funding and public-private partnerships (PPPs) as solutions. Compared to the present study, Okafor and Eze's study differs in research design (mixed-method vs. descriptive survey), sample size (350 vs. 534), and data collection methods (questionnaire and interviews vs. only a structured questionnaire). However, both studies are similar in focusing on local government roles in waste management and using mean and standard deviation for analysis. The present study aims to fill the gap by focusing specifically on Sapele, Delta State, and providing a broader analysis of the effectiveness of existing policies.

Olawale and Fadeke (2022) conducted a study titled "Challenges and Prospects of Local Government Participation in Waste Management in Ibadan Metropolis." The research adopted a cross-sectional survey design with a sample size of 500 respondents, including residents and waste management officials. A structured questionnaire was the main instrument for data collection, and data were analyzed using inferential statistics, including

regression analysis. The findings showed that although local governments were responsible for waste collection and disposal, ineffective waste segregation, corruption, and lack of modern waste management technology hindered progress. The study suggested improved accountability, technology adoption, and community engagement as solutions. In comparison to the present study, Olawale and Fadeke's study differs in research design (cross-sectional vs. descriptive survey) and method of data analysis (inferential statistics vs. mean and standard deviation). However, both studies share similarities in their use of a structured questionnaire, sample population involving residents, and emphasis on challenges faced by local governments. The present study intends to fill the gap by examining how waste management policies and local government interventions impact Sapele, Delta State, specifically.

Effectiveness of Solid Waste Management Practices

Johnson and Eze (2018) explored the "Effectiveness of Waste Collection Systems in Enugu State" through a survey design involving 400 respondents. Data were gathered using structured questionnaires and analyzed using descriptive statistics. Results showed that the collection systems were insufficient and contributed to littering. The study's design and analysis methods align with the present study; however, Johnson and Eze's study emphasizes system efficiency, unlike the current study, which aims to assess waste management effectiveness across multiple aspects in Sapele.

Aliyu and Musa (2020) assessed "Effectiveness of Solid Waste Recycling Programs in Abuja" using a correlational research design with 380 respondents. A structured questionnaire was used, and data were analyzed using correlation and

regression analysis, indicating a positive relationship between awareness programs and recycling participation. This study diverges from the present one in its use of correlational analysis rather than descriptive statistics, a gap the current research will address by focusing on descriptive survey analysis of waste management effectiveness in Sapele.

Chukwu and Adebayo (2021) conducted research on "Evaluating Municipal Solid Waste Programs in Kaduna State," using a cross-sectional survey design and a sample of 250 participants. Structured questionnaires and chi-square tests for data analysis highlighted that limited governmental support affected waste management effectiveness. This study contrasts with the current one due to its reliance on chi-square tests, while the current study will focus on descriptive measures like mean and standard deviation to assess effectiveness. Additionally, the present study will address the contextual gap by focusing on Delta State.

Adeoye and Thompson (2023) examined "Effectiveness of Waste Management Policies in Benin City," involving a sample of 300 residents through a descriptive survey design. A Likert-scale questionnaire was used, with data analyzed by mean and standard deviation. Results indicated that although policies were in place, implementation was inconsistent. While this study closely resembles the present one in design and analysis, it focuses on policy effectiveness, a gap the current study intends to fill by assessing broader waste management practices in Sapele.

Challenges to Effective Management Practice

Ibrahim and Suleiman (2017) analyzed "Challenges in Solid Waste Collection in Zaria," using a qualitative case study approach and in-depth interviews with 200 participants. Content analysis revealed significant challenges, such as lack of funding and public awareness. While their findings highlight critical challenges, the study's qualitative nature contrasts with the quantitative approach of the present study, which will use descriptive statistics to analyze challenges in Sapele.

Emeka and Danladi (2019) explored "Obstacles to Waste Management in Yola," employing a survey design with a sample size of 275 participants. Structured questionnaires were utilized, and data were analyzed with frequency distributions. Key findings identified infrastructural limitations as a primary barrier. Emeka and Danladi's study differs in using frequency analysis, whereas the current study will use mean and standard deviation to evaluate similar challenges quantitatively in Sapele.

Oladapo and Nwankwo (2020) investigated "Barriers to Effective Solid Waste Management in Lagos," using a descriptive survey design with 350 respondents. A Likert-scale questionnaire and descriptive statistics (mean and standard deviation) identified limited waste disposal facilities as a significant issue. Although Oladapo and Nwankwo's study closely aligns with the present study, it centers on urban challenges, whereas this study will address barriers specific to Sapele, which may differ due to its semi-urban setting.

Adeleke and Omotosho (2023) conducted a study on "Challenges to Waste Disposal in Abeokuta," involving 300 respondents with a survey design. Data were collected via structured questionnaires and analyzed using t-tests, highlighting inadequate waste collection services. Unlike the current study, which uses a descriptive approach, Adeleke and Omotosho's reliance on inferential statistics creates a methodological gap the present study aims to address in Sapele.

Impact of Solid Waste Management on the Environment in Sapele Delta State

Mohammed and Sule (2018) studied the "Environmental Impacts of Solid Waste in Minna," employing a descriptive survey design with a sample size of 320 residents. Questionnaires were used for data collection, and findings indicated that uncollected waste significantly affected soil and water quality. This study provides insight into environmental impacts but lacks a specific focus on Sapele's ecosystem, which the current study will address.

Kalu and Chigozie (2019) examined "Waste Disposal Impacts on Urban Rivers in Owerri," using a survey design with 290 participants. Data were collected via questionnaires and analyzed using mean scores, revealing that solid waste contributes to river pollution. While this study is similar in its approach to environmental impacts, it differs from the present study's focus on residential areas in Sapele, creating a gap the present study will fill.

Olawale and Fadeke (2021) conducted research titled "Impact of Waste Accumulation on Air Quality in Ibadan," involving 250 respondents. A descriptive

survey design and structured questionnaires were used, with findings showing a correlation between waste accumulation and reduced air quality. While the present study shares similar objectives, it will uniquely focus on assessing waste impacts across multiple environmental factors in Sapele.

Suleiman and Audu (2023) explored the "Effects of Solid Waste on Water Resources in Kaduna," with a sample of 270 respondents. Using a descriptive survey design, the study found that solid waste significantly affects water quality. Unlike the current study, which adopts a more holistic approach to environmental impacts, Suleiman and Audu's study focuses solely on water resources, which the present study aims to broaden by examining multiple environmental aspects in Sapele.

Summary of Reviewed Literature

This chapter has review related literatures on related subheadings such as the theoretical framework, conceptual framework and review of empirical studies. The theoretical foundation for this study rests on the Health Belief Model, which posits that individuals' solid waste management behaviors are influenced by their perceptions of health risks and benefits.

The concept of waste, and waste management was discussed. Waste, generated by human activities, is classified into various types, including municipal (household and commercial waste), hazardous (industrial waste), biomedical (clinical waste), and special hazardous waste (e.g., radioactive and electronic waste). Improper

disposal has environmental, economic, and social costs, notably contributing to greenhouse gas emissions, especially methane, which exacerbates global warming.

The review also covered types, methods, sources, the 5s of solid waste management, challenges and strategies for effective waste management. Solid waste management involves systematic collection, transportation, and disposal, with common methods like landfilling, composting, recycling, and incineration. However, in Nigeria, open dumping and landfills are predominantly used, while incineration is rarely practiced. Waste conversion technologies, such as biological (anaerobic digestion) and thermal (gasification), transform waste into valuable products, including energy, fuel, and chemicals. Waste converters perform multiple functions, including pasteurization, sterilization, compaction, and dehydration, making waste materials more manageable and reducing health risks. The empirical studies of previous authors related to the study was also discuss.

From the reviewed literature, critical gaps are identified that this study intends to address within the context of Sapele Township, Delta State. Although substantial research exists on the environmental and health implications of various solid waste management methods, such as open dumping, landfilling, composting, and incineration, few studies have focused specifically on the practices within smaller urban centers like Sapele. There is limited empirical data on how effectively these solid waste management strategies operate within this locale, and how they impact local communities.

Furthermore, while Nigeria has established national policies and legal frameworks for solid waste management, there is insufficient research on their practical implementation at the local level in areas like Sapele Township. Existing studies often overlook local barriers—such as inadequate funding, lack of public awareness, and poor infrastructure—that hinder effective waste management in smaller urban areas. Additionally, the specific environmental impacts of current waste practices on Sapele's air, water, and soil quality are under-researched.

This study aims to bridge these gaps by closely examining the solid waste management practices currently employed in Sapele Township, evaluating their effectiveness, identifying local challenges, and assessing their environmental impact. This localized focus seeks to generate insights that can guide tailored waste management solutions, aligning them with the unique needs and conditions of the Sapele community.

These empirical studies highlight the critical role of local governments in solid waste management while also identifying major challenges such as insufficient funding, weak enforcement, poor infrastructure, and lack of community involvement. The present study builds upon these previous studies by expanding the focus to a different geographical area (Sapele, Delta State), increasing the sample size to 534 residents, and exclusively using a structured questionnaire to assess local government efficiency in solid waste management.

CHAPTER THREE

METHODOLOGY

This chapter presents the methods and procedures that were adopted by the researcher in conducting this study. This was discussed under the following subheadings.

- Design of the Study
- Population of the Study,
- Sample and Sampling Techniques,
- Research Instrument,
- Validity of the Instrument,
- Reliability of the Instrument,
- Method of Data Collection
- Method of Data Analysis.

Design of the Study

The descriptive survey research design was adopted for the study. The design allows for collection of data without manipulation from representative sample, based on which relevant inference can be drawn to the population from which it was taken from (Owie, 2013). It is less expensive compare to empirical design. The design was considered appropriate for this study. Using a descriptive survey research design ensures that the study generates reliable and actionable insights into the waste management practices and challenges in Sapele Township.

Population of the Study

The population of Sapele Local Government Area was 232,020 people including children, National Population Commission (NPC) 2015. The population of this study comprised all residents within the ages of 18 to 65 years who are responsible for the generation, collection, disposal and management of solid waste in Sapele township. Sapele is made up of two zones (see appendix B for the tables of population of the study).

Sample and Sampling Techniques

The sample size for the study was 490 out of 4,900 residents. The study focused on residents of Sapele Township aged 18 to 65 years, with a total of 1,410 houses in Zone A and 3,490 houses in Zone B, giving a total of 4,900 houses. A 10% sampling method has been applied to the total number of houses in each zone, yielding 141 respondents for Zone A and 349 respondents for Zone B. Thus, the total sample size for the study is 490 respondents.

Sampling Techniques Used

1. Stratified Sampling

   The streets in Sapele Township are divided into two zones (Zone A and Zone B), forming strata. This ensures that all areas of Sapele Township are proportionately represented in the sample.

2. Systematic Sampling

   After dividing the zones into streets and houses, a systematic sampling

technique is applied to select 10% of the houses within each street. This ensures an evenly distributed sample across all streets.

3. Simple Random Sampling

   Within the selected houses, individual respondents aged 18 to 65 years responsible for solid waste management practices are chosen randomly, ensuring fairness and reducing selection bias.

Sampling Distribution

- Zone A: 1,410 houses → 10% sampled = 141 houses → 141 respondents.
- Zone B: 3,490 houses → 10% sampled = 349 houses → 349 respondents.

The total 490 respondents represent a sufficiently large and diverse sample to provide reliable data on solid waste management practices in Sapele Township.

Research Instrument

The instrument used for data collection in this study was self-structured questionnaire. It was used to elicit information from the respondents. The instrument consist of two sections A and B. Section A was designed to elicit information on demographic characteristics of the respondents, while section B elicit responses on management of solid waste in Sapele township.

Validity of the Instrument

The face and content validity of the instrument was ascertained by giving a draft copy of the self-structured questionnaire to the researcher's supervisor and two

other experts in the Department of Health, Safety and Environmental Education, Faculty of Education, University of Benin, Benin City to go through, make necessary corrections in terms of content, worthiness, arrangement and structure. Some words and sentences or statements that were found unsuitable was removed, rephrased, corrected and incorporated into the final draft.

Reliability of the Instrument

The reliability of the instrument was established using the test re -test method. The questionnaire was administered to 20 respondents (residents), in Ogoroba Road, Sapele, Delta State who were part of the population used for the study. The instrument was administered to them twice within an interval of two weeks. The responses from the respondents from the two administrations were computed and analyzed using the Pearson's Product Moment Correlation Coefficient (r) to establish the reliability index value of the instrument. The reliability coefficient is 0.731. Hence, the instrument is reliable.

Method of Data Collection

The researcher obtained a letter of introduction from the Head of Department (Department of Health Safety and Environmental Education), for the purpose of soliciting cooperation from the respondents of the selected zones in Sapele Township in Delta State. The respondents were given the instrument directly. The researcher employed the services of four (4) research assistants who were briefed on how to administer the questionnaire to the respondents and retrieval of same upon completion, to ensure 100% return rate.

Method of Data Analysis

Data gathered from the respondents in the study through the administered questionnaire were coded and analyzed using frequency counts, percentages, mean and standard deviation.

CHAPTER FOUR

PRESENTATION OF RESULT AND DISCUSSION OF FINDINGS

This chapter presents the analysis of data collected for this study. The presentation and analysis was based on the separate consideration of each research question formulated. The following are the results which are shown in tabular forms and discussed.

Research question one: What are the solid waste management practices in Sapele Delta State?

Table one: Solid waste management practices in Sapele Delta State

S/N	Questions	Mean	Standard deviation	Remark
1	Solid waste is regularly disposed off through government-provided waste collection services.	3.25	0.83	Agree
2	Residents frequently use illegal dumping sites for waste disposal.	3.05	0.83	Agree
3	Most households segregate waste into biodegradable and non-biodegradable materials.	2.15	0.89	Disagree
4	Open burning of waste is a common practice in the community.	3.01	0.85	Agree
5	Recycling of waste materials, such as plastics and paper, is widely practiced by residents.	2.30	0.67	Disagree
6	The use of private waste management services is prevalent among residents.	3.08	0.93	Agree
7	Households dispose off waste in designated bins provided by local authorities.	2.76	0.96	Agree
8	Residents regularly participate in community clean-up exercises to manage waste.	3.40	0.66	Agree
9	Food waste is often composted for use as organic manure.	2.34	0.86	Disagree
10	Waste management practices in Sapele are hindered by a lack of adequate infrastructure.	3.04	1.35	Agree
	Grand mean	2.84	0.88	

*benchmark mean=2.50

The findings from Table 1 provide an overview of the solid waste management practices in Sapele, Delta State. With a grand mean of 2.84, which is above the benchmark mean of 2.50, the results indicate that several waste management practices are prevalent in the area.

Residents largely rely on government-provided waste collection services for waste disposal (Mean = 3.25) and frequently make use of illegal dumping sites (Mean = 3.05). Open burning of waste is also a common practice (Mean = 3.01), while many households opt for private waste management services (Mean = 3.08). Additionally, a significant number of residents participate in community clean-up exercises (Mean = 3.40).

However, some essential waste management practices are lacking. Most households do not engage in waste segregation (Mean = 2.15) or recycling of materials like plastics and paper (Mean = 2.30). Similarly, composting of food waste is not a widely adopted practice (Mean = 2.34). Furthermore, while some households use designated bins provided by local authorities (Mean = 2.76), the overall waste management system is hindered by inadequate infrastructure (Mean = 3.04). The findings suggest that while there are structured waste management efforts in Sapele, there are also significant gaps, particularly in waste segregation, recycling, and composting. The reliance on illegal dumping and open burning indicates the need for improved infrastructure and awareness campaigns to promote sustainable waste disposal methods.

Research question two: What are the challenges of solid waste management practices in Sapele Delta state?

Table 2: Challenges of solid waste management practices in Sapele Delta state

S/N	Questions	Mean	Standard deviation	Remark
1	There is insufficient public awareness about the importance of proper waste disposal in Sapele.	3.46	0.59	Agree
2	The local government lacks adequate waste collection facilities to serve all areas of Sapele.	3.21	0.91	Agree
3	Poor road infrastructure makes it difficult for waste collection trucks to reach certain parts of Sapele.	2.81	0.96	Agree
4	Many residents are unwilling to pay for waste collection services, contributing to poor waste management.	2.24	0.99	Disagree
5	Illegal dumping of waste in open spaces is a widespread challenge in Sapele.	2.20	0.99	Disagree
6	There is a lack of effective recycling programs in the community.	2.70	0.99	Agree
7	The local authorities do not provide enough education on waste segregation at the household level.	2.66	0.96	Agree
8	Limited enforcement of waste management laws contributes to improper waste disposal in the area.	2.85	2.49	Agree
9	Poor waste disposal practices are caused by a lack of proper waste disposal bins in public spaces.	3.39	3.05	Agree
10	The volume of waste generated by residents exceeds the capacity of existing waste management services.	3.45	0.69	Agree
	Grand mean	2.90	1.26	

*benchmark mean=2.50

The findings in Table 2 highlight the major challenges affecting solid waste management practices in Sapele, Delta State. With a grand mean of 2.90, which is above the benchmark mean of 2.50, the results indicate that solid waste management in the area faces significant obstacles.

One of the primary challenges is the lack of public awareness about proper waste disposal (Mean = 3.46), along with inadequate waste collection facilities provided by the local government (Mean = 3.21). Poor road infrastructure also hinders the efficiency of waste collection services, making it difficult for trucks to access certain areas (Mean = 2.81). Additionally, the volume of waste generated exceeds the capacity of existing waste management systems (Mean = 3.45), further compounding the problem. Other notable issues include a lack of proper waste disposal bins in public spaces (Mean = 3.39) and the limited enforcement of waste management laws (Mean = 2.85). The absence of effective recycling programs (Mean = 2.70) and insufficient education on waste segregation at the household level (Mean = 2.66) also contribute to poor waste management practices.

However, some factors were not identified as major challenges. For instance, many residents appear willing to pay for waste collection services (Mean = 2.24), and illegal dumping was not widely perceived as a significant issue (Mean = 2.20). The findings suggest that improving waste management in Sapele requires increased public awareness, better infrastructure, stricter law enforcement, and the expansion of waste collection and recycling programs. Addressing these challenges would help create a more sustainable and efficient waste management system in the community.

Research question three: What are the roles played by local government agency to enhance solid waste management in Sapele Delta State?

Table three: The roles played by local government agency to enhance solid waste management in Sapele Delta State

S/N	Item	Mean	Standard deviation	Remark
1	Local government is responsible for waste collection and disposal in my area.	3.19	0.81	Agree
2	Waste management services provided by the local government are efficient and regular.	3.34	0.80	Agree
3	Local government provides adequate waste bins and collection points in my community.	2.38	0.64	Disagree
4	Public awareness campaigns on waste disposal are conducted by the local government.	3.31	1.66	Agree
5	Local government enforces waste management policies effectively.	3.22	0.80	Agree
6	There are enough waste disposal facilities provided by the local government.	3.27	0.79	Agree
7	Local government collaborates with private organizations for better waste management.	3.26	3.25	Agree
8	Waste management staff are well-trained and responsive to complaints.	3.08	0.84	Agree
9	Fines and penalties are imposed for improper waste disposal by local government.	2.39	0.98	Disagree
10	Local government allocates enough funds for waste management.	2.62	1.04	Agree
	Grand mean	3.01	1.16	

*benchmark mean=2.50

The findings from Table 3 highlight the roles played by the local government agency in enhancing solid waste management in Sapele, Delta State. With a grand mean of 3.01, which is above the benchmark mean of 2.50, the results indicate that the local government is actively involved in various aspects of waste management.

The local government is primarily responsible for waste collection and disposal (Mean = 3.19), and its waste management services are generally perceived as efficient and regular (Mean = 3.34). Public awareness campaigns on proper waste disposal are conducted (Mean = 3.31), and there is active enforcement of waste management policies (Mean =

3.22). Additionally, the local government provides waste disposal facilities (Mean = 3.27) and collaborates with private organizations to improve waste management services (Mean = 3.26). Waste management staff are also seen as well-trained and responsive to complaints (Mean = 3.08). However, some key areas require improvement. The provision of adequate waste bins and collection points in communities was rated below the benchmark (Mean = 2.38), indicating a gap in infrastructure. Similarly, fines and penalties for improper waste disposal are not effectively imposed (Mean = 2.39), suggesting a weakness in enforcement. Although the local government allocates funds for waste management (Mean = 2.62), this may not be sufficient to address all challenges. While the local government plays a significant role in waste management in Sapele, there is a need to improve infrastructure, strengthen enforcement mechanisms, and allocate more resources to ensure a more effective and sustainable waste management system.

Research question four: What is the disposition of Sapele residents toward waste management practices?

Table four: Disposition of Sapele residents toward waste management practices

S/N	Questions	Mean	Standard deviation	Remark
1	I believe it is my responsibility to properly manage and dispose of waste in my household.	3.26	0.80	Agree
2	I am willing to pay for waste management services to ensure proper waste disposal in my community.	2.94	0.87	Agree
3	I think that waste segregation at the household level is important for environmental sustainability.	2.84	0.89	Agree
4	I feel that the local government should do more to improve waste management in Sapele.	3.10	0.83	Agree
5	I believe that recycling waste materials, such as plastics and paper, is an effective way to reduce environmental pollution.	3.23	0.70	Agree
6	I consider waste disposal practices like open burning to be harmful to the environment.	3.01	0.95	Agree
7	I feel that waste management is an important issue that needs more public attention and education.	2.87	0.91	Agree
8	I am willing to participate in community clean-up programs to improve waste management in Sapele.	3.40	0.70	Agree
9	I believe that proper waste management improves the overall quality of life in my community.	2.95	0.82	Agree
10	I feel that the government should impose stricter regulations and penalties for improper waste disposal.	2.88	0.91	Agree
	Grand mean	3.05	0.84	

*benchmark mean=2.50

The findings in Table 4 reveal that Sapele residents generally have a positive disposition toward waste management practices, with a grand mean of 3.05, which is above the benchmark mean of 2.50. This indicates that most residents recognize the importance of

proper waste disposal and are willing to take actions to support effective waste management.

A majority of respondents agree that managing and disposing of household waste is their personal responsibility (Mean = 3.26) and that waste segregation is important for environmental sustainability (Mean = 2.84). Additionally, they acknowledge that recycling is an effective way to reduce environmental pollution (Mean = 3.23) and that open burning of waste is harmful to the environment (Mean = 3.01).

Residents also express a willingness to support waste management efforts. Many are ready to pay for waste collection services (Mean = 2.94) and actively participate in community clean-up programs (Mean = 3.40). Furthermore, they believe that proper waste management enhances the overall quality of life in their community (Mean = 2.95) and that stricter government regulations and penalties for improper disposal are necessary (Mean = 2.88). However, there is a strong perception that the local government should do more to improve waste management in Sapele (Mean = 3.10), suggesting that while residents are willing to contribute, they expect better infrastructure and support from the authorities. Additionally, waste management is seen as an important issue that requires more public attention and education (Mean = 2.87). The findings suggest that while Sapele residents are generally aware of and supportive of proper waste management practices, there is a need for increased government involvement, better infrastructure, and more public awareness campaigns to further encourage responsible waste disposal behaviors.

Discussion of Findings

The findings of this study highlight both the existing waste management practices and the challenges faced in Sapele, Delta State. With a grand mean of 2.84 for waste management

practices, it is evident that structured waste management efforts exist, but gaps persist, particularly in recycling, waste segregation, and composting. These findings align with prior studies while also revealing unique local dynamics in Sapele.

The findings reveal that residents of Sapele primarily rely on government-provided waste collection services (Mean = 3.25) and private waste management services (Mean = 3.08). However, open burning (Mean = 3.01) and illegal dumping (Mean = 3.05) remain prevalent, indicating that sustainable disposal methods are not yet fully embraced. These findings are consistent with Onyeka (2019), who found that in Lagos, inadequate waste collection led to frequent waste disposal in open areas. Similarly, Adamu and Ibrahim (2017) reported that Kano State faced challenges due to insufficient waste collection systems, reinforcing the importance of proper infrastructure.

Despite some level of organized waste management, Sapele residents exhibit low engagement in recycling (Mean = 2.30), composting (Mean = 2.34), and waste segregation (Mean = 2.15). This trend aligns with Okafor and Ibe (2020), who found that waste segregation was virtually absent in Onitsha due to low awareness and education on the practice. Similarly, Smith and Ogbu (2022) reported that in Warri, there were inadequate recycling efforts and limited resident participation in waste management programs. This suggests that beyond infrastructural gaps, behavioral and attitudinal factors also contribute to ineffective waste management.

The study identified major challenges affecting waste management in Sapele, with a grand mean of 2.90. A lack of public awareness (Mean = 3.46), inadequate waste collection facilities (Mean = 3.21), and poor road infrastructure (Mean = 2.81) were the most significant issues. These challenges mirror findings from Adamu and Ibrahim (2019), who

noted that municipal solid waste management in Kano suffered from inadequate funding, weak enforcement, and infrastructure deficiencies.

The limited enforcement of waste management laws in Sapele (Mean = 2.85) also aligns with Okafor and Eze (2021), who found that local governments often struggle to implement and enforce environmental regulations effectively. Similarly, the absence of effective recycling programs (Mean = 2.70) is a recurring issue in several Nigerian studies (Smith & Ogbu, 2022; Okafor & Ibe, 2020). The findings suggest that while there is willingness among residents to support waste management (Mean = 2.94), systemic inefficiencies limit their ability to do so effectively.

The study found that the local government plays a significant role in waste collection and disposal (Mean = 3.19) and organizes public awareness campaigns (Mean = 3.31). These findings align with Adamu and Ibrahim (2019), who highlighted similar roles played by local governments in Kano. However, both studies indicate that infrastructure remains a critical limitation, with inadequate waste bins (Mean = 2.38) and poor enforcement of penalties for improper waste disposal (Mean = 2.39) in Sapele.

Despite efforts by the local government, the allocation of funds for waste management (Mean = 2.62) appears insufficient. This is consistent with Okafor and Eze (2021), who found that budgetary constraints often prevent effective implementation of waste management strategies. Addressing this issue requires increased investment in waste infrastructure and stronger policy enforcement mechanisms.

The findings suggest that Sapele residents generally have a positive attitude toward waste management (Grand Mean = 3.05). Many believe in the importance of proper waste disposal (Mean = 3.26) and recognize the environmental impact of recycling (Mean =

3.23). These findings contrast with Okafor and Ibe (2020), who found low awareness of waste segregation in Onitsha. The difference may be attributed to regional variations in environmental education and awareness campaigns.

However, while residents are willing to participate in waste management efforts, they expect greater government involvement (Mean = 3.10). This sentiment is echoed in Adamu and Ibrahim (2019), who noted that local governments must improve infrastructure and increase public awareness campaigns to foster effective waste management.

The study findings suggest that while Sapele residents engage in various waste management practices, there are notable gaps in recycling, segregation, and composting. The challenges identified—ranging from poor infrastructure to weak enforcement—are consistent with findings from other Nigerian studies. Strengthening local government efforts, increasing public awareness, and improving waste management infrastructure are critical steps toward achieving a more sustainable waste management system in Sapele.

CHAPTER FIVE

SUMMARY CONCLUSION AND RECOMMENDATIONS

Summary of the Study

The purpose of the study was to examine the management of solid waste in Sapele, Delta State. The objectives of the study are to: investigate the solid waste management practices in Sapele Delta State; find out the challenges to effective management practices in Sapele Delta State; examine the roles played by local government agency in of solid waste management in Sapele Delta State and assess the disposition of Sapele residents toward waste management practices.

The descriptive survey research design was adopted for the study. The design allows for collection of data without manipulation from representative sample, based on which relevant inference can be drawn to the population from which it was taken from. The population of Sapele Local Government Area is 232,020 people including children, National Population Commission (NPC) 2015. The population of this study comprised all residents within the ages of 18 to 65 years who are responsible for the generation, collection, disposal and management of solid waste in Sapele township. The total 490 respondents represent a sufficiently large and diverse sample to provide reliable data on solid waste management practices in Sapele Township. The instrument used for data collection in this study was self-structured questionnaire. It was used to elicit information from the respondents. Data gathered from the respondents in the study through the administered questionnaire were coded and analyzed using mean and standard deviation.

Findings

The following findings were discovered:

1. The findings suggest that while there are structured waste management efforts in Sapele, there are also significant gaps, particularly in waste segregation, recycling, and composting.
2. One of the primary challenges is the lack of public awareness about proper waste disposal, along with inadequate waste collection facilities provided by the local government. Poor road infrastructure also hinders the efficiency of waste collection services, making it difficult for trucks to access certain areas. Additionally, the volume of waste generated exceeds the capacity of existing waste management systems, further compounding the problem. Other notable issues include a lack of proper waste disposal bins in public spaces and the limited enforcement of waste management laws. The absence of effective recycling programs and insufficient education on waste segregation at the household level also contribute to poor waste management practices.
3. The local government is primarily responsible for waste collection and disposal, and its waste management services are generally perceived as efficient and regular. Public awareness campaigns on proper waste disposal are conducted, and there is active enforcement of waste management policies. Additionally, the local government provides waste disposal facilities and collaborates with private organizations to improve waste management services. Waste management staff are also seen as well-trained and responsive to complaint. However, some key areas require improvement. The provision of adequate waste bins and collection points in communities was rated below the benchmark, indicating a gap in infrastructure.

Similarly, fines and penalties for improper waste disposal are not effectively imposed, suggesting a weakness in enforcement. Although the local government allocates funds for waste management, this may not be sufficient to address all challenges.

4. A majority of respondents agree that managing and disposing of household waste is their personal responsibility and that waste segregation is important for environmental sustainability. Additionally, they acknowledge that recycling is an effective way to reduce environmental pollution and that open burning of waste is harmful to the environment. Residents also express a willingness to support waste management efforts. Many are ready to pay for waste collection service and actively participate in community clean-up programs.

Conclusion

To enhance solid waste management in Sapele, a multi-faceted approach is required. This includes increased investment in infrastructure, stricter enforcement of waste disposal regulations, expansion of recycling programs, and public awareness campaigns to promote sustainable waste management behaviors. Strengthening collaboration between government agencies, private waste management firms, and local communities will be essential in developing a more effective and environmentally sustainable waste management system.

Recommendations

The following were recommended from the findings:

1. The government should provide more waste bins and designated collection points across communities to reduce illegal dumping and encourage proper waste disposal.
2. Public and private sectors should collaborate to establish effective recycling initiatives and promote household waste segregation to reduce environmental pollution.
3. Educational programs should be intensified to inform residents about the environmental and health hazards of improper waste disposal and the benefits of sustainable waste management practices.
4. Authorities should enforce stricter penalties for illegal dumping and open burning while ensuring consistent monitoring and compliance with waste management regulations.
5. More funding should be allocated to waste management services, and partnerships with private organizations should be encouraged to enhance service delivery and innovation in waste management.
6. Schools should incorporate environmental and safety education topics on waste management, recycling, and sustainability to instill responsible environmental behaviors in students from an early age.

Implications for Environmental and Safety Education

1. The study highlights the need for educational institutions to integrate practical waste management strategies into environmental education curricula to encourage responsible behaviors.
2. By addressing the risks associated with improper waste disposal, environmental and safety education can help mitigate health hazards such as respiratory diseases caused by open burning and contamination from illegal dumping.
3. The findings support the need for environmental educators to engage communities in participatory programs, such as clean-up campaigns and waste segregation initiatives, to foster collective action in waste management.
4. The study underscores the importance of evidence-based advocacy for better waste management policies. Environmental education programs can equip individuals with knowledge to influence policy formulation and implementation.
5. Environmental and safety education can promote innovative waste recycling and management solutions, creating economic opportunities such as upcycling, composting, and waste-to-energy initiatives.

By addressing these recommendations and implications, Sapele can develop a more effective, sustainable, and environmentally friendly waste management system.

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APPENDIX A

QUESTIONNAIRE ON MANAGEMENT OF SOLID WASTE

SECTION A:

Demographic Characteristics of Respondents

1) Marital Status: Single ( ) Married ( ) Divorced ( ) 2) 3) 4) 5) 6) 7) 8)
2) Sex: Male ( ) Female ( )
3) Age (yrs): 18 – 27 ( ) 28 – 37 ( ) 38 – 47 ( ) 48 – 57 ( ) 58 – 67 ( )
4) Highest Educational Status: None ( ) Primary ( ) Secondary ( ) Tertiary ( )
5) Religion: Christianity ( ) Islam ( ) None ( ) Others ( )
6) Occupation: Government Staff ( ) Business ( ) Farmers ( ) Others ( )
7) Number of household members: 1 – 5 ( ) 6 – 10 ( ) 11 and above ( )
8) Area of Resident: _____
9) How long have you been living in the area? 1 – 3 yrs ( ) 4 – 6 yrs ( ) 7yrs and above ( )

S/N	Questions	SA	A	D	SD
1	Solid waste is regularly disposed off through government-provided waste collection services.				
2	Residents frequently use illegal dumping sites for waste disposal.				
3	Most households segregate waste into biodegradable and non-biodegradable materials.				
4	Open burning of waste is a common practice in the community.				
5	Recycling of waste materials, such as plastics and paper, is widely practiced by residents.				
6	The use of private waste management services is prevalent among residents.				
7	Households dispose off waste in designated				

	bins provided by local authorities.				
8	Residents regularly participate in community clean-up exercises to manage waste.				
9	Food waste is often composted for use as organic manure.				
10	Waste management practices in Sapele are hindered by a lack of adequate infrastructure.				

SECTION B:

Solid waste management practices in Sapele Delta State

Challenges to effective management practice in Sapele Delta state

S/N	Questions	SA	A	D	SD
1	There is insufficient public awareness about the importance of proper waste disposal in Sapele.				
2	The local government lacks adequate waste collection facilities to serve all areas of Sapele.				
3	Poor road infrastructure makes it difficult for waste collection trucks to reach certain parts of Sapele.				
4	Many residents are unwilling to pay for waste collection services, contributing to poor waste management.				
5	Illegal dumping of waste in open spaces is a widespread challenge in Sapele.				
6	There is a lack of effective recycling programs in the community.				
7	The local authorities do not provide enough education on waste segregation at the household level.				
8	Limited enforcement of waste management laws contributes to improper waste disposal in the area.				
9	Poor waste disposal practices are caused by a lack of proper waste disposal bins in public spaces.				
10	The volume of waste generated by residents exceeds the capacity of existing waste management services.				

Roles of played by local government agencies to enhance solid waste management in Sapele Delta State

S/N	Item	SA	A	D	SD
1	Local government is responsible for waste collection and disposal in my area.				
2	Waste management services provided by the local government are efficient and regular.				
3	Local government provides adequate waste bins and collection points in my community.				
4	Public awareness campaigns on waste disposal are conducted by the local government.				
5	Local government enforces waste management policies effectively.				
6	There are enough waste disposal facilities provided by the local government.				
7	Local government collaborates with private organizations for better waste management.				
8	Waste management staff are well-trained and responsive to complaints.				
9	Fines and penalties are imposed for improper waste disposal by local government.				
10	Local government allocates enough funds for waste management.				

Disposition of Sapele residents toward waste management practices

S/N	Questions	SA	A	D	SD
1	I believe it is my responsibility to properly manage and dispose of waste in my household.				
2	I am willing to pay for waste management services to ensure proper waste disposal in my community.				
3	I think that waste segregation at the household level is important for environmental sustainability.				
4	I feel that the local government should do more to improve waste management in Sapele.				
5	I believe that recycling waste materials, such as plastics and paper, is an effective way to reduce environmental pollution.				
6	I consider waste disposal practices like open burning to be harmful to the environment.				
7	I feel that waste management is an important issue that needs more public attention and education.				
8	I am willing to participate in community clean-up programs to improve waste management in Sapele.				
9	I believe that proper waste management improves the overall quality of life in my community.				
10	I feel that the government should impose stricter regulations and penalties for improper waste disposal.				

Appendix B

Table 1:

Showing the sampling distribution of Roads/Streets, number of houses, percentage sample of houses and respondents per houses of zone A.

	Roads/street	**No of houses**	**10% sampled of houses**	**No of Respondents per Road/ Street**
1	NDDC	70	7.0	7
2	Old Eku	120	12.0	12
3	Community	72	7.2	7
4	Ogurode	105	10.5	11
5	OTC	35	3.5	4
6	Ogaga	63	6.3	6
7	JES motel	52	5.2	5
8	J.J. Scot Avenue	36	3.6	4
9	Okirigbagha	80	8.0	8
10	Benin Road	50	5.0	5
11	MTN	67	6.7	7
12	Town gate	80	8.0	8
13	Mountain of Fire	35	3.5	4
14	Ikoyo Avenue 15	53	5.3	5
15	Akpoaisi Avenue	44	4.4	4
16	Shell Road	183	18.3	18
17	Ugbeyiyi	140	14.0	14
18	Esir, Avenue	30	3.0	3
19	Ajemele	50	5.0	5
20	Okoloko	35	3.5	4
	Total	**1,410**	**141**	**141**

Table 2: Sampling Distribution of Roads/streets, number of houses, percentage sample of houses and respondents per houses of zone B.

	Roads/street	No of houses	10% sampled of houses	No of Respondents per Road/ Street
1	Abeke 2	112	11.2	11
2	Adeniyi	58	5.8	6
3	Adeola	60	6.0	6
4	Agbohoroma	80	8.0	8
5	Agoba	40	4.0	4
6	Akpeki crescent	40	4.0	4
7	Atufe	50	5.0	5
8	Awotowo	80	8.0	8
9	Boyo	70	7.0	7
10	Mission	108	10.8	11
11	Cementry	30	3.0	3
12	Christmas	46	4.6	5
13	Commercial Avenue	80	8.0	8
14	Ekpoto	70	7.0	7
15	Fonseca	68	6.8	7
16	Fovie lane 17	30	3.0	3
17	Green Agbedi	40	4.0	4
18	Housai	78	7.8	8
19	Ikom	80	8.0	8
20	Izu	60	6.0	6
21	Jakpo	92	9.2	9
22	Erieto	58	5.8	6
23	Lawrence	102	10.2	10
24	Oleh	120	12.0	12
25	Major Bowen	50	5.0	5
26	Market Road	30	3.0	3
27	Newagorode	210	21.0	21
28	Ogodo	168	16.8	17
29	Okpe	100	10.0	10
30	Urban area	110	11.0	11
31	Reclamation	82	8.2	8
32	Ugberikoko	102	10.2	10
33	Urhobo	64	6.4	6

34	Youba	100	10.0	10
35	Benin	60	6.0	6
36	Ghana	50	5.0	5
37	Ojolu	108	10.8	11
38	Omene	40	4.0	4
39	Otite	68	6.8	7
40	Rd one	50	5.0	5
41	Rdsix	33	3.3	3
42	Renner	30	3.0	3
43	Temile crescent	43	4.3	4
44	Tutuway	38	3.8	4
45	Adarere	40	4.0	4
46	1soko	51	5.1	5
47	Otor	40	4.0	4
48	Ofutoku	30	3.0	3
49	Crudas	67	6.7	7
50	Ogage (Sapele)	70	7.0	7
	Roads/streets	**3,490**	**349**	**349**

Field data, 2023