# A Study of the Role Communities and Relevant Stakeholders Play in the Management of Unofficial Waste Sites in Developing Countries- A Case Study of Ado-Ekiti, Nigeria

**by**

**Temitope Stephen Olowolafe**

A thesis submitted in partial fulfilment for the requirements for the degree of (Doctor of Philosophy) at the University of Central Lancashire

February 2025

## RESEARCH STUDENT DECLARATION FORM

**Type of Award: PhD**

**School: School of Engineering**

*Sections marked * delete as appropriate.*

**1. Concurrent registration for two or more academic awards**

*I declare that while registered as a candidate for the research degree, I have not been a registered candidate or enrolled student for another award of the University or other academic or professional institution

**2. Material submitted for another award**

*I declare that no material contained in the thesis has been used in any other submission for an academic award and is solely my own work

**3. Collaboration**

Where a candidate's research programme is part of a collaborative project, the thesis must indicate in addition clearly the candidate's individual contribution and the extent of the collaboration. Please state below:

---

**4. Use of a Proof-reader**

*No proof-reading service was used in the compilation of this thesis.

**Signature of Candidate** 

**Print name: Temitope Olowolafe**

## ACKNOWLEDGEMENT

I wish to express my profound gratitude to my Director of Studies, **Professor Karl Williams**, and my second supervisor, **Dr. Matt Stables**, for their unwavering support, patience, and encouragement throughout the course of this research. Their intellectual guidance, insightful feedback, and steadfast mentorship have been invaluable in shaping this work. This research would not have reached completion without their expert direction and consistent commitment, and I remain deeply indebted to them.

My sincere appreciation also goes to the **Ekiti State Waste Management Authority (EKSWAMA)** for their generous support in providing relevant materials, data, and information essential to this study. I am especially grateful for the organization's openness and assistance, which significantly facilitated the smooth conduct of my fieldwork. I would like to particularly acknowledge **Mr. Ogunleye**, Head of the Policy and Research Department at EKSWAMA, whose vital support in coordinating the recruitment of research participants played a critical role in the successful execution of this study.

I am equally thankful to **Gbenga Olowolafe**, **Ayodeji Ogundipe**, and **Akinwale Akinyele** for their hands-on contributions during the data collection phase. Their dedication, cooperation, and assistance greatly enhanced the efficiency and effectiveness of the research process.

I also wish to acknowledge the unwavering support of my parents, **Mr. and Mrs. Olowolafe**, and my in-laws, **Pastor and Pastor (Mrs.) Ayokunke Ojo**, for their constant prayers, encouragement, and moral support. Their faith in my journey provided a solid foundation that carried me through the most challenging moments.

Above all, my heartfelt appreciation goes to my beloved family—my dear wife, **Tolulope Olowolafe**, and our cherished children, **Janey** and **Janelle Olowolafe**. Your boundless love, patience, and understanding have been a source of strength and inspiration throughout this academic pursuit. I am forever grateful for your sacrifices and for standing by me every step of the way. I love you always.

## ABSTRACT

Within low-middle income countries (LMIC), a common feature of urban centres is the prevalence of unofficial waste disposal sites (UWDSs). Such sites present challenges to both state and local authorities. As these sites are commonly situated in low-income communities, the control and management are particularly difficult. The waste disposal sites are often within residential areas which pose both a health and environmental risk.

This research was undertaken to determine how roles of the local community play in association with other external stakeholders in managing the development of these sites using a case study of Ado-Ekiti, Nigeria. The research sought to utilize the concept of integrated sustainable waste management (ISWM) to analyse and model intervention strategies to diversify waste from the existing UWDSs and prevent development of future sites.

The research employed a mixed method research approach which encompassed (i) geospatial mapping of (29) UWDSs across the study area (ii) a resident survey (n=225 respondents), (iii) interviews with key stakeholders (n=10), (iv) focus group discussions with the community and (v) field observations. Geospatial analysis of the UWDSs showed that these sites were located predominantly along the road near residential areas. It was found that this was independent of socioeconomic classes being in low, medium and high-income areas.

Despite the efforts of the local authority to provide waste collection service across all of the three income areas through house-to-house waste collection, the majority of the waste went uncollected. The survey results showed that waste collection was irregular (37%) or rarely provided (35%) which attested to both an ineffective and inefficient waste management service. This was a major driver in the development of UWDSs. It was found that to improve the situation a framework of Integrated Sustainable Waste Management was required which identified and engaged all of the relevant stakeholders.

Findings of the waste compositional analysis showed that waste streams in UWDSs consisted of organic wastes such as fruit (12.5%), food (9.5%) and tuberous peels (8.4%) and recyclables such as polythene products (12.7%) and glass and ceramics (9.7%) that can be diverted through reuse, community composting, and recycling schemes as source-reduction and waste-diversifying interventions for the management of UWDSs in the study area.

SWOT analysis of intervention strategies associated with the waste profile of the UWDSs aided the development of a model to encourage waste diversion away from UWDSs. According to the waste diversion model, the governance structure identified the significant influence made

by Ekiti State Waste Management Authority (EKSWAMA) and community groups (such as the landlord-tenant association, youth community development association) as well as non-governmental organizations in the diversion of waste from the UWDSs. This model connected directly with the existing waste management system to ensure efficient material flow through waste segregation, community composting and recycling schemes.

The adoption of the model relied on the adequate education of both the participatory and non-engaging community members. In order to keep members motivated and encourage others to join the provision of incentives was deemed necessary. This would be in the form of discounts on waste fees, vouchers, or compost. This would ensure the diversion of wastes from the UWDSs and thereby reduce the community reliance on these for disposal.

The research has demonstrated that a bottom-up approach to waste management in LMIC is required to deal with the challenges associated with infrastructure and engagement that drives the development of UWDSs. Effective collaboration of all stakeholders is required to promote diversion of wastes from the UWDSs such that their risks are mitigated, and further development is prevented.

## TABLE OF CONTENTS

## LIST OF FIGURES

## LIST OF TABLES

## LIST OF ACRONYMS

| | |
|---|---|
| ACDA | Ajilosun Community Development Association |
| AEPB | Abuja Environmental Protection Board |
| AWR | Ababin Waste Resources |
| CBWDO | Community-Based Waste Organisation |
| COVID-19 | Coronavirus Diseases 2019 |
| DPR | Department of Petroleum Resources |
| EHORCON | Environmental Health Officers Registration Council |
| EKS-WAMA | Ekiti State Waste Management Authority Ado-Ekiti |
| EKSG | Ekiti State Government |
| EKSWAMA | Ekiti State Waste Management Authority |
| EKSWMB | Ekiti State Waste Management Board |
| EKTV | Ekiti State television |
| EMCA | Environmental Management Coordination Act, 1999 |
| ESMENR | Ekiti State Ministry of Environment and Natural Resources |
| FEPA | Federal Protection Agency |
| FGD | Focus Group Discussion |
| FMEnv | Federal Ministry of Environment |
| GHG | Green House Gas |
| GPS | Global Positioning System |
| GRA | Government Reserve Areas |
| HDPE | High-Density Polyethylene |
| INFGD | Intervention Focus Group Discussion |
| ISWA | International Solid Waste Association |
| ISWM | Integrated Sustainable Waste Management |
| IWB | Itinerant Waste Buyers |
| LDPE | Low-Density Polyethylene |
| LMIC | Low-Middle Income Countries |
| LTA | Landlord-Tenant Association |
| MDAs | Ministries, Departments, and Agencies |
| MOE | Ministry of Environment |
| MPSR | Mr. Parker Service Resources |
| MSW | Municipal Solid Waste |
| MSWM | Municipal solid waste management |

| | |
|---|---|
| MWA | Market Women Association |
| NESREA | National Environmental Standards, Regulation and Enforcement Agency |
| NGO | Non-Governmental Organizations |
| NIMASA | Nigerian Maritime and Safety Administration |
| NOSDRA | National Oil Spill Detection and Response Agency |
| NSWMS | National Solid Waste Management Strategy |
| NWMS | National Waste Management Strategy |
| OWDSs | Official Waste Disposal Sites |
| PE | Polyethylene |
| PET | Polyethylene terephthalate |
| POPs | Persistent Organic Pollutants |
| PP | Polypropylene |
| PPE | Personal protective equipment |
| RSA | Republic of South Africa |
| SDGs | Sustainable Development Goals |
| SSA | Sub-Saharan African |
| STEMH | Science, Technology, Engineering, Medicine, and Health |
| SWM | Sustainable waste management |
| USWM | Urban Solid Waste Management |
| UWDS | Unofficial Waste Disposal Site |
| WMA | Watershed Management Agency |
| WMIS | Waste Master Integrated Services |
| WP | Waste pickers |
| YDCA | Youth Development Community Association |

# CHAPTER ONE: INTRODUCTION

## 1.1 RESEARCH BACKGROUND

Over the last 50 years, the management of solid waste has witnessed significant paradigm shifts that feature a transition from a cradle-to-grave system of waste management, where materials assume a linear flow necessitating disposal, to a more holistic circular approach that features a cradle-to-cradle system of resource management where materials flow in a closed loop (Chioatto and Sospiro, 2022). Developed economies such as the European Union (EU) have made significant progress in reducing the impacts of waste generation on the environment and human health through environmentally sound waste management practices and are currently driven towards a circular economy; a closed-loop system of resource management which is regenerative by intention and design and thus eliminates waste (Geissdoerfer et al., 2017). However, the increasing attention in many developed countries on resource management in a complex circular economy has been seen to demonstrate that environmental sanitation and public health issues associated with solid waste management may no longer be of primary concern in urban centres (Sotamenou et al., 2019).

It is pertinent for public health and sanitation that the waste management system is conducted safely and sustainably. However, waste management in urban centres continues to present challenges as the drive for economic development in urbanizing cities flourishes. Presently, the urban population constitutes half of the global population, and over the next three decades, it is estimated that 6 billion people will reside in the urban cities across the globe (UN-Habitat, 2014). This is a clear variation from the even population distribution in rural and urban centres witnessed in the 1990s (Wahab, 2015). The sub-Saharan African countries are estimated to be urbanising at a faster rate than any other regions in the world. Accordingly, it is projected by 2050, 56% of African population will be residing in urban centres (Saghir and Santoro, 2018). The current trend implies urbanization is a rapidly growing phenomenon which positioned urban centres as propellers of economic development but not without the associated increasing waste generation (Sotamenou et al., 2019).

The unprecedented growth of urban cities across the globe over the last two decades have been accompanied with high resource use in response to rapid urbanization, growing population and changing lifestyles (Ferronato and Torretta, 2019). The accompanying waste generation has expanded, and it is predicted to increase by 70% in 2050 from the 2020 rate of 2.24 billion tonnes under business-as-usual scenarios (Maalouf, and Mavropoulos, 2023). Accordingly, the challenge of effective management of wastes in urban cities presents a global issue, but

increased attention has particularly been drawn to solid waste management in urban centres in developing countries where the waste generation rate is considered fastest compared to other developed countries. Godfrey et al. (2019) acknowledged that there is an impending major social and economic transformation for developing countries, especially sub-Saharan Africa, in the foreseeable future due to increasing population, urbanization of cities, and pronounced change in consumer habits. The consequence of such transformation is increased waste generation, which will exert pressure on already constrained urban solid waste services and infrastructure and further worsen the present state of waste management.

Accordingly, there is intensifying demand for sustainable waste management practices in keeping with increasing waste generation and expansion of economic development in developing countries (Elgizawy et al., 2016; Azevedo et al., 2019). Palakurthy et al. (2021) recognized it had become a challenging task to effectively manage waste in large population centres in developing countries as waste generation has grown to a scale that outstrips the existing capacity of the municipality to manage them. Urban centres in developing countries are confronted with challenges that render waste management systems ineffective in providing adequate environmental protection, public health, and sanitation. The growing number of urban slums associated with the prevalence of open dumping of waste and poor waste management practices in recent times have been decried in the literature (Wahab, 2015; Elgizawy et al., 2016; Amasuomo and Baird, 2016; Azevedo et al., 2019).

The recent drive towards sustainability in solid waste management has necessitated the need to restrict the practice of open dumping of waste in developing countries. Practices of open dumping are noted to be inimical to achieving the Sustainable Development Goals (SDGs) enshrined in the UN 2030 agenda most especially for developing countries. Apart from posing threats to the public and degrading the environment, open waste disposal sites in developing countries are projected to account for 8-10% of global anthropogenic greenhouse emissions by 2025, making it a global problem (Wilson et al., 2015; Mavropoulos et al., 2015). In 2015, the International Solid Waste Association (ISWA) registered the fifty biggest official open waste disposal sites across the globe and provided a roadmap for their closure to pave the way for a more sustainable solid waste management system (Mavropoulos et al., 2015).

Azevedo et al. (2019) posited that the proliferation of open dumping is one conspicuous result of ineffective urban solid waste management (USWM) in developing countries. This has generated huge concerns such that it has been declared a global environmental and health emergency given the large number of health-related incidents precipitated by this unsafe

method of waste disposal (Sankoh et al., 2013; Mavropoulos and Nilsen, 2020). Some of the repercussions of open waste disposal sites are (i) the degradation of land, (ii) infiltration of leachate into the groundwater system, (iii) release of methane gas into the atmosphere, and (iv) the pervasion of foul smell (Wilson et al., 2015; Ojuri et al., 2018). In addressing the impacts of open dumping of waste, Law and Ross (2015) stated that.

> *"The most important impacts of open dumps on the environment and to public health and safety are those relative to proximity to waterways, geological/hydro-geological conditions, climatic conditions, long-term contamination due to leachate or landfill gas migration, and of course the greenhouse effect via emissions of carbon dioxide and methane, including open burning of waste releasing smoke, particulates, and gaseous contaminants into the atmosphere". (Law and Ross, 2015)*

While the official operation of open waste disposal sites in developing countries continues to receive attention given the demand for a healthier environment and the present global focus on climate change and sustainability, Unofficial Waste Disposal Sites (UWDSs) are another aspect of open dumping of waste outside official provisions which is quite prevalent in developing countries. The development of UWDSs in developing countries has not been given due attention in the literature. UWDSs are informal land disposal sites where open dumping of wastes is practiced with little or no course of action to control the operation and safeguard the environment. Many open waste disposal sites in developing countries are UWDSs situated in close proximity to people living in various communities in urban centres (Kassah, 2020). Table 1.1 describes UWDSs compared to Official Waste Disposal Sites (OWDSs) and sanitary landfills. UWDSs are predominantly unplanned, unmanaged sites (unregistered and unregulated) in close proximity to residential areas for immediate disposal of waste (Afon, 2007; Kassah, 2020). UWDSs are unregulated disposal sites operated at no cost to the users.

In Nigeria, cases of widespread uncollected waste piles and the development of UWDSs in communities and neighbourhoods have been reported (Ogwueleka, 2009; Tobore, 2012; Abur et al., 2014; Kassah, 2020). The proximity of UWDSs to the people in affected communities constitutes grave consequences to their health as much as it is detrimental to their immediate environment. Residents living near these sites have to deal with odours and vermin issues and may frequently be exposed to poor inhalation due to burning such sites to reduce the waste (Kassah, 2020). Olorunlana, and Ogunade (2022) posited that the presence of UWDSs also diminishes local communities' aesthetic value, constitutes an economic loss for property sellers and leasers, and removes community pride from residents of such communities.

Kassah (2020) argued that the development of UWDSs reflects unsustainable waste management practices fostered by many challenges in developing countries. It is reported that within the proportions of waste generated in developing countries, about 30-40% of the waste remains uncollected, while over 90% of collected waste ends up in unregulated open dumps such as UWDSs or is burnt openly (Kaza et al., 2018). It is posited that the incapacity of municipal authorities to provide efficient and effective SWM in urban centres has promoted the practice of open dumping of waste with utter disregard for the consequent environmental and health impacts of the malpractice (Ali et al., 2014; Nnaji, 2015). Kaza et al. (2018) noted that widespread open dumping of waste is fostered by poor waste management infrastructure and ineffective waste collection systems in many urban communities in developing countries. For Instance, Ekiti State Waste Management Authority Ado-Ekiti (EKS-WAMA), in charge of managing waste in Ado-Ekiti, Nigeria, is evidently struggling to provide effective waste services in the city over the development of UWDSs in the city (Figure 1.1).

Similarly, Funding of a SWM system to provide appropriate and adequate infrastructure for effective waste collection and disposal is one of the prominent barriers to delivering sustainable practices in developing countries. Despite the huge cost associated with waste management, budget allocation for Municipal solid waste management (MSWM) across cities in developing countries is low and incapable of addressing the various elements of existing waste management systems, particularly waste collection, waste treatment and disposals (Guerrrero et al., 2013; Malik et al., 2015). It is estimated that municipal authorities in developing countries expend 3-15% of the available municipal budget on MSWM, with over 80% of the total funds spent on waste collection services alone, thus rendering other crucial aspects of USWM, such as waste disposal and treatment underfunded (Oteng-Ababio, 2021). The consequence of such a shortfall in proper financing of MSWM contributes to the lingering regime of waste mismanagement, as is the case with the development of UWDSs in developing countries (Ferronato & Torretta, 2019).

Table 1.1: Comparison of Illegal/unregulated Dumpsites with Managed Sites (Modified after; D Waste, 2014)

| **Criteria** | **Unofficial Waste Disposal Sites (Unregulated)** | **Official Waste Disposal Sites (Managed)** | **EU Standard Sanitary Landfill** |
|---|---|---|---|
| On site Management | No formal management, uncontrolled burning of waste, no covering of waste | Formal management, partial covering of waste, compaction | Formal management, full covering of waste, compaction |
| Leachate management | No leachate management | No/partial leachate management | Full leachate management |
| Location | Within the city residential, on roads and drainages | Remote location, Outskirts of city/town | Outskirts of city/town |
| Gas management | No gas management | Partial or no gas management | Full gas management |
| Fencing | No fence | Partially fenced/fenced | Secure fencing with gate |
| Cost | No initial cost, high long-term cost | Low to moderate initial cost, high long-term cost | Increase initial, operational and maintenance cost, moderate long-term cost |
| Waste Record keeping | None | Partial/ none | Complete |
| Waste Input | No control on the quantity of waste deposited | Partial / no control on the quantity of waste deposited. | Full control over quantity and composition of wastes deposited |
| Closure Plans | No closure plans | Partial or no Closure plans | Adequate closure plans |
| Environmental and Health Impact | High potentials for fire and adverse environmental and health impacts | Lesser risk of adverse environmental and health impacts compared to unofficial waste disposal sites. | Minimum risk of adverse environmental and health impacts. |

Figure1.1: A Typical Unofficial Waste Disposal Site (UWDS) located along the Roadside within Ado-Ekiti.

However, the development of UWDSs can no longer be ignored by policy makers in waste management. Addressing the development of UWDSs is particularly important as the emergence of the COVID-19 pandemic and corresponding measures in place to protect lives and livelihoods have amplified the existing burden on SWM structures globally (Sarkodie and Owusu, 2020). While UWDSs constitute both environmental and public health threats, it is a repository for the recovery of recyclables or reusable materials and the harvesting of organic manure for agricultural purposes (Kassah, 2020). Therefore, sustainable strategies to manage the development of UWDSs is crucial to this research. Accordingly, the primary research question for this study is how to manage the development of UWDSs in urban centres in developing counties with similar circumstances and MSW challenges to Ado-Ekiti, Nigeria? From the sustainable waste management (SWM) point of view, SWM strategies should be appraised from the social (stakeholders), environmental and economic aspects. Hence, this research is focused on developing a strategy that accommodates key stakeholders' roles in diverting waste from UWDSs.

## 1.2 RESEARCH AIM AND OBJECTIVES

This research aims to evaluate the role that community and relevant stakeholders play in the management of UWDSs in developing countries. This will form part of integrated participatory local waste management strategies using a case study in southwest Nigeria. The following objectives are illustrated to meet the aim of this research.

**Research Objectives**

i. Identify UWDSs/waste dumps according to set criteria,
ii. Investigate the current Urban Solid Waste Management (USWM) system within the case study region,
iii. Evaluate drivers of UWDSs in the case region,
iv. Evaluate stakeholder-based targeted interventions at phasing out UWDSs,
v. Develop a community-based SWM model based on evaluated interventions for adoption as part of local waste management strategies in phasing out the development of UWDSs.

## 1.3 THESIS STRUCTURE

CHAPTER ONE- INTRODUCTION: Chapter one of this thesis introduces the background and puts the main research question into context. It also introduces the aim and objectives of the research and highlights the thesis structure.

CHAPTER TWO- LITERATURE REVIEW: Chapter two provides a literature review on USWM in sub-Saharan African countries, with particular attention to four countries: South Africa, Kenya, Ghana, and Nigeria. It covers aspects of the regulatory framework and waste management practices.

CHAPTER THREE – RESEARCH METHODOLOGY: Chapter Three presents the methodology for this research and the justification for the choice of methods highlighted.

CHAPTER FOUR- UWDSs AND WASTE MANAGEMENT PRACTICES: Chapter Four presents findings on the current waste management practices in Ado-Ekiti including the development of UWDSs in the study area.

CHAPTER FIVE—FORMAL AND INFORMAL INSTITUTION IN USWM IN ADO-EKITI: Chapter Five presents findings on the formal and informal institutions for waste management in Ado-Ekiti. Particular attention was drawn to the roles and challenges of these stakeholders in the USWM in the case region.

CHAPTER SIX – THE DEVELOPMENT OF UWDSs in ADO-EKITI: Chapter Six discusses the drivers of the development of UWDSs by integrating the findings in chapter four and five to reflect the USWM challenges in Ado-Ekiti.

CHAPTER SEVEN- INTERVENTIONS FOR THE MANAGEMENT OF UNOFFICIAL WASTE SITES IN ADO-EKITI COMMUNITIES: Chapter Seven discusses the waste diversion model developed through the evaluation of intervention strategy to manage the development of UWDSs in the case region. It highlights the roles of different stakeholders within the context of ISWM.

CHAPTER EIGHT- CONCLUSION AND IMPLICATION: Chapter Eight concludes on the research findings and highlights their implications for research and practice.

# CHAPTER TWO: LITERATURE REVIEW

## 2.1 URBAN SOLID WASTE MANAGEMENT IN DEVELOPING COUNTRIES

According to many studies, Urban solid waste management (USWM) constitute a unique and central problem in many urban centres across the globe (Azevedo et al, 2019; Guerrero et al., 2013; Marshall and Farahbakhsh, 2013). The collection, storage, transportation and disposal of waste in many cities in developing countries has particularly been very challenging for state and local authorities. The growth of slums, cases of uncollected waste and development of UWDSs are examples of the product of these challenges (Egizawy et al., 2016). Many of these challenges stem from the fact that the municipal authorities who solely shoulder the responsibility of waste management are ill- equipped to manage the burgeoning waste generated in these settings. Increased population growth accelerated rural-urban migration and lack of adequate housing are factors associated with increasing waste generation in many cities that presents challenges to manage by municipal authority (Almanaseer et al., 2020). The municipal authority lacks adequate financial, human and technical capacity to deal with urban wastes and accordingly, cases of waste mismanagement are recorded in many cities.

The challenges of USWM for city authorities in developing countries are mainly due to the increasing waste generation, the financial burden on municipal budgets due to high management costs, and the lack of understanding of various factors affecting different stages of waste management. Additionally, there is a need for effective linkages to ensure the proper functioning of the entire waste-handling system (Guerrero et al., 2013). While systems analysis has been employed to aid SWM agencies in industrialized countries since the 1960s, the SWM sector in developing countries remains dominated by the collection and removal processes (Guerrero et al., 2013; Marshall and Farahbakhsh, 2013).

Municipalities often allocate 20 to 50 percent of their available recurrent budget to solid waste management (SWM), whereas about 60 percent of urban solid waste remains uncollected, and less than half the population receives service (Malik et al., 2015). Studies have shown that much of the service is concentrated in high income communities where service users are in close communication with the authorities. This has effected a regime of prioritisation of waste collection services in these areas relative to medium and low income communities (Oteng-Ababio, 2021).

## 2.2 URBAN SOLID WASTE MANAGEMENT IN SUB-SAHARAN AFRICAN (SSA) COUNTRIES

Over the past three decades, urban cities around the world have experienced dramatic growth; the rural-urban migration in sequence with other factors such as technological advancement, population growth and change in the political landscape has been noted to impact the global economies (Cohen 2006; Wahab, 2015; Nnaji, 2015; Chalhoub, 2018). A projection study on global SWM undertaken by the World Bank (2018) has found Sub-Saharan Africa (SSA) as one of the fastest-growing regions in the world, and it was projected that the total waste generation in the region will triple by the year 2050. Such projection would not have raised huge concerns for MSW management in these regions if the present waste generation rate (Figure 2.1) had been paralleled with effective and efficient waste management practices. On the contrary, it is rather a case of mismanagement of solid wastes in SSA (Cohen 2006; Wahab, 2015; Ferronato and Torretta, 2019).

Godfrey et al. (2020) posited that management practices in SSA regions have resulted in waste being overlooked for the value it can provide to the local economies. The development of UWDSs, for instance, demonstrates opportunities to develop secondary resources economy that are still largely unexplored. Resources such as plastics, glasses, paper, and metals, which could have been reintroduced back into economies to support manufacturing industries, are being disposed of in open dumpsites and landfills (Yudoko, 2000; Wahab, 2015; Kaza et al., 2018). Many studies including Ezeah,and Roberts (2012) and Ferronato and Torretta, (2019), have highlighted sustainable SWM in this region suffers from various barriers including institutional weaknesses, inadequate infrastructure, lack of skilled human resources, insufficient funds, administrative incapacity, and poor implementation of environmental legislation (Ezeah,and Roberts, 2012; Ferronato and Torretta, 2019).

To review the challenges in this region, four sub-Saharan countries, South Africa, Ghana, Kenya, and Nigeria, are selected for this review and an overview of the SWM practices is given in Table 2.1. The selection of these four countries is based on the availability of data on waste management that would allow proper review of SWM practices in Sub-Saharan Africa.

## 2.3 URBAN SOLID WASTE MANAGEMENT IN SOUTH AFRICA

Municipal Solid Waste Management in urban centres of South Africa is faced with numerous difficulties which typify various challenges identified in various cities in SSA at large. Due to urbanization, population growth and economic development, generated waste stream across

the nine provinces of the Republic of South Africa (RSA); Limpopo, Northern Cape, Western Cape, Northwest, Mpumalanga, KwaZulu-Natal, Gauteng, Free state and Eastern has been escalating. In 2017, waste generated across these provinces is recorded to be 121 million tonnes (Halkos and Petrou, 2019). The capacity to effectively manage waste across these provinces most especially in urban centres remains challenged with key issues such as poor collection services, the proliferation of open dumpsites, poor data recording and management and poor enforcement of waste regulations (Mannie and Bowers, 2014; Godfrey and Oelofse, 2017; Dlamini et al., 2019). Figure 2.2 depicts a case of uncollected waste in the streets of Johannesburg, leading to overspilling and littering despite efforts invested in improving waste management in cities across South Africa, (Kubanza, 2024).

South Africa is one of the SSA countries with dedicated legislative frameworks and comprehensive environmental policies and regulations that address and support SWM in urban centres and rural dwellings (Table 2.2). Over the past 15 years, a lot of waste policies and regulations have been instituted towards the effective management of waste but found to be counter-productive because they essentially create duplicity of roles and make the realization of waste reduction difficult without prompting avoidable conditions (Dlamini et al., 2019). Fakoya (2014) came to the same conclusion in his study on institutional challenges to municipal waste management service delivery in South Africa. He emphasized that the lack of a clear definition of roles in waste management prevented desired progress.

The publication of the White Paper on Pollution and Waste Management (IPC-WM) through Gazette No. 227 in the year 2000 serves as a prominent stride in delivering effective waste management under the 1999 National Waste Management Strategy (NWMS) (Halkos and Petrou, 2019). This policy paved the way for the current waste management architecture developed around the waste hierarchy, which is targeted at driving increased waste flow management up the hierarchy towards reuse, recycling, reduction, and avoidance. However, implementing and enforcing these regulations to improve waste services and recovery still leaves much to be desired (Godfrey, 2019). Despite considering waste disposal as the least preferred management option in the adopted waste hierarchy, the operation of landfills, open dumpsites, and incidences of uncollected waste remain prevalent across various cities in South Africa. Figure 2.2 depicts a case of uncollected waste in the city of Johannesburg.

Table 2.1: Overview of Solid Management Policies and Practices in Nigeria, Ghana, Kenya and South Africa

| **Elements of SWM** | **Nigeria** | **Ghana** | **Kenya** | **South Africa** |
|---|---|---|---|---|
| Policy and Regulation | Federal Environmental Protection Agency (1988), NESREA Act No 25 (2007).<br>Partial Economic Instrument.<br>Poor Enforcement (Maiyaki et al., 2019). | Environmental Protection Agency Act (1994), Act 462 Partial economic Instrument. Improved regulation enforcement (Njoroge, 2020). | Environmental Management and Coordination Act (EMCA, 1999).<br>Weak Institutional framework<br>Poor Enforcement (Haregu et al., 2017). | National Waste Management Strategy (NWMS) Waste Act (Act 59 of 2008). Waste Amendment Act (Act 26 of 2014).<br>Partial Economic Instrument.<br>Improved enforcement of regulation. (Polasi, 2018). |
| Generation | 0.65-0.95kg/capita/day (Ike et al., 2018; Sowunmi, 2019). | 0.47kg/capita/day (Kaza et al., 2018; Kyere et al., 2019). | 0.56kg/capita/day (Kaza et al., 2018). | 0.63kg/capita/day (Godfrey et al., 2019). |
| Source separation | Not organised. Few households undertake source separation into organic waste to feed livestock (Ike et al., 2018). | No organized programmes, (Agbefe et al., 2019). | Very few households. No organized programmes and considerable segregation of biomedical wastes (Sibanda et al, 2017). | Low, mostly organized by the private sector (Addaney and Oppong, 2015). |
| Collection | Low collection coverage. Up to collection rate 40%<br>Sporadic and inefficient Service limited to high visibility areas, High fraction of inert and compostables impact collection—(Ike et al., 2018). | Up to 83% collection rate. Improved services in Major cities such as Accra (Meizah et al., 2015). | Up to 50%<br>Irregular and use of inappropriate transportation trucks. Unregulated waste fees (Koech and Munene; 2020; Sibanda et al., 2017). | Up to 69% of waste collected<br>Improved Services. Regulated waste fees (Mohee et al., 2015; Kaza et al, 2018). |
| Recycling | Recycling is through the informal sector and waste scavengers (Wahab, 2015; Ike et al., 2018). | Recycling is through the informal sector and waste picking. | Recycling is through the informal sector and waste picking. 5% in Nairobi. Recycling market is | 57% collection of paper and packaging recycling Informal |

| | | | | |
|---|---|---|---|---|
| | | Recycling markets are unregulated. Large price fluctuations (Oteng-Ababio, 2021. | unregulated (Haregu et al., 2017). | sector responsible for collection of 80-90% of recyclables.<br>Recycling markets are somewhat more regulated (Addaney and Oppong, 2015; Kubanza et al., 2018). |
| Composting | Composting is very low due to poor awareness and subsidization of fertilizers by government. Poor markets (Wahab, 2015). | Few households engaged by private scheme between 2015-2017 (Oteng-Ababio, 2021). | Rarely undertaken. 5% in Nairobi.<br>Markets for, and awareness of composting are lacking (Njoroge, 2020). | Small-scale composting projects by private contractors at community/ neighborhood level. Increasing use of anaerobic digestion (Mohee et al., 2015). |
| Incineration | Not common, and generally not suitable to high moisture content in waste (Wahab, 2015; Kaza et al., 2018). | Old incinerators still in use. Unlicensed and lack air pollution control. (Oteng et al., 2013; Agbefe et al., 2019). | Utilized only for medical wastes. Existing facilities are unlicensed. (Haregu et al., 2017) | Used commonly for medical waste but experiencing financial and operational difficulties. Little or no stack emissions monitoring (Addaney and Oppong, 2015). |
| Landfill/Open Dumping | Open dumping of wastes. High polluting to nearby aquifers, water bodies, settlements. Often receive medical waste. Waste regularly burned. (Wahab, 2015; Sowunmi, 2019). | Some controlled landfills are in place. Open dumping is common in rural settlements (Meizah et al., 2015; Godfrey et al., 2019). | Open dumping is still prevalent . Significant health impacts on local residents and workers (Haregu et al., 2017) | 90% of waste disposal to Landfill gate fees (€10 – 15)/ tonne.<br>Most landfills are unlicensed (Kubanza et al., 2018). |

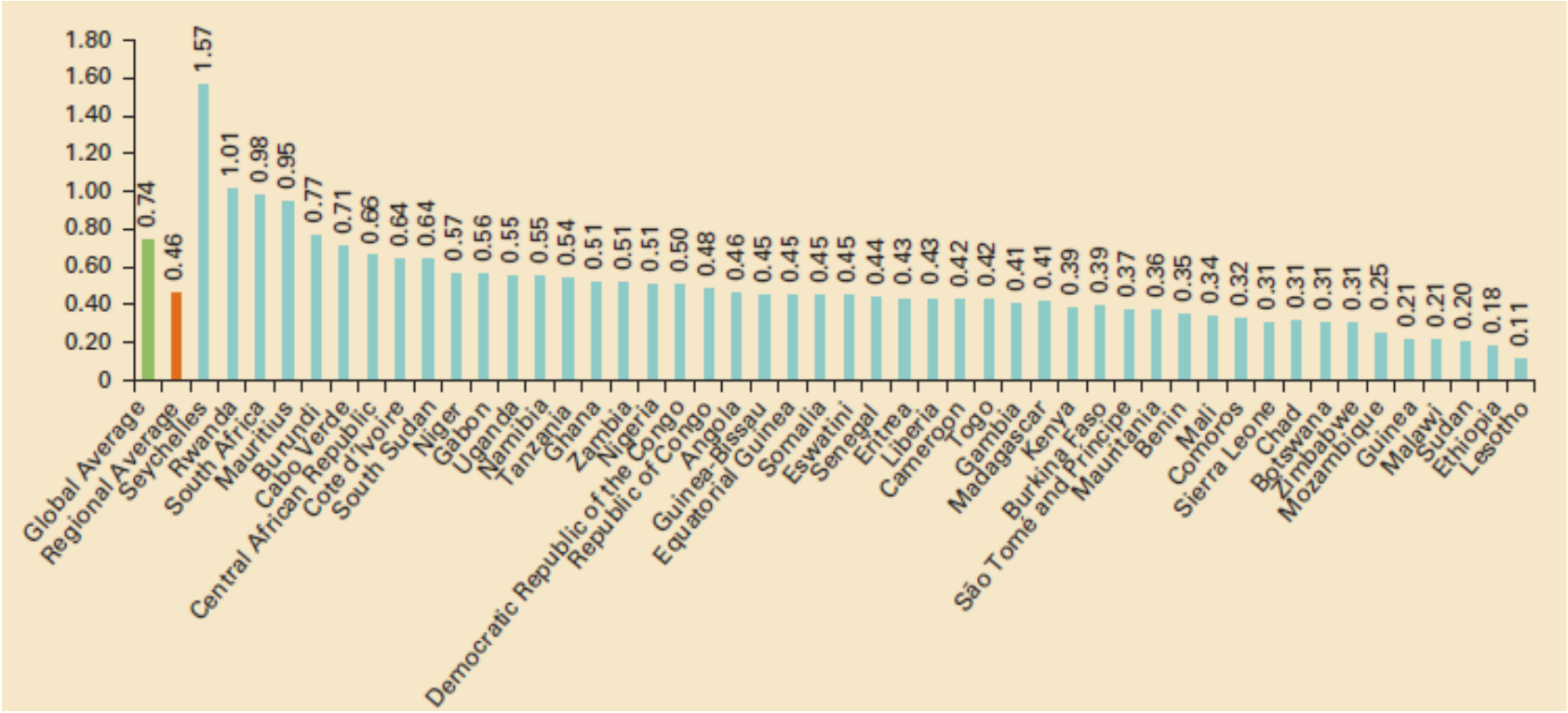


Figure 2.1: Waste Generation Rates (Kg/Capita/day) in Sub-Saharan Africa (Kaza et al., 2018).

According to Halkos and Petrou (2019), municipal waste from cities is largely landfilled, while only 11% of the general waste managed to be diverted for recycling in 2017. This is a gross departure from the 25% recycling target set in the 2001 Polokwane Declaration under the NWMS as part of the commitment of the RSA government to enhance recycling and recovery of products from the waste stream. Godfrey and Oelofse (2017) attributed the problem to the government's inability to integrate informal waste pickers into mainstream MSWM systems. The informal waste pickers in RSA, estimated to be about 90,000, are mainly responsible for the recovery of waste from landfills and kerbsides in various cities and serve as a crucial link between waste services and the value chain within the waste management system.

Figure 2.2: Case of Overspilled Wastes in Johannesburg, South Africa (Kubanza, 2024).

Table 2.2: Evolution of Waste Management Legislations, Regulations and Policies in RSA (Modified after Ally, 2021).

| Year | Waste Policy and Regulations |
|---|---|
| Legislation | |
| 1973 | Environmental conservation act no. 73 |
| 1977 | Occupational health and safety act no. 85 |
| 1989 | South African constitution (act no. 108) |
| 1993 | National water act no. 1998 |
| 1996 | National environmental management act no. 107 |
| 1998 | Municipal structures act no. 117 |
| 2000 | Municipal systems act no. 32 |
| 2004 | Air quality act no. 39 |
| 2006 | Amendment notices for notice no. R386-7 of NEMA act 1998 |
| 2008 | NEMWA act no. 59 |
| 2014 | NEMWA act no. 26 |
| | Amendment on the waste act implementation guidelines |
| | Amendments on NEMA act no. 25 |
| Regulations | |
| 2003 | Waste tyre regulations |
| 2008 | National waste information regulations |
| 2009 | Regulations to Phase out PCB materials |
| 2012 | Regulations to phase out substances that deplete the ozone |
| 2014 | Amended regulations on waste tyre management |
| 2015 | Regulations on management of residue deposits and stockpiles |
| 2016 | Waste tyre regulation |
| 2017 | Regulations to control export and import waste |
| 2022 | Integrated Waste Management By-law, 2022 |
| Policies | |
| 2008 | Integrated waste management policy |
| 2009 | Thermal treatment of hazardous and general waste policy |
| 2011 | Policy on provision of basic waste services to poor households |
| 2020 | National Waste Management Strategy 2020 |

## 2.4 URBAN SOLID WASTE MANAGEMENT IN KENYA

As in most SSA countries, waste management is designated as a devolved mandate under Kenya's constitution. As such, all 47 local governments in Kenya are charged with the

responsibility of providing sustainable waste management in their various counties under the National Solid Waste Management Strategy (NSWMS) and the Environmental Management Coordination Act, 1999 (EMCA) (Ozoike-Dennis et al., 2019). The NSWMS is supposed to serve as an enabling regulatory policy in driving sustainable waste management practices along with urban planning in the country. It aims to improve waste collection rates, close existing open dumpsites and establish various material recovery centres for segregating wastes and transform the biodegradables as compost and the non-degradable as recyclables (Njoroge et al., 2014).

However, the rising trend of wastes generated in the cities across Kenya has engendered concerns among stakeholders given the current state of MSWM in the country. Major cities in Kenya, such as Nairobi, Mombasa, and Kisumu, have experienced expanded population growth due to the influx of people and considerable economic development. Currently, 25% of the Kenyan population lives in urban areas, and it is estimated that by 2030, about half of the population will be residing in various cities in Kenya (Kaza et al, 2018). The consequence of the urban population explosion is not limited to increasing waste generated but also includes over-stretched resources, infrastructure, and municipal services, including sanitation and MSW management services in these urban areas.

The existing SWM architecture to manage burgeoning wastes in these urban centres is bedevilled with challenges similar to cases in other regions of SSA. Despite being adjudged to have one of the best waste legislations, regulations, and policies, Kenyan cities are confronted with cases of uncollected waste piles and open dumping and burning of waste in unregulated dumpsites located across various cities in the country (Tanui, 2019). In the city of Nairobi, Otieno et al., 2017 reported that due to inadequate and ineffective waste collection service only 50% of the inhabitants have access to waste collection services and in all, only 60% of the waste generated in the city managed to be collected (Njoroge et al., 2014; Nyaluogo, 2016). In Kishimu City, only 20-30% of the waste is collected, whereby the majority of the collected waste is overseen by private contractors through a door-to-door system of collection (Sinbanda et al., 2017).

While some waste generated in many urban centres in Kenya is unaccounted for, waste collected from cities ends up in official dumpsites without provision for diversion for recycling and recovery. OWDSs such as Dandora in Nairobi or Kachok in Kishimu are open, unregulated sites close to housing estates and slums where these wastes are managed poorly. Ajega et al.

(2019) reported that the OWDSs are more or less operated like UWDSs, which pervade the streets of Kenya without control.

These unsustainable waste management practices present a huge threat to public health and the environment. They also constitute underutilization of the value chain of waste resources for job and wealth creation and aesthetic defacement of the environment, which impacts adversely on tourism and the general well-being of the populace in Kenya (Haregu et al., 2017; Sibanda et al., 2017).

## 2.5 URBAN SOLID WASTE MANAGEMENT IN GHANA

Ghana exemplifies most SSA countries with respect to the status and challenges of USWM in cities despites its impact on public health and environmental protection. UNICEF (2018) revealed poor SWM in Ghana presents environmental risks such as flooding and groundwater contamination and promotes outbreaks of cholera, typhoid, and diarrhoea, particularly in low-income urban centres. According to Miezah et al. (2015), six of the ten major diseases in Ghana can be connected to degraded environmental sanitation and protection with typhoid, malaria and diarrhoea collectively representing over 70% of out-patient cases at Ghana health Services. Ghana has failed to deliver effective SWM to address the burgeoning wastes generated in its cities amidst rapid economic activity and expanding urbanization. Consequently, the accumulation of uncollected wastes and the prevalence of UWDSs represent the acute nature of some of the SWM challenges in various cities of Ghana, such as Kumasi, Takoradi, and Tamale.

These challenges can hardly be passed off as a case of lack of effective policy or regulations. In the past 10 years, Ghana has developed many policies and legislations framework that seeks to keep pace with best SWM practices and initiatives under the Environmental Protection Agency. In recent times, the Kenyan government has made a concerted effort to decentralize the SWM system in the country, but progress in tackling the challenges of USWM remains slow (Addaney and Oppong, 2015). Kyere et al. (2018) submitted that decentralization efforts of the government are misdirected, mostly embroiled in politics, and devoid of the drive needed to achieve effectiveness and improved service delivery it is designed to attain, especially at the local levels. Elsewhere, Sodoke et al. (2022) noted that the local authorities in charge of waste management in urban centres in Ghana lack financial, infrastructural, and technical capacity to manage urban wastes, and enforcement of waste policies and regulations is weak, and hence, these challenges remain unabated.

## 2.6 URBAN SOLID WASTE MANAGEMENT IN NIGERIA

### 2.6.1 Urban Solid Waste Management Developments in Nigeria

Historically, waste management in urban communities in Nigeria fell within the urban planning and management delegated as part of the function of the local government (Onibokun, 1989). In the pre-colonial era, urban centres in the four regions of the country, northern, southern, eastern, and western regions, were governed by a hierarchy of chiefs, including defined regions of jurisdiction and administration. The people living in these urban centres are guided by a set of clear guidelines and functional distinctions which reflects that women are mostly responsible for making sure public places are kept clean and tidy through a system of rotational street sweeping. At the time, waste was disposed of in bushes and undeveloped vegetation where it was left to decay.

The advent of the period of British colonial rule in 1900 hardly showed any marked changes from the pre-colonial administration on waste management in the urban centres. The adoption of the indirect rule by the British colonial masters at the early stage still reflects poorly on urban solid waste management as there was no defined set of rules and regulations regarding environmental sanitation and protection (Onibokun, 1989). At the time, the focus of the colonial administrators was only on political and economic interest which mostly centred on the need to secure access to natural resources rather than the desire to pursue environmental issues of the colony (Onibokun and Kumuyi 2003). Waste, in particular, was not considered an issue.

However, in his review of the evolution of environmental policy in Nigeria, Adelegan and Itesi, 2019) noted that while there were bye-laws for environmental protection, such as the Criminal Code of 1958 and the Public Health Act of 1958, there were no defined policies or regulations specifically addressing solid waste management (SWM). The introduction of the Public Health Act in 1958 demonstrated the colonial government's commitment to controlling disease spread and managing the disposal of refuse and sewage, and since then, other environmental laws have been enacted. Table 2.3 gives an overview of environmental policies, laws and regulations in Nigeria. Hence, the general perception that there are no policies and regulations on waste is untrue (Yakubu, 2017). It may not be properly enforced, which gives room to waste mismanagement experienced in the country (Ezeah and Roberts, 2012).

### 2.6.2 Urban Solid Waste Generation in Nigeria

The generation of solid waste in Nigeria is in tandem with the waste generation trend as generally observed in other SSA countries due to population explosion and increased economic

activities and growth. The resulting effect of such trends is visibly reflected in the existing poor solid waste management systems in the country as waste generation rate preponderates over the capacity of the local authorities to manage them effectively (Amuda et al. 2014). Historically, computation of waste generation in Nigeria has not been given due consideration. The paucity of data on the waste generation rate and volumes has been condemned amidst a regime of poor record keeping, which was cited as the principal cause (Nnaji, 2015). A few attempts by studies such as Adedibu (1983, 1988), and Filani and Jegede (1992) to estimate the daily waste generation rate at the time have also been confronted with questions bordering on the accuracy of results and methodological flaws.

However, in recent times, more studies have emerged to address the gap in the literature (Chikwendu, et al., 2020; Ogwueleka, 2009; Atta et al., 2016; Kaza et al., 2018). Review of these studies show that the national waste generation trend has been on the increase from estimates of 9 million tonnes in 1995 to 25 million tonnes in 2009 (Ogwueleka, 2009; Chikwendu et al., 2020). More recently, Atta et al. (2016) projected that Nigeria would record waste generation volume ranging between 38 million to 40 million tonnes in 2020. The projection study pegged the waste generation rate of Nigeria at 0.5 kg/person/day, accounting for population and economic growth rates of 2.5% and (0.8-1.2%) respectively. In response to household size, income level, and educational background, the solid waste generation rate per capita is estimated to range between 0.44-0.66 kg/capita/day for rural and urban dwellers (Ogwueleka, 2009; Ojo and Adejugbagbe, 2017).

Table 2.3: The solid waste policies, laws and regulations of Nigeria (adapted from Nzeadibe et al., 2020).

| **Solid waste policies, laws and regulations** | **Institutions responsible for regulations** |
|---|---|
| National Policy on Environment, revised Federal Environmental Protection Agency Act, 1992 | Senate Committee on Environment and Ecology |
| Environmental Impact Assessment Act of 1992. | House Committee on Environment and Habitat. |
| National Environmental (Sanitation and Wastes Control) Regulations, S.I No.28 of 2009. | Federal Ministry of Environment (FMEnv). |
| The National Guidelines and Standards for Environmental Pollution Control in Nigeria. | National Environmental Standards, Regulation and Enforcement Agency (NESREA). |
| The National Environmental (Electrical/Electronic Sector) Regulations 2011, as reported in the Federal Government Gazette No. 5, Vol. 98. In the gazette, the 3Rs of waste management were expanded to 5R' s, namely: Reduce, Repair, Reuse, Recycle and Recover | Environmental Health Officers Registration Council (EHORCON). |
| The National Oil Spill Detection and Response Agency Act 2005 (NOSDRA Act) vii. The Harmful Wastes Special Criminal Provision Act No42 of 1998. | Nigerian Maritime Administration and Safety Agency (NIMASA). National Oil Spill Detection and Response Agency (NOSDRA). |
| Environmental Guidelines & Standards for the Petroleum Industry in Nigeria. | Department of Petroleum Resources (DPR). |
| National Environmental (Base Metal, Iron and Steel Manufacturing/Recycling Industries Sector) Regulations, 2011. | Abuja Environmental Protection Board (AEPB). |
| National Policy on Municipal & Agricultural Waste Management, 2012 (Draft). | States Ministries of Environment. |
| The National Environmental Standards and Regulations Enforcement Agency Act.<br>National Environmental Protection Management of Solid and Hazardous Waste Regulations S.I.15 of 1991; 2007 (NESREA Act). Review of existing policies, laws, regulations and institutional frameworks.<br>National policies on solid waste management. National Environmental (Pulp and Paper, Wood and Wood Products sector) Regulations, S.I 34 of 2013. | States Environmental Protection Boards, Agencies, Commissions, etc.<br>Local Governments' Authorities (Departments of Environment and Health, Works, etc.).<br>Waste/Refuse Management Authorities. Private sector - formal and informal ("Scavengers") in Solid Waste Management |

### 2.6.3 Urban Solid Waste Composition in Nigeria

According to Pressley et al., (2015), waste composition can be regarded as the constituents of the waste stream taken as a percentage of the total mass. The components of waste generated globally can be taken to reflect several factors which include economic activity, geographical location, change in lifestyle, energy sources, culture, religion and climate (Zorpas et al., 2015). It thus follows that concentration of more inorganic components may be favoured in a waste

stream as urbanization, population and economic development increases (Oteng-Ababio, 2014). Figure 2.3 shows comparative computation of MSW compositions across notable cities in Nigeria. The proportion of putrescibles is notably high ranging from 25% in Maiduguri to as high as 55% in Nsukka. There is evidence of a much higher proportion of putrescibles recorded, as high as 77% (Rushbrook and Pugh, 1999; Ogwueleka, 2009). Similarly, the proportion of recyclables such as plastics, metals, glass and paper vary accordingly with comparative abundance of paper (21%) and plastics (28%) recorded in Abuja. The availability of high proportioned putrescibles and recyclables in both official and unofficial dumpsites constitute resources that could be diverted into value chain streams through composting and recycling.

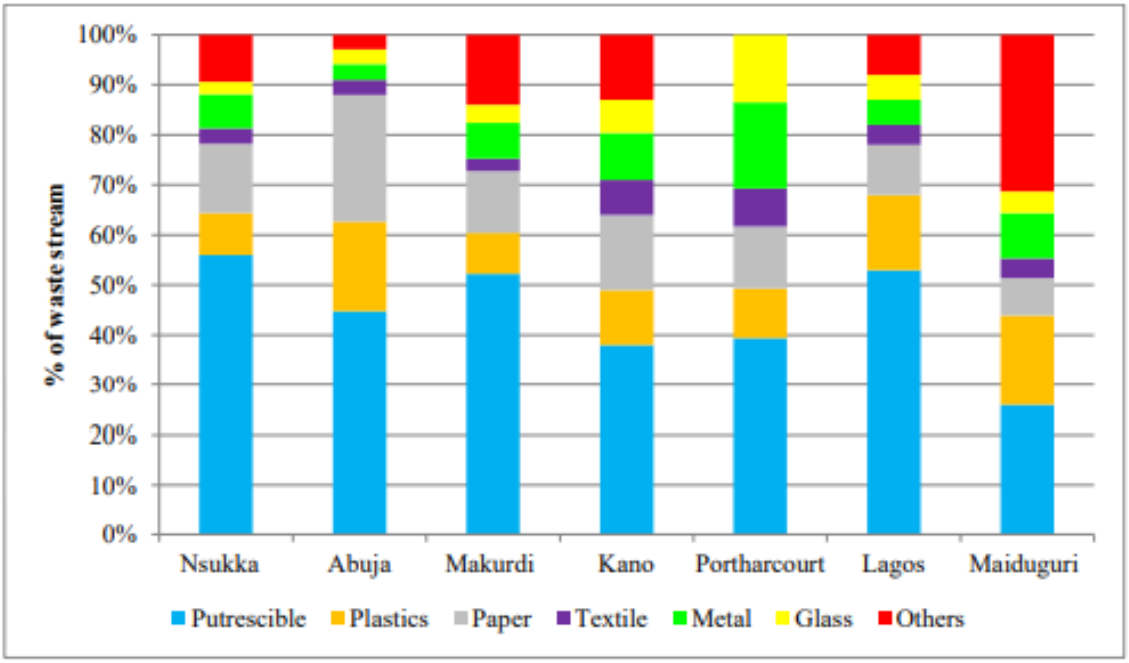


Figure 2.3: MSW Composition from different cities in Nigeria collated as a percentage of the Total Mass (adapted after Ayuba et al., 2013; Dauda & Osita ,2003; Igoni et al. 2007).

### 2.6.4 Urban Solid Waste Collection

The state of a waste management regime can easily be adjudged by the efficiency of its waste collection system. MSW collection in urban centres remains a challenging task as waste generation continues to increase in response to population growth and economic developments. Like in many SSA countries, the task of collecting waste in Nigeria is considered difficult and expensive and becomes even more challenging in unplanned areas without good layouts and motorable roads (Ezeah and Roberts, 2012). As a result, many urban environments struggle with piles of uncollected garbage, overflowing waste containers, clogged drains and blocked

stream channels (Simatele et al., 2017). Common waste collection strategies in Nigeria include door-to-door collection, bin, block, and central waste collection, but these are majorly deployed in formal settlements and high-income areas with almost no form of representation in the poor urban areas (Iriruaga, 2012; Kaza et al., 2018). Factors such as social stigma, potential inaccessibility, violence and crime, and difficulties in fee collection have been cited to influence poor waste collection in poor urban communities and rural areas (Godfrey et al., 2019).

Waste collection strategies in urban areas of Nigeria are aided by varieties of waste collection vehicles including side loaders, rear loaders, mini trucks, tippers, skip trucks for transfer of wastes to disposal sites (Abur et al. 2014). Essentially, these vehicles are usually not enough due to financial challenges or misappropriation of allocated funds. Abur et al. (2014) decried poor maintenance of available vehicles as it is common to find service trucks out of commission and thus informing on poor collection coverage and efficiency recorded across major parts of Nigerian cities. Many studies have varied reports on waste collection rates in urban centres of Nigeria, but it essentially ranges from as low as 20% to as high as 60% (Iriruaga, 2012).

### 2.6.5 Urban Solid Waste Treatment in Nigeria

Common treatment options for urban waste in Nigeria include composting and recycling.

#### 2.6.5.1 Composting

Harir et al., (2015) defined composting as the biological decomposition of organic waste materials in the presence of organisms such as bacteria and fungi at acceptable pH. Composting process is into two forms which are aerobic composting where the decomposition process occurs in the presence of oxygen, and anaerobic composting where the process occurs in the absence of oxygen. The significance of composting in waste management is explicated in many forms by Ogwueleka (2009). In addition to producing organic fertilizers, composting is positioned to facilitate the reduction of organic waste in the waste streams, thereby contributing to the reduction of Green House Gases (GHG) in many open dumpsites and UWDSs in developing countries, including Nigeria (Nabegu, 2011; Harir et al., 2015). Harir et al. (2015) posited that a reduction of 65% of waste could be effected through composting strategies as a large fraction of organic waste is recorded in waste streams across developing countries, including Nigeria. composting minimizes air and water pollution and reduces GHG emissions by up to 82% compared to landfills (Farrell & Jones, 2009; Harir et al., 2015; Nabegu, 2011).

Despite the numerous benefits of composting, it is surprising that composting potential in Nigeria has not been realized. Harir et al., (2015) posited that the current demand for chemical fertilizer that necessitated the recourse to import could have promoted composting in Nigeria. However, limited records of composting in Nigeria demonstrate the underdevelopment of the strategy in Nigeria. Ogbu et al. (2022) highlighted the establishment of a composting facility by Earth Care Nigeria Ltd in Lagos State to generate compost in a bid to capture and influence an organic fertilizer market in Nigeria. He emphasized the abundant organic matter content in municipal and forest wastes in Nigeria, while Adekunle et al. (2011) performed in-vessel composting on source-separated waste materials in Abeokuta city, exemplifying composting as a crucial element of sustainable solid waste management in Nigeria. The aspect of home composting is still at its nascent stage, as few reports of pilot composting projects have been undertaken, including Christiana and Olusegun (2014) and Coker et al. (2008).

Composting not only facilitates waste management but also provides environmental and agricultural advantages. Amaechi (2023) advocates for composting as the optimal waste management approach in Lagos State and Nigeria, citing its various financial, environmental, health, and agricultural benefits. Similarly, composting can potentially reduce groundwater associated with the use of chemical fertilizers in agriculture (Ogunseye et al., 2017). The presence of organic waste in as part waste materials facilitated by microbial activity under aerobic or anaerobic conditions (Adekunle et al., 2011).

#### 2.6.5.2 Recycling

Nigeria currently lacks institutional and infrastructure capacity to address the source separation and recovery of wastes (Elemile et al., 2015). Accordingly, most waste ends up in disposal points. However, the significance of the participation of informal workers plays a crucial role in the recovery of materials from various sources including OWDSs and UWDSs (Kofoworola 2007, Amasuomo and Baird, 2016). The informal workers go around the waste sites with their carts to retrieve these using basic tools such as iron sorting rods, hand rakes, and shovels to dig wastes out (Amasuomo and Baird, 2016). Nabegu, (2010) noted that there are other groups of informal workers called itinerant buyers who go from door to door buying recyclables from people. Several calls on promoting recovery of resources in Nigeria have equally called for formal recognition and integration of these workers (Ogwueleka, 2009; Amasuomo and Baird, 2016; Nabegu et al., 2016). This is in recognition of the impact the recovery of resources would have on, not only reducing waste transportation costs, but also limiting the environmental and health impact constituted by the waste. Additionally, the environmental and health risks that

this group of people are exposed to in the course of retrieving and sorting the wastes have been condemned by many studies (Adeniyi et al., 2018; Ohajinwa et al., 2017). Accordingly, Agbaeze et al., (2021) recommended that entrepreneurial innovation in engaging the informal workers may enhance their working condition and improve recycling efforts in Nigeria.

### 2.6.6 Urban Solid Waste Disposal

The approaches to urban solid waste disposal in Nigeria include Landfills, and Unofficial Waste Disposal Sites (UWDSs).

#### 2.6.6.1 Landfills

Landfills remain the most common approach for waste disposal across the globe. However, according to Kassah (2020), there are three types of landfills that are employed for waste disposal: (i) Sanitary Landfills., (ii) Controlled Landfills, and (iii) Open/Uncontrolled landfills

**(i) Sanitary landfills**

Sanitary landfills are landfills which are waste disposal system engineered for burial of wastes and collection of leachates and gases to mitigate environmental impacts (Christensen et al., 2014). While they are the most desired waste disposal system, sanitary landfills are expensive to build. Ogwueleka, (2009) noted that sanitary landfills cost as much as three to eight times more than open landfills. Accordingly, most sanitary landfills are located in developed countries where proper financing of waste is given priority compared to developing countries. Besides financing issues, technological constraints also constitute barriers to adopting sanitary landfills in developing countries (Srivastava et al., 2015). The practical development of sanitary landfills is hinged on the provisions that no matter how a waste management system is designed to recycle, recover, or burn wastes for energy conversion, there will still be residual waste that needs to be managed. Sanitary landfills are developed on this basis to manage such residues in a safe manner.

**(ii) Controlled landfills/non-sanitary landfills**

Controlled landfills/non-sanitary landfills are common in developing countries. They receive all kinds of waste and then bury it in a controlled manner. In Nigeria, it is purported that most cities are operating controlled landfills, for the burial and compaction of wastes without any form of segregation. Controlled landfills are partly equipped with leachate collection but are insufficient to guarantee outright environmental protection. However, the controlled nature of the operation of the sites ensures there are no cases of nuisances to people living close by in the form of blown litter, odour, or vermin intrusion (Lavagnolo et al., 2023). Kasbah (2020) posited that without much additional financing, the adoption of controlled landfills in low-medium income countries. However, in Nigeria, it is purported that most cities operate controlled landfills but actually they are open landfills. A study conducted by Ogwueleka (2009) found that of all the 183 landfills sampled, none of them qualified as controlled landfills.

**(iii) Open Landfills (Official waste Disposal Sites).**

Open landfills are common waste disposal sites in developing countries like Nigeria that are officially registered for waste disposal but without any form of control for leachate and gas collection or control for waste covering (Lavagnolo et al., 2023). Open landfills are usually associated with uncontrolled burning, smokes, odors, and other nuisances that are inimical to the living conditions of those living in close proximity (Agamuthu, 2013). In addition, Kassah, (2020) noted these sites are operated openly with access to the informal worker and there is no waste registration and weighing done on-site. Accordingly, most open landfill sites do not require much development or operational cost and, as such, are found operated by most cities in Nigeria despite being unsafe to both the environment and public health. They are originally located at the outskirts of the cities but in reality, most developments have come close to them in response to urbanization and population growth (Ogwueleka, 2009). The problem associated with developing these open dumpsites has prompted calls for its closure in developing countries (Law and Ross, 2015). But developing countries are not only associated with OWDSs but with far-threatening evidence of OWDSs in close proximity to people.

**2.6.6.2 Unofficial Waste Disposal Sites (UWDSs).**

Unofficial Waste Disposal sites (UWDSs) are also uncontrolled waste disposal outside official provisions of municipalities. They are unregistered and unregulated disposal sites haphazardly created close to residential developments (Adeoye et al., 2011). The creation of these sites is usually not monitored or controlled, and thus, they are prevalent in many Nigerian communities

with grave environmental and health impacts on the people living around them. McDougall et al. (2008) reported that it is not uncommon to find that these sites are associated with uncontrolled burning and odours constituting nuisances to the immediate environment and the public. Kassah (2020) reported that the development of UWDSs is usually encouraged by informal workers who profit from recovery of materials from such sites. Ogwueleka, (2009) reported that weak legislative and poor enforcement instrument have enhanced the development of these to foster without control. A comprehensive impact of UWDSs on the environment and health are reviewed below to emphasize how important it is to address strategies that can manage the development of these sites.

**Environmental and Health Impacts of UWDSs.**

The phenomenon of indiscriminate dumping of waste is as much a health problem as it is environmental. Development of UWDSs in locations such as trenches, on roadsides, in or near rivers, on open lands is often associated with environmental risks. These include air pollution from burning of composed wastes in these sites, clogged drainage system leading to flooding, leachate infiltration into water bodies causing surface water and ground water contamination, leaching out of important elements resulting in loss of soil fertility and land degradation (Niyobuhungiro, and Schenck; 2022: Kaza et al., 2018; Etea et al., 2021). Mavropoulos et al., (2015) noted that uncontrolled burning of wastes around open dumpsites releases Persistent Organic Pollutants (POPs) in the atmosphere and are potentially carried by wind to environments away from their source. These pollutants adversely impact on plants as well as animals that are often found dead within the zone of impact possibly precipitated by direct leachate contamination or movement of gases on account of such uncontrolled burning or smoke.

Several studies have attempted to establish a possible linkage between health outcomes and exposure in order to document the various consequences of poor management practices on public health (Giusti, 2009; Vrijheid, 2009; Hu et al., 2000; Haylamicheal and Desalegne, 2012; Antwi, 2016; Ziraba et al., 2016; Etea et al., 2021). The submissions from these studies establish that the health impact of poor solid waste management practices may be direct as well as indirect and thus may often not be apparently linked to the overall health outcomes of a population (Ziraba et al., 2016).

There are several pathways through which poor SWM practices can adversely impact the health outcomes which include physical, chemical and biological (Sankoh et al., 2013; Dos Muchangos et al., 2014; Dladla et al., 2016). Accordingly, the health exposure to waste often

takes the form of physical contact, inhalation, piercing injuries (Ziraba et al., 2016). However, the consequence effects of waste exposure to health are varied and range from simple psychological impacts to serious morbidity, disability and on rare occasions death depending on the type of waste, length of exposure, health history of the concerned population and availability of prevention and mitigation measures in place (Abd El-Wahab et al., 2014).

Figure 2.4 gives a framework that describes the linkages of elements of poor waste management practices to adverse health outcomes. Accordingly, the health impact of poor waste management practices depends on how much waste is generated, the mode of waste collection and transportation and disposal methods (Boadi et al., 2005; Oguntoyinbo, 2012; Ziraba et al., 2016). Poor urban residents living in the vicinity of the location of UWDSs not only endure the pungent smell of the wastes but are often exposed to the risk of infection transmission through vectors and rodents that are living on these wastes. These vectors, including houseflies and mosquitoes, are usually attracted to open dumpsites by decomposing wastes and are therefore capable of transmitting disease-causing microbes. The increasing cases of Malaria in developing countries especially in Sub-Saharan Africa has been attributed to open dumpsites infested by mosquitoes (Dos Muchangos et al., 2014).

Moreover, uncontrolled burning of waste on these waste sites causes adverse health outcomes through inhalation of toxic fumes which may lead to respiratory complications or development of allergy. Etea et al. (2021) highlighted various pollutant particles such as carbon dioxide, sulphur dioxide, carbon monoxide, particulate matter, dioxins, furans, ash, metals and organic compounds in the environment that are derived from incineration of wastes in open dumpsites. These pollutants are considered to pose significant risks to the mental, physical and emotional health of residents living where these open dumpsites are located.

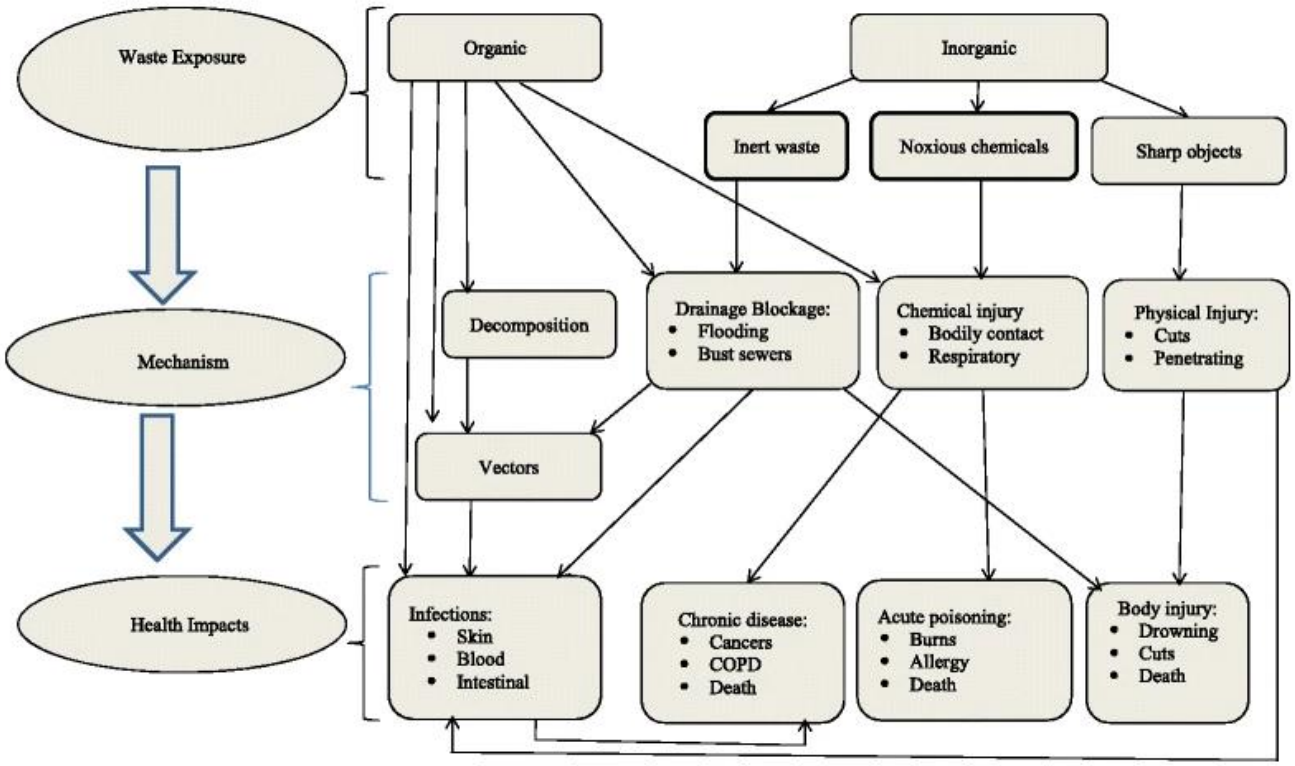


Figure 2. 4: Linkage between Poor Waste Disposals and Adverse Health Outcomes (Ziraba et al., 2016).

## 2.7 INTEGRATED SUSTAINABLE WASTE MANAGEMENT (ISWM)

The development of UWDSs in developing countries reflects poor waste management in the system, which has social, environmental, and economic implications for the institution, stakeholders, and people living close to these sites. Accordingly, continued use of UWDSs is an unsustainable practice that needs to be addressed with a system of best practices in the waste management system. According to (UNEP) 1996, Integrated waste management constitutes one of the best practices in waste management that provides a framework by which existing systems, as well as the design and implementation of new waste management systems can be optimised to address waste management challenges. The framework considers the waste management hierarchy which addresses the various aspects of the management including transportation, collection, treatment and disposal of waste (Seadon, 2006).

ISWM underpins this research to assess urban solid waste management in developing countries through the lens of various aspects of the sustainability model to address the situation. By evaluating the social, environmental, and economic aspects of the system within the context of ISWM, the major factors driving the development of UWDSs in Ado-Ekiti may be uncovered to pave the way for evaluating management strategies that are amenable to the development of

UWDS in Ado-Ekiti. The ISWM is a comprehensive approach to managing waste sustainably, encompassing various aspects of waste management. ISWM is depicted in Figure 2.5, showing three dimensions of the waste management system needed to manage waste sustainably. These include (i) The stakeholders, (ii) the elements of the waste system, and (iii) the sustainability aspects of the local context.

### 2.7.1 The Role of Stakeholders (Governance)

The stakeholder is the primary dimension of ISWM, which is concerned with participation in waste management. Tennakoon and Kulatunga (2021) defined stakeholders as people or organizations who have an interest in managing waste or/and participating in activities that are related to it. Accordingly, stakeholders may include the government, which regulates and provides waste services, and the citizens who use the service (Rosilawati et al., 2023). However, Joseph (2006) posited that the oversimplification of stakeholders' governance for planning, designing, and executing SWM has partly resulted in the present outlook of waste mismanagement in developing countries. This is often related to a lack of recognition of key stakeholders in their roles to implement and sustain waste management strategies (Abas and Wee, 2014).

Depending on the institutions, the roles of stakeholders are quite varied. Stakeholders may generate waste (waste generators), function as service providers (waste collectors), act as regulators (state and local governments), or educators (non-governmental organizations) (Rosilawati et al., 2023). Additionally, there are other key stakeholders whose roles are often ignored but are vital to the SWM system. The informal institution that recycles (waste pickers, waste dealers), teachers, youth and community leaders. Table 2.4 depicts common stakeholders in SWM and their interest in the system, highlighting their responsibilities' versatile and multifaceted nature. This complexity underscores the importance of stakeholders and the need for their roles to be given due consideration in the planning of SWM system. Marshall and Farahbakhsh (2013) noted that the deficiencies in recognition of stakeholders and their roles are hinged on the issues with the governance of waste management in development. The traditional governance in waste management centred around the roles of the government alone, cannot promote sustainable waste management. This, on many occasions, has precipitated a poor public attitude to waste in their negligence to be responsible in waste management, which has occasioned palpable practice of open dumping in many parts (Trimurni, 2018). Marshall and Farahbakhsh (2013) posited that governance in waste management requires collaboration

and participation of all key stakeholders, including government, public, community-based associations, youth, informal workers, and private sectors.

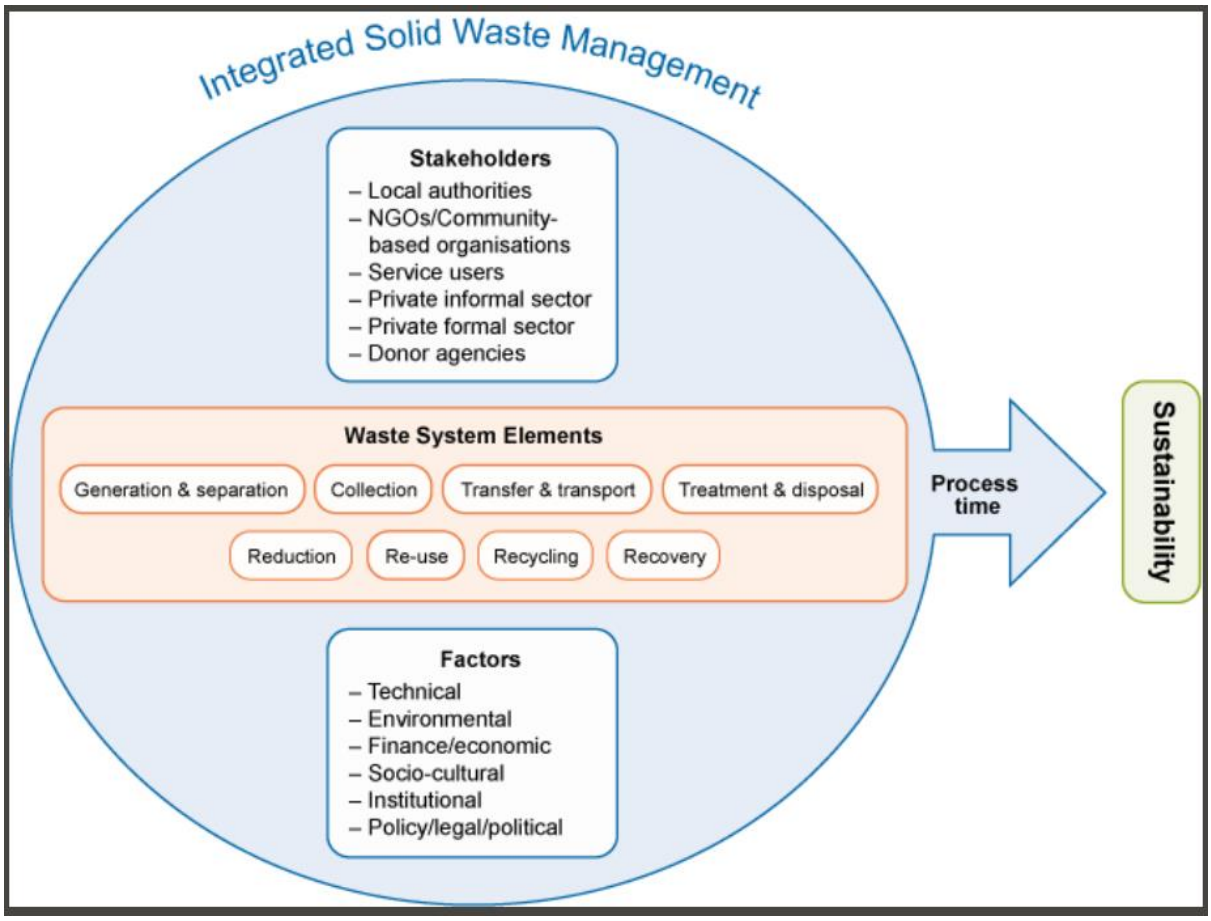


Figure 2.5: Integrated Sustainable Waste Management (Adapted after Anschutz et al., 2004)

### 2.7.2 Elements of Waste Systems (Material Flow in the System)

The second dimension of ISWM concerns the waste system elements, which address the flow of materials in the waste management system from generation through collection to recovery. These waste elements are mainly concerned with the environmental aspect of the SWM system, which seeks to look at how waste is handled and where it ends up. The environmental implications of many SWM systems in developing countries have triggered interest in adopting a waste management hierarchy as an operational guideline for policy implementation. Figure 2.6 depicts the hierarchy of waste systems, which shows that Preference is given to prevention. Waste disposal is below the hierarchy.

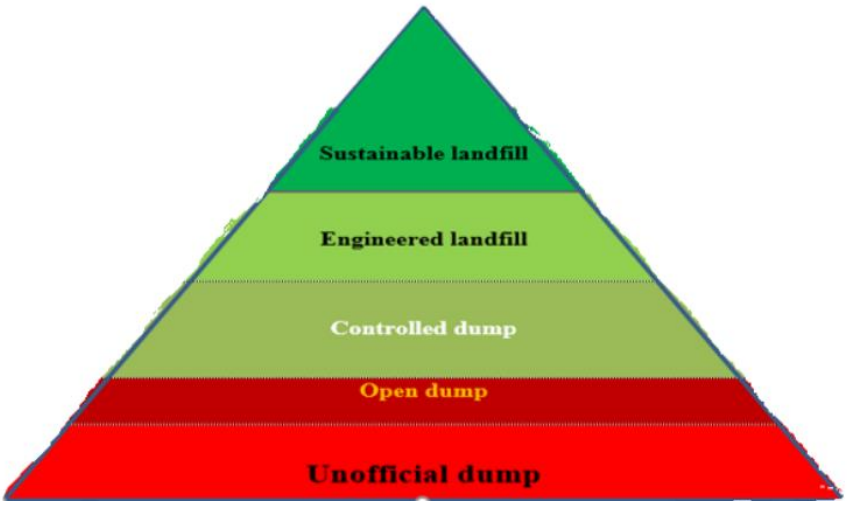


Figure 2.6: Waste Management Hierarchy (Adapted after Marshall and Farahbakhsh (2013)

The development of UWDSs is the lowest with a high environmental impact. Other than environmental benefits, paying attention to the flow of materials in waste management systems is significant to promote the recovery of materials back into the economy (Hultman & Corvellec et al., 2012). Kofoworola (2008) indicated many materials in the open dumpsites in developing countries are resources that can be recovered and reintroduced into the system to support local industries. Ferronato and Torrretta, (2019) posited that the growing material footprint in developing countries reflected in the palpable practice of open dumping hinders economic growth and sustainable development. In this respect, many studies reported various strategies to improve SWM systems, such as organic waste buybacks with composts (Hettiarachchi et al., 2018), community waste banks (Sekito et al., 2013), integrating waste pickers in waste management, incentivization of waste management practices (Ghisolfi et al., 2017). These studies recognised the environmental implications of the flow of materials in waste systems, and this should be considered to address the development of UWDSs in developing countries.

Table 2.4: Stakeholders and their Roles in Waste Management (Adapted from Joseph et al., 2006)

| Stakeholders | Roles |
|---|---|
| Public | Practice source reduction and source segregation.<br>Pay for waste management. |
| Municipalities | Prioritizing waste management.<br>Providing infrastructural inputs and waste collection services<br>Institutionalised trainings of staff.<br>Implement legislation and institute incentives and penalty for non-compliance.<br>Enlisting informal workers participation. |
| City Planners | Incorporate waste management considerations into city planning.<br>Designate space for waste management facilities with appropriate buffer zones. |
| NGOS/Social Workers | Establish ward committees and encourage community participation.<br>Collaborate with like-minded organizations to integrate efforts and avoid duplication.<br>Utilize existing connections with municipal and influential bodies to gain support.<br>Engage unemployed youth in various roles.<br>Organize or sponsor 'Clean City' campaigns. |
| Teachers/Academia | Promote a culture of solid waste management.<br>Instill discipline regarding solid waste in children.<br>Conduct relevant research and development. |
| Community Leaders | Assist NGOs and CBOs in organizing cleanliness drives.<br>Encourage community members to participate in waste management strategies. |
| Unemployed Youth | Seize part/full-time employment opportunities created by the 'Clean City' initiative, such as: managing garbage collection, assisting in road show organization and promoting the campaign. |
| Children/Students | Segregating garbage.<br>Encouraging parents and domestic workers to participate. |
| Scientific Community | Ensure waste is properly disposed of in nearby bins.<br>Place small garbage bins outside shops.<br>Ensure customers do not litter outside shops.<br>Adhere to bio-medical waste rules. |
| Politician | Lead and collaborate on the 'Clean City' campaign and advocate for the municipal corporation to prioritize the 'Clean City' initiative. |
| Corporation | Ensure all employees understand the importance of cleanliness, take serious action within office/factory premises, and spread the message citywide.<br>Provide dustbins outside office/company premises to prevent littering on the road. |

### 2.7.3 Sustainability Aspect

The third dimension of ISWM deals with sustainability aspects, which can be assessed through a management system. Six aspects of sustainability are considered, including technical, environmental, financial, sociocultural, institutional, and policy that influence the system's sustainability (Scheinberg, 2011). These aspects play a large role in the running of a SWM system. Policy aspects of the SWM system are vital to aligning a community's actual needs with the system's goal. Many SWM systems have failed due to policy weakness which manifested through inadequate formulation and lack of implementation (Issock et al., 2020; Dada et al., 2024). In line with enacting policies, the application of incentives and penalties is crucial to enhancing effective participation. In South Africa, Issock et al. (2020) posited that much participation has not been recorded in household segregation in South Africa despite a mandatory policy instituted by the government for residents to separate waste at source without provisions for penalty for non-compliance. Thus, the aspect of policy measures in SWM needs to be holistic for resources invested in the SWM sector to be productive.

Another aspect through which the SWM system can be assessed is through institutional frameworks. Marshall and Farahbakhsh (2013) posited that institutional aspects of SWM are multifaced and include (i) the degree of decentralization in the system, which specifies various roles between local and government institutions. (ii) the structures of the institution, (iii) organisational procedures, and (iv) institutional capacity and integration of other stakeholders. An institution for SWM remains effective when legal and regulatory frameworks are complemented with enforcement and regular inspection (Zurbruegg, 2003). The institutional aspects of the SWM underpin other aspects of sustainability in waste management such as the institution's finances to fund SWM systems to support the provision of technical resources to carry out waste management operations. The socioeconomic aspects of a SWM system deals with the nature and characteristics of the people that use the system. By taking account of the diversity of social and ethnic groups in an urban centre, SWM strategies may be greatly influenced. The behavioural and underlying attitudes of the people may also influence the performance of the SWM system (Shubeler, 1997). Such influences may manifest in many facets such as compliance with source segregation (Issock et al, 2020), unwillingness to pay for waste services (Massoud et al., 2021), open dumping of waste (Talang & Sirivithayapakom, 2021; Inazumi et al., 2011).

## 2.8 SUMMARY OF CHAPTER

This chapter has provided a review of solid waste management practices in SSA countries with emphasis on four selected countries, including South Africa, Ghana, Kenya, and Nigeria. The review has highlighted many background challenges that are common to these countries. This review has also provided information on the development of UWDSs and their environmental and health impact, which informs the need for sustainable strategies to manage their development.

# CHAPTER THREE: RESEARCH METHODOLOGY AND DESIGN

## 3.1 INTRODUCTION

The purpose of this chapter is to present the research methodology and design adopted in this study to address the research problem and provide justifications for adopted choices in the research process. The theoretical concept of Research Onions proposed by Saunder et al, (2018) provides the basis for constructing the methodology for this research (Figure 3.1). Hence, this section is presented in two parts; the first (3.2-3.5) discusses the research philosophy and paradigms underpinning the research process and illuminates the research approach in this study. The second (3.6-3.8) discusses the research design and strategy, providing details on the data acquisition techniques and analysis and highlighting ethics of the research with a focus on the validity and reliability of the study.

## 3.2 RESEARCH PHILOSOPHY

The starting point of research methodology is concerned with delineating the research philosophy (Saunders et al., 2018). According to Günbayi and Sorm (2018), research philosophy can be simply described as assumptions adopted by a researcher in undertaking research. Primarily, all research is based on some underlying philosophical assumptions which guide the researcher in the choice of appropriate approach and strategy such that a linkage between the research logic and appropriate research design can be established in the course of developing knowledge in a study (Mingers, 2004).

Research philosophy can be defined as a system of beliefs and assumptions which govern the approach by which information is acquired, analyzed and interpreted in the development of knowledge (Bettis and Gregson, 2001; Wahyuni, 2012). These assumptions can take different dimensions depending on the views on the objectives of the research and the best approach to take in undertaking the research (Håkansson, 2013). Accordingly, there are three different aspects of research philosophies which are concerned with epistemology, ontology, and axiology (Günbayi and Sorm, 2018). Epistemological assumptions deal with the nature and sources of the knowledge being developed while ontological assumptions deal with beliefs on the nature of reality in the development of the knowledge. The axiological assumptions are concerned with views on the values and ethics of the research.

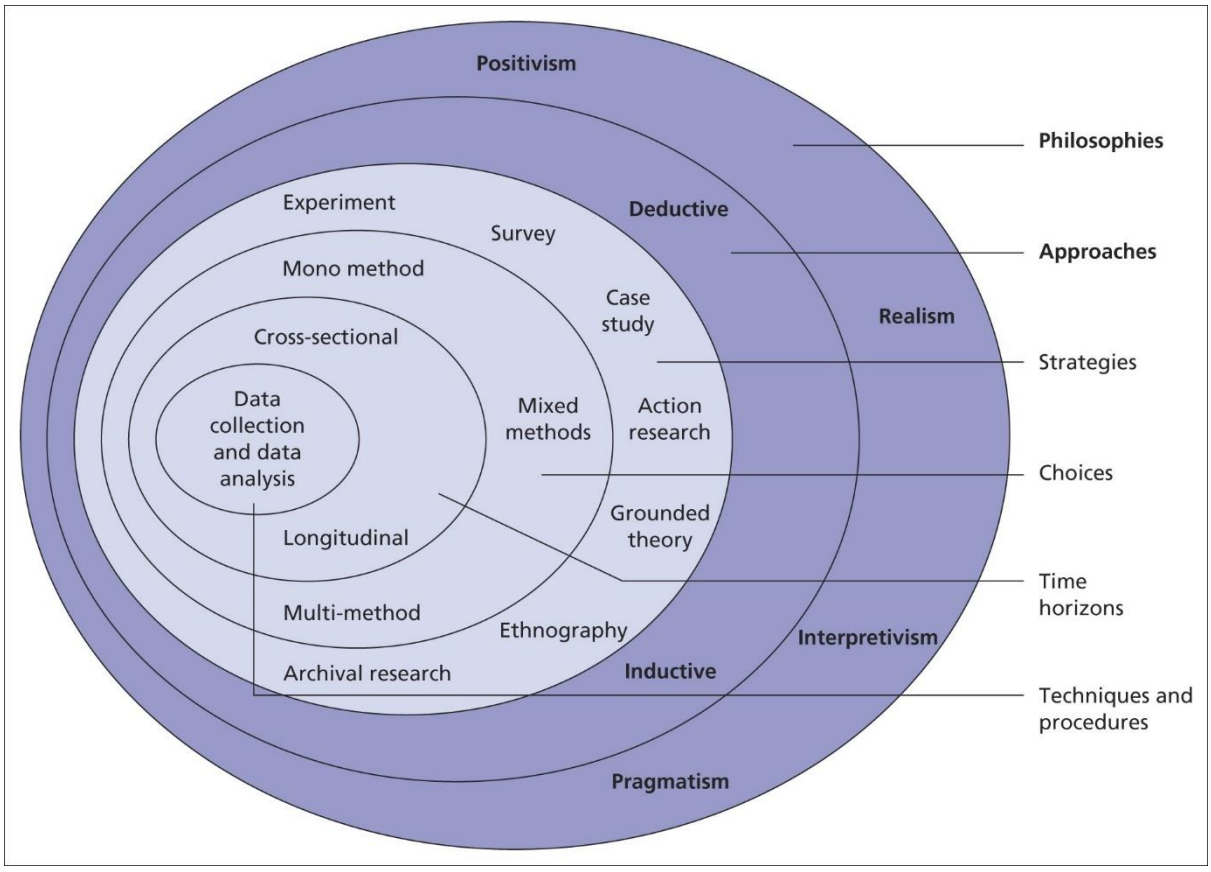


Figure 3.1: Research Onion Model (Saunder et., 2018). The research Onion Model depicts a various elements of research methodology including Research philosophies, approach strategies techniques and procedures.

However, there are different philosophical theories underlying research methodology that exists along the dimensions of ontology, epistemology, and axiology. These philosophical theories constitute research paradigms that provide interpretative framework for a set of assumptions that govern the nature of an inquiry in the development of knowledge (Guba and Lincoln, 1994; Antwi and Hamza, 2015). There are three major research philosophies that are considered as mainstream from which other philosophical theories are formulated. These include positivism, interpretivism, and realism (Falconer and Mackay, 2000; Rehman and Alharthi, 2016).

### 3.2.1 Positivism

Positivism is the philosophical branch that became prominent in the early nineteenth century following the efforts of August Comte (Talmy and Richards, 2011). The positivists believe that reality is somewhat static and controlled by immutable laws (Levin and Stephan, 1991). As such, entities can be observed and measured from objective standpoints using only observatory and empirical data. According to Saunders et al. (2018), positivism is derived from the assumptions of the natural sciences and likened the existence of social entities to physical entities. Positivists believe that social phenomena are governed by laws that can be formulated through the application of scientific methods and presented by data (Goduka, 2012).

The epistemological position of positivists is objectivism whereby social phenomena are viewed as existing independently of social actors and can be objectively observed and described in their natural state without any interference (Rehman and Alharthi, 2016). In essence, positivists hold that the search for knowledge, truth, and reality should be based entirely on direct observation and empirical measurements using quantitative methods (Flowers et al., 2011; Saunders et al., 2018).

### 3.2.2 Interpretivism

Interpretivism rejects the consideration of social entity as a verifiable reality that exists external to social actors (Plack, 2005). Grix (2010) ascribed the stance of interpretivists as a reaction to the over-dominance of positivism. The positivist perspectives on social entities are contended by interpretivists who maintained that social entities are quite distinct from physical phenomena and cannot be observed objectively in the same manners as held in the natural sciences. Instead, Interpretivists believe that the access to reality cannot be observed directly without interference from the views, concepts, and backgrounds of the social actors. This is incumbent on the understanding that external realities are not static entities but moderated by the perceptions of social actors and that they cannot only be created and not discovered as held by the positivists (Pouliot, 2007).

Accordingly, interpretivists take a subjective stance in the study of social phenomena since the objective of interpretive research is to observe social realities in their context through the meanings they create. These meanings are a product of perspectives from different people of different backgrounds, cultures and circumstances and thus different social realities. Hence, an insight into these meanings is underpinned by subjective observation and interpretation of qualitative data for construction and re-construction of the social realities in their context (Myers et al., 2013; Flowers et al., 2011)

### 3.2.3 Realism

The critiques of over-dominance of positivism and profound relativist nature of interpretivism birthed the philosophical branch of the realism paradigm. The philosophical stances of positivist and interpretivists are condemned to be devoid of the emancipatory drive to change the world since they are enmeshed in dominant ideology (Scott and Usher, 2011). Thus, critical realism is concerned with the reconciliation of positivism and interpretivism and thus holds that reality exists independently of the social actors but there is a tendency for such reality to be incorrectly observed due to the complexity of social entity (Grix 2010).

In other words, this philosophical stance recognises that social realities are external and independent but cannot be directly observed. A critical realist subscribes to the belief that the nature of reality is a product of social conditioning, observed as mere sensations manifested from the things in the world (Saunders et al., 2018). Essentially, a critical realist beams his focus on explaining the nature of observations by identifying the underlying causes and mechanisms that govern the representation of social structures in reality (Goduka, 2012)

Hence, the philosophical position underlying this study adopted by the researcher is that of a critical realist because the present state of urban solid waste management in the study area was observed from objective standpoints while recognizing the differences in the roles of identified stakeholders (social actors) have played in the development of UWDSs in the area. This philosophical stance allowed the researcher to address the research problem using both qualitative and quantitative methods in the study.

## 3.3 RESEARCH APPROACH

The research approach to the formulation of research design within the framework of adopted philosophical assumptions is underpinned by two main contrasting forms of reasoning (Saunders et al., 2018). These are deductive and inductive reasoning. The deductive research approach is concerned with forms of reasoning that develop from the particular to the general while Inductive research approach stems from generalisation and concludes on specific (Calhoun, 2002; Soiferman, 2010).

### 3.3.1 Deductive Research Approach

Generally, deductive reasoning commences with development of hypothesis based on existing theory which is then subjected to testing by collecting evidence in order to accept or reject the hypothesis. Essentially, the goal of the deductive approach is concerned with falsifying or verifying existing theory through inferences drawn from premises formulated. (Saunders et al.,

2018). Accordingly, deduction is the primary research approach in the natural sciences since laws provide the foundation for explanations, enable events to be anticipated, forecast their recurrence, and ultimately govern them (Norris, 2006; Collis and Hussey, 2013).

Meanwhile, Blaikle (2018) proposed five steps which govern the progress of deduction in research approach

i. Formulating a hypothesis or premise,
ii. Deducing propositions under the conditions of existing theories,
iii. Examining and comparing formulated hypothesis with existing theories,
iv. Testing the hypothesis through collection and analysis of pertinent data, and
v. Making deductive inference on either falsifying or verifying the existing theory

### 3.3.2 Inductive Research Approach

Informally, the induction process is referred to as a "bottom-up" process which proceeds from a particular observation to broader generalizations and theories. In this regard, the process of reasoning does not start with formulating a hypothesis but rather with sets of research questions about phenomena (Pathirage et al., 2008). Accordingly, inductive reasoning starts with the process of collecting data about a phenomenon, and then, an attempt is made to derive themes and describe patterns to develop a theory. Jensen (2002) noted that the application of inductive research approach is common in qualitative research where possible bias in data collection could be avoided since there is no reliance on any theory or laws to inform the research process.

Essentially, inductive approach is applicable to making inferences on a phenomenon in a broader field by focusing on specifics within the same field. The inferences in this case are informed by analysis of the data on the specifics which usually involve theme identification and patterns examination to give a broader representation of the phenomenon in the field (Perry, 1998). Accordingly, an inductive approach is adopted in this doctoral research to address the development of Unofficial Waste Disposal Sites (UWDSs) which is a specific phenomenon within the context USWM in developing countries.

## 3.4 RESEARCH STRATEGY

Research strategy describes the systematic way research is carried out such that it provides direction to the thought process of the researcher (Darke et al., 1998; Saunders et al., 2018). Typically, research strategy encompasses the research method, research designs, sampling strategies, and data analysis techniques which are essential to answering the research questions in a timely manner (Saunders et al., 2018). The selection of these vital components of research

strategy is grounded in the nature of the research. Accordingly, an appropriate research strategy for a study must be selected in consideration of the research objectives, existing knowledge in the field of study, philosophical stance of the researcher and available resources and time for the research (Saunders, 2012).

Several strategies in the literature can be adopted in research including experiment, survey, action research, case study grounded theory, ethnography, participatory inquiry longitudinal studies, cross-sectional studies, and archival research (Saunders, et al., 2009; Collis and Hussey, 2013). It should be understood that the abundance of various strategic approaches to research does not preclude that some elements of these strategies do not overlap. It is often applicable to deploy two or more research strategies as an integrated approach by merging elements of different strategies in a single study (Collis and Hussey, 2013). Essentially, it is pertinent that the most favourable strategy is selected on account of the research in question (Yin, 2013). Accordingly, the recommendations of Yin, (2013) on the selection of an appropriate research strategy demand that the following conditions should be met.

i. The nature of question the research is addressing,
ii. The degree of influence of a researcher over actual behavioural event, and
iii. The extent of attention on current or past events.

These conditions are outlined by Table 3.1 to describe the aspects of different research strategies for consideration in a study.

Table 3.1: Outline of Characteristics of Different Research Strategies based on Yinian Conditions (Adapted from Yin, 2013)

| Research Strategies | Nature of Research Question | Degree of Influence on Actual Behavioural events | Extent of Attention on Current or Past Events |
|---|---|---|---|
| Experimental Research | How, why | Yes | Yes |
| Historical Research | How, why | No | No |
| Case Study Research | How, why | No | Yes |
| Survey Research | Who, what, where how many, how much | No | Yes |
| Archival Research | Who, what, where how many, how much | No | Yes/No |

In consideration of the nature of this research and various research strategies outlined above, the case study research strategy was deemed appropriate and hence adopted for this study. The following section provides in detail the description of case study research strategy and highlights the justification for its preference over other strategies.

### 3.4.1 Case Study Research

Over many years, there have been various perspectives on what case study research connotes. Historical understanding revealed case study research is the study of a phenomenon as a single case to provide valid descriptions within its context. Eisenhardt (1989) defines case study research as "a research strategy that focuses on understanding the dynamics present within single settings and aims at providing a description, testing theory, or generating theory". Stake (1995) defines case study research as "The study of the particularity and complexity of a single case, coming to understand its activity within important circumstances". Similarly, the definition of research strategy by Gerring (2004) stipulates that the single case being studied should demonstrate a spatially bounded phenomenon within a particular time or over a period.

However, Yin (2013) defines a case study as "An empirical inquiry that investigates a contemporary phenomenon in depth and within its real-life context, especially when the boundaries between phenomenon and context are not evident". Essentially, these definitions agree on the significance of case study research in the exploration of complexity in a variety of real-life situations. Unlike other strategies such as experiments and surveys, case study research investigates phenomenon witing its context. It is adjudged to be a most appropriate strategy in answering "why" and "how" research questions to derive robust knowledge about the phenomenon especially where the researcher lacks control over the event (Yin, 2013).

According to Collins and Hussey (2009), case study research strategy can be regarded as a strategy appropriate for the exploration of a single phenomenon in a natural setting utilizing various techniques to obtain in-depth knowledge. Thus, case study strategy cannot be regarded only as a method in and of itself but a design frame which incorporates several techniques (Simons, 2009). Similarly, Yin, (2003) agree that case study research can accommodate both qualitative and quantitative data which gives an investigator an advantage of analysing a rich mix of data for the research and should not be confused as qualitative research.

Accordingly, cases study research can be descriptive as well as being exploratory and explanatory (Yin, 2009). This doctoral research is case study research as it seeks to describe urban solid waste challenges and explore suitable intervention to manage the development of

unofficial dumpsites in urban centres with similar challenges to Ado-Ekiti using both qualitative and quantitative methods.

#### 3.4.1.1 Rationale for Selecting Case Study Research Strategy

The suitability of case study strategy to any research has been explicated from the foregoing definitions case study research. According to Yin, (2013), the viability of a case study strategy to research is hinged on the following conditions.

i. The phenomenon under focus has to be studied in its natural settings
ii. The behaviour of participants cannot be influenced or manipulated
iii. The study is structured to answer "how" and "why" research questions
iv. There are no clear boundaries between the phenomenon and context of research
v. There are few if any, prior studies in the area where research is being undertaken

Therefore, the phenomenon being studied in this doctoral research is the development of UWDSs in its real-life context which in effect satisfies the criteria of selecting case study research strategy especially as the boundaries between this phenomenon and the context of research are not clearly defined.

Similarly, the major research question in this study which is how to manage the development of UWDSs in developing countries equally satisfies the second criterion by which case study research strategy is selected for this study. This research equally answered a question on why UWDSs are prevalent in urban centres; how SWM in the developing countries with similar circumstances with case regions can be improved upon; and how community participation can be leveraged for effective SWM. These research questions are primarily why and how questions that outrightly support the adoption of a case study research strategy in this research.

Other research strategies such as experiments, or historical research are deemed inapplicable for this research. In this study, the researcher has no control and cannot influence the behaviour of the participants, and as such the experimental research strategy is considered less applicable for the study. Moreover, the development of unofficial dumpsites being studied in this research is a contemporary phenomenon, and as such the historical research strategy is considered inappropriate for this study.

#### 3.4.1.2 Validity and Reliability in Case Study Research

Among the methods being exploited in social science, case study research has been widely accompanied by many criticisms from the most practical ones to the abstract viewpoints (Yin 2013; Quintao et al., 2020). According to Cresswell, (2021), the controversies surrounding the application of case studies in qualitative research emanate from its objectives, capabilities as well as conclusions. Critics have maintained that case study research cannot offer grounds for unbiased findings, objective conclusions, replicability, and generalizable conclusions. The dependence of case study research on a single case for generalization of conclusions remains one of the major criticisms since it is believed that the study of a few cases cannot in any form be sufficient to establish the reliability of research (Quintao, 2020).

However, some scholars feel strongly about the validity and reliability of case study research and have refuted the criticisms associated with the research strategy (Stake, 2005; Cresswell, 2021; Yin, 2013). Yin (2013) dismissed the criticism surrounding generalization of results and maintained that there is a clear distinction between statistical generalization and analytical generalization in which developed theory provides a template by which findings of case study research are compared. In this regard, generalization of findings is made concerning theory and not necessarily to the population in respect of the phenomenon being studied.

Furthermore, to establish validity and reliability in case study research, four tests have been provided which include construction validity, internal validity, external validity and reliability (Cresswell, 20231; Yin 2013). The tactics through which the provisions of these tests can be met are provided in Table 3.2

Table 3.2: Tactics for testing Validity and Reliability in Case Study Research (Yin, 2013)

| **Test** | **Case study tactics used in the research** |
|---|---|
| Construction Validity | Application of multiple sources of evidence, the establishment of a chain of evidence<br>Review of draft case study reports by key informants |
| Internal Validity | Pattern Matching<br>Explanation building |
| External Validity | Use of replication Logic |
| Reliability | Use of case study Protocol<br>Case study Database development |

## 3.5 CASE STUDY AREA DESCRIPTION

Ado-Ekiti, the capital city of Ekiti state, Nigeria is located between latitudes 7º 33′ and 7º 43′ North of the equator and longitudes 5º 07′ and 5º 22′ East of the Greenwich meridian (Figure 3.2). It is bounded in the north by Ido-Osi and Oye local government Areas, in the West by Ijero and Ekiti West Local Government and in the South by Ekiti Southwest Local Government Area and covers an area of approximately 884 $km^2$ (Awosusi and Jegede, 2013). Geologically, the city is underlain by the pre-Cambrian basement complex rock group, which covers the entire state. The mean annual temperature of the area is 27ºC whereby March constitutes the hottest month with an average temperature of 28ºC while the month of June is the coolest with a temperature of 25 ºC (Adebayo, 1993). Rainfall is highly seasonal with well-marked wet and dry seasons.

As an administrative centre of the state, Ado-Ekiti has witnessed economic, social and political transformation which had informed increasing growth in urbanization, population, and physical expansion in terms of development of buildings, construction of new and expansion of old roads, the establishment of new markets and creation of social, economic and religious facilities (Awosusi, 2010). Figure 3.3 depicts the population growth trajectory of Ado-Ekiti from 1950 to 2023. According Akinluyi et al. (2022), the city's growth trajectory changed significantly in 1953 when it was designated as the headquarters of the Ekiti Division. This marked the beginning of its transformation into a notable urban centre. During Nigeria's first republican regime in 1963, Ado Ekiti experienced rapid growth when Ekiti Division was recognized as one of the key regional development areas. Further administrative changes came in 1979 with

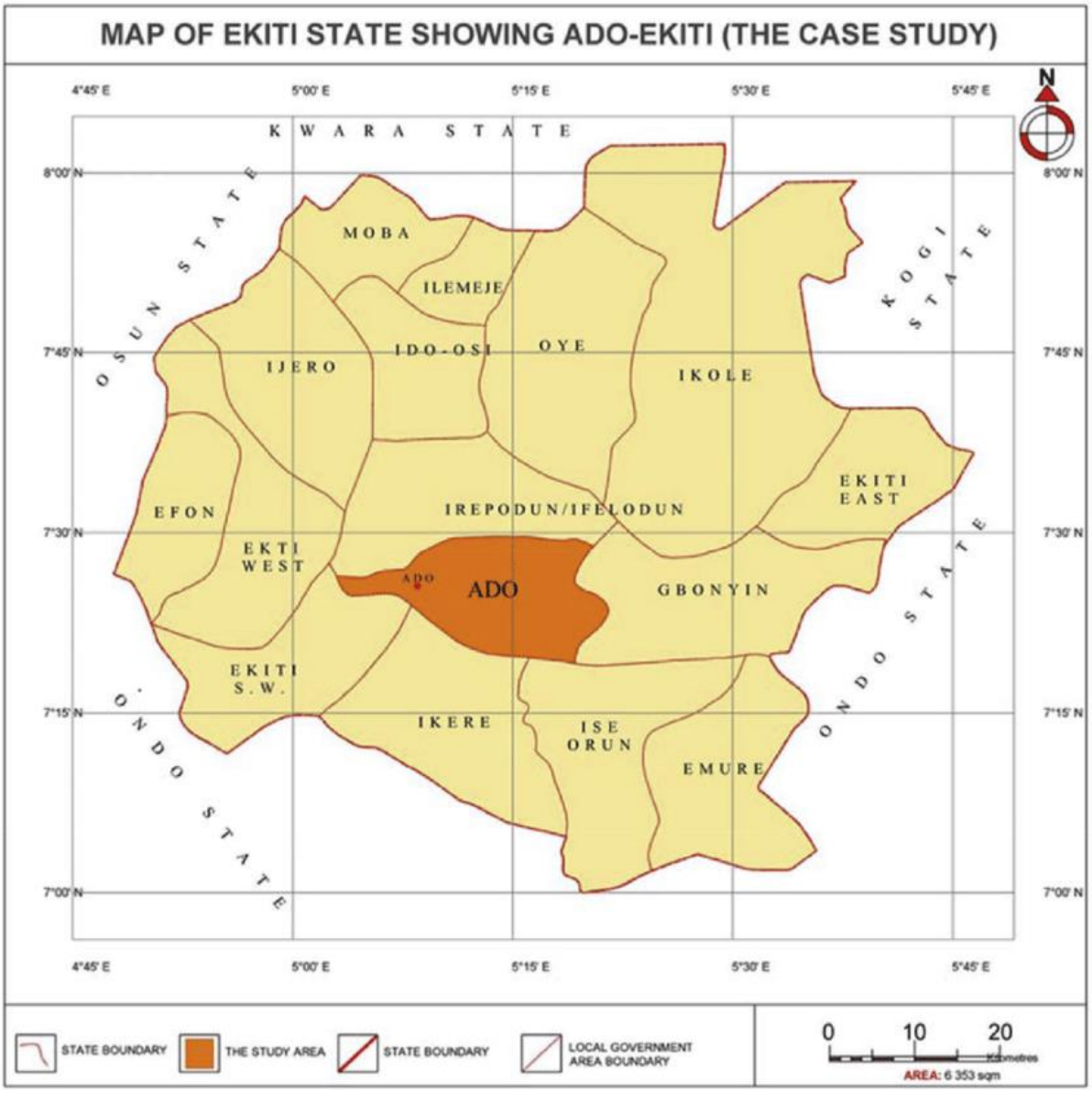


Figure 3.2: Map of Ekiti State Showing the Study Area (Omoniyi et al., 2019). Ado-Ekiti is the location of the study area which also serve as the capital of Ekiti State

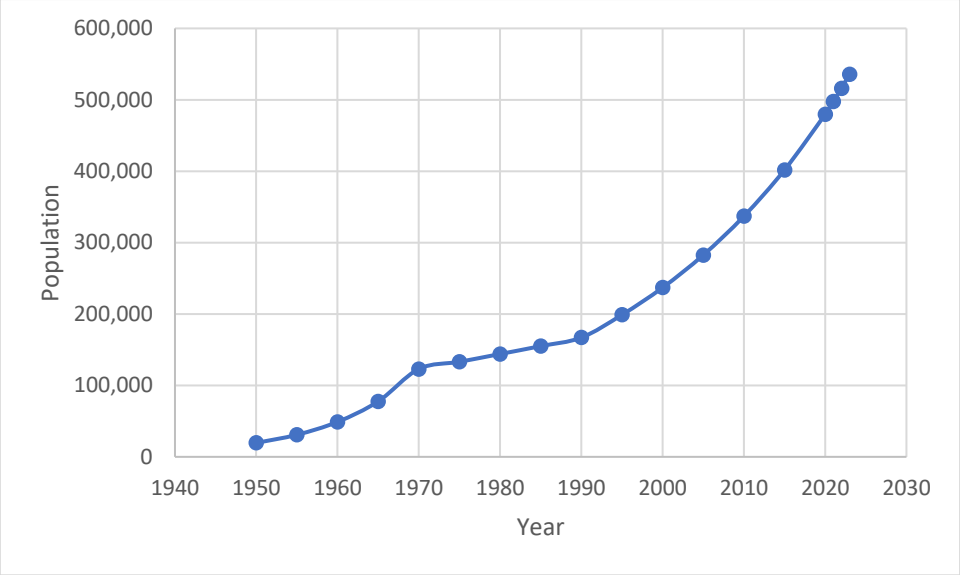


Figure 3.3: Population Growth in Ado-Ekiti (Adapted from Awosusi et al. (2012).

the reorganization of Nigeria into more states. Ado Ekiti was then designated as one of the local government areas in the old Ondo State, which was one of the nineteen states carved out from the former Western Region.

The most significant change in Ado Ekiti's status came with the creation of Ekiti State on October 1, 1996, when the city was declared the state capital. This designation catalysed further development and urbanization. Evidently, the influx of people into the city has increased the volume of generated waste and exacerbated the challenges of effective management of solid waste in the city. Awosusi et al. (2012) showed municipal solid waste generated in the city recorded 26% growth in 2011 with an estimate of 120 tonnes per day from 95 tonnes per day in 1996 while taking into account wastes derived from durable goods, construction materials, organic matter, and street vendors. The Ekiti State Waste Management Authority (EKSWA) charged with managing SWM in the Ado-Ekiti, and other parts of the state are grappling with adequate collection of waste in the city. Essentially, the widespread of unofficial waste disposal sites in the city showed that the efficiency of waste collection rate leaves much to be desired (Ogunleye and Uzoma, 2018).

### 3.5.1 Case Study Area Selection and Justification

Depending on the context of the study and phenomenon being studied, the focus of case study research can either be based on a single case or multiple cases. Single-case studies are proven to provide a holistic understanding of a phenomenon with the advantage of robustness while multiple case studies are noted to offer a comparison of multiple results from different cases in the study of phenomenon where emphasis is placed on the clarification of findings (Yin, 2013). However, the argument of Dyer and Wilkins (1991) favours the adoption of single-case studies over multiple cases studies in seeking high-quality theory in a study and consider single-case research appropriate in providing better theory especially if a literature gap is being addressed.

The present research is a single–case research utilizing mixed method approaches to address the phenomenon of unofficial waste disposal sites (UWDSs) within the context of urban solid waste management in developing countries. The city of Ado-Ekiti in Nigeria is the single case study area adopted for this research. The choice of Ado-Ekiti is based on several criteria which are outlined below.

i. As an administrative centre of Ekiti state, Ado-Ekiti represents a rapidly growing urban city in the southwestern axis of Nigeria.

ii. The influx of people into the city has increased the volume of generated waste and exacerbated the challenges of effective management of solid waste in the city. This is reflected by widespread informal dumpsites located around the city.

iii. There are no documented records of community participation in solid waste management from the city. In Nigeria at large, there are only a few documented community-based USWM (Wahab, 2015, Yakubu and Mado, 2018).

## 3.6 RESEARCH DESIGN

A research design refers to the comprehensive plan or framework that directs the execution of research (Sileyew, 2019). It stands as a pivotal element in the research process, functioning as a roadmap detailing how a study will unfold, encompassing the methods and techniques employed for data collection and analysis. A meticulously crafted research design is logical and systematic allowing a researcher to answer research questions and fulfil research objectives, ensuring the validity and reliability of the obtained results. In this case, it serves as a connection between the research questions and the implementation of the research strategy. Wahab (2015) concluded that a research design is a conceptual blueprint that encompasses the

collection, measurement, and analysis of data and this should not be confused with research methods. While research design entails the plan to answer research questions set out for research, the research methods lay out the strategy to implement the plans.

Figure 3.4 summarizes the research design adopted for this study utilizing both qualitative and quantitative methods through which questions set out in this research can be answered to a valid and logical stance. This research was designed to be undertaken in four phases. The first phase encompassed the literature review, formulation of the research questions and designing the research methodology. The review of the literature covers aspects of unofficial waste disposals and urban solid waste management in sub-Saharan African countries which identifies gaps that informed the valid formulation of the research question and designing the data collection strategy for the study.

The second phase marked the mapping of the unofficial waste disposal sites in the study area, sampling, pilot study, questionnaire survey, and the identification and recruitment of the key informants and stakeholders pertinent to answering the research questions and fulfilling the research objectives set for this research. The third phase of this research entailed community engagement in the waste management of Ado-Ekiti through focus group discussions (FGDs) and semi-structured interviews with key informants and stakeholders in the communities selected for this study. The final phase encompassed the development of intervention strategies for the management of UWDSs through the lens of the people most affected by the development of UWDSs. This phase produced the development of a waste diversion intervention model which was validated through a set of structured questionnaires.

### 3.6.1 Pilot Study

Pilot testing is a crucial step in the survey research development as it allows researchers to pre-test the research instrument to ensure its reliability, validity, and practicability (Van Teijlingen & Hundley, 2002). Pilot studies, also known as feasibility studies, involve testing a mini version of the full-scale study, including pre-testing specific research instruments like questionnaires. Rothgeb (2008) explicated on the significance of pilot testing to survey in allowing researchers a valuable opportunity for reflection and revision of their projects before the cost of errors can begin to multiply later on. Pilot testing is crucial for identifying problem areas, minimizing measurement errors and limiting the burden of respondents. It helps determine whether respondents are interpreting questions correctly and ensures the order does

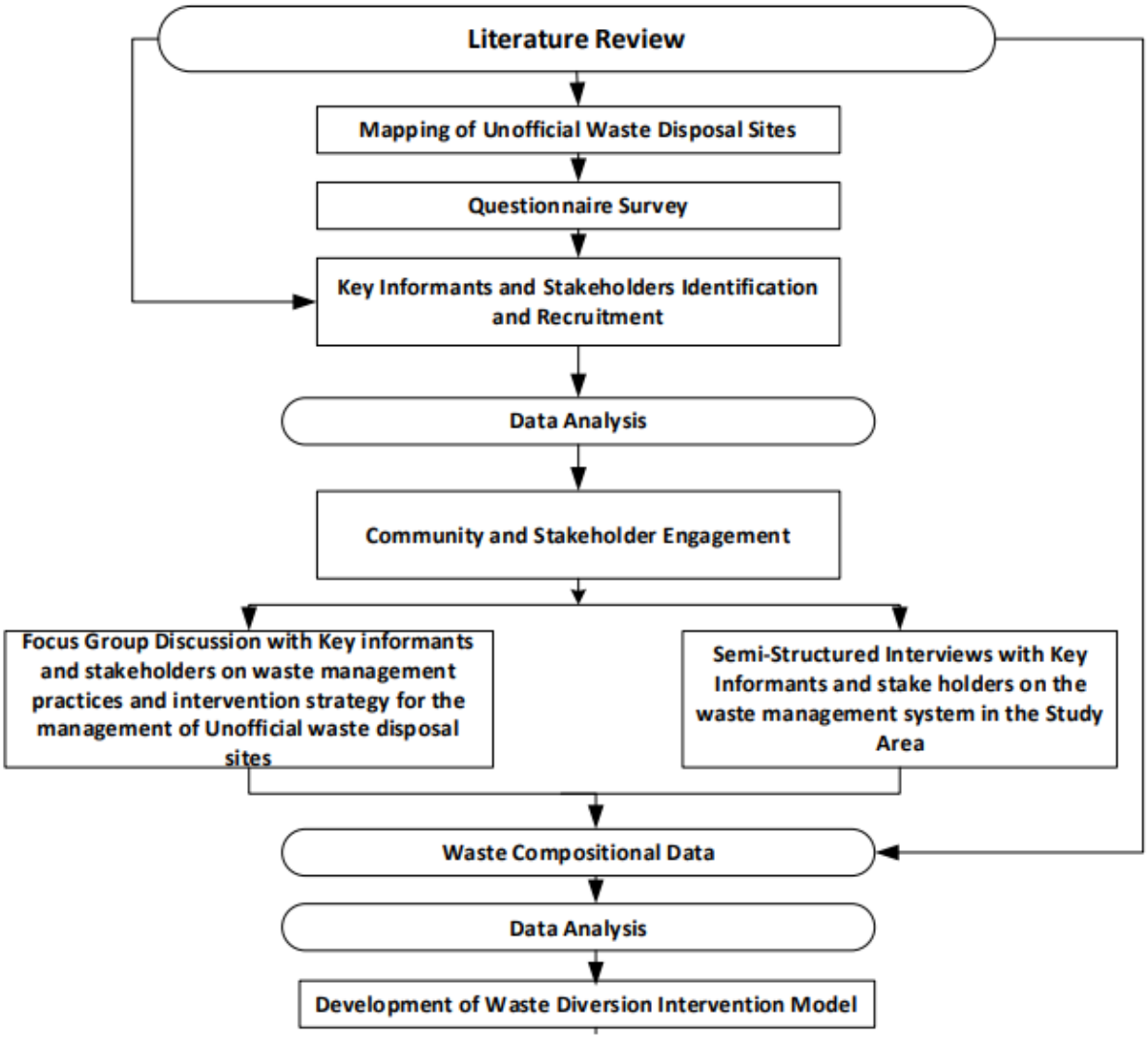


Figure 3.4: Research Workflow and Data Collection Design (Adapted from Kassah, 2020). The research workflow provides step-by-step description of how the research was undertaken.

not bias their responses. In other words, a pilot test is a critical survey instrument, helping to ensure that it functions properly as a valid and reliable tool social science research.

The process typically includes steps such as defining constructs, exploring literature, item generation, item reduction, and pilot testing for content validity, relevance, acceptability, and feasibility. Pilot testing helps in refining the wording of questions, improving data quality, and ensuring that the questionnaire is well understood by respondents (Van Teijlingen & Hundley, 2002). The pilot study was conducted in the northern district of the study area. The choice of the northern district allows the questionnaire administrators (Ayodeji Ogundipe, Gbenga Olowolafe and Temenu Temitope) who are residents of the area to be able to survey the area in

a timely fashion given the pandemic restrictions in place. The initial set of the questionnaires was piloted in households, and this allowed the questionnaires to be refined to suit the research objectives with the questions in the questionnaire and by extension reduced the completion time from 15 minutes to 12 minutes. Another useful advantage of the pilot study is that it allows the researcher to choose a suitable method of administration of the questionnaires in view of the COVID 19 restrictions in place as the field assistants recorded a significant level of non-cooperation from some visited households during the pilot study.

### 3.6.2 Sampling

Sampling is the process of selecting a sample of a population individual or a large group for a certain type of research objective (Makwana et al., 2023). The sampling process is a critical aspect of research that significantly influences the validity and generalizability of study findings since the data collected from the samples selected is expected to reflect the characteristics of the whole population. Various strategies exist for sampling in research, ranging from purposeful sampling to mixed methods sampling, each serving specific research needs (Palinkas et al., 2013; Teddlie & Yu, 2007). Taherdoost (2016) provided a detailed framework for the selection of samples in research methodology, and this was carefully followed while deciding the sampling strategy and size for this study.

A combination of snowball sampling and purposeful sampling techniques (Makwana et al., 2023) was embraced for the FGD and interviews. The choice of these non-probability sampling techniques is hinged on their success in providing key informants who have knowledge of the subject of study and are willing to provide information. The snowball sampling has been particularly helpful to this research since part of the data collection phase was conducted during the Coronavirus disease 2019 (COVID-19) period and referrals from other recruited participants have helped recruit key informants and stakeholders for the FGD and semi-structured interviews. Key informants and stakeholders sampled for the FGD and semi-structured interviews in this research include waste generators, community leaders, service providers, informal workers, waste managers and regulators. The waste generators sampled in this study are majorly community members who are homeowners, tenants, and business owners in selected communities that have been identified with the development of UWDSs in the study area.

The sampling for the questionnaire survey in this research was targeted at households in the study areas and it was undertaken through a combination of systematic sampling and convenience sampling. The systematic sampling method is a probability method of sampling

whereby the samples from the population of interest are selected randomly at regular intervals in which the sampling units reflect the characteristics under study with the subpopulation (Saunders et al., 2018). However, the emergence of COVID-19 and the restrictive measures in place caused some residents to refuse to be selected for sampling which affected the response rate of the questionnaire survey. Therefore, it became necessary for the researcher to adopt convenience sampling in view limited time and resources allocated for the research. Residents who were willing to participate in the research were administered with questionnaires and their responses were collected and analysed.

### 3.6.3 Mapping of Unofficial Waste Disposal Sites

The development of unofficial waste disposal sites within the context of urban solid waste management is the phenomenon of interest in this research. Mapping of these waste sites becomes necessary to understand the nature and extent of the phenomenon as part of fulfilling the objective of this research. Mapping of the unofficial dumpsites in the case study area entailed site visitation to existing unofficial dumpsites, recording their respective geographical coordinates using a Global Positioning System (GPS) unit, and noting key features such as location of wells, proximity of buildings in the ambient environment that will aid characterizing these sites on.

The mapping of the UWDSs was undertaken in two phases. The first phase was undertaken between March 2020 and May 2020 during the coronavirus lockdowns. Due to the restriction of movement in place, only 7 UWDSs were mapped at the time. The second phase of mapping UWDSs started on 19$^{th}$ April 2021 and ended on 13$^{th}$ June 2021 and 22 more UWDSs were mapped. In all, 29 UWDSs were mapped during these two phases with the help of three field assistants who are residents of the study area. The use of local residents was necessary to overcome barriers to provide guidance and obtain necessary information regarding the activity of the waste sites.

However, a selection protocol (Figure 3.5) was designed to guide the selection and mapping of these unofficial sites using parameters such as location, size, and activity status and surrounding features. A combination of urban transect method of sampling and cross-sectional method of survey was adopted for the field exercise to provide the researcher and field assistants with a snapshot of the link between the identified UWDSs and the community where it is sited.

The urban transect method has proved to be effective in urban mapping of incidences of illegally dumped waste piles (Nagpure 2019; Nagpure et al., 2015; Lal et al., 2016). The cross-sectional method of survey is an observational method of study that is significant at determining the frequency or level of an attribute in a defined population at a single point in time. The guidelines of Wang and Cheng, (2020) were carefully followed in this research to map and describe the nature of the UWDSs identified in the study area using the selection protocol.

The transect method involved the researcher traveling along a street/road in the study area and recording the occurrence of UWDSs cross-sectionally according to the selection protocol for UWDSs identification designed for this study. The first step in the protocol is to identify the UWDSs and log the coordinates using the GPS unit to determine if it is within the study area. The geographic coordinates of the location identified UWDSs were recorded using Garmin eTrex GPS and noted in the field notes. The recorded coordinates of the selected sites were geo-referenced on the study area map using analytical Surfer Golden software 12. Analytical Surfer Golden software 12 is utilized in combination with ArcGIS in this research to maximize accuracy, precision, and customization for the spatial analysis of the UWDSs

Once confirmed it is within the study area, a photograph of the site is taken, and the field tape is used to measure the diameter of the site. The size of the UWDSs is another important factor that is considered in the selection protocol, and therefore, disposal sites less than 3 m in diameter are not considered as UWDSs in this research. After recording the size of the disposal site, the active status of the site is considered. This is done through observation of the composition and the use of the sites. Upon identifying that the disposal site is active, the observable materials in the site and other surrounding features around the sites are recorded. The year of use (if known) and existing management plans in place are noted.

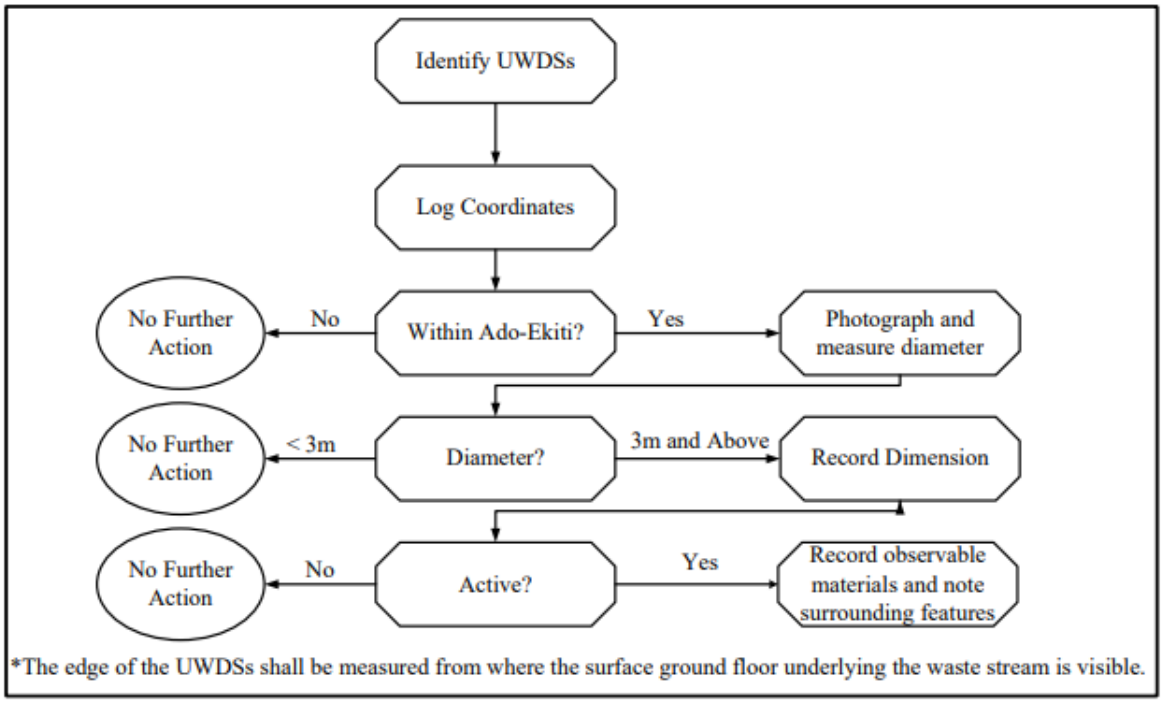


Figure 3.5: Selection Protocol for Mapping of UWDSs in the Study Area. The selection protocol guided the mapping of the UWDSs in line with the scope of this research.

### 3.6.4 Questionnaire Survey

This study has adopted a questionnaire survey to understand the current SWM practices, the level of community participation, and factors that have contributed to open dumping in the case study area. This approach allows the researcher to acquire a directly measurable set of information pertinent to achieving the set objectives.

The SWM operations in the city are divided into three zones which include (i) planned areas in the western district of the city including Government Reserved Areas (GRAs) (ii) core areas which include market and developing areas in the North and south districts and (iii) the hinterlands which include unplanned areas in the central and eastern district of the city. However, for adequate representation, given the development of UWDSs in the communities outside the SWM operation in the study, the area was sub-divided into five, including the low-income communities, middle-income communities, and high-income communities for the public survey (Table 3.4). Sixty (60) random households in each area using systematic sampling were selected for the questionnaire survey at uniform intervals. Hence, a total of 300 sets of the structured questionnaire were administered using a combination of door-to-door and postage methods of administration. However, a total of 225 questionnaires were correctly completed and returned to the researcher for analysis (Table 3.3). Given the estimated

population size of Ado-Ekiti to be 497,674, the sample size of 225, representing less than 0.1 of the population, is considered small. However, because of the constraints and logistic challenges due to COVID restrictions in place, conservative sample sizes are still considered adequate to be of statistical and scientific significance (Bowan, 2018).

The questionnaire survey proved valid and reliable for this research due to several key factors. A pilot study involving research participants was conducted to refine the questionnaires, ensuring they aligned with the research objectives of this research. The questions comprehensively addressed the entire scope of the research problem, with each question logically linked to one or more research objectives. Additionally, the questionnaire survey was well-suited to the research sample and population, effectively engaging households and other waste management stakeholders (Lietz, 2010; Roopa and Rani, 2012; Brace, 2018; Fife-Schaw, 2020).

Table 3.3: Communities in the Five Areas of Ado-Ekiti considered for the Questionnaire Survey

| **Area A**<br>**Middle-Income Communities** | **Area B Communities** | **Area C**<br>**Low-Income Communities** | **Area D**<br>**High-Income Communities** | **Area E**<br>**Low-Income Communities** |
|---|---|---|---|---|
| Adebayo<br>Similoluwa<br>Nova<br>Adehun<br>Opopogboro | Ajilosun<br>Moferere<br>Oke-Oniyo<br>Ekute<br>Oke-Bola | Odo-Ado<br>Igirigiri<br>Olokemeji<br>Ureje<br>Idofin | Falegan<br>Government Reserved Area<br>Federal Housing Secretariat | Ijigbo<br>Okeyinmi<br>Okesa<br>Oke-Ila<br>Irona<br>Ajilosun |
| 47* | 44* | 45* | 46* | 43* |

*Number of completed questionnaires in each category of the areas

### 3.6.4 Semi-Structured Interview Method

Interviews have been described as the most important form of data collection in qualitative research and are suitable to provide deep insights into a studied phenomenon (Jamshed, 2014; Luhrmann, 2021). Luhrmann (2021) defined an interview as an in-depth, extendable conversation between two people aimed at obtaining detailed information about a specific topic or subject through which a phenomenon can be interpreted based on the meanings and perspectives provided by the interviewees. Similarly, Alshenqeeti (2014) described an interview as a conversation whose sole objective is to gather descriptions of the interviewee about the interpretation of the meanings of the described phenomena. Interviews provide an

avenue for respondents to offer insights into topics that may not be comfortable discussing in groups and can also be used as a follow-up method of enquiry in a study (Mann and Mann 2016).

Compared to structured interviews, semi-structured interviews were considered suitable for this research as it offers flexibility for the researcher to ask additional questions on an interesting line of inquiry. This is quite important where little is known on the subject of enquiry (Alshenqeeti, 2014). Accordingly, both face-to-face and video interviews were employed in this research using semi-structured questions. The use of personal and video interviews in this research is predicated upon the significance of capturing both verbal and non-verbal hints during interview with the respondents which may not be feasible with other techniques of interviewing such as telephone interviews (Warren, 2002).

Draft interview questions were designed based on the literature review and documentary analysis of policy and regulation obtained from Ekiti State Ministry of Environment and Natural Resources (ESMENR) and (EKSWAMA) and piloted with the research supervisor (Prof. Karl Williams) and selected number of identified key informants in this study before final interview questions were produced by the researcher.

The institution responsible for urban solid waste management (USWM) in Ado-Ekiti (EKSWAMA) was the first port of call at the interview stage of this research. Two senior officials in the administration and research department, a director of operation at the OWDS (INT-EKS_1 and INT-EKS_2), one member of the enforcement team (INT-EKS_4), and one budget officer (INT-EKS_5) in the institution were formally interviewed. Also, the two private collectors (one driver (INT-PC_1 and a director (INT-PC_2) and a member of the sweeping team (INT-SW) were interviewed to understand their mode of operation and possible challenges faced in the collection of waste. Three informal waste workers (one scrap dealer and two waste pickers (INT-WP) were also interviewed (Table 3.4). Four community leaders and two community members who were part of those who indicated to join the research for FGD during the questionnaire survey were also interviewed on their perception of general waste management practices and operations in their communities.

Table 3.4: Coding of the participants of the Interviews and Focus Group Discussion.

| **Interviews** | | **Focus Group Discussion** | |
|---|---|---|---|
| INT–CL_ | Ureje Community Leader | FG-AJ_CL | Ajilosun Community Leader |
| INT-CL_OM | Omisanjana Community Leader | FG-GRA_CL | GRA Community Leader |
| INT-EKS1 | EKSWAMA Resprentative_1 | FG-EK_1 | EKSWAMA Resprentative_1 |
| INT-EKS_2 | EKSWAMA Resprentative_2 | FG-AD_CL | Adebayo Community Leader |
| INT-SW | Sweepers Representative | FG-TEX_1 | Community Member |
| INT-WP | Waste picker Representative | FG-OM_CL | Omisanjana Community Leader |
| INT-PC | Private collector representative | FG-EK_1 | EKSWAMA Resprentative_1 |
| INT-IOCL | Ido-olofin Community Leader | FG-EK_2 | EKSWAMA Resprentative_1 |
| INT-EK_3 | EKSWAMA Resprentative_3 | FG-AJYL | Ajilosun Community Youth Leader |
| INT-EK_4 | EKSWAMA Resprentative_4 | FG-TEX_2 | Community Member |

The interviews with formal institutions were facilitated by the letter of introduction and request of assistance written by the director of studies (Prof. Karl Williams) for this research on behalf of the researcher which prompted a subsequent letter of acceptance from the institution. Accordingly, formal interviews with EKSWAMA were arranged beforehand with the institution to decide the suitable time for the researcher to come and interview them. The officials of EKSWAMA helped direct the researcher to the operations of informal workers in the study area for their interviews to be conducted. Where interviewees were not available for face-to-face interviews, video interviews were scheduled with them, and this was conducted over the WhatsApp video app which appeared to be a common phone video application.

Generally, the interviews with the respondents took between 45 minutes and 1 hour depending on responses and challenges with network connection as applicable in the online video interviewing of respondents in the research.

### 3.6.5 Focus Group Discussions (FGDs)

FGDs involve bringing together a small group of participants to discuss a specific topic guided by a moderator. The goal is to generate in-depth insights and perspectives on the topic through group interaction and discussion with a small representative sample of a larger population (Akyildiz and Ahmed, 2021). Nyumba et al. (2018) likened FGD to group interviews as a qualitative tool to uncover the perceptions and values of people on a subject. However, scientific evidence on the specific role of the researcher and the participants has provided a

clear contrast between interviews and FGDs (Kamberelis, 2005; Heary and Hennessy, 2002; Huge and Mukherjee, 2018). In interviews, the researcher acts as an investigator, controlling the dynamics of discussion, but in FGDs, the researcher takes on the role of facilitator, moderating a group discussion among participants. Accordingly, FGD has been particularly found useful in participatory research, especially for completing other research tools for triangulation and validation of findings (Hohenthal et al., 2015). Yakubu (2017) utilized FGD in investigating the challenges of waste management systems and waste reduction opportunities in low-income areas of Jos, Nigeria, while Bowan (2018) used the same method to validate the planning framework for MSW disposal decision-making.

Four sessions of FGD were conducted in this study to obtain the perceptions of participants as they engaged on the issues surrounding SWM practices in Ado-Ekiti, the developments of UWDSs in their communities, and possible interventions on the role they can play in phasing out development of these waste disposal sites. Two sessions of the engagement FGDs were conducted between 9/3/2023 and 10/3/2023 where the participants were engagement on their perspectives on the present state of USWM in their communities. The two other sessions of the intervention FGDs were conducted between 13/3/2023 and 14/3/2023 where participants provide perspectives on possible interventions to address the development of UWDSs in their communities. Community members including household owners, tenants, community leaders, business owners, and representatives of the EKSWAMA constitute the participants of the FGD for both the engagement and intervention sections (Table 3.5). The four sessions of the FGD were held in the same venue at King's Court Hall, Ajilosun, Ado-Ekiti, at varied times, as summarised in Table 3.5.

The FGD sessions were moderated by a facilitator engaged for this research in the person of (Gbenga Olowolafe) with the aid of guiding questions. The role of the facilitator was to foster group interaction, ensuring balanced participation and preventing any individual from dominating the discussion. In this respect, the facilitator moderated the conversation among the participants by spelling out the rules and regulations that guided the discussion. The facilitator introduced the subjects of discussion as the participants were referred to the information sheet provided by the researcher ahead of the debate. Participants were also reminded of the consent form given to them to make them aware they have the right to opt out of the discussion at any point in time.

Table 3.5: Summary of the Four Sessions of Focus Group Discussion

| FGDs | Engagement FGD | Engagement FGD | Intervention FGD | Intervention FGD |
|---|---|---|---|---|
| **Date** | 9/3/2023 | 10/3/2023 | 13/3/23 | 14/3/23 |
| **Duration (mins)** | 120 | 90 | 120 | 120 |
| **Attendance** | 12 | 11 | 12 | 12 |
| **Language used** | Yoruba/English | Yoruba/English | Yoruba/English | Yoruba/English |

The main discussion centred around the current SWM practices in Ado-Ekiti and the development of UWDSs in their various communities. Participants were able to discuss different challenges of SWM in Ado-Ekiti which have driven the development of UWDS in their various communities. Participants' involvement in waste management were also discussed to address intervention for the development of UWDSs in their various communities.

The role of the researcher in all four sections of the FGD was to listen, document the participants' views, and clarify any misunderstandings. The discussions were recorded to ensure no details were missed. Each focus group and its members were coded for easy identification of contributions during the write-up of the results.

### 3.6.6 Observation Method

The observation method is one of the most important research methods in social sciences particularly in the study of human and animal behaviour (Kawulich, 2005). Marshall and Rossman (1989) define the observation method as the systematic description of events, behaviours, and artifacts in the social setting that is specified in research. It is a qualitative method of data collection that enables a researcher to describe existing situations under study in their natural settings without being influenced by the presence of the researcher (Ciesielska et al., 2018). While the observation method may constitute the main research method in a study, it can be used as a complementary research method to corroborate or refine findings from other methods (Platt, 1983).

The use of observation methods in the field of waste management has been exploited in the past by many researchers to document SWM practices (Wahab, 2015: Yakubu, 2017, Bowan, 2018). Accordingly, the observation method was adopted in this study to collect direct information in line with fulfilling the objectives of this research. Therefore, the scope of the direct observation study in this research is limited to waste management practices in the study area and the use of UWDSs in the community where they have been identified. Aspects of

household waste handling and storage, street sweeping, waste collection routine, and disposal of wastes in UWDS in the communities formed part of the direct observation in this research.

The observational study was conducted in the second phase of this research and data were collected in the form of photographs and recorded field notes which are then used to inform subsequent data collection process.

### 3.6.7 Secondary Data Collection

Secondary data collection is usually attached to the academic discipline generally referred to as secondary research (Daas and Arends-Toth, 2012). This method of data collection refers to the collection of pre-existing information for a purpose different from which they were originally gathered. This is in contrast with collection of primary data where the information is originated by the researcher for the first time to provide solution to the problem at hand (Ajayi, 2017). In this research, sources of secondary data include journal articles, government publications, books, municipal documents, and websites. The review of these sources was undertaken to provide background information and sources for this study. Chapter two of this thesis focuses on the concept of urban solid waste management (USWM), covering subjects such as SWM practices in developing countries, sustainable waste management and community-based waste management.

## 3.7 DATA ANALYSIS

Data analysis is a systematic approach to describing, illustrating, condensing, recapping and evaluating datasets using statistical and logical techniques in a manner that communicates meaningful findings (Wickham and Wickham, 2016). In this research, quantitative data were analysed using statistical analysis while qualitative data were analysed using thematic analysis. Table 3.6 depicts how forms of analysis used in this research have been employed to address the objectives of this research.

### 3.7.1 Statistical Analysis

Anderson and Finn (2012) described the nature of statistical analysis as a systematic and penetrating way of providing bases for an investigation that cut across many fields of knowledge including social, physical, education, engineering medical, and law. Wide applications of statistics are hinged on its ability to interrogate large datasets and discern patterns and trends in data using numerical analysis (Ali and Bhaskar, 2016). Two forms of

Table 3.6: Relationship between Objectives, Research Methods and Analysis for this Research

| **Research Objective** | **Data Sources** | **Research Methods** | **Method of Analysis** |
|---|---|---|---|
| Identify unofficial waste disposal sites (UWDSs) according to set criteria, | Study area | Transect method.<br>Observation methods | Geospatial Analysis |
| Investigate the current Urban Solid Waste Management (USWM) system within the case study region, | Literature review, households, key informants, stakeholder | Questionnaire survey, Interviews, focus group discussion | Statistical Analysis, thematic analysis, documentary analysis, content analysis |
| Evaluate drivers of UWDSs in the case region, | Community members key informants, stakeholder | Questionnaire survey, Interviews, focus group discussion | Triangulation, Thematic Analysis |
| Evaluate community-based interventions at managing development of UWDSs in case region | Households, waste composition key informants, stakeholder | Focus group discussion, literature review | Thematic analysis, waste compositional analysis |
| Develop a waste diversion SWM model based on evaluated interventions for adoption as part of local waste management strategies in phasing out the development of UWDSs. | Households, key informants, stakeholder | Focus group discussion, literature review | SWOT analysis, literature review, thematic analysis, triangulation |

statistical analyses are employed in the numerical evaluation of datasets, and these include descriptive and Inferential statistical analyses.

Descriptive analysis deals with analysing datasets using frequencies, percentages, mean and standard deviations and presenting them in the form of charts, graphs, and tables while inferential analysis is mainly used to predict outcomes for a whole population through comparison of variables in datasets. In this study, descriptive analysis was employed to analyse quantitative data from the questionnaire survey which are mostly categorical in nature. A coding system was designed for responses in each question. A grid was prepared for the analysis which allows collation of the coded data. Proportion of the respondents in each category of the coding system was calculated and presented as bar charts and pie charts.

### 3.7.2 Thematic Analysis

Thematic analysis is a method for identifying, analysing, and reporting patterns (themes) within qualitative data (Clarke and Braun, 2017). It involves systematically coding and categorizing data to identify recurring themes that capture the essence of the data. Thematic analysis aims to uncover the underlying meanings, patterns, and relationships within the data, providing insights into the research question or phenomenon under investigation. Thematic analysis is suited to analyse varied range of data sources which include transcripts, field notes, supporting documents (journals or historical papers), participant-written information (diaries), research memos, pictures, drawings, maps, digital audio files, and video files (Guest et al., 2012; Neuendorf, 2018). Accordingly, thematic analysis is considered the most suitable approach to analyse qualitative data in this research and has been widely used by other studies, such as Kasssah (2020), using thematic analysis to analyse qualitative data on the factors influencing the development of UWDSs in Nigeria.

The qualitative data obtained from FGD, semi-structured interviews, and observation methods in this research were analysed using thematic analysis. This approach helped describe urban solid waste management (USWM) practices in Ado-Ekiti, identify factors influencing the development of UWDSs, and evaluate strategies for managing UWDS in the case region.

The interviews and FGDs were transcribed verbatim and cross-checked against field notes for accuracy. Content analysis is applied to transcribed data using induction and deduction processes. This is done to identify, examine, and record themes within the data sets. Line-by-line coding was carried out to describe the contents of the transcribed data. Subsequently, assigned codes were reviewed to explore for patterns that constitute themes in answering the

questions raised in this research. The analysis of FGD and interview data was aided by Nvivo 12.0 software. The results were presented as descriptive narratives supported by illustrative quotes. However, the latter chapters four, five and six have been presented in this thesis to provide discussions of the results, drawing on the findings of each research elements.

### 3.8 ETHICS

Ethics in research is a fundamental aspect that is essential for maintaining the integrity and credibility of scientific investigations. Research ethics involve a set of principles and guidelines designed to protect the rights, well-being, and confidentiality of research participants, ensure the validity and reliability of research outcomes, and uphold the moral responsibilities of researchers (Madge, 2007).

Accordingly, the researcher completed the UCLan checklist and was given ethical approval for this study from UCLan Science, Technology, Engineering, Medicine, and Health (STEMH) Ethics Committee which was valid for a period of five years. The ethical approval was hinged on the satisfactory assessment of the risk this research may pose to the participants and the researcher.

Accordingly, the participants were presented with a research information sheet which specified the aims, significance, research implications, and data handling procedures. This was adequately explained to the participants and clarity was provided by the researcher where questions were raised. Consent forms were also provided for the participants to seek their voluntary participation in the research and were informed of their rights to opt out of the research at any point in time.

# CHAPTER FOUR: UNOFFICIAL WASTE DISPOSAL SITES AND URBAN SOLID WASTE MANAGEMENT PRACTICES IN ADO-EKITI

## 4.1 INTRODUCTION

This chapter presents the results of the development of UWDSs as well as the waste management practices in the city of Ado-Ekiti. The geospatial development of the UWDSs as well as its architecture, observable materials, and existing management approach, has been discussed. Aspects of waste handling/storage, collection, disposal, and treatment have also been captured in this chapter to describe the waste management practices in the case study region.

## 4.2 THE DEVELOPMENT OF UWDS IN ADO-EKITI

Figure 4.1 shows the spatial distribution of the 29 identified UWDSs in the study area, which indicates the wide development of UWDSs across the case region. Detailed analysis of the findings from the survey field reveals that the UWDSs varies in material composition, locational features, architecture and management. These UWDSs present as active, long-standing waste repositories near human inhabitation. Unlike the official waste disposal sites that are located on the outskirts of the city, OWDSs are situated near residential developments in open spaces, undeveloped lands, and abandoned farmlands, while some are located along roads (Figure 4.2-4.6). Figure 4.6 presents a typical and disturbing case of the proximity of UWDSs to the people, located in the middle of the streets in Odo-Ado community. It demonstrated incapacity of EKSWAMA to address effective waste disposal in the area. However, on inquiry with the EKSWAMA representative, the site is considered an illegal point of waste disposal and are often cleared by them during waste collection operation.

UWDSs are mostly low-lying, ranging in height from 0.2 metres to 2 metres, while the diameter of these sites ranges from 3 metres to 8 metres. This is in contrast to the expansive features of the two OWDSs in the city. They are located in low-income and middle-income communities, where EKSWAMA's waste management services are either absent or ineffective. The architecture of the development of UWDSs in Ado-Ekiti varies between a laterally spreading and mounting structure. Field study shows that UWDSs found along the road are spreading laterally, which may indicate that motorists primarily facilitate the development of such UWDSs. During the interview, it was uncovered that people take their waste with them in the morning and dump it along the road on their way to work. This is a case of waste transfer from

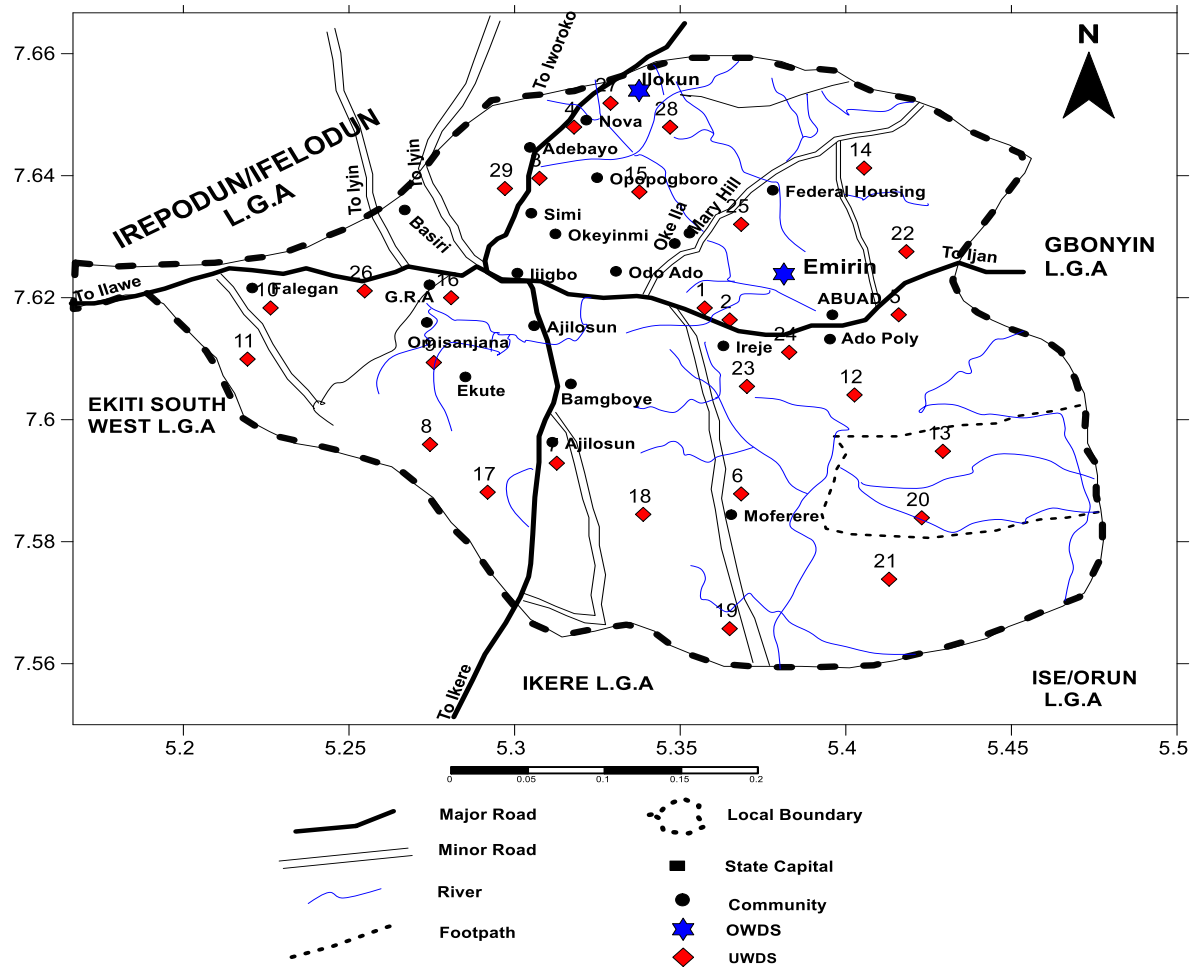


Figure 4.1: Spatial Analysis of the Identified UWDSs in Ado-Ekiti. The figures the widespread of the UWDSs across the three income group area (High, middle, and low-income areas)

Figure 4.2: UWDS 23 Located along the road with evidence of Burning in Ureje Community. (See Figure 4.1 for exact location).


Figure 4.3: UWDS 27 located in undeveloped lands adjacent to a building in Nova Community (See Figure 4.1 for exact location).

Figure 4.4: UWDS 12 located at Ido-Olofin Community (See Figure 4.1 for exact location).

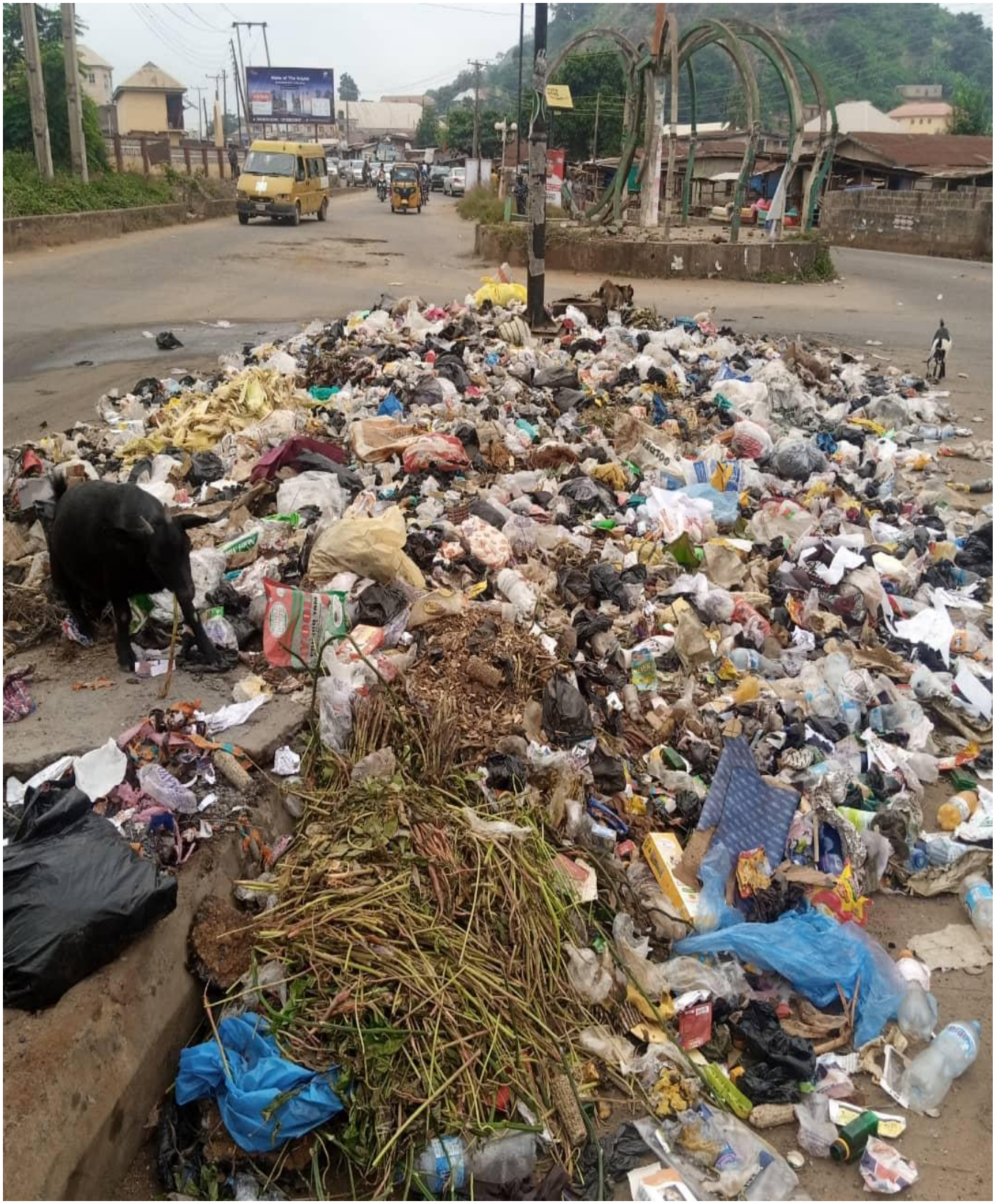

Figure 4.5: UWDS 1 located in close proximity to a residential house In Odo-Ado Community (See Figure 4.1 for exact location).

one community to another, which was also corroborated during the focus group discussion. However, the effect of wind blowing the waste around cannot be discounted in this regard.

Most cases of development of UWDSs in Ado-Ekiti are located along the road, whereby no one takes responsibility for the waste in terms of management. During the field survey, it was uncovered that UWDSs that have undergone burning are those that the community is managing and are regularly being used. For instance, the two UWDSs identified at Ureje community record evidence of burning, and an investigation with a community member indicated that the community often uses it as their primary means of waste disposal.

The burning of waste at UWDSs constitutes both health and environmental risks, especially for those living close to them. Kassah (2020) also reported such burning of waste in UWDSs in her study on the factors influencing the development of UWDSs in Minna, Nigeria. Apart from the environmental and health impacts of living close to these sites, the adverse effect of the presence of these UWDSs on the aesthetic value of the environment is also worrisome. It is reported that UWDSs located along the roads constitute a nuisance to the host communities and thus render some of the buildings undervalued and, in some instances, unliveable. The response from the community leader of Ureje (CL-UJ) on the impact of unofficial dumpsite captured the cost paid by landlords on the presence of UWDS 24;

*"I have tenants who have left living in my compound because of the presence of these dumpsites but as it is, I cannot leave. This is where I built my house. I cannot just pack up and go and start paying rent elsewhere when I have my own building because of these dumpsites".*

The observable materials across the 29 UWDSs identified in this study varies from plastic bags, food wastes, cans, cassava peels, yam peels, paper and cardboard. Other materials include woven sacks, plastic bottles, charcoals, and sands. However, there is a preponderance of plastic bags, plastic sachets and food wastes among other wastes, especially in those UWDSs located along the road compared to those that developed in undeveloped sites (Figure 4.2-4.6). It could also be observed that some wastes are contained in sacks, reflecting the possibility of encountering mixed wastes (Figure 4.3).

### 4.2.1 Compositional Analysis of UWDSs in Ado-Ekiti

As illustrated earlier, the composition of waste observed on identified unofficial open dumpsites during the field observation is diverse in nature. Table 4.1 depicts a compositional analysis of waste streams in UWDSs in Ado-Ekiti (adapted after Rominiyi and Adaramola, 2020). The analysed waste materials represent some of the observed waste materials in UWDSs during the field survey. Polythene product waste constitutes the largest fraction of the total waste by 12.7 wt% of the total waste analysed for UWDSs in Ado-Ekiti. The preponderance of polythene products is reflected from the field survey as plastic bags, and sachet bags are observed to dominate most of the wastes in UWDSs identified in the study. The prevalence of polythene products in waste streams from Nigeria has been reported in many studies including Oyelola & Babatunde, 2008). In the present time, polythene products like plastic bags have been more useful as both primary and secondary packaging materials in the manufacturing and retail sectors which accounts for their prevalence in the waste system. At the same time, plastic waste is a source of pollution as it is easily blown away when it is deposited. Plastics can end up clogging drainage systems and potentially result in flooding. However, the upside is that it can be recycled, as is discussed in Chapter Seven of this thesis.

The next largest fraction of the waste composition of the UWDSs is fruit waste, with a percentage composition of 12.5%, followed by food waste, with a percentage composition of 9.79%. Challenges with food preservation in developing countries is critical to the prevalence of food and fruit wastes in the waste streams. Joardder et al. (2019) posited that factors such as transportation, contamination, limited refrigeration and low-quality post processing are responsible for poor preservation which accounts for food and fruits wastes. However, both fruit and food wastes represent organic waste that has remained untapped for biological conversion into production of composts.

Similarly, the leaves and vegetables and tuberous peel waste represents significant constituents of waste streams in UWDSs which accounts for 8.39 wt% and 7.66 wt% respectively of the waste composition. The prevalence of leaves, vegetables and tuberous peels in the waste streams reflects high consumption of unprocessed foods households in communities which often requires home-processing and preparation labour and subsequent disposal of unwanted and inedible parts of the food items in urban centres in developing countries. This is in contrast with prevalence of discarded cans and glasses from high consumption of packaged, industrialized, ultra-processed foods in developed countries (Reardon et al., 2021).

Table 4.1: Compositional Variation of Waste streams in UWDSs in Ado-Ekiti (adapted after Romiluyi and Adaramola., 2020)

| S/N | Waste Materials | % Composition | Quantity MSW Generated (Kg/day |
|---|---|---|---|
| **1** | Food Waste | 9.79 | 29400 |
| **2** | Bones | 3.73 | 11200 |
| **3** | Rubber and Leather | 3.71 | 11100 |
| **4** | Polythene Products Waste | 12.7 | 38100 |
| **5** | Paper and Cardboards | 8.15 | 24500 |
| **6** | Textile Waste | 4.36 | 13100 |
| **7** | Leaves and Vegetables | 8.39 | 25,200 |
| **8** | Animal Dungs and Excreta | 5.83 | 17500 |
| **9** | Wood Waste | 5.20 | 15600 |
| **10** | Charcoal | 1.35 | 4050 |
| **11** | Fruit Waste | 12.5 | 37600 |
| **12** | Coconut and Parm Kernel | 1.13 | 3390 |
| **13** | Tuberous Peels Waste | 7.66 | 23000 |
| **14** | Metal and cans | 3.90 | 11700 |
| **15** | Glass and Ceramics | 9.70 | 29100 |
| **16** | Miscelanous Waste (Sands, dirts, ashes, stones) | 1.90 | 5700 |

Significant proportion of glass and ceramics accounting for 9.7% indicate they are equally potential products for recycling. Other items analysed include charcoal, wood waste, metal and cans with percentage composition of 1.35 wt%, 5.20 wt% and 3.90 wt% respectively.

Further analysis of the composition with respect to their potential as recyclables and organic wastes is shown in Figure 4.6. It is revealed that the waste composition is dominated by organic wastes, representing 49.03% of the total waste materials analysed. This value compares with the findings of Ngumah et al. (2013), which account for 50% of organic waste in Nigeria. The organic nature of the major composition of the waste streams reflects household wastes generated by residents who solely depend on the UWDSs especially in low-income urban communities with no or ineffective access to official waste services from EK-SWAMA. Accordingly, the preponderance of organic waste materials in waste streams of the UWDSs in these communities represents a huge potential of untapped resources that can be harnessed for the production of compost. Similarly, the recyclables represent a good fraction with a waste composition of 49.07%, indicating a high proportion of recoverable materials.

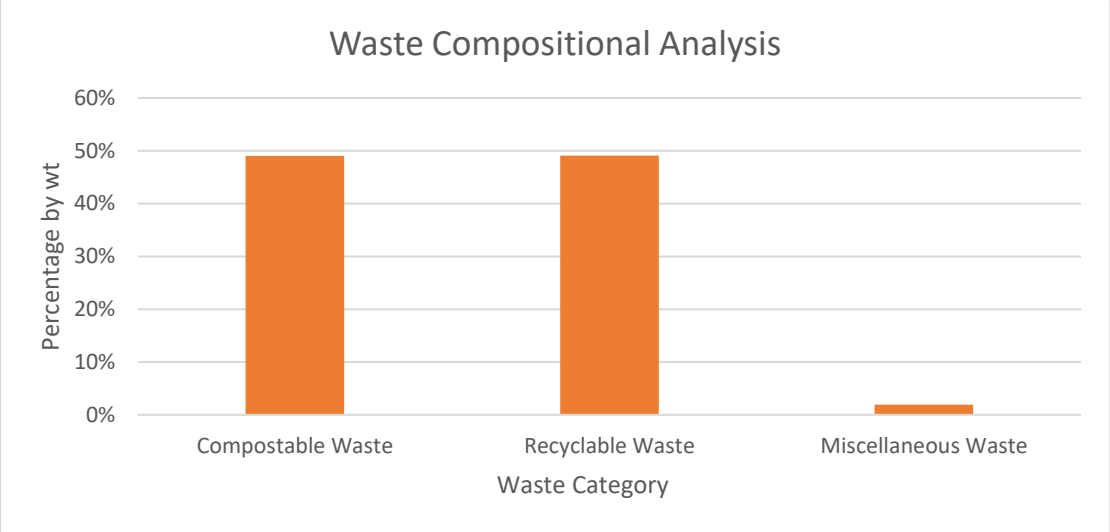


Figure 4.6: Waste Compositional Analysis of Waste Streams in Unofficial Dumpsites in Ado-Ekiti (Adapted after Romiluyi and Adaramola, 2020).

## 4.3 PRESENT URBAN SOLID WASTE MANAGEMENT PRACTICES IN ADO-EKITI

Currently, urban solid waste management practices in Ado-Ekiti can be categorized into three phases: solid waste storage and source segregation, solid waste collection and disposal, and recycling. The following section discusses these phases, as evident from the results of field observations, surveys, interviews, and focus group discussions.

### 4.3.1 Solid Waste Storage and Source Segregation Practices in Ado-Ekiti

Solid waste handling and primary storage is primarily within the purview of the waste generators, including households and the general public. In Ado-Ekiti, field observations revealed solid waste is generally stored in different items, including wheelie bins, sacks, woven baskets, plastic bags, plastic buckets, and woven (Figure 4.7 and Figure 4.8). One of the ways EKSWAMA is enhancing the primary storage of waste is by providing suitable items for storage. In Ado-Ekiti, the wheelie bins are provided by the EKSWAMA at a cost of ₦20,000 (£35) to each household in its bid to modernize primary waste storage. However, field observations show that the wheelie bins are concentrated in the high-mid-income communities such as the Government Reserve Areas (GRA), Ajilosun, Adebayo Communities, and a few areas in the market zones. This development is learned to be a result of the inability of most households to afford the cost of the wheelie bins and hence resort to the traditional or available means of storing their waste. From personal communication, CL_OM remarked;


Figure 4.7: Typical Wheelie Bins Provided by EKS-WAMA in the Market areas of the city (EKSWAMA, 2020)

Figure 4.8: Common Woven Sacks and Baskets used for Primary Storage being Collected by House-to-House Collection Services in Ado-Ekiti.

*"It is those in GRA who can afford the wheelie bin. 20,000 naira is too much. A lot of the people cannot afford it and that is why you don't see the bin in other areas. Even the ones in the market areas are provided by the market. If not the situation would have been worse in those areas because of the amount of waste generated on daily basis" (CL _OM)*

According to Ogwueleka (2009), primary waste storage is pertinent to proper handling during collection. Common use of woven sacks and plastic bags can potentially encourage littering, especially when the storage material is not sturdy enough to support the load of the waste. Similarly, such improper waste storage was observed as part of the waste materials in UWDSs, as highlighted in Table 4.1

The significance of source segregation in improving the economics and challenges of urban solid waste management is well established (Godfrey et al., 2019; Thabit et al., 2020). Segregation of waste at the source is potentially capable of capturing valuable resources from post-consumer material streams by providing clean feedstocks for downstream recyclers while reducing possible upstream segregating cost (Thabit et al., 2020). Meanwhile, source segregation of waste in Ado-Ekiti is still at a very low level and unorganised. Survey results on source segregation in households revealed that 72% of the respondents indicated they do not sort waste prior to disposal while only 23% of the respondents sort organic waste from other waste mostly to feed livestock (Figure 4.9).

One of the problems confronting sorting of waste at the source in Nigeria as it is in Ado-Ekiti is lack of public awareness on source segregation. Although EKSWAMA has a handful of staff for public enlightenment on solid waste management in the city, awareness programmes in the city have been strictly focused on keeping the city clean, which is often irregular and fragmented. Personal communication with some of the community members show their ignorance on the subject. Most of them are not aware of the nature and significance of the source segregation. However, it was uncovered that some community members have inadvertently been practicing waste sorting by keeping items such as glass bottles, plastic bottles, and plastic bags for reuse. Another example of such ignorance on sorting is the practice of saving the containers of products, most especially glass bottles for assorted drinks, which are compelled by the retailers to be returned to them, or they will be surcharged from the deposit made on the purchase of such products if they fail to return the glass bottles.

At present, apart from a lack of awareness of source segregation, EKSWAMA is challenged with a lack of appropriate collection infrastructure to promote and support source segregation

at the household level and in public places. It is important to note that source segregation of waste cannot be effective without community involvement, suitable infrastructure, and trained collectors to deal with the sorted waste. However, there are plans to introduce source segregation in the city through a recycling pilot scheme, as is evident from the EKSWAMA key performance indicator document made available to the researcher. The Authority is planning to undertake pilot source segregation programmes under the Ekiti State Recycling Project tagged “Sodotin Dowo” (meaning turn waste to wealth) in Ministries, Departments, and Agencies (MDAs) as a foundational approach to kicking off city-wide recycling of wastes. The programme is expected to expand to public schools and buildings in the city upon review of its impact on identified MDAs. This goes to show it may take a while for urban residents of Ado-Ekiti to be fully engaged in source segregation since they are yet to be incorporated into the pilot schemes.

### 4.3.2 Urban Solid Waste Collection Practices in Ado-Ekiti

The formal approaches to solid waste collection by the Ekiti State Waste Management Authority in Ado-Ekiti include house-to-house waste collection, central waste collection points, and street sweeping. The nature of these formal approaches is discussed below.

#### 4.3.2.1 Urban House to House Waste Collection in Ado-Ekiti

Urban house-to-house waste collection was introduced in 2021 as part of the programmes of Ekiti State Waste Management Authority to improve solid waste management in the city in conformity with international standards and practices. To this effect, the authority procured 4 rear loaded Trucks for daily waste collection across the city (Figure 4.8). In addition, they partnered with the private sector and secured the services of four private contractors, which include Williams Neat Service Resources, Waste Master Integrated Services (WMIS), Mr. Parker Service Resources (MPSR), and Ababin Waste Resources (AWR). The private sector partnership aided the inclusion of four other trucks to the fleet available for service delivery.

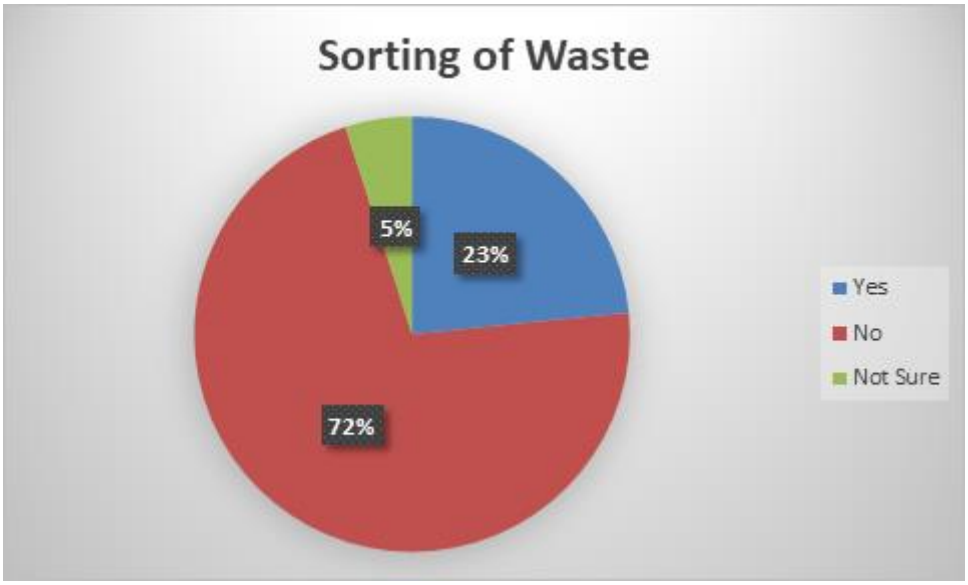


Figure 4.9: Sorting of Waste among the Respondents

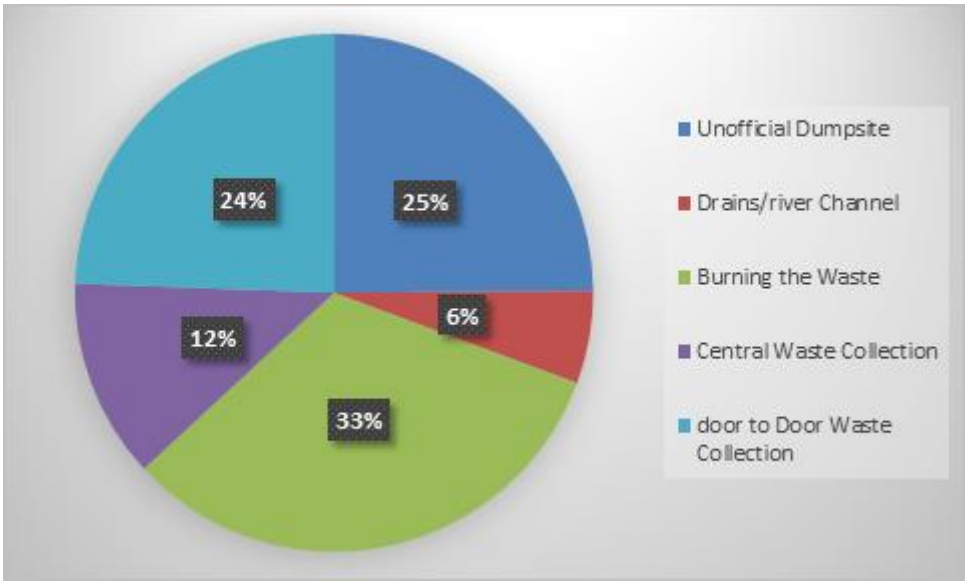


Figure 4.10: Solid Waste Disposal Methods adopted in the Study Area.

For smooth operation of the house-to-house waste collection, Ado-Ekiti was segmented into four areas which include Area 1 (Ekute), Area 2 (Olorunsogo), Area 3 (Oke-ila and Area 4 (Odo-Ado). In this scheme, EKSWAMA covers Area 1 and Area 2 while MPSR covers Area 3 and AWR covers area 4. The WMSR covers waste collection from hotels and hospitals in Ado-Ekiti. It appears EKSWAMA has a good coordination of the waste collection in the city but the development of the UWDSs and piles of unattended waste in the city negate the assertion. Firstly, the availability of just eight waste collection trucks to service the whole of Ado-Ekiti is inadequate to provide adequate waste collection coverage and effective service to the urban dwellers in the city. To support this, survey results revealed that only 36% of the respondents enjoy official waste collection services through house-to-house waste collection (24%) and central waste collection points (12%). This indicates that the remaining 64% of respondents resorted to other means of disposing of their waste, which includes rivers channels/drains (6%), UWDSs (25%), and burning (32%) in open spaces (Figure 4.10). This thus reflects the prevalence of unsafe means of waste disposal observed in the city including the development of unofficial dumpsites whose nature has been discussed earlier in this chapter.

Furthermore, survey results reveal that only 42% of respondents in high-income communities receive house-to-house waste collection services. While this proportion preponderates over figures from middle-income communities (36%) and low-income communities (22%), it is rather a poor outcome given that residents in these communities are wealthy enough to secure efficient and effective waste services.

It is evident that the scheme in place for house-to-house waste collection in Ado-Ekiti needs to be more effective and needs some improvements to capture more residents of the city. However, the researcher gathered the nascent nature of the scheme's struggle with acceptability from the general public, especially where payment of fees is involved. For the first time, EKSWAMA instituted payment of waste collection fees from urban dwellers in Ado-Ekiti. Field investigations show that waste collection fees are not uniform among the residents. Table 4.2 gives the description of the amount allocated to be paid by different categories of people and businesses in the city. Payment of the fees is facilitated by revenue collectors also known in the city as “Billers” who are engaged by EKSWAMA on a casual basis. The revenue collectors go from house to house to collect the fees and issue receipts on payment. The introduction of fees does not sit well with some residents. Field investigation reveals some defaulters refuse to pay

Table 4.2: Description of Fees Paid for Waste Collection in Ado-Ekiti (Field Note, 2021)

| **Categories** | **Fees/Month (₦)** |
|---|---|
| Residents in High-income Communities (GRA) | 1,000 |
| Residents in Flats | 2,000 |
| Residents in rented rooms | 500 |
| Shops attached to houses | 500 |
| Detached Businesses | 1,000 |
| Banks | 10,000 |
| Hotels | 10,000 – 20,000 |

and rather dispose of their waste by other means. In response, EKSWAMA often has enforcers accompanying the revenue collectors to collect funds from defaulters.

#### 4.3.2.2 Urban Central Waste Collection Points and Open Dumping in Ado-Ekiti

Although the official position of the authority is to eradicate central waste collection points by removing waste skips from the streets of Ado-Ekiti, field observations reveal that the waste collection operations of the authority still cover central waste collection points, which include dividers along the road, old waste collection skip locations and dedicated locations of roll-on containers in the core areas of the city (Figure 4.11). Survey results reveal that users of central waste collection points are preponderant in low-income (58%) and middle-income (39%) communities compared to high-income communities (4%) (Figure 4.12).

Field observations reveal that all sorts of waste are found in these points, including faeces and dead animals. This practice exposes the public to environmental and health risks, which can often become palpable on account of foul smells and the presence of flies. The researcher gathered that a lot of residents in Ado-Ekiti use these waste collection points to avoid paying for waste collection fees. The position of EKSWAMA central waste location points can be captured from the following remarks,

*"We no longer have official waste collection skips. The old waste skips located in Oja oba market areas and other places in the city have been removed to pave way for the house-to-house waste collection programme. But you know our people do not respond easily to change. Because they don't want to pay for waste, they continue to use these old points and dividers along the road to dispose their waste there. They come very early in the morning and commit this act. But we can't ignore these wastes, so our waste collectors ensure these wastes are evacuated as they drive around daily. We have however instructed our enforcers to come*

*out as early as possible to arrest these defaulters because it is serious offence if you are caught dumping refuse in open spaces in Ado." (INT-EKS_1)*

However, the preponderance of users of unsafe means of disposing of waste in Ado-Ekiti, culminating in the prevalence of uncollected piles of waste and unofficial dumpsites, certainly engenders questions on the status of service delivery of the formal house-to-house collection in the city. It is evident from personal communications with community members there is poor service delivery, mostly irregular and, in some cases, non-existent. To corroborate this, survey results highlight the current status of official waste collection in the study area and reveal that 37% of the respondents regard official waste collection services as irregular, while 35% of the respondents indicated their waste is rarely collected or never collected (Table 4.3). Godfrey et al. (2020) revealed that ineffective waste collection service is one of the factors driving practices of unsafe disposal of waste in developing countries, especially in urban centres where waste generation is expanding. It is evident that respondents in areas where there is formal waste collection choose to opt for other unsafe waste disposal methods. About 40% of respondents in such category adopts open burning of waste (15%), unofficial dumpsites (20%) and drains/river channels (4%) as means of waste disposal (Figure 4.13). Palpable practice of open dumping at these waste collection points is deplorable and bears the characteristics of UWDSs identified in this study except it is being managed by EKSWAMA.

#### 4.3.2.3 Urban Street Sweeping in Ado-Ekiti

Across Nigeria, street sweeping is one of the urban solid waste management strategies employed by waste management agencies to create healthy and aesthetically acceptable urban environments (Wahab and Kehinde, 2014). The problem of littering and unhygienic waste disposal practices in the Ado-Ekiti necessitated the Ekiti state Government to introduce Street sweeping in Ado-Ekiti about 2 decades ago. This is in a bid to rid the urban centres of Ado-Ekiti and Ikere-Ekiti town including drainage facilities and roads of all forms of dirt. Ojedokun and Balogun (2011) described public littering of waste as attitudinal and reflects utter disregard to personal hygiene and unpatriotic manifestations.

Figure 4.11: Typical Central Waste Collection Points close to Old Garage Market, Ado-Ekiti. Other forms of the central waste collection points are found along dividers on the road and abandoned areas marked for development.

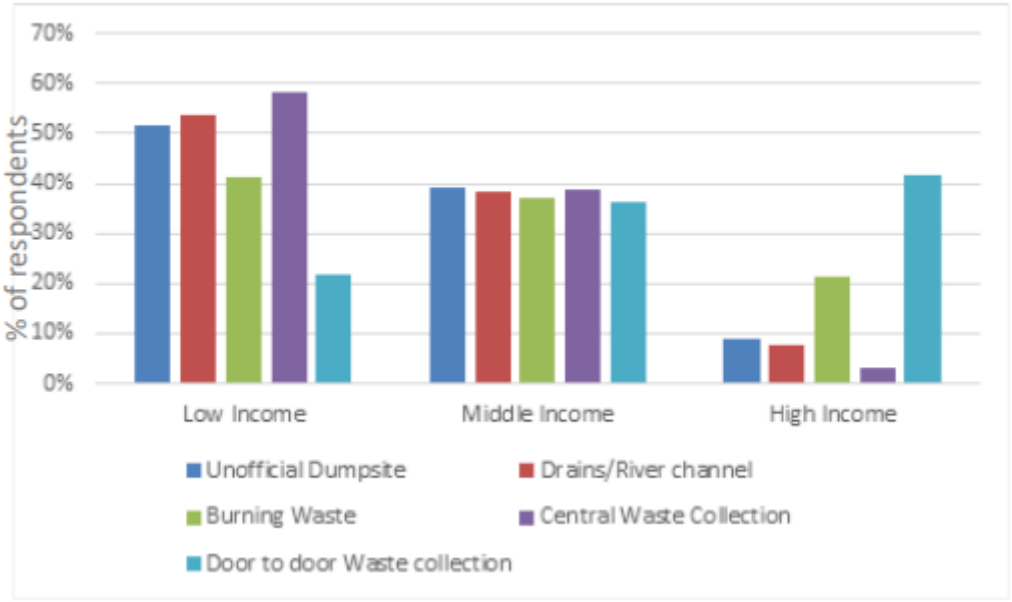


Figure 4.12: Solid Waste Disposal Methods across the Three Social Economic Classes in the Study Area. The Figure highlights the relative adoption of the house-to-house waste collection in the High income areas compared to the middle and low- income areas

Table 4.3: Table showing the Frequency of Waste Collection in the Study Area

(N=225, p>0.05)

| Row Labels | Low Income | Middle Income | High Income | Grand Total |
|---|---|---|---|---|
| Regular | 15% | 19% | 44% | 22% |
| Irregular | 35% | 42% | 33% | 37% |
| Rarely Collected | 25% | 28% | 20% | 25% |
| Never Collected | 25% | 11% | 2% | 15% |
| Grand Total | 95 | 85 | 45 | 100% (225) |


Figure 4.13: Presence of Collection Services Correlated with Adopted Waste Disposal Methods

In Ado-Ekiti, street sweeping initiatives kicked off with 128 female sweepers and 12 supervisors who were engaged as casual workers (Wahab and Kehinde, 2014). However, records obtained from EKSWAMA reveal that the number of sweepers had increased to a total of 625, whereby 505 of the street sweepers are assigned to Ado-Ekiti under the supervision of 14 supervisors, while the other 94 are assigned to Ikere-Ekiti under the supervision of 12 supervisors. All the sweepers are within the employ of EKSWAMA on a casual basis with a meagre monthly wage of ₦5,000 naira (£6). On enquiry about the ridiculous wage being paid to the sweepers, interviewee INT-EKS_3 remarked.

*"Until recently, the sweepers are paid ₦10,000 (£12) monthly, but the Authority cannot no longer afford paying the said sum. Hence an agreement was reached with the sweepers to cut their wage by half tentatively rather than discontinuing the street sweeping programme. Even at that, all of them still turn up for work and there are other applicants still on waiting list to be employed. I understand it is a poor pay for those women but there is nothing we can do." (INT-EKS_3)*

Field observations reveal that the street sweepers in Ado-Ekiti are composed of only female workers who are equipped with brooms, dust pans, plastic bags, and personal protective equipment (PPE) to carry out their operations (Figure 4.14). The gender-biased nature of the street sweeping in Ado-Ekiti can be attributed to the traditional practice and belief of the Yoruba tribe of Nigeria, where sweeping is considered the sole responsibility of a female child and women (Wahab and Kehinde, 2014). The operation of the sweepers covers 21 major roads of the city, which comprises ten dual carriageways and eleven single roads (Table 4.4). Field observations reveal the sweepers encounter all forms of waste during their operation, which include sand, plastic bags (nylon), plastic bottles and straws, leaves, wood, papers, cardboards, and batteries. Some of this waste comes from indiscriminate disposal practices of pedestrians, businesses located along those roads, and road users who often throw out of moving vehicles.

Walch (2006) posited that street sweeping is usually done in the early hours of the day when there is little or no traffic but the operation of the street sweepers in Ado-Ekiti often extends up to mid-day amidst busy vehicular traffic. This practice undoubtedly exposes the street sweepers to the risk of vehicular accidents during their operation. The sweepers are also observed to be without appropriate PPE during their operation. Some of them lack gloves and safety boots, which are necessary to safeguard them against health and environmental hazards.

Figure 4.14: Street Sweepers cleaning one of the roads in Ado-Ekiti. The safety risks to the sweepers are highlighted in this research as their operation are conducted during the day.

Despite the significance of the role of sweepers in Ado-Ekiti in keeping the city clean, they face social exclusion and harassment from the general public. The researcher gathered from interviewee,

*"the sweepers are often treated without respect by some members of the public who are often in the habit of throwing waste at places they have already swept and met with reproach on challenging them on such bad behaviour. And because these women belong to the poorest of the society, some of them are widows, orphans and single parents, they face despicable treatment and harsh conditions which otherwise would not exist if they had alternatives to lean on". (INT-SW)*

The social exclusion faced by street sweepers was no different from that faced by the informal workers, which are discussed in detail in Chapter 5 of this thesis.

Table 4.4: Streets in Ado-Ekiti under the operation of Street Sweeping

| S/N | Street Name | Street Type | Length (km) | No of Sweepers |
|---|---|---|---|---|
| **1.** | Fajuyi -Basiri-Police Headquarter | Double Carriage | 4.5 | 49 |
| **2** | Commissioner of Police-Secretariat-CBNHouse of Assembly | Double Carriage | 1 | 15 |
| **3** | Fajuyi-State Secretariat-Basiri Junction | Double Carriage | 2.8 | 28 |
| **4** | Mathew Junction-Irona-Ile Abiye-Isa to Post Office- Igbehin-Atikankan | Double Carriage | 3.4 | 35 |
| **5** | Ile Abiye-Falegan-Ilawe Road | Double Carriage | 2.1 | 21 |
| **6** | Commissioner of Police-NTA-Baptist Junction | Double Carriage | 3.0 | 29 |
| **7** | Fajuyi-Okesa-Ereguru-Okeyinmi-Oke-Ila to Housing Road | Double Carriage | 2.8 | 34 |
| **8** | Old Garage to Agric. Junction | Double Carriage | 2.9 | 29 |
| **9** | Agric. Junction-Mobil-Ajebandele | Double Carriage | 4.0 | 40 |
| **10** | Pathfinder-Christ school-Fajuyi Park | Double Carriage | 5.7 | 54 |
| **11** | GRA-Onigari-Bisi Elegberun-Ile AbiyeAjibade-Ilawe Road | Single | 3.5 | 16 |
| **12** | Old Garage-New garage-Ajebade lane to Immaculate Mugbagba-Idemo-St. Paul | Single | 2.8 | 22 |
| **13** | Ijigbo-Odo Ado-Igirigiri-Local Government to Mathew Junction-St. Paul | Single | 3.8 | 23 |
| **14** | Deputy Governor's Office-Government House-Barracks road to Oke-Oriomu | Single | 5.0 | 29 |
| **15** | Nova road-Opopogbooro Junction-Basiri | Single | 3.7 | 18 |
| **16** | Dallimore-Stadium-Kajola-Oduduwa-OkeEse-Okutagbokuta | Single | 2.6 | 16 |
| **17** | Ereguru-Oja-Oba-Palace-Old Garage | Single | 2.0 | 21 |
| **18** | Old Garage-Agere-Idolofin-Idemo junction to Immaculate to Oke-Ila junction | Single | 2.0 | 10 |
| **19** | Coca-cola Junction via Moferere-Agric. | Single | 2.3 | 9 |
| **20** | Mobil Junction-Orire-Housing-Oke-Ila | Single | 1.6 | 6 |
| **21** | Adebayo-Orire Junction-Housing-Oke Ila | Single | 1.6 | 6 |
| | Total | | 63.1 | 519 |

### 4.3.3 Official Urban Solid Waste Disposal Sites in Ado-Ekiti

The Authority confirmed there is no sanitary landfill in Ado-Ekiti, and there is currently no plan to develop one. At present, there are two dumpsites in the city of Ado-Ekiti. These dumpsites are located in Omirin and Ilokun communities and have been tagged as Omirin dumpsites and Ilokun dumpsites. Omirin and Ilokun dumpsites are each situated on 25 hectares of land, receiving wastes collected from the city. These designated waste sites are open dumpsites and remain the cheapest means of disposals for burgeoning wastes from the city of Ado-Ekiti. The waste sites are not fenced which promote open access to uncontrolled waste picking and illegal dumping.

These waste sites originally belong to landowners who are mostly farmers with farmlands on these sites. The formal arrangements between the Ekiti state government and landowners of these waste sites have promoted the use of these sites for waste disposal as well as farming. Essentially, these landowners are being paid by the government for access and occupation of these sites. However, field investigations reveal that such formal arrangement on Ilokun waste sites is currently being challenged. There have been various complaints from the landowners and farmers using the waste site for farming about the unsanitary nature of these sites which prevent them from using the land. These concerns include;

i. Smokes emanating from continuous burning of wastes.
ii. Foul smell from the accumulation of the wastes in these sites
iii. Flies hovering around their building on account of the location of the dumpsites, constituting agents for spreading diseases such as cholera, dysentery and diarrhoea

The EKSWAMA representative confirmed concerns from the public about these waste sites, and the authority is considering relocation of Ilokun Dumpsites. In his remark;

*"There have been discussions with the stakeholders to relocate Ilokun dumpsites, we have been talking to the landowners and other concerned associations. we have resolved to construct roads along the sites to give access to the farmers. We are already fumigating these sites. We are also planning to fence the wastes sites. We are looking at digging big holes to bury these wastes so that the pollution from the sites will reduce. We are working with Ilokun Residents to provide security personnel to man the dumpsites against scavengers and other intruders that lit fire on the dumpsite. We are working with other ministries to achieve this" (INT-EKS_1)*

Field investigations of the designated dumpsites show the waste dumpsites are located in close proximity to residential houses, which implies that the residents are directly at risk of health and environmental impacts by these waste sites. The researcher gathered that these waste sites were originally remote from residential dwellings, but as the city urbanizes and pressure on housing continues to build up due to population growth in the city, there have been accelerated developments towards the waste sites.

The management of open dumpsites across Nigeria is through the open burning of waste in order to reduce the quantity of waste and make more room for future waste. Similarly, the waste streams in Ilokun and Omirin dumpsites are often openly burnt by EKSWAMA attendants managing the sites. Field investigations also reveal there is no provision for burial of wastes in

these sites as it is done in other dumpsites in Nigeria in dealing with the wastes. The only management option to control air pollution and flies from the wastes on these sites is through fumigation (Figure 4.15). Fumigation of the two dumpsites is a periodic exercise initiated by the authority in 2021 to arrest the foul smells and control the potential for disease spreading from the sites.

At the time of the visit, necessary equipment such as an excavator and payloader was absent from these waste sites. When asked why this equipment was absent, the waste site attendant revealed that it is usually hired from a private company when needed.

### 4.3.4 Urban Solid Waste Treatment in Ado-Ekiti

Currently, there is no formal scheme for waste treatment at the point of waste generation in Ado-Ekiti. Essentially, all the wastes collected from the cities end up in the two dumpsites of the city without formal provision for source segregation for organic waste and recyclables management. This is despite the economic, health, and environmental gains that can be benefitted from diverting these potential resources before reaching final disposal sites.

However, one of the waste sites in Ado-Ekiti (Ilokun dumpsite) is equipped with a recycling plant, a plastic pelletizing machine with the capacity to process and transform 3000 tonnes of plastic waste into pellets on a daily basis. According to the EKSWAMA representative, the operation of the recycling machine at the Ilokun site serves two purposes which, in one part serve to reduce the quantity of waste on the site, thereby preserving space for other waste and in another part, serve to generate revenue for the authority through sales of recyclables retrieved and processed from the waste streams.

The plastic wastes being fed to the pelletizer constitutes all kind plastic wastes including High Density Polyethylene (HDPE), Low Density Polyethylene (LDPE), Polypropylene (PP) and Polyethylene (PE) (Figure 4.16). These plastic wastes are retrieved from waste streams in the dumpsites by EKSWAMA attendants who are often exposed directly to potential health and environmental hazards of the wastes in sorting the plastics from the general wastes on the site. However, the EKSWAMA representative maintained they use appropriate PPE while retrieving the plastic wastes from the waste stream and gave a summary of their operation below;

*We receive our plastic wastes directly from the dumpsite where we sort them. We have staff who pick the raw materials from the pit and sort them into different families because plastics are of different families. They are all sort of plastics like HDPE, LDPE, PE and PP. Also these plastic have different colours and structures and we have to sort them appropriately.*

*The major ones are PET (Polyethylene Terephthalate) used to package bottled water and the HDPE (High Density Polyethylene) used in making bowls. After sorting, we wash them and sanitize them before putting them in the machine. The machine pelletized the plastics and process them into pellets which we sell directly to companies". Some of these companies usually come to us and demand for our products to make shoe soles, chair and buckets. The products are 'hot cake' (meaning in high demands)" (INT-EKS_3)*

Figure 4. 15: An Attendant of Ilokun Dumpsites Fumigating the Wastes. The OWDSs are essentially open dumpsites without sanitary measures to safeguard the public

Meanwhile, the researcher gathered that the smooth operation of the recycling scheme on the waste site is challenged in many ways. The challenges are operational in nature. At the time of visit to the sites, the machine was not operational because fuel was not available for the generator that powers the pelleting machine despite the huge number of plastic wastes in line for recycling. The pelletizing machine has not been connected to the national grid, which makes the operation of the machine rely on a power generator on the site. In reacting to the challenges of the recycling scheme, the following comments were made.

*"The major challenge we have are logistic in nature. You know the place is run by the government and we have issues here and there. Presently, the recycling plant is run on diesel, and we need to link the power consumption with the national grid. Also, we need water because water is the soul of any recycling business. For now, we lack water despite the fact that we have a borehole. But the pumping machine is not functional. However, the government has promised to give us another pumping machine so that we resume using the borehole for operation. Also staff -wise, we have challenges. The number of staff in the factory is not adequate. We need to have 2 or 3 more staff but because of the financial situation of the authority, we are not adequately staff" (INT-EKS_3)*

These challenges described accentuated many issues surrounding USWM in Nigeria as it is in many developing countries regarding the operation and maintenance of infrastructure (Kaza et al, 2018; Godferey et al, 2019).

Figure 4.16: Recycling Pelleting Machine Located at Ilokun Dumpsites, Ado-Ekiti, and various kinds of plastic materials being fed into the machine.

## 4.4 SUMMARY OF CHAPTER

This chapter has provided an overview on the development of UWDSs as well as the present waste management practices in the case study region. The development of UWDSs is shown to cut across the socio-economic classes, located mostly along the roads. Observed materials in the UWDSs revealed they correspond with compositional analysis which indicated a preponderance of organic wastes and recyclables in the waste streams. However, the development of UWDSs reflects on the present status of the waste management practices in the case region. Findings revealed deficiencies in the collection and disposal of wastes despite the introduction of house-to house waste collection in the study area. The extent of such deficiencies in driving the development of UWDSs is discussed in Chapter Six of this thesis.

# CHAPTER FIVE: WASTE MANAGEMENT STRUCTURES AND STAKEHOLDERS' PARTICIPATION IN URBAN SOLID WASTE MANAGEMENT IN ADO-EKITI

## 5.1 INTRODUCTION

The primary objective of this chapter is to furnish a comprehensive overview of both formal institutional structures and informal sectors governing urban solid waste management as well as community participation in urban solid waste management in the city of Ado-Ekiti. This overview is structured into three distinct sections. The first section explores the institutional framework governing waste management and assessing the operational capacity of the Ekiti State Waste Management Authority and private waste collectors, providing insights into the collaborative efforts between public and private entities in addressing waste management challenges in the city. The second section explores the challenges faced by individuals or groups engaged in informal waste collection activities. The third section delves into the community participation aspect of urban solid waste management, examining the level of engagement, challenges faced by understudied communities, and potential avenues for enhancing their participation in waste management initiatives.

## 5.2 INSTITUTIONAL FRAMEWORK OF USWM IN ADO-EKITI

Historically in Nigeria, the administration of waste management is a devolved function delegated to the local governments in Ekiti State as it is in every other state. However, the failure of Ado-Ekiti local government to ensure effective management of waste in the city of Ado-Ekiti raised serious concerns among the residents as well as other stakeholders USWM and prompted incessant calls for improvement. These calls led to the creation of Ekiti State Waste Management Board (EKSWMB) charged with the mandate to oversee the solid waste management of Ado-Ekiti and her neighbouring towns in Ekiti State. The EKSWMB as well as other agencies such as the Federal Protection Agency (FEPA), National Environmental Standards and Regulations Enforcement Agencies (NESREA) and Watershed Management Agency (WMA) exists under the Ministry of Environment (MOE) in Ado-Ekiti. Being subjected to the MOE in the state, EKSWMB is constrained in terms of financial and technical capacities in delivering on its mandate which is linked to the poor state of MSW management in the city. To prioritize waste management in the state, it is recommended that the agency in charge of waste management be fully autonomous. Consequently, Ekiti State Waste Management Authority (EKSWAMA) was formed in 2020 under the Ekiti State Waste Management Authority law No. 18 of 2020.

EKSWAMA has a number of departments which are detailed in Table 5.1. These include (i) empowerment to conduct research and establish waste collection and disposal system standards, (ii) responsibility for the clearance and maintenance of public drainage facilities and (iii) the cleaning of streets within the entire Ekiti state in collaboration with appropriate government authorities. While the reach of EKSWAMA is not felt equally across other parts of Ekiti state, EKSWAMA has its main office in Ado-Ekiti with a managing director at the helm of affairs to oversee the five departments of the Authority. As a result of technical constraints, some departments that would otherwise stand on their own have been merged. For example, the operation and maintenance departments are merged, which leads to a conflict of focus between the operation section and maintenance section in the daily collection and disposal of waste in Ado-Ekiti and scheduled maintenance and repair of operational vehicles as well as general maintenance of facilities of the authority. Conflict of focus is one of the challenges reviewed in Chapter Two of this Thesis to have an impact on the smooth-running operation of SWM in Sub-Saharan African Countries.

### 5.2.1 Overview of Finances of USWM in Ekiti

The issue of funding constitutes one of the major barriers to implementing effective solid waste management. As with many developing countries, Nigerian cities struggle with the capacity to effectively fund three key areas: (i) operational costs of the solid waste collection (ii) treatment and (iii) disposal. EKSWAMA suffers from lack of adequate funding and is the primary cause of poor waste management in Ado-Ekiti. The conventional approach to funding solid waste management in Ado-Ekiti is through the allocation of funds by the Ekiti State Government (EKSG) in accordance with the approved budgetary provisions of EKSWAMA.

Table 5.2 shows a summary of the financial allocations as well as local revenue of EKSWAMA in Ado-Ekiti across 2021 and 2022. It is evident that there is a funding gap in the actual capital received compared to actual capital requested for funding solid waste management in the city. For instance, in 2021, ₦263,501,749 was requested by the authority but just ₦175,345,599 was approved. In the same year, only ₦162,530,000 out of the approved capital of ₦175,345,599 was released and spent which is not enough to fund the proposed recurrent expenditure of ₦191,749,625 Naira for solid waste management in the city.

Table 5.1: Summary of the Departments of EKSWAMA and their Roles

| **Departments** | **Roles** |
|---|---|
| Administration | Staffing and Personnel management<br>Private Contractors Registration |
| Operation and Maintenance | Daily waste collection and disposal<br>Dumpsites maintenance and management<br>Waste recycling management<br>Vehicles maintenance and repair<br>EKSWAMA facilities maintenance |
| Finance and Accounting | Auditing<br>Budgetary preparation |
| Enforcement and Enlightenment | Enforcement of Sanitation law<br>Awareness creation about waste management |
| Planning and Research | Data collection and compilation<br>Supporting other agencies/students with data<br>Data analysis |

This shortfall of funding to the authority is also evident in 2022 where only ₦268,229,835.97 of approved capital of ₦270,325,000 was released and spent on solid waste management in the city. The impact of solid waste management funding gaps from internal funding shortfall has been reported by Wahab (2015) in his study in Ibadan, Nigeria. The perennial problem of shortfalls in funding in Nigerian cities ensures that pertinent projects such as the purchase of equipment are not executed and necessary operational costs, including labour, fuel, awareness, training and workshop maintenance, and repairs of equipment, are not adequately provided for. The consequence of funding gaps for EKSWAMA on poor waste collection services was highlighted by a representative of the authority to lack of necessary items and equipment. This is a similar challenge reported by Nabegu and Mustapha (2015) in Kano as only 40% of the required budget was released to the institution in its best year. Both the 2021 and 2022 allocation were refused by EKSG, meaning there was no investment in the provision of DAF Roll on Truck, Tipping Caster Vehicle Weigh – in Scale, Wheelie Bins, and PPE for collection crew.

To overcome the lack of funds from EKSG, the authority has commenced charging service fees from waste generators in the city. Table 5.2 show proposed revenues and actual revenues for

2021 and 2022. While the revenue collection has improved over the year, it is evident that such income is not sufficient to fill the funding gaps created by the shortfalls in the budgetary provisions for the authority to manage increasing solid waste in Ado-Ekiti.

Table 5.2: Financial Allocation and Revenue of EKSWAMA in 2021 and 2022.

| **2021 Estimate** | **Fund (₦)** | **2022 Estimate** | **Fund (₦)** |
|---|---|---|---|
| Requested Capital | 263,501,749 | Requested Capital | **370, 071,603.47** |
| Approved Capital | 175,345,599 | Approved Capital | **270,325,000.00** |
| Proposed Overhead | 190,749,625.00 | Proposed Overhead | **290, 071,603.47** |
| Actual Overhead | 162,530,000 | Actual Overhead | **268,229,835.97** |
| Proposed Revenue | 12,985,259.19 | Proposed Revenue | **12,985,259.19** |
| Actual Revenue | **866,824.45** | **Actual Revenue** | **9,446,824.48** |

### 5.2.2 Human Capital in EKSWAMA

The development of human resources is central to the administration of SWM, and hence, its mismanagement can reflect poorly on the overall outcome of environmental sanitation in urban centres. Wahab (2105) submitted that the problem of understaffing is endemic in a Nigerian context of urban solid waste management. In this regard, EKSWAMA is no exception, as information collected from the authority revealed a profound shortage of staff in relevant departments. During data collection, the human resources of Ekiti State Waste Management Authority are categorized into either permanent or non-permanent employment (Table 5.3). The permanent staff of the authority are limited in number (32) and are entitled to pension upon retirement. The non-permanent staff on contract constitute the bulk of the human capital of EKSWAMA and are not entitled to retirement benefits. This employment category includes sweepers, revenue officers (billers), securities, enforcement officers, cleaners, and mechanics who can be laid off upon expiration of their contracts if they are not renewed after a year. However, the agency sometimes makes provision for renewal of the contracts at the discretion of the planning and research department in conjunction with the finance and accounting departments. The researcher ascertained that insufficient authority funding is responsible for the huge employment of contract staff in the agency so that they can be sacked at any time and re-employed when funding is available. An example was EKSIV who decried poor management and late payment of contract staff stating.

*"The contract staff do not get paid on time and some have not been paid for six months. I pity the women who are sweepers. Despite reducing their wage and not getting paid on time, they still turn up for work every day because there are others who are on waiting list to take their spots if they stop coming to work" (EKSIV).*

Table 5.3: Human Resources of EKSWAMA

| **Categories** | **Permanent** | **Contract (1 year)** | **Total** |
|---|---|---|---|
| Admin Staff | 23 | 6 | 29 |
| Drivers | 5 | | |
| Supervisors (Sweepers) | | 26 | 26 |
| Enforcement | | 28 | 28 |
| Billers | | 8 | 8 |
| Storekeepers | | 2 | |
| Mechanics | 1 | 2 | |
| Motor boys | | 30 | |
| Sweepers | | 600 | 600 |
| Dumpsite Attendants | 1 | 4 | 5 |
| Security | | 4 | 4 |
| Planning and Research Officers | 2 | 2 | 4 |
| Total | 32 | 712 | 744 |

Nabegu (2010) argued that staffing should not have been a problem if SWM was taken as a priority in the administration of USWM. The funding challenge for SWM in Nigerian cities is not limited to inadequate provision of SWM equipment but also has consequences for staffing. The involvement of contract staff in the SWM operation exposed them to looking for better opportunities elsewhere without putting total commitment on the job.

### 5.2.3 Technical Resources of EKSWAMA

The technical capacity and maintenance of infrastructure is crucial to the success of the system in achieving its objectives (Ogwueleka, 2009; Ugwuanyi and Isife, 2012; Wahab, 2015; Amasuomo and Baird, 2016). In Ado-Ekiti, EKSWAMA is equipped with various types of technical resources for its various operations including daily waste collection and disposal, maintenance of the dumpsite and recycling. Table 5.4 shows different types of equipment

available to Ekiti State Waste Management Authority and depicts functional status of this equipment. However, there are other waste collection vehicles that belong to private contractors that are not included in the table.

Table 5.4 clearly provides evidence of shortages of material resources necessary to promote effective urban solid waste management in Ado-Ekiti, given the population of the state. The problem of inadequate technical resources has been an issue for waste management across Nigeria. The abundance of service trucks in a state of disrepair is quite common due to poor maintenance culture and added to poor service delivery (Wahab, 2015). In Ado-Ekiti, one of the major reasons for the accumulation of non-functional vehicles is the lack of parts for vehicles that are not available in the country. These parts can be obtained, but they come with additional purchase and shipping costs, which often make them too expensive for the authority.

Additionally, lapses in delivery from maintenance department often render some vehicles to remain inoperative for a longer time. EKSIV commented on the lack of serviceable vehicles:

*'The maintenance guys are usually not around to attend to these vehicles when they break down because they are on contract basis. At times, there is no money to repair them or to buy materials to replace in them even if you write to the management'(EKSIV)*

It is clear that local conditions are not taken into consideration in the acquisition of the waste collection equipment to assess if there is a local market for the spare parts. This has a recurring issue in USWM in Nigeria (Ogwueleka, 2009). Amasuomo and Baird (2016) attributed such failure to wrong leadership in the SWM system, as is the case with politicians made to head over environmental departments.

Table 5.4: Vehicular Resources of EKSWAMA

| **Functional** | **Total** | **Non-Functional** | **Total** |
|---|---|---|---|
| DAF Roll on Truck | 2 | DAF Roll on truck | 1 |
| Mercedes Tegear Compactors | 4 | DAF LF Compactor Trucks | 1 |
| | | Mitsubishi canter truck | 1 |

## 5.3 INFORMAL WASTE SECTOR IN USWM IN ADO-EKITI

The role of the informal sector in handling solid waste in developing nations has been extensively explored in academic literature (Akpeimeh et al., 2019; Ferronato et al., 2019; Steuer et al., 2018). This crucial yet unregulated sector, involving the collection, sorting, and sale of waste, has been identified as a force driving waste reduction, providing raw materials to industries, and unlocking the resource potential of waste streams.

This is clearly seen in Ado-Ekiti, especially in the aspect of resource recovery and recycling, as there is no formal recycling programme in Nigeria as a whole. This has driven the lack of a formal recycling programme in Nigeria as a whole. The informal sector is responsible for the recovery of resources from waste streams in Ado-Ekiti. Due to the nature of the activity, the informal collectors are from the impoverished or socially marginalized sector of the urban population (Velis, 2017). This research categorises informal waste collectors, into three groups (i) waste pickers, (ii) itinerant waste buyers, and (iii) scrap metal dealers.

### 5.3.1 Waste Pickers

The waste pickers traverse the streets, and households collecting wastes. They are often operated and managed by the scrap dealers who act as intermediaries between them and the recyclers. Field observations reveal that these waste pickers also frequent unofficial dumpsites, sifting through waste streams to salvage recyclable materials. Notably, plastics, clothes, and metallic materials emerge as the primary focus of their engagement. Interviews reveal that some waste pickers are disposed to help people dispose of their household or business wastes in unofficial dumpsites for free with the underlying intention of finding target materials amidst the wastes. However, there are complaints about the mode of engagement of the waste pickers which often confronts their acceptability among the people. Waste pickers are often accused of stealing and disrupting waste. Some residents have discouraged the presence of waste pickers in their community because they believe they are prone to taking items without permission from unsuspecting household compounds. Some have also complained that they usually disrupt waste left for disposal by the official waste collectors, thereby creating litter in their community. Similar issues were reported in Kano, Nigeria, as one of the challenges with the mode of engagement of the waste pickers, which requires prompt regularisation of the informal sector (Ogwueleka, et al., 2021).

### 5.3.2 Itinerant Waste Buyers (IWB)

Itinerant waste buyers (IWB) traverse the city collecting particular waste types from homes, shops, and businesses. In most cases, IWB are specific in their targeted materials, which is

quite different from that of the waste pickers that collect all manners of waste. IWB buys or trades items for specific wastes from households. For example, it was gathered that there are IWB who deal specifically in textile wastes and usually travel from house to house to buy these wastes or trade them for plastic bowls. Generally, IWB deals in specific materials, which can include bottles, plastics, glass, used cement bags, electronics, and sometimes furniture, and resell these items to scrap dealers for higher profits. IWB are usually seen ringing bells or knocking on glasses to inform their customers of their presence in the streets and such attention creation shows they are more acceptable than the waste pickers whose presence in communities is often shunned.

### 5.3.3 Scrap Dealers

The scrap dealers are higher up than the waste pickers and itinerant waste buyers within the hierarchy of the informal waste recycling system as they serve as the middlemen. They are usually involved in the conversion and processing of the recovered materials from waste streams into secondary raw materials which are then sold to the recycling companies. In Ado-Ekiti, there is no evidence of any recycling companies, so the recovered materials are usually transported to other states where recycling companies are situated. In some cases, some recycling companies often have trucks that travel around to collect recovered materials to stay ahead of the competition with other recycling companies. The scrap dealers often have waste pickers who work directly under them, sourcing recyclables for them. Table 5.5 shows the subsisting prices of recyclable materials in Ado-Ekiti. These prices are paid to the scrap dealers and not to the waste pickers and IWBs. The income of the waste pickers and IWBs are quite varied depending on the middlemen they are dealing with and on the existing demand pressure for particular recyclable items.

### 5.3.4 Challenges of the Informal Sector in Ado-Ekiti

Field observations reveal that scrap metal dealers frequently manage substantial volumes of reusable materials, necessitating the utilization of trucks for transportation. Beyond selling recyclable materials to recycling companies, these dealers play a crucial role in the local repair system. They are often sought after by local repairers as a source of vital components required in the repair of electronic items like fridges, radios, televisions, and even automobiles. Despite

Table 5.5: Prices of Recovered Materials by the Scrap Dealers in Ado-Ekiti

| **Recovered Materials** | **Price (₦) per kg** |
|---|---|
| Plastic polyethylene terephthalate (PET) | 6,500 |
| Plastic high-density polyethylene (HDPE) | 2,200–3,500 |
| Duplex paper such as posters, books, snack box paper, etc. | 800 |
| Other types of paper: newspaper, white paper, cement paper, cardboard paper | 1,900–2,600 |
| Aluminum | 14,000 |
| Metals | 2,700–3,650 |
| Glass bottle | 150–250 |

the importance of their role in recycling and providing essential components for repairs, the mode of operation of scrap metal dealers is often characterized as indiscriminate and unsafe. One notable concern is their proximity to residential areas, directly impacting the well-being of the residents. Ogwueleka et al. (2021) identified that the presence of these operations close to homes raises safety and environmental issues, including noise, dust, and the risk of accidents associated with large trucks and heavy machinery.

The indiscriminate nature of their operations may contribute to an unsightly environment and potentially compromise the health and safety of nearby residents. Additionally, the handling of scrap metals may involve the dismantling of electronic devices, leading to the release of hazardous materials, if not managed properly. In many urban landscapes in developing countries, the informal waste sector, despite their critical role in waste management, lacks the support and formal recognition from the government (Black et al., 2019). These individuals, engaged in the informal sector, actively contribute to waste reduction and resource recovery by collecting, sorting, and recycling materials. However, the absence of official acknowledgment and assistance places them on the fringes of the established waste management system.

Similarly, the failure of the Ekiti state government to formally recognize the importance of waste itinerants in Ado-Ekiti leaves them operating without the institutional support necessary for their safety, well-being, and effective contribution to waste management. These individuals often work under challenging conditions, navigating through uncollected waste and unofficial dumpsites in search of recyclables. Their efforts, while vital for the environment, remain overlooked by formal waste management policies.

The lack of recognition manifests in several ways. Firstly, these informal waste collectors face limited access to resources such as safety equipment, proper training, and healthcare, leaving

them vulnerable to health hazards associated with handling waste. In an interview, WP asserted that they face of a lot of health challenges from their direct exposure to waste without Personal Protective Equipment. In his response to health challenges faced in the line of waste picking he remarked as follows;

*"Many a time I have faced challenges with waste retrieval which impacted my health. We have to go through burnt dumpsites or wastes located in the bush. I have treated coughs, malaria from mosquito bites, and rashes in this line of work. But there is no support anywhere. The motivation we have on this job is that we get paid for the value of wastes we are able to deliver to our vendors". (WPI)*

The deplorable living and working condition of waste itinerant pickers is corroborated by Morais et al. (2022) in their global review of waste picking and its contribution to poverty

Figure 5.1: A Scrap Metal Dealer "Storage facility" located close to residential areas. The location of storage facility close to residential constitute environmental and health risks to the public especially those living close to the sites.

alleviation and circular economy. the absence of regulatory frameworks means that their contributions may go unmonitored, hindering the optimization of their impact on waste reduction and resource recovery.

Moreover, the informal status of these waste itinerants leads to social stigma and economic instability. Their lack of formal recognition translates into limited access to social benefits and financial support, perpetuating a cycle of marginalization. Many researchers (such as Morais et al., 2022; Ogwueleka, et al., 2021, and Velis, 2021) have maintained that the measure to combat the situation requires a comprehensive approach that includes recognizing the essential role played by waste itinerants, implementing supportive policies, and integrating them into the broader waste management framework. By acknowledging and empowering these individuals, the government can harness their potential to enhance the sustainability of waste management practices while promoting social and economic inclusivity.

## 5.4 COMMUNITY INVOLVEMENT IN URBAN SOLID WASTE MANAGEMENT IN ADO-EKITI

The participation of the community residents in the urban solid management of Ado-Ekiti has been explored in this research to understand the level of involvement of the public in the management of waste in the city. Six communities in Ado-Ekiti including Ajilosun, Adebayo, Ido-Olofin, Ureje, Omisanjan, and GRA communities were studied in this research using field observations, interviews, and focus group discussions to highlight the extent of community participation in urban solid waste management. Field investigations have shown significant variations in what is expected of urban residents of Ado-Ekiti for sustainable solid waste management practices away from what is observed during field investigations. These variations centred around the primary storage and disposal, waste segregation which is connected to their attitude, poor awareness and lack of empowerment and government support.

It was observed that in areas where waste services are provided, many urban residents in Ado-Ekiti participate effectively in the primary storage and disposal of household waste during house-to-house waste collection operations. This is quite revealing in the high-income areas such as GRA and parts of the Ajilosun communities where there is visible presence of wheelie bins for primary storage of household wastes and easy and smooth disposal. The level of support provided by the EKSWAMA in providing waste storage bins and informing the residents on the developments in the waste management sector in these areas is noted to have gone a long way in impacting the attitude of the residents towards waste management. Apart from the active participation in the proper storage and disposal of wastes by these communities,

they are actively involved in the payment of required waste fees. It is noted during interviews that the residents in these communities are quite motivated by the level of progress in the USWM in the city compared to their experience before the introduction of the house-to-house waste collection services provided by EKSWAMA. This is translated into their commitment to support the government to put an end to the indiscriminate dumping of waste in the city by reporting on cases of waste dumping through their community associations to the government. Community leaders in Ajilosun emphasized that the active community participation in USWM in Ado-Ekiti is reflected in the limited number of unofficial dumpsites in these localities and where found, such unofficial dumpsites are often prone to regular cleanup by the authorities.

Although there is no evidence of community-based projects in all studied communities, there is active participation of some communities in USWM through their association relative to others in Ado-Ekiti. In communities such as Ajilosun and Adebayo, community-based efforts have facilitated close working relationships with allocated private contractors for the disposal of waste in their community through their community associations. This usually entails having an open line of communication with the operators through which locations for unremoved wastes in their communities can be provided and also getting first-hand information on the nature of challenges faced by private collectors in arriving on time for the disposal of their wastes which can be communicated to other members in the community. In the Ajilosun community where there are households without wheelie storage bins provided, there is the engagement of the community members through the Ajilosun Community Development Association (ACDA) to use good storage bins for the disposal of their household waste in response to reports of people of using substandard bins which often creates problem for the operators to lift the wastes without spilling the contents in the streets.

Similarly, in Adebayo communities, issues of waste management to be addressed with the government are often discussed in their monthly meetings. During the focus group, it was reported that the previous allocation of community waste bins in their community has been facilitated through discussions in the meeting by identifying flashpoints for waste build-ups for the government for prompt attention. Also, reports of the recent coordination of a team of community residents to monitor and arrest the practice of indiscriminate dumping of refuse at a localized unofficial dumpsite in the community were mentioned during one of the series of discussions with the community leaders and residents. Responding to questions on the involvement of the Adebayo area community development association in USWM in Ado-Ekiti,

the community leader in Adebayo community made the following remarks during focus discussions,

*"We have liaised with the authorities through our community-based -actions to increase the number of waste community bins in the Bisi Market and to make disposal of waste in our community a daily affair given large number of businesses in these communities as existing mode of waste disposal is not enough to keep up with the waste generating capacity of our community."(FGAJCL).*

Like many other communities actively involved in the USWM in their localities, Ajilosun and Adebayo communities are driven by several factors to organize themselves in response to environmental situations in their communities. Chiefly among these factors is the need recognized by these two communities to put a stop to the environmental deterioration of the environment amidst a regime of unsustainable waste management in the city. Interviews with the residents and community leaders reveal that the communities have been actively involved in the USWM before the introduction of the house-to-house waste collections programme in the city. FGADCL attests to the failure of the government to ensure active collection and disposal of waste has driven the collective efforts of individuals in the community to carry out monthly clean-up of the community as part of their sanitation duties. It is recorded that members in the communities are usually mobilized to engage in the sanitation exercise which usually involves cleaning of drainage system, clearing vegetated areas, sweeping their surroundings, and clearance of pockets of unofficial dumpsites in the communities.

Apart from shared environmental concerns, FGTEX maintained that the leadership and champion of the environmental projects often engender support and collaboration from the community members through their commitment to the idea. He went further to assert that community members find it easy to trust such leaders and follow his initiatives. This is equally corroborated by FGGRA as he highlighted that the quality of the leadership of the Landlords-Tenant Association in the GRA community have prompted prompt responses of the community members in contributing to projects in their community such as buying a transformer for improved power supply services in the community.

However, communities such as GRA, Ureje and Omisanjan have not recorded any active community-based participation in the USWM in the city. While field observations reveal that GRA communities possess one of the cleanest environments in the city through regular service of the waste collectors, Ureje and Omisanjana communities are low-income communities in

Ado-Ekiti that are poorly served by formal waste collection services. It is thus surprising that Ureje and Omisanjana communities have not had community-based efforts to improve the quality of their environment as it is noted that it is the absence of formal waste collection that has occasioned the organisation of community-based waste management in many deprived communities in developing countries.

Field observations also show that residents in these communities are responsible for the disposal of their household wastes and as such there is the prevalence of waste burning and preponderance of unofficial dumpsites in these communities. It was revealed during an interview that the disconnection from formal waste collection services is primarily due to a lack of road access in these communities. The unplanned nature of many communities in developing countries has made it difficult for sustainable waste management to be practiced. However, the technical resources of EKSWAMA along with that of the private contractors is deemed inadequate to address the waste collection demand of the city. FGTEX pointed out that insufficient resources are primarily responsible for the concentration of waste services in major communities which leads to the deprivation of the hinterlands and developing communities in the city. This is the case in many developing countries where available resources are not matched with the demand for public services in various communities.

While indiscriminate dumping and burning of waste highlights the participation of these communities, their disposition to improved waste management in their communities is also questioned. Direct observations reveal there is no community-based project for solid waste management in these communities to address the lack of formal waste collection in the communities. During the focus discussions, there is no evidence of discussion of waste management issues at the level of community as it is revealed that the monthly landlord-tenant associations meetings in these communities are usually driven by security issues. Commenting on the awareness of SWM issues in their communities, FG-OMCL made the following assertions

*"The discussions on waste management issues rarely come up since everybody is responsible for their waste management. This is not to say that some of us are not bothered by the menace of indiscriminate dumping in our communities but since the government is not ready to help, there is nothing we can do." (FG-OMCL)*

The focus group discussions involving leaders of associations and selected residents from Omisanjana, Ido-Olofin, and Ureje communities highlighted various factors that constitute

obstacles hindering the implementation of community-based actions towards urban solid waste management in Ado-Ekiti. These factors were diverse, with a predominant issue being the absence of proactive associations within the communities willing to spearhead community-based efforts at managing waste in the communities. Following closely was the indifferent attitude of residents and their reluctance to actively participate in such initiatives. It was noted that residents in these areas generally overlook the gravity of waste-related issues and the ensuing disruptions within the communities. Furthermore, some leaders and residents highlighted that government policies discourage the promotion of community-based waste management initiatives at the local level.

It is also revealed that the diverse culture and attitudes of community members in Ido-Olofin and Ureje communities pose significant challenges for the organisation of community-based actions as uncovered in an interview with the youth leaders in these communities. A prevailing sentiment emerged, indicating that a substantial portion of residents within the community displays minimal concern regarding waste-related issues and their subsequent consequences. The indifference is notable, with a majority exhibiting little interest in waste problems or their aftermath.

Moreover, the interpersonal dynamics among residents were highlighted as another major challenge. According to one of the community leaders in Ido-Olofin community, community interactions among residents are notably poor due to their diverse cultural backgrounds. Ido-Olofin community is a developing community area open to various people of different backgrounds which often hinders close associations. This sentiment was also substantiated by evidence from direct field observations whereby the Ido-Olofin community which should be essentially a Yoruba community are preponderantly inhabited by the Hausas, Egbiras, and Ibo people. The lack of mutual contact among households in the neighbourhoods was emphasized by some interviewees, portraying a scenario where such interactions are infrequent and, in some cases, even rare.

Furthermore, the absence of non-governmental organizations (NGOs) in the community was identified as a contributing factor to the lack of community-based waste management initiatives. The interviewees suggested a reciprocal relationship between the dearth of NGOs and the absence of effective waste management initiatives. It was explicitly stated that the community's inability to attract NGOs could be linked to the lack of proactive community-based waste management efforts, and conversely, the absence of such initiatives hinders the establishment of NGOs in the community. This interdependence emphasizes the need for a

holistic approach to address both cultural attitudes and the organizational landscape in order to successfully implement community-based waste management projects.

The narrative above indicates that the community members in Ureje, Ido-Olofin, GRA, and Omisanjana communities encountered challenges preventing the organization of community-based action towards effective waste management. Several factors contributed to this failure, including a scarcity of face-to-face interactions among households, ingrained cultural and behavioural attitudes of residents, a lack of charismatic leadership, insufficient cooperation among community members, and the unwillingness or inability of community leaders to mobilize residents for the provision of public goods. The complexity is further heightened by the influence of government policies, or the absence thereof, which either discourages or fails to encourage the formation of community-based SWM initiatives.

## 5.4 SUMMARY OF CHAPTER

This chapter has provided insights into both formal and informal structures impacting the urban solid waste management of Ado-Ekiti which includes the institutional arrangement of USWM of Ado-Ekiti, the informal sector and the participation of the community in this regard. The results of this research have highlighted gross deficiencies in the resource allocation including financial, technical and human resources for USWM in Ado-Ekiti. Evidence of funding gaps in the funding of recurrent expenditure of the institution revealed by the results of this research accentuates the lack of capacity of EKSWAMA to provide needed human and technical resources to effect regular daily waste collection and disposal in the city of Ado-Ekiti which could have abated the prevalence of unofficial dumpsites in the city.

The results of this research have also illuminated the role of the informal sector in the recovery of resources from waste streams in Ado-Ekiti. While representing a vital sector responsible for diverting valuable resources from waste streams for recycling operations, this research has highlighted the challenges faced by the informal collectors which include non-recognition by the government, deplorable working conditions and social stigma suffered by the public.

Similarly, community participation in waste management in Ado-Ekiti has also been given attention in this research to assess the current role and awareness of the public in proffering solutions to the prevalence of unofficial dumpsites in the city given the current state of waste management in the city. It is revealed that while some understudied communities have instituted community-based action to support the government in improving waste management in their localities, other communities have had challenges in responding to calls to improve the

environmental sanitation of their surroundings and consequently resorted to waste dumping and burning. The following chapter discusses in detail the USWM challenges that promoted the prevalence of unofficial dumpsites in Ado-Ekiti.

# CHAPTER SIX: DEVELOPMENT OF UWDSs IN ADO-EKITI

## 6.1 INTRODUCTION

This chapter discusses the results presented in chapters four and five to address one of the objectives of this research which is determining solid waste management challenges driving the development of unofficial waste disposal sites in the city of Ado-Ekiti. The integration of the results from questionnaire survey, in-depth interviews and focus group discussions provide insights into factors responsible for the indiscriminate dumping of waste and development of unofficial dumpsites within the urban centres of Ado-Ekiti.

## 6.2 DRIVERS OF DEVELOPMENT OF UWDS IN ADO-EKITI

Identifying factors responsible for the development of UWDSs in Ado-Ekiti is considered pertinent to providing a sustainable solution to the problem of open dumping in urban centres within similar developing countries. This section of the thesis discusses the two major themes of (i) waste management practice and (ii) public engagement. These have been identified as drivers in waste management, identified as drivers of the practice of open dumping and development of unofficial dumpsites in the analysis of the results presented in chapters four and five as depicted in Figure 6.1.

### 6.2.1 Urban Solid Waste Management Practice

Under the primary theme of urban Solid waste management practice, various sub-themes were analysed within the framework of the drivers responsible for the facilitation and sustenance of open dumping and development of UWDSs in Ado-Ekiti. These sub-themes include increasing waste generation, poor road access, irregular waste collection/poor service coverage and lack of formalised recycling and composting programmes.

#### 6.2.1.1 Inadequate Staffing

The issue of understaffing presents a significant challenge to urban solid waste management. The increasing population growth in Ado-Ekiti and the corresponding increase in waste generation has exponentially increased, putting increased demand on waste services. Inadequate or lack of staffing for relevant departments such as technical, waste collection, waste disposal, enforcement of waste regulations, and education of the public on waste management challenges the operation of an effective waste collection and disposal service. This has led to the development of UWDSs in the city.


Figure 6.1: Identified Drivers for the Development of UWDSs in Ado-Ekiti

As presented in Table 5.3, 95% of the staff of EKSWAMA are employed on a casual basis with no assurance of permanent placement. The downside to being employed under a casual contract basis, as uncovered in this research, is that a large number of the personnel are grossly underpaid, therefore preventing them from being committed to duty. This is demonstrated from an interview with the representative of EKSWAMA (INT-EKS_1) on the challenge of absenteeism. In his remark,

*"Many a times some do not turn for work, but these people are usually contract staff who do not get regular payments like the permanent staff. Many of them are owed their wages. Their absence at work often affects daily clearance of wastes dumped on the streets because some of them are engaged for that purpose to follow the compactor trucks and assist in loading the wastes. It is often common that daily quotas for number of routes needed to cover daily for waste collection are not met because the follow boy did not show up or there is no driver to drive the trucks". (INT-EKS_1)*

It is evident that staff shortages impact on the daily operation of waste collection and results in uncollected wastes dumped on many roads. This is illustrated in Figure 4.7.

Moreover, shortages in other relevant departments of EKSWAMA, like the technical departments, have also resulted in the delay of execution of tasks that are pertinent to the safe disposal of waste in the city. For instance, during a visit to the premises of EKSWAMA, it was uncovered that some waste collection vehicles remain unserviceable and non-operational on the premises because there is only one mechanical personnel on the payroll. Figure 6.2 shows a compactor that has remained non-operational in the premise of EKSWAMA for lack of a qualified technician to service it. Shortage of skilled personnel in the management of solid waste remains a challenge to sustainable SWM in Nigeria, and this has been substantiated by many studies (Egesi et al., 2016; Chinwe and Ejiofor, 2022). It thus shows that the faulty vehicle required to collect wastes may remain non-operational when the technician is not available to repair it. This, in effect, renders household wastes uncollected and amplifies tendencies for adoption of unofficial dumpsites where available for waste disposals or prompt practice of indiscriminate open dumping in unserved areas. In Uganda, a similar case of uncollected wastes, littering of abandoned pile of wastes by pet animals and growth of UWDSs occasioned by shortage of waste workers has been reported (Castellani et al., 2022).


Figure 6.2: Faulty Waste Collection Vehicles in the Premise of EKSWAMA during field visitation. Lack of prompt of repair of these impacts on the regular waste collection which may lead to open dumping of waste.

Apart from funding challenges, insufficient training opportunities for staff improvement and skill acquisition in waste management further exacerbate staffing issues in USWM in Ado-Ekiti as it is in many Nigeria cities. Lack of adequate training and seminar workshops for staff improvement have meant important tasks in solid waste management remain uncompleted especially when the person in charge of such duty is not available. The instances of absenteeism being indulged by contract staff of EKSWAMA that have rendered tasks such as driving waste collection trucks for daily operation could have been averted if adequate training of qualified substitutes is in place to produce more qualified drivers to drive the compactor trucks in those instances.

#### 6.2.1.2 Inadequate Finance

Adequate financing of waste management systems remains critical in-service delivery. Over the years, SWM in developing countries has been beset with financial constraints that have had detrimental consequences on public health and the environment. In Ado-Ekiti, the financing of waste management systems is mainly sourced from the government's budgetary allocations, which have been noted to be responsible for underfunding of waste management, as shown in section 5.2.1. In addressing the impact of underfunding on the SWM operation in the city, EKSII remarked,

> *"We have proposals from as back as two years on the purchase of new trucks, Personal Protective Equipment (PPE), social awareness programmes that is on the Executive Secretary's desk which is yet to be attended because there is no funding allocation for them. Some of the funds approved by the house of assembly are not enough to cover even daily operation and payment of staff. There are many casual staffs that are being owed. The women sweepers whose money is even as little as ₦5,000 monthly are being owed" (INT-EKS_2)*

Underfunding of waste management operations in Ado-Ekiti has repercussions on the provision of necessary and adequate infrastructure and equipment for service delivery, training of staff, and adequate staffing for effective and efficient waste management operations, which invariably has facilitated and sustained the development of UWDSs in the city. For instance, EKSII intimated that smaller waste collection vehicles needed to access communities such as Idoolofin, Omisanjana, and Ureje Communities, where their road conditions have made it difficult to use compactor trucks cannot be provided with waste collection services due to a lack of funds. Funding challenges in USWM of Ado-Ekiti will continue to facilitate open dumping of waste and development of UWDSs in those unserved communities if left unaddressed.

Even in areas currently served by house-to-house waste collection, reports of an irregular nature of waste collection operation in the city and poor coverage of established routes for waste collection had been linked to lack of funds to effect prompt repair of damaged waste collection vehicles, A representative of one of the private companies engaged for waste collection in parts of Ado-Ekiti complained of how lack of prompt release of funds for repair of faulty waste collection vehicles have often stalled their operation. In his remarks

*"Despite the arrangement made to provide funds for management of our staff and repair of our vehicles, the authority has often reneged on the contract signed with us by delaying payment. What we usually get from them is that funds have not been released by the government. Most often, we cannot make arrangement for the repair of our faulty vehicles or pay our staff because of this issue. As a result, we cannot make the usual rounds to collect wastes as scheduled" INT-PC_1*

The problem of funding is a common challenge for effective management of wastes in urban centres across Nigeria not just in Ado-Ekiti. Significant shortfalls in the funding capacity of some cities such as Ibadan, Enugu, Porthacourt and Uyo has been reported in the literature (Wahab, 2015; Mafara and Magami, 2019; Noiki et al., 2021). Mafara and Magami (2019) submitted that the funding challenge of USWM in many cities in Nigeria stem from the low priority given to SWM such that needed support for good funding of SWM projects is missing amidst a culture of corruption and misappropriation of funds. This, in effect, diminishes the confidence of the people in complying with payment of waste fees, as it is the case in Ado-Ekiti with possible expectation that such fees will be misappropriated by the government. Proceeds from the internal funding scheme of waste management in Ado-Ekiti are not only enough but not forthcoming as many residents refuse to pay and rather have their wastes disposed of indiscriminately in order to evade paying waste fees.

#### 6.2.1.3 Inadequate Equipment

The lack of capacity of the waste management authorities to procure suitable and adequate equipment for proper management of waste in urban centres present a challenge to effective and efficient waste collection and disposal services (Oyedele, 2016; Wilson et al., 2013). With growing urbanization and increasing waste generation, the pressure on waste management services requires sufficient waste collection equipment and appropriate infrastructure to meet the demands. However, findings in this research have shown that EKSWAMA is challenged with inadequate equipment to ensure effective and efficient waste management in Ado-Ekiti (section 5.2.3). This in effect has contributed to palpable presence of uncollected waste and

development of open dumpsites around the city especially in areas that are denied regular waste collection services. In cases where available trucks are broken down and require spare parts to be procured abroad, which usually takes time, the situation becomes worse as even serviceable areas may have to be left unattended till repair is done on affected trucks. It therefore means that the residents in such areas will have to find means to dispose of their waste which in effect aggravates open dumping in the city. The representative of EKSWAMA elaborated on the situation with non-operational waste collection trucks in their garage and remarked,

*"Some of those service vehicles have remained non-operational because the authority could not procure the needed spare part for them. Some of the spare parts are not found in the Nigerian market and can only be ordered abroad in foreign currency. With the current financial situation of the agency and couple with the exchange rate, those spare parts are yet to be procured. Also, many times we struggle to get Mechanic to fix these vehicles especially when they are down on the road. The agency only has one permanent staff in the mechanical department and if some reasons the person is not at work, operation will be delayed until a mechanic can be found to fix the affected vehicle" (INT-EKS_2).*

Wahab (2015) in his findings attributed challenges with availability of service trucks for waste collection in Ibadan to inability to procure spare parts of imported waste collection trucks. Noiki et al. (2021) share similar views and suggested that vehicles with locally available spare parts should be engaged for local waste collection services in order to avoid delays in fixing faulty vehicles in timely fashion. Effective coverage of Ado-Ekiti for waste collection services requires adequate number of compactor trucks for house-to-house waste collection, roll-over trucks for collection communal waste disposal skips and the procurement of small waste collection tricycles to access unserved areas whose road conditions prevented access by compactor trucks and rollover trucks.

#### 6.2.1.4 Poor Enforcement of Waste Regulations

Over the past 20 years, there has been improvement in the promulgation of laws to protect the environment in developing countries. The trajectory of the development of environmental laws and regulations in Nigeria has been reviewed in Chapter Two. However, the significance of these laws and regulations is defeated when they remain unenforced even if they are well designed and timely enacted. Poor enforcement of environmental laws in Nigeria continue to present challenge to environmental sustainability (Abubakar et al., 2022). The palpable practice of open dumping and the presence of UWDSs in Ado-Ekiti reflects partly poor enforcement of waste regulations and policy guidelines in the state. The enforcement of waste management

regulations in Ado-Ekiti is anchored by the EKSWAMA enforcement department, understaffed by 28 casual staff with no single permanent staff. The implication of employing casual staff to manage waste in Ado-Ekiti amidst culture of lack of dedication and absenteeism has been covered in sub-section 6.2.1.1.

The operation of the enforcement team in the city is challenged by many factors including lack of operational vehicles, lack of public recognition and acceptance, lack of tools such as communication gadgets and cooperation of the police. The EKSMA enforcement team lacks the proper tools to effectively carry out their operation. There is no dedicated operational vehicle for them as they had to rely on hired vehicles anytime they are out in the field. This has somehow inhibited their physical presence in monitoring hotspots for open dumping even in areas covered by house-to-house waste collection. Field observation reveals that the enforcement team is not well equipped. Standard communication gadgets to aid communication in monitoring and arresting defaulters are lacking. It was gathered that apprehension of defaulters in most instances had been impeded by lack of this communication gadgets. In his response to some of the challenges facing the enforcement team, INT-EKS_2 remarked:

*"We don't have any vehicle; we hire bus most times. We can only do what we can. At times when the defaulters see us, they ran away and because we are not equipped with gadgets like walkie talkie to communicate with other members of the team, some of the defaulters were able to get away. Some of them will even resist arrest when we don't have any compliance tools like the police. I think we should be accompanied by police especially in areas where our members are usually exposed to dangers. Most at times, we hardly get away unscathed when we are mobbed by these defaulters" INT-EKS_2.*

The exposure of waste management officers to dangers from the public contributes to poor enforcement of waste regulations in Ado-Ekiti especially when the public are not properly sensitized on the importance of their operation. Abubakar et al., (2022) cited lack of awareness of the public as one factor contributing to failed enforcement of waste regulations in Nigeria. Lack of proper education of the public contributes to the unwillingness of some defaulters to pay waste fee which in turn makes enforcement of waste regulation difficult as open dumping and development of open dumpsites becomes prevalent in urban centres.

#### 6.2.1.5 Non-Provision of Public Waste Containers

Field observation shows there is no provision of litter bins and community bins for disposal of unwanted items by pedestrians in the city's core areas, especially areas not covered by the house-to-house waste collection scheme. Key flashpoint areas such as the market areas, main high streets, and business district areas that are potential sites for indiscriminate dumping of waste in the city are devoid of adequate waste containers for use by the public. For instance, in Bisi market area at Ajilosun Community, there is only one waste disposal skip in the area. It, therefore, implies that pedestrians will have to walk several metres to dispose of unwanted items in the area, which is usually not the case. There are several other cases where there are no single public storage community bins such as Nova Community, Idoolofin, Ureje and Ago Aduloju communities.

Focus group members identified that open dumping of waste is partly facilitated by the lack of provision of these public containers in strategic locations. FG-AJCL opined that many people find it easy to dump waste openly when there is no waste basket in the proximity of waste disposal. Packaging materials for products such as plastic bags and papers are easily disposed of indiscriminately when there is no available storage container for disposal. However, FG-EK_1 countered the submission of FG-AJCL and mentioned that the EKSWAMA made for provision for this in the past, but they were vandalised, and some waste pickers even removed them and sold them for scraps. He added that the government removed most existing public waste storage around the city which were often an eyesore on account of being filled up and remain uncollected for days to pave way for the house-to-house waste collection scheme.

Awosusi and Jegede (2013) submitted that street and drain wastes constitute a large part of waste emanating from open dumping and the provision of litter bins and community bins play a prominent role in redirecting streams of waste littering the streets and drains to allow for a cleaner environment. However, Thabit et al. (2020) submitted that the presence of litter bins and community bins have little effect to control open dumping of waste if there is no proper and effective enforcement of waste regulations while noting that the people are inherently prone to openly discard unwanted items in a place where open dumping is already in existence

Reacting to provision of public storage bins during focus group discussion, FGTEX maintained that it is not enough to provide litter bin and community bins to eradicate practice of indiscriminate open dumping of refuse and emphasized that key anti-litter regulations and its implementation has to remain in force to protect those public waste containers as well as

encourage their use by the public. He went further to suggest that provision of standard storage bins should also be provided at household levels to forestall possible transfer of household waste to the streets. This submission was made in reference to cases of possible waste leakages from improper household storage containers in the form of plastic bags, woven baskets and old woven sacks during transfer of wastes for primary disposal. It is noted during field observation that some residents in the city are still accustomed to the use of these unconventional storage containers because they could not afford the provision of standard wheelie bins by EKSWAMA at a cost of ₦20,000. The suggestions that the use of poor household storage containers can potentially aid indiscriminate open dumping in Ado-Ekiti was supported by the findings of Yakubu (2017) in her study on low-income communities in Jos, Nigeria where the use of old improper waste containers may not support the weight of the emanating wastes from households and therefore contribute to waste being burnt or openly dumped in the streets.

#### 6.2.1.6 Increasing Waste Generation

Increasing urbanization, expanding development of buildings, and a growing population in Ado-Ekiti have increased waste generation in the city. As covered in section 3.5, the population of Ado-Ekiti has expanded since the creation of the Ekiti state in 1996 birthing unprecedented influx of people especially the Ekiti indigenes into state capital (Ado-Ekiti). With increasing development in Ado-Ekiti, the rural-urban migration surges, exerting pressure on social services including solid waste management. The increasing waste generation in the city outstrips the capacity of the waste management authority in providing effective and efficient waste management service. The resultant effect of such incapacity promotes open dumping of waste and development of UWDSs as it is in other parts of Nigeria (Ogwueleka and Naveeen, 2021). The representative of EKSWAMA attests to the exponential population growth in Ekiti and how its impact has affected waste management services in the city of ado-Ekiti. Comparing his experience now with that before 1996, FGTEX mentioned,

*"Before the creation of the state, we did not have much of the waste we currently have to deal with then. There is proper enforcement of waste management regulations. Then we have "wolewole" (environmental officers) who goes around the city to ensure that the people are complying with environmental laws by keeping their environment clean and not leaving waste unattended. We have a good system then but now there is a lot of people in the city now, the existing infrastructure for waste management is not sufficient to cater for the demands. And that is why we have several cases of dumping grounds for waste within the city. Although the*

*government is trying but people themselves need to change and have positive attitude towards waste management" (FGTEX).*

Increasing generation of waste in Ado-Ekiti would not have had significant impact on the palpable practice of open dumping and development of UWDSs in the city if proper and adequate SWM infrastructure are in place for effective and efficient waste collection and disposals. Popoola et al. (2017) submitted that the urban sprawl incidences in Ado-Ekiti due to uncontrolled rural-urban migration have resulted in a number of environmental challenges, including the creation of UWDSs, which outstrips the capacity of the government. It is, however, inevitable that with the projected increase in urban dwellers by 50%, solid waste management will continue to present challenges across urban centres in developing countries if sustainable solutions for waste reduction and reuse are not incorporated into existing SWM systems (Srivastava et al., 2015).

### 6.2.2 Public Engagement

Aspects of public engagement in waste management in Ado-Ekiti has also been recognised as a composite theme driving the practice of open dumping of waste and development of UWDSs in the city. Sub-themes identified during analysis of the results include poor road access, irregular waste collection, waste disposal fees, poor awareness on waste, poor public attitude and poor involvement of people in waste management decisions in the city.

#### 6.2.2.1 Poor Road Access

The poor state of road access to communities, especially low-income communities, has been known to hinder effective and efficient waste collection in developing countries (Feronato and Torretta, 2019; Yakubu, 2017). This is occasioned by the impassable state of most of these roads to waste collection vehicles, which prevents their access to effective collection of wastes from waste generators in the affected communities. Similarly, the waste collection service in the city of Ado-Ekiti has been hindered by the number of unmotorable roads in the city which denies access to present house-to-house waste collection in the urban centres. Several studies have reported a number of poor road networks in Ado-Ekiti, which has made social service delivery difficult in recent times (Ayeni, 2021; Popoola et al., 2017).

Despite efforts directed at urban renewal in Ado-Ekiti since the creation of Ekiti state, the consequence of poor urban planning in the city is still reflected in the existence of poor road networks, seasonal nature of road access, untarred road networks, and even lack of road access in parts of the city. Field observation shows that while some communities, such as Adebayo,

G.R.A, and Ajilosun, enjoyed good road networks, some communities, such as Idolofin, Ereguru, and Ijigbo, are without good road networks. Some of the road networks in these poorly served communities have remained untarred without drainage systems, indicating that in rainy seasons, they may become impassable by motorists on account of being waterlogged and pothole-filled. Ayiti (2023) emphasized the damage and lack of a good drainage system impact on many road networks in Ado-Ekiti, making them impassable during the rainy seasons. The dense nature of building development in some communities in the core areas of Ado-Ekiti, such as Okeyimin and Oke-ila communities, has made motorable road access difficult, except for the dilapidation of buildings carried out to pave way road construction in these areas. There are no ways that waste collection vehicles can be deployed for house-to-house collection in these areas hence the propensity of waste generators to have recourse to open dumping of waste as primary means of waste disposal.

Furthermore, the transformation of Ado-Ekiti from local administrative headquarters to the State capital had occasioned an influx of people into the city, thus aggravating the need for more building development in the city. In response, a lot of remote areas have been opened up for development but without road access. Communities like Idoolofin and Omisanjana communities lack good road access and therefore waste services have been completely absent in these communities. The chairman of the landlord –tenant association of Idoolofin attested to the impact lack of road access, has had on waste collection in the communities in his remark below,

*"We have not seen anyone from government to come and collect our wastes since I have been living here. At least for the past 6 years, the people living here have been seeing to the disposal of their own waste. The government waste collection vehicles cannot come here become there is no road for them to pass. Some of us burn our waste in our backyards while some just throw it out in the open and no one has bothered anyone about it" (INT-IOCL).*

The remark made above by CLIII is a testament to the adoption of open dumping of waste and the development of UWDSs in Ado-Ekiti in places where official waste collection services remain absent. This is corroborated by the findings of Ogunleye and Nzoma, (2017) in their study on challenges of sustainable solid waste management in Ado-Ekiti.

#### 6.2.2.2 Irregular Waste Collection/ Poor Service Coverage

The state of urban waste collection primarily reflects the salubrious state of urban centres whereby effective collection services command a clean environment and promote healthy well-

being. Findings in this research have shown that waste collection service in Ado-Ekiti is irregular (Table 4.4). This often occasioned cases of uncollected wastes on streets, on road dividers and provided waste collection skips because the waste collection service providers were not able to turn up as scheduled. The persistent nature of such irregular waste service delivery has seen the palpable presence of waste from uncollected piles of waste, overflowing waste collection skips, and unattended waste collected on road dividers on the streets (Figure 4.13). The position of Ogunleye and Uzoma (2017) on irregular waste collection service delivery remained that such irregularity and inconsistencies birthed the lack of trust nurtured by waste generators to have recourse to open dumping in Ado-Ekiti which in effect promotes development of UWDSs in affected communities. During focus group discussion, participants have substantiated claims of irregularity and inconsistencies in service delivery on the part of EKSWAMA. Some participants, such as FGYLI and FGCG, also pointed out poor service coverage in the city, noting that only the high-income areas and corporations paying huge waste fees enjoyed regular and good waste collection service delivery in the city.

FGYLI narrated his experience with the poor service coverage in Ado-Ekiti and explained

*"I live in the Nova area, and sometimes we see the waste collectors moving from house to house along Adebayo Road, but they don't come to our community, which is just off Adebayo Road. I think they only visit those that they can get money from" (FG-OMYL).*

The effect of such poor coverage of service, especially in proximity to serviced communities, could initiate and sustain the transfer of uncollected waste from unserved places to serviced communities, creating open dumping sites for these serviced communities with the underlying notion that will be removed since they are currently being served by the waste collection. An account of waste transfer was uncovered during an interview with a resident of the Ureje community, citing that a lot of wastes found in UWDSs are not necessarily from the ambient communities. Some of the waste may have been transferred from other communities to keep it away from the community of the dumpsite user.

#### 6.2.2.3 Waste Disposal Fees

Payment of waste fees is a newly introduced scheme as an internal funding mechanism for the management of solid waste in Ado-Ekiti by the current administration to support house-to-house waste collection services in the city. Payment for a waste container of ₦20,000 is not made compulsory, but household waste collection fees remain mandatory for every household and business organisation being served. However, not every household is captured within tax

net of the waste disposal fees. Despite adopting subjective waste fee charging schemes whereby high-income communities pay different rates from middle-income and low-income communities, some households, especially in the middle-income and low-income communities, are currently not disposed to paying waste fees at all. This has prompted households in these categories to evade this tax by adopting open dumping of their household wastes.

INT-EK_1I noted that these defaulters undertake open waste dumping during the night or early hours in the morning to avoid detection or evading arrest by the enforcement team. In his statement,

*"We have noted some people openly dumped their wastes, especially at the road dividers at the old garage because they don't want to pay wastes. They do this during the night or early in the morning so that our enforcers will not catch them, but we have instructed our enforcers to start coming out early in the morning to catch these defaulters in the act and be made to face the law" (INT-EKS_1).*

It may be argued that the defaulting of payment of waste disposal fees is hinged on the willingness and capacity of the public to pay for it in the first place. Findings in this study show that willingness to pay waste disposal fees is not enough when the capacity to pay is absent. 5% of the respondents in the questionnaire survey indicated that high waste disposal fees are one of the reasons for adopting UWDSs in Ado-Ekiti. During the focus group discussion, FGEXP indicated that the urban poor in Ado-Ekiti, especially in the low-income communities, may find ₦500 waste disposal fees too expensive to pay, and that may be responsible for sustained adoption of open dumping of waste in those communities. The willingness to pay waste disposal fees has also been investigated in Ado-Ekiti by Adebo and Ajewole (2012) and found out that poverty, large family size and living in close proximity to dumpsite may negatively impact the willingness to pay waste disposal fees in the city. Similarly, findings in this research reveal the proximity of unofficial dumpsites and central waste collection points to the respondents of the questionnaire survey in this research concerning the socio-economic status of their neighbourhood. 57% of respondents using unofficial dumpsites in low-income and middle-income communities indicated that these waste sites are within 5 minutes' walk from where they live, while 40% of respondents in similar communities have revealed central waste collection points exist within similar distances (Table 6.1).

Table 6.1: Percentage of Waste Disposal Points within certain distances of different social economic community groups in the Study Area.

| Distance to adopted waste disposal Sites | Low Income | | Middle Income | | High Income | |
|---|---|---|---|---|---|---|
| | Unofficial dumpsite | Central Waste Points | Unofficial dumpsite | Central Waste Points | Unofficial dumpsite | Central Waste Points |
| 0-5 min Walk | 30% | 29% | 27% | 11% | 0% | 0% |
| 6-10 min Walk | 18% | 19% | 7% | 9% | 7% | 3% |
| 0-10 min Drive | 4% | 10% | 5% | 2% | 2% | 0% |

** (i)Walking speed with waste estimated as 12 minutes /km (ii) Driving 3 minutes/km*

#### 6.2.2.4 Lack of Formalised Recycling and Composting Programmes

Lack of formalised recycling and composting programmes in Ado-Ekiti has been uncovered in this research to be linked to the practice of open dumping and development of UWDSs in Ado-Ekiti. There is currently no formal recycling and composting programmes in Ado-Ekiti that could have diverted a lot of resources such as food wastes, plastics, metals and glasses being openly dumped in the streets or some that are found in the UWDS in the city. The majority of the respondents (72%) of the questionnaire survey indicated they do not practice waste segregation (Figure 4.11), while some participants in the focus groups were not aware of the resourcefulness of waste that could have gone into recycling and composting programmes. The underlying factor for the poor practice of recycling and composting at household levels in Ado-Ekiti is the poor awareness on the subject.

The representative of EKSWAMA during focus group discussion admitted that the administration is just taking up recycling programmes as pilot schemes in the state which is currently proposed to be piloted at the Government Ministries, Departments and Agencies (MDAs). It was conceived during the focus group discussion that recognizing values in waste being disposed of could have limited the ease with which people openly disposed of recyclables in the city, especially considering that people could earn a living from it. Moreover, the development of formalized recycling and composting programmes in Ado-Ekiti would have reduced the existing quantity of waste required to be collected by the house-to-house waste collection, which in turn reduces the current burden of waste collection and disposal that is driving the development and adoption of UWDSs as primary and secondary means of waste disposal in the city.

Furthermore, the only recycling schemes in the city are currently being undertaken by the informal sectors, with members who go about visiting households and open dumpsites to collect recyclables to be sold to vendors (see section 5.3). Lack of formal recognition of these vital stakeholders of solid waste management in the city have sustained social bias and discrimination against this group such that only a few people are involved in the capturing of the resources in the existing waste streams in Ado-Ekiti towards sustainable materials management and waste reduction in the city.

It is thus pertinent that government supports integration of the informal sector in the scheme of waste management. It is vital that policy is put in place to restructure and regulate the sector alongside creating awareness for recycling and composting programmes at both household levels and community levels to facilitate the growth of the economy and phase out the development of open dumpsites serving as repositories for recyclables. In substantiating this recommendation, Oni et al., (2019) submitted that the recognition of informal sector in Ado-Ekiti would improve management of MSW in the city such that efforts in capturing resources lost in waste streams can be amplified to a substantia degree that can drive the economy and minimise waste.

**6.2.2.5 Poor Awareness on Waste Management.**

The perception of people on waste has been found to influence their behaviour towards the nature of waste. The general view on waste as dirty unwanted materials has caused many in developing countries to dissociate themselves from it and such crass ignorance summed up their waste behaviour. The challenges of waste mismanagement in developing countries are partly derived from the low public awareness on waste and therefore recent studies have been devoted to raising proper awareness on solid waste management (Adekola et al., 2021;). In Ado-Ekiti, poor awareness on waste is partly responsible for the prevalence of unofficial waste dumpsites such that even people living in close proximity to these waste sites are not even aware of the danger it poses to them. Apart from the aesthetic defacement of the environment, which was uncovered to discourage some people about UWDSs, it was observed people are not really bothered by the presence of these waste sites. This goes to show that awareness on environmental issues in Ado-Ekiti remain poor, substantiating the findings of Daramola et al. (2023).

Participants of the Focus Group discussion reveal that some residents are less concerned about the presence of UWDSs in their neighbourhoods as far as it is not obstructing the entry into their residences noting that environmental issues do not really come as an agenda in their

discussion during their community meetings. This is because it is believed that it is solely the responsibility of the government to manage waste in the state. However, responding to the effort of the government in the areas of awareness EKSII made the following remark.

*"Very often we receive complaints from people especially in the G.RA. some of whom who have connection with people in power on the abandoned waste in their Neighbourhood. We have had various programmes on creating awareness about waste management issues. We pay airtime on TVs and radios to warn people about open dumping of waste in the state. We used to have radio programmes to sensitize people on environmental issues in their community and give them opportunity to call in to express themselves on the environmental state of their community". (EKSII)*

It is however uncovered that the socio-economic status of residents may bear significantly on the level of awareness and reaction to environmental issues in their surroundings. The prevalence of unofficial dumpsites in low-income communities such as Ureje, Oke-Ila, Ago Aduloju communities may not entirely results from the absence of waste collection services in these areas. It is believed that proper awareness of environmental issues would have made people have recourse to self-help in dealing with the menace of UWDSs as it is in countries such as India, Indonesia and Bangladesh (Thakur et al., 2021; Yandri et al., 2023; Ashikuzzaman and Howlader, 2019). As such, social economic status of the residents in Ado-Ekiti may bear influence on the level of awareness and active response to environmental concerns in their communities. This is in agreement with the findings of Daramola et al. (2023), submitting that social-economic attributes constitute determinants of awareness of environmental issues across development zones in Ado-Ekiti.

#### 6.2.2.6 Poor Public Attitude

Attitude has been described as a cultivated behaviour which reflects reactions to a phenomenon or object that may either be positive or negative (Omonijo et al., 2019). Public attitude to waste management in Nigeria has become a subject of research in recent times (Omonijo et al., 2019; Alagbe et al., 2021). Poor attitude to waste remains a challenge to effective MSW management and poses a significant threat to government efforts to achieve significant progress, especially in solid waste collection and disposal. It is uncovered in this research that the general attitude to waste by urban dwellers in Ado-Ekiti leaves much to be desired from the point of generation to disposal. Apart from the fact that many residents consider waste as dirty materials, the impression held by many that government should be solely responsible for waste management

in the city has sustained negative attitudes of some residents towards proper storage of waste, handling of waste and unsafe disposal of wastes.

Several accounts by the participants of the focus group depicting the attitudes of people which culminates into indiscriminate dumping of waste in the city of Ado-Ekiti are as follows:

*"It is my view that some people are just lazy and do not really care about the environment. I have seen people dumping waste openly at work through windows even when there is provided waste bin to use. Some are just brought up that way and that's why I believe awareness should be done at household levels not the usual one you see people on the streets marching with banners for a period of two to three hours and get paid" (FG-ADCL)*

*"People consider that waste business is dirty and would be associated with it. Majority of the men are turned off by anything waste and that's the reason why you see only women doing cleaning at home or involved in sweeping the streets. I can tell you that indiscriminate dumping of waste is mostly practiced by men. Women are more disposed to a clean environment and would not litter waste around or find it difficult to dispose of their household waste where disposal facilities are made available" (FG-AJCL)*

*"I think the adults can also be blamed for this when they use children to do most of the household chores at home including disposal of waste. Many households don not have a good compound which affords them to burn their wastes at home. So, they had to take it out and dumped it in dumpsites or anywhere. But when you use children to this, they just tend to dispose the wastes anyhow if it is away from their homes. Sometimes, these wastes are too heavy for these kids and are not properly stored in good containers. So, there is tendency for these wastes to be dispose at any first opportunity which on many occasions pile of wastes have been found in unusual places such as the front of someone else's gate or in the middle of the road". (FG-TEX_1)*

From the accounts above, it is clear that aspects of indiscriminate dumping of waste are direct results of negative household attitudes which is corroborated by the findings of Kamau (2016). It is also revealed that age and gender constitute key determinants for open dumping of waste and development of unofficial dumpsites in Ado-Ekiti. Households composed mainly of men and children may be more disposed to adoption of open dumping relative to households where women significantly shoulder environmental responsibilities. In a separate study from Ghana. Adzawala et al. (2019) found out that indiscriminate dumping of waste is more ascribed to men than women.

#### 6.2.2.7 Non-Inclusiveness of Residents and Communities on SWM Decisions

The non-inclusiveness of residents and communities in the decisions on management of Solid waste in Ado-Ekiti has been uncovered in this study as one of the drivers of indiscriminate open dumping of waste and development of UWDSs in the city. The respondents of the In-depth interview and participants of the focus discussion revealed how the government failed to engage them on issues concerning waste management in the city. Some of the responses that highlights poor engagement with the residents and communities on the management of solid waste in Ado-Ekiti are provided as follows:

*"The government has never consulted us and send anybody to know how we feel many about many decisions they have taken. You will just wake and hear that we are supposed to pay certain fees for waste collections, something that has never happened before. It is very unfair. A lot of people are struggling to eat as it is in this very bad economy. How do expect them to pay for waste collection if you know you are not capable to carry out the programme yourself".*

*"To tell you the truth, the purchase of those compactor trucks came as a shock. I know these vehicles are being used abroad to collect wastes effectively, but this is not abroad. Many of the spare parts are not available in Nigeria in case the vehicles break down. Those vehicles cannot even access some places in Ado. People that don't about waste management are ones making decision because they are connected with present administration".*

*"If we have been consulted on their plans, we can easily educate them on what we want as a community when it comes to waste management. You see those dumpsites needs to be removed to pave for skips that are once located in Oja Bisi. That way their vehicles can come in and take them away regularly".*

*"This government do not really care about us. All they do is looking after their own pocket in the name of providing for the people. The waste fee is for their pocket, there is nothing they will do about it. Nobody asked us anything about it. I found out from neighbour when it was introduced. It is not as if people don't what they usually do with their and they think making people to pay the waste fees will not make people throw the wastes away in a bid to escape paying the fees" (FG-TEX_2).*

It is evident from the accounts above that the public are not carried along in the decision making on SWM in the city which is crucial to enlisting their full cooperation in their waste programmes for the people. Open dumping of waste and development of open dumpsites would have been drastically reduced if the public are actively engaged in the programmes in place to eradicate open dumping such as the house-to –house waste collection programmes and the introduction of waste fees. As much as it is the responsibility of the government to manage solid waste in the city, the public is an important stakeholder whose active participation is required as a user of the services provided. Wilson et al. (2013) submitted that the approach taken government in the developing countries to take decisions on waste management in isolation constitute barriers and challenges to integrated sustainable waste management.

## 6.3 MITIGATION MEASURES FOR THE DEVELOPMENT OF UWDS IN ADO-EKITI

The challenges of the present urban solid waste management in Ado-Ekiti have been expressly linked with the drivers of open dumping and development of UWDSs in the city in this chapter under three primary themes which include Governance, Solid waste management practices and Public Management. Based on these findings, the following measures have been proposed by the researcher for implementation. However, some of the measures can be ambitious and deemed unfeasible for short term implementation under the existing waste management system in the city.

### 6.3.1 Revamping staffing structure.

This research has identified shortage of staffing and unstainable staffing structure as a challenge to sustainable USWM in Ado-Ekiti which in effect has facilitated practice of open dumping in the city. It is recommended that the government revisit the staffing structure of EKSWAMA to give room for more employment on a permanent basis than the present provisions. This will enshrine dedication and commitment which is currently missing with the disposition of attitudes towards important task in their various departments. It is also advisable that staffing levels are increased substantially most especially in important departments that sees to effective removal of wastes from the house, streets and communities of Ado-Ekiti such as the technical and operation departments. In addition, scheduled training of staff will be needed for upskilling of the staff especially in promoting the pool of alternates to ensure vital operations are not put on hold on account of unavailability of specific staffs.

### 6.3.2 Increased Funding for USWM in Ado-Ekiti.

The funding of USWM in Ado-Ekiti should be increased to address perennial cases of shortfall in funding both recurrent and capital expenditures which was uncovered in this study. The budgetary allocations from the Government for USWM should be increased for improved services to be achieved. While the increased budgetary allocation may seem unlikely, the internal funding scheme in form of payment of waste collection fees can be enhanced by undertaking proper enumeration of houses in Ado-Ekiti as a lot of houses are not currently captured in the tax net. Moreso, the waste fees should be made mandatory for every house in Ado-Ekiti such that residents that are currently served by house-to-house waste collection scheme will stop adopting other means of waste disposals once they are aware they will eventually pay for the waste fees.

Funding for USWM can also be supported by establishing formalised recycling and composting programme in the city. The capture of resources in form of recyclables and compostable wastes form the potential to generate income and means of livelihood for the government as well as the public.

Moreso, the government should look into external funding schemes through more partnerships with private sectors and non-Governmental Organisations (NGOs) such that effective coverage of the city for waste collection can be achieved. Aspects of contract in respect of remunerations should be favourable to attract biddings for waste management projects in the city. The present arrangement favoured 4/5 of the remunerations to the private sectors. However, a complete control of remunerations by the private sector can enhance their operation such that waste collection and disposal will no longer be obstructed by delay in payment by the government.

### 6.3.3 Adequate Provision of Waste Containers at household and Community Levels.

The provision of adequate containers for waste storage at both household and community levels will significantly reduce the practice of open dumping and development of open dumpsites which will in turn improve SWM performance in the city. Major hotspots for open dumping of waste such as people concentrated areas as in the market areas, main high streets and business districts should be equipped with waste containers within reasonable distance of a few metres to encourage waste generators to use without having to travel miles to use them. Strategic location of waste containers has been reported to enhance safe disposal of waste in the literature (Ogwueleka, 2009). The current provision of a wheelie bin at ₦20,000 should be subsided for the affordability of households in middle-income and low-income communities so that the

problem of transfer of wastes from unsuitable waste storage containers to street can be addressed.

### 6.3.4 Improved Road Accessibility

The problem of road accessibility by waste collection vehicles has been highlighted in this research to constitute drivers for the practice of open dumping and development of UWDSs in Ado-Ekiti. It is therefore important that the urban renewal programme by the Ministry of Housing and Urban Development should be re-activated and extended to areas with poor access, most especially the low-income communities such as Ureje, Idoolofin, Ago-Aduloji and Omisanjana communities. This intervention will enable these communities to be able to access the house-to–house waste collection services such that the prevalence of open dumpsites in these areas can be phased out. It is acknowledged that this may not be feasible as a short-term intervention. An alternative model is provided in Chapter seven which outlines the community-based interventions as part of an integrated participatory approach to urban solid waste management in Ado-Ekiti.

### 6.3.5 Improved Awareness on Waste Management in Ado-Ekiti

As highlighted in this research, one of the barriers to effective public participation in USWM in Ado-Ekiti that has promoted practice of open dumping in the city is the poor public awareness on waste. The seasonal street-walk campaigns should not be limited to the main high streets in the city but extended to the remotest locations in parts of Ado-Ekiti where poor education on waste has partly culminated into palpable practice of open dumping and development of unofficial dumpsites. This needs to be addressed by improved campaigns targeted at households and communities through community-based approaches. Community platforms such as schools, churches, mosques and community-based associations can be leveraged to connect with more urban dwellers as a complimentary intervention on the existing approach by EKSWAMA. Moreso, electronic awareness campaigns should be intensified on radios, Televisions and social media platforms. While this may be a costly intervention, improved low-cost airtime for environmental and sanitation awareness should be secured with the state-owned local radios and televisions. The Ekiti State television (EKTV) and Ekiti FM Radio can be engaged to provide improved environmental and sanitation awareness in the city.

An ambitious strategy is the introduction of waste and sanitation programmes in education programmes in primary and secondary education as an integral part of basic education curriculum. The early inculcation of basic waste and sanitation programmes will improve

awareness of children and young people so that occasions of children mishandling wastes may phase out.

### 6.4.5 Inclusive Waste Management Policy Design

Research has shown that effective and sustainable SWM can be achieved through an integrated system that recognizes the contribution of the communities in the provision of waste services and in the making of policies that impact the success of such services (Kain et al., 2021). Findings in this research has highlighted the failure of the government in the adoption of an inclusive system. Most importantly, the informal sector which represents a vital stakeholder in capturing the resources from waste streams in the city has not been given any formal recognition to improve recycling and composting programmes in the city. By representing a significant sector in the inventive form of participatory co-production of waste management services, formal integration of waste pickers in USWM systems is expected to promote waste reduction and limit transfer of wastes to UWDSs.

Moreso, the public, which represents the largest waste generators in the city constitutes a vital stakeholder whose involvement should be given a place in the process of designing waste management policies in the city. However, it is revealed in this study that the communities are not involved in the making of waste management policies especially in areas that pertains to the provision of waste management services and location waste containers. Environmental policy making should involve the chairmen of community associations, youth leaders, ward chiefs and other community leaders that can wield the power of influence over the behaviour and attitude of community members towards waste management projects in the city.

## 6.4 SUMMARY OF CHAPTER

The results of this research have shown that urban solid waste management in Ado-Ekiti faces many challenges which is accentuated by the problem of open dumping and development of unofficial dumpsites across the city. Environmental implication of the prevalence of UWDSs in the city is concerning, as the city faces an expanding population and increasing wastes.

The findings of this research have highlighted the major drivers responsible for the practice of open dumping development of UWDSs in Ado-Ekiti under the existing institutional framework and waste management practices. The major drivers are grouped under three major themes which include governance, waste management practices and public engagements.

In respect of the findings of this research, the researcher has made a lot of recommendations which is acknowledged to be ambitious and may be difficult to implement as a short-term

measure under the existing solid waste management system. However, another approach to address the SWM challenges in Ado-Ekiti is to explore interventions which are targeted towards resource management and waste reduction. Chapter seven of this thesis evaluates community-based interventions which are targeted towards phasing out development of unofficial dumpsites in the city.

# CHAPTER SEVEN: INTERVENTIONS FOR THE MANAGEMENT OF UNOFFICIAL WASTE SITES IN ADO-EKITI COMMUNITIES

## 7.1 INTRODUCTION

This chapter evaluates intervention options for the management of UWDSs in Ado-Ekiti communities. From discussion in Chapter 6, UWDSs are created principally through an aggregation of factors which included ineffective waste management practice and poor engagement of the public in waste management. Despite the incapacity of the local authority to provide a sustainable waste management system, public engagement in waste management is rather poor. It is therefore considered within the scope of this research that the community and other relevant stakeholders can play a crucial role in interventions targeted at the development of these waste sites in their local environment such that the environmental degradation associated with open dumping is minimized while valuable secondary resources are retained within the economy.

Hence, community-based waste reduction and utilization interventions within the context of ISWM are deemed pertinent for consideration in this research to close the gap that has perpetuated the development of unofficial waste sites in communities.

## 7.2 PROPOSED INTERVENTIONS

Table 7. 1 presents the result of the preliminary analysis of intervention by the participants of the focus groups, which reveals that the majority of the wastes dumped in these sites can be diverted through source-reduction and waste-diversifying initiatives, including reuse, home composting, community composting, and community recycling scheme as analysed by participants of the focus groups. For instance, participants identified that home composting can effectively reduce food waste in the waste streams while items such as rubber, leather, and polythene bags can be used for reuse or sent for recycling. Community composting and community recycling are waste diversion initiatives within the waste hierarchy of integrated solid waste management. The evaluation of the present waste management system in Ado-Ekiti reveals there are no formal composting and recycling programmes in the city except for the proposed pilot recycling scheduled to be demonstrated in the ministries, departments, and agencies of the government. The absence of these vital schemes that could have diverted valuable resources from open dumping in the study area demands that an evaluation is carried to understand the possible barriers and drivers towards the implementation of the scheme.

Hence, a SWOT analysis of community composting and community recycling schemes is undertaken in this research by engaging with the key informants in a focus group discussion.

## 7.3 STAKEHOLDER-BASED SWOT ANALYSIS OF PROPOSED WASTE DIVERSION INTERVENTION

Figures 7.1 and 7.2 present the stakeholder-based SWOT analysis of the waste diversion schemes. The strength, weakness, opportunity and threat components of community composting in Ado-Ekiti is discussed before the analysis of the community recycling schemes.

### 7.3.1 Community Composting

#### 7.3.1.1 Strength

In the consideration of the strength of community composting by the participants of the focus group discussion, it is revealed that community composting is preferred over home composting for waste diversion in communities. The preference for community composting over home composting was influenced by the spatial constraints faced by households in the study area, making community composting a more practical choice. Although home composting shares some strengths with community composting it is perceived that community composting presents the opportunity to drive greater diversion of wastes from UWDSs and OWDSs through joint community effort which may not be recorded with home composting by limited individuals in communities. For instance, INTFG11 mentioned that it is easier to monitor and expand with community compositing through community-based organizations than to commit the task to households who in most cases may not be willing to practice. With centralized composting facilities, community members can easily key in to divert huge number of compostable wastes emanating from households.

Table 7.1: Stakeholder-Based Preliminary Assessment of Waste Reduction and Diversion of the Waste Profile of UWDSs during the Intervention Focus Group Discussion.

| **Waste Materials** | **% Composition** | **Quantity MSW Generated (Kg/day** | **Source Reduction Intervention** | **Waste diversifying Intervention** |
|---|---|---|---|---|
| Food Waste | 9.79 | 29,400 | Reduce, Home Composting | Community Composting |
| Bones | 3.73 | 11200 | x | Community Composting |
| Rubber and Leather | 3.71 | 11,100 | Reuse | recycling |
| Polythene Products Waste | 12.7 | 38,100 | Reuse (Bagco bags, Dangote cement bags for shopping, reusable bottles) | recycling |
| Paper and Cardboards | 8.15 | 24500 | Home composting | recycling |
| Textile Waste | 4.36 | 13100 | Recycling | recycling |
| Leaves and Vegetables | 8.39 | 25,200 | Home Composting | Community composting |
| Animal Dung and Excreta | 5.83 | 17500 | Home composting | Community Composting |
| Wood Waste | 5.20 | 15600 | Home composting | Community Composting |
| Charcoal | 1.35 | 4,050 | x | x |
| Fruit Waste | 12.5 | 37600 | Composting | Community composting |
| Coconut and Palm Kernel | 1.13 | 3390 | Home composting | Community Composting |
| Tuberous Peels Waste | 7.66 | 23000 | Home composting | Community composting |
| Metal and cans | 3.90 | 11700 | | Recycling |
| Glass and Ceramics | 9.70 | 29100 | Reuse | Recycling |
| Miscellaneous Waste (Sands, dirt, ashes, stones) | 1.90 | 5700 | x | x |

x - Disposal

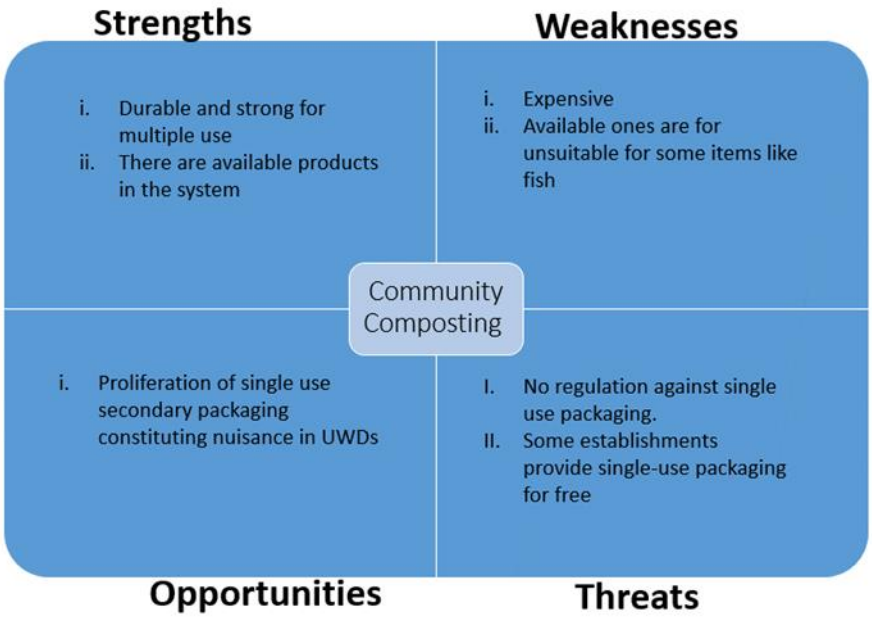


Figure 7.1: SWOT Analysis of Community Composting as a Waste Diversion Scheme

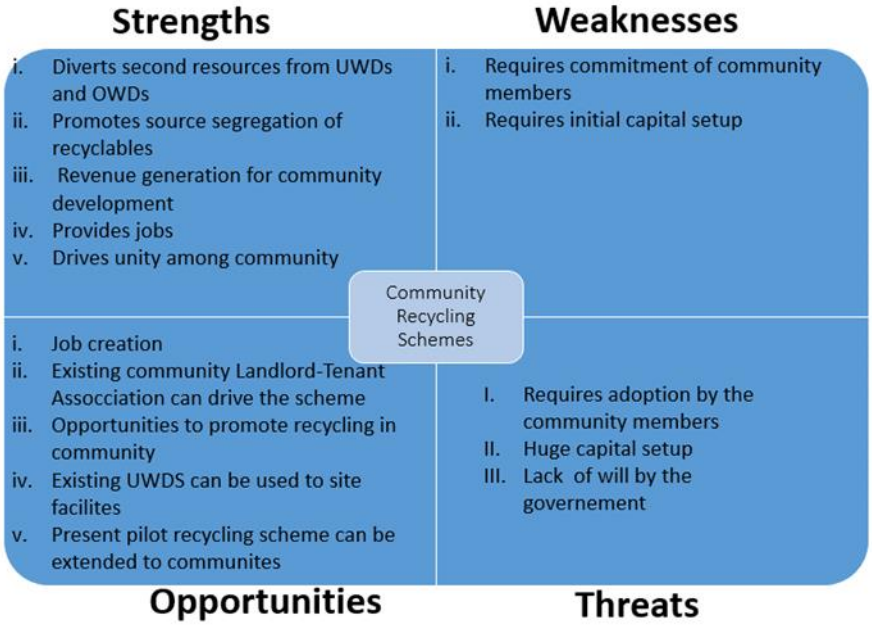


Figure 7.2: SWOT Analysis of Community Recycling Scheme as a Waste Diversion Scheme

Moreover, community composting is suitable for the organic component of the waste streams which constitutes 49.1% of the waste profile of UWDSs in Ado-Ekiti. Participants acknowledged that by opting for community composting, they have a better chance to divert these aspects from local UWDS which otherwise presents danger to the environment or saves cost of collection and transportation to OWDSs. More emphasis is placed on the communal approach associated with community composting which serves to foster unity and cooperation among community members through interactions and engagement. INTFG03 identified that community composting brings people of different backgrounds and culture in the neighbourhood together to develop a sense of shared responsibility towards a common goal. In essence, such shared endeavour facilitated the management of organic waste and served as a platform for building social connections and strengthening community ties.

Moreover, the utilization of compost generated from community composting initiatives was seen as a tangible benefit for the community. Participants acknowledge that compost produced from organic waste within the community could be utilized in place of chemical fertilizers, which are often bought at higher cost to support their gardening and farming for various purposes that benefit the neighbourhood, such as enriching soil for community gardens or landscaping projects. It was mentioned that INTFG 02 and INTFG 06 intimated that composts from community composting can be sold to support local community projects. This aspect not only highlighted the environmental advantages of recycling organic waste but also underscored the potential for community composting to create tangible outcomes that enhance the quality of life for residents.

#### 7.3.1.2 Weakness

While it is a preferred choice among the participants, community composting presents challenges that may impact on its adoption and viability. One of the primary concerns identified by participants was the availability of resources needed to implement and sustain community composting. In these regards, concerns were raised regarding finances, infrastructures, and logistics. For instance, INTFG07 highlighted that the Omisanjana community could not buy a new transformer to restore power to the area due to financial constraints and added that without the support of the government or other stakeholders, funding and other needed resources may hamper the implementation and sustainability of community composting.

Another concern was that securing suitable land spaces for community composting may constitute an issue (INTFG02, INTFG05, INTFG07). It is acknowledged that the proposed land space for such a community project should not only be accessible and suitable to accommodate

the composting needs of the community. In a countered response to challenges of securing land space for community composting, INTFG 04 recommended that existing UWDSs should be cleared and converted to composting facilities.

Another significant issue identified by participants was the timescales associated with the composting process. Participants (INTFG11, INTFG07) pointed out that community members might find composting time-consuming to address the immediate needs of farmers to procure composts. While it is raised that impatience may prompt potential customers to resort to alternatives such as chemical fertilizers, it is believed that constant output of composts may be relied upon once the system is up and running. However, these concerns underscore the significance of efficiency and timeliness in community composting to ensure the continued participation of community members in the initiative. The need to overcome these obstacles is essential for maximizing the effectiveness and sustainability of community composting initiatives, highlighting the need for strategic planning, stakeholder collaboration, and potentially external support to mitigate these challenges and enhance the overall success of community-based composting programmes.

#### 7.3.1.3 Opportunities

One major opportunity identified by participants (INTFG03, INTFG06, INTFG 11) was the potential for larger-scale production of organic fertilizer presenting a significant opportunity for sustainable and economic development. It was acknowledged that large production of composts in communities presents opportunities for job creation and skills development for unemployed youths who, in their teeming numbers in the country, will not only be engaged in the initiatives but promote the grassroots youth support for farming to drive the agricultural-based economy in Ekiti state.

Participants also considered income generation associated with large-scale production of organic fertilizers an impetus to drive the initiative and facilitate its expansion across communities. The economic benefits of compost production will incentivize community members' participation and enhance the initiatives' financial viability.

For instance, INTFG06 stated that

*"sales of composts on a large scale will potentially force the cost of chemical fertilizers down. One litre of Super Gro costs about ₦15000 in the market. This is quite expensive for people with large farms. Many people will start looking into compost once it is available in the market". INTFG06*

Another Opportunity identified by participants (INTFG09, INTFG04) is the potential of community composting to foster environmental awareness of the usefulness of organic waste thus presenting a cultural shift towards eco-friendly behaviour which protects open dumping of organic waste in communities

#### 7.3.1.4 Threat

The potential risk of pollution associated with community composting when not managed well was raised as major concerns. Participants (INTFG02, INTFG04) emphasized the odour associated with large-scale production of composts, which may threaten the communal initiative's adoption, location, and sustainability if not addressed. Moreover, exposure to different organic waste from variable sources also presents health-related risks to the waste collectors and managers of the composting sites. There are shared concerns on the attraction of pests and vermin in composting sites which can potentially aid transfer of infection and diseases, thus constituting public health risks, especially for those living close the composting sites. INTFG02 advised that the need for stringent protocols and hygiene practices is essential to minimize the transmission of pathogens and ensure the safety of individuals involved in composting.

Other threat factors similar to those raised as the weak component of the community composting are the financial resources needed to implement community composting and thus the involvement of the government in funding the initiative is needed. INTFG02 initiated that the involvement of EKSWAMA in promoting the initiative will not only ensure its sustainability but also reduce costs associated with the transportation of wastes to OWDSs

### 7.3.2 Community Recycling Schemes

#### 7.3.2.1 Strength

In addressing the strength of community recycling schemes, participants of the focus group discussion identified several benefits of the communal approach. One primary strength identified by participants (INTFG02, INTFG07, INTFG08) is that community recycling schemes presents the potential to divert recyclable wastes from the waste stream in both UWDSs and OWDSs. Shared concerns on the prevalence of plastic wastes such as “pure water sachet” and shopping “nylon” bags by participants lends support for the adoption of community recycling schemes. For instance, INTFG08 mentioned that the communal scheme will discourage open dumping of valuable materials that can be recycled for secondary uses. Another significant benefit of community recycling schemes is the potential to turn waste into wealth for community development. Few participants (INTFG02, INTFG04) identified that a

community recycling scheme presents the potential revenue generation schemes for participating individuals and the community in general by selling recyclables to recycling vendors.

Furthermore, the tendency of community recycling schemes to foster unity and cohesion in a community in responding to environmental challenges and creating awareness that enshrines pro-environmental behaviour in community members was also identified as a major strength. INTFG02 acknowledged that a communal approach to recycling will promote social cooperation and participation in neighbourhoods in his remark;

*"I know there are some in my community that we have not had chance to talk to each other until we had a power problem. Some of these people attended the first meeting we had and we were able to deliberate on how to restore power to our community. I am not particularly happy with way people litter wastes around, So I believe that community projects on waste management will cause people to interact with each other to find a way to solve their common problem" (INTFG02)*

*The submission above was also shared by INTFG 09 and re-emphasized that individuals can be moved to engage in an initiative if they can see it being undertaken by others close to them. He further advised that recycling is currently the direction of the present administration to divert recyclables from waste stream in Ado-Ekiti by initiating pilot recycling schemes in Ministries, Departments, and Agencies (MDAs) of Ekiti State government parastatals.*

**7.3.2.2 Weakness**

One primary weakness identified by participants (INTFG07 and INTFG 03) was the resources needed to implement and sustain community recycling schemes. Share concerns on the major weaknesses regarding resources, funding, and infrastructure. Questions on who and how to fund the initiative feature in the discussion. INTFG02 emphasized that without the government's backing to provide resources such as bins for waste segregation and facilities to accommodate segregated wastes, community recycling may not be easily accomplished by individuals in the community.

Another weakness raised is that community recycling schemes require community members to be fully engaged in the schemes such that results can stimulate and perpetuate continued participation. Participants (INTFG06 and INTFG07) noted that some community members

may not partake in the schemes especially those that hold the perception that the government should be solely responsible for the management of waste in the city. Such perceptions often present resistance to community engagement in waste management if proper and adequate awareness is not in place to educate the public on individual responsibility for the waste they generate (INTFG06).

#### 7.3.2.3 Opportunity

Most of the Intervention Focus Group Discussion (INFGD) participants identified several community recycling opportunities. Apart from the significant opportunities to divert recyclable wastes from the waste streams in UWDSs and OWDSs, the schemes present opportunities to provide job for the unemployed in the community. In this respect, the pool of unemployed youth in the community can be tapped into to drive and sustain the scheme (INTFG05). INTFG03 hinted that the community youth development association is a good place to start where teeming youths can be recruited in the scheme, highlighting that the youth can mobilize for support for the scheme in the community as they possess the number, the reach, and the network to garner necessary cooperation among community members.

Another opportunity identified by the participants is the potential that the schemes present opportunities for the government to establish partnerships with non-governmental agencies, private sector organizations, and local informal workers such as waste pickers and scrap dealers in the community. INTFG 03 noted that partnerships with all relevant stakeholders are needed to ensure sustainable growth in addressing waste managements in Ekiti state. The local informal workers most especially remain untapped resources for formal integration in the recovery of valuable resources in the city of Ado-Ekiti. The recognition of the inform sector presents an opportunity to work with community members in collecting their segregated wastes and delivering them to appropriate facilities for treatment (INTFG03).

Furthermore, community recycling schemes present an opportunity to convert existing UWDSs to recycling sites to mitigate concerns raised regarding land allocation, which is considered the initiative's weakness. INTFG03 mentioned that many UWDSs are abandoned land that the government can convert to establish centralized recycling facilities accessible to community members.

#### 7.3.2.4 Threat

The threat component of community recycling schemes is similar to those expressed for community composting in the discussion. Despite various benefits and opportunities presented

by community recycling schemes, it is evident that the schemes may be impacted by two key threats which include funding and habitual open dumping practices by the public.

Funding of community recycling schemes has been highlighted by participants as a threat factor that bears on the implementation and sustenance of the initiative. INTFG03 identified that funding is required to set up recycling facilities, procure resources for collection, create awareness, and pay recycling staff. The initial capital is often a bottleneck with strong financial backing from the government, private sectors, and NGOs. The community may not have the financial capability to initiate the schemes but can contribute through source segregation and payment of waste fees (INTFG06)

Another threat to recycling schemes identified by participants borders on the cooperation of community members in the schemes. Like the weakness component, there is shared concerns that community recycling may not deliver on its mandate if it fails to garner support from the community members. Resistance to behavioural change (INTFG07), unwillingness to pay waste fees (INTFG05), cultural and religious-based apathy to recycling (INTFG11). INTFG11 emphasized that community recycling schemes may face resistance, especially from religious sects whose beliefs do not support the reuse of materials or recycling of waste and targeted campaigns that consider such beliefs and cultural norms is crucial.

## 7.4 STRATEGIES DEVELOPMENT

The evaluation of the stakeholder SWOT analysis of the waste diversion intervention for the development of unofficial dumpsites in Ado-Ekiti has provided a basis for the strategic development for the management of UWDSs in the study area. The governance structure, which specifies the role of the stakeholders (Figure 7.3), and waste elements, which specify the flow of materials in the system and financial flow, are captured in the waste diversion model (Figure 7.4)

### 7.4.1 Waste Diversion Governance Structure

Figure 7.3 depicts the waste diversion governance structure to establish the hierarchical control and influence of different stakeholders in their role to implement and sustain waste diversion intervention for the management of UWDSs and future waste in Ado-Ekiti communities.

The municipal authority in charge of waste management in Ado-Ekiti (EKS-WAMA) sits at the top of the affairs of the waste diversion with the responsibility to coordinate and provide regulatory framework to promote community composting and community recycling schemes in Ado-Ekiti. EKSWAMA is expected to play a leading role in controlling and influencing the

effective participation of community members through community groups by coordinating waste diversion organizations toward building a healthy and sustainable urban environment. Wijayanti and Suryani (2015) posited that the diversion of waste in Surabaya, Indonesia, is hinged on the active role of the government as the initiator, providing regulation, policy, and controlling mechanisms significant in the diversion scheme of waste. Accordingly, EKSWAMA is expected to drive the schemes by establishing good working relationships with other stakeholders to deliver their specific roles. In this manner, concerns raised on distancing of the government in policy formulation such as the issue of introduction of waste fees will no longer be a concern. Accordingly, concerns from community members can be channelled through direct access to their community leaders who are part of the community-based waste diversion organization (CBWDO).

The private waste collectors are under the influence of EKSWAMA to provide regular waste collection services for the public, including regular removal of waste from the waste transfer skips in communities such as Ido-Olofin, where poor road access has prevented house-to-house waste collection. The already established relationship between private collectors and community members under the house-to-house collection scheme can be extended to community members under this scheme. This is crucial to collecting transfer waste skips in their communities for prompt disposal. Overflowing waste skips are just as bad as open dumping, as reflected in the review of USWM of South Africa in Chapter Two of this Thesis. In this respect, the government through EKSWAMA can monitor the working of the private collectors as it is with the house-to house waste collection.

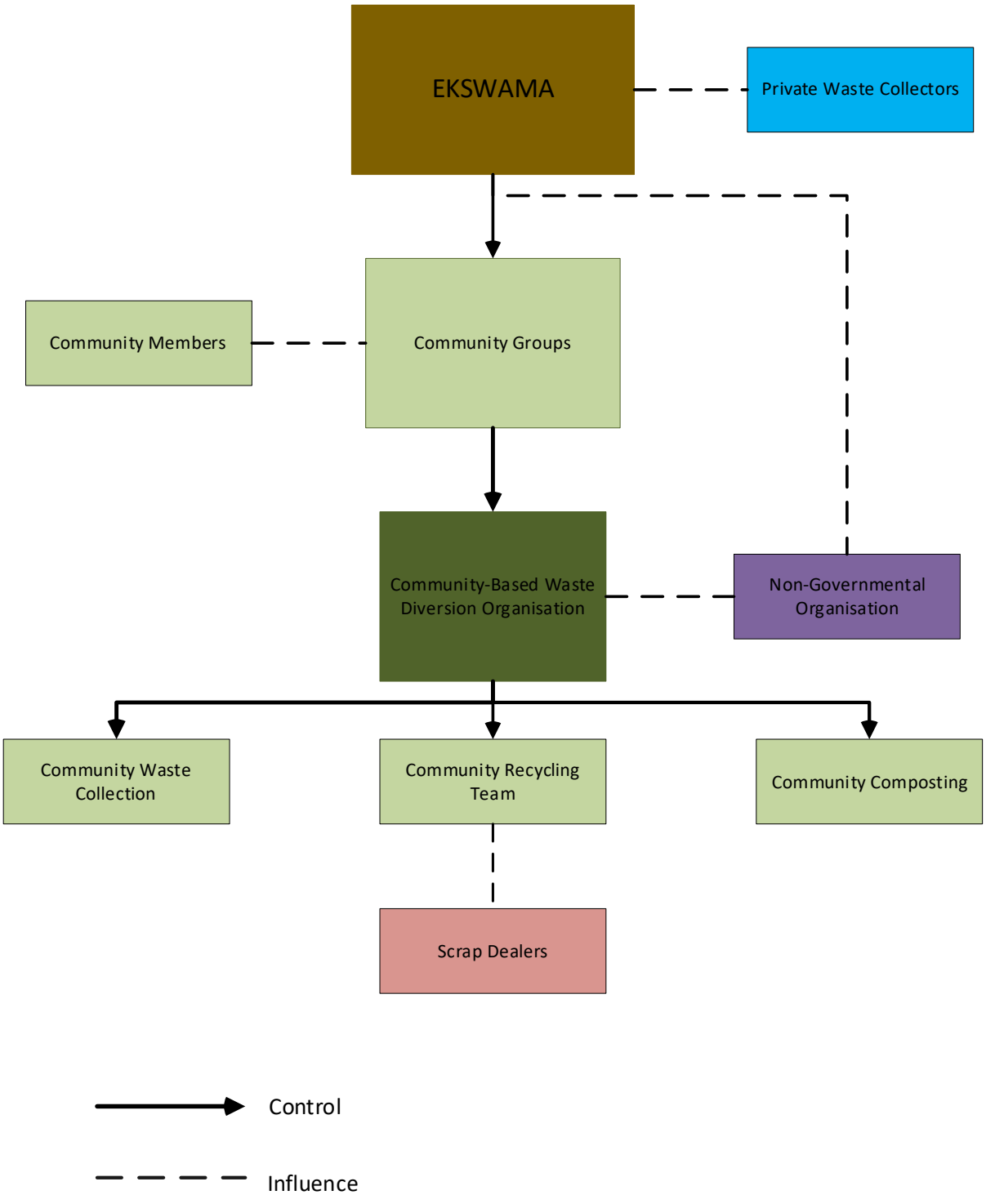


Figure 7.3: The Waste Diversion Organisation Structure providing the relationship among the stakeholders. (Note that the colours do not bear any significance other than to further differentiate the stakeholders in the governance structure.)

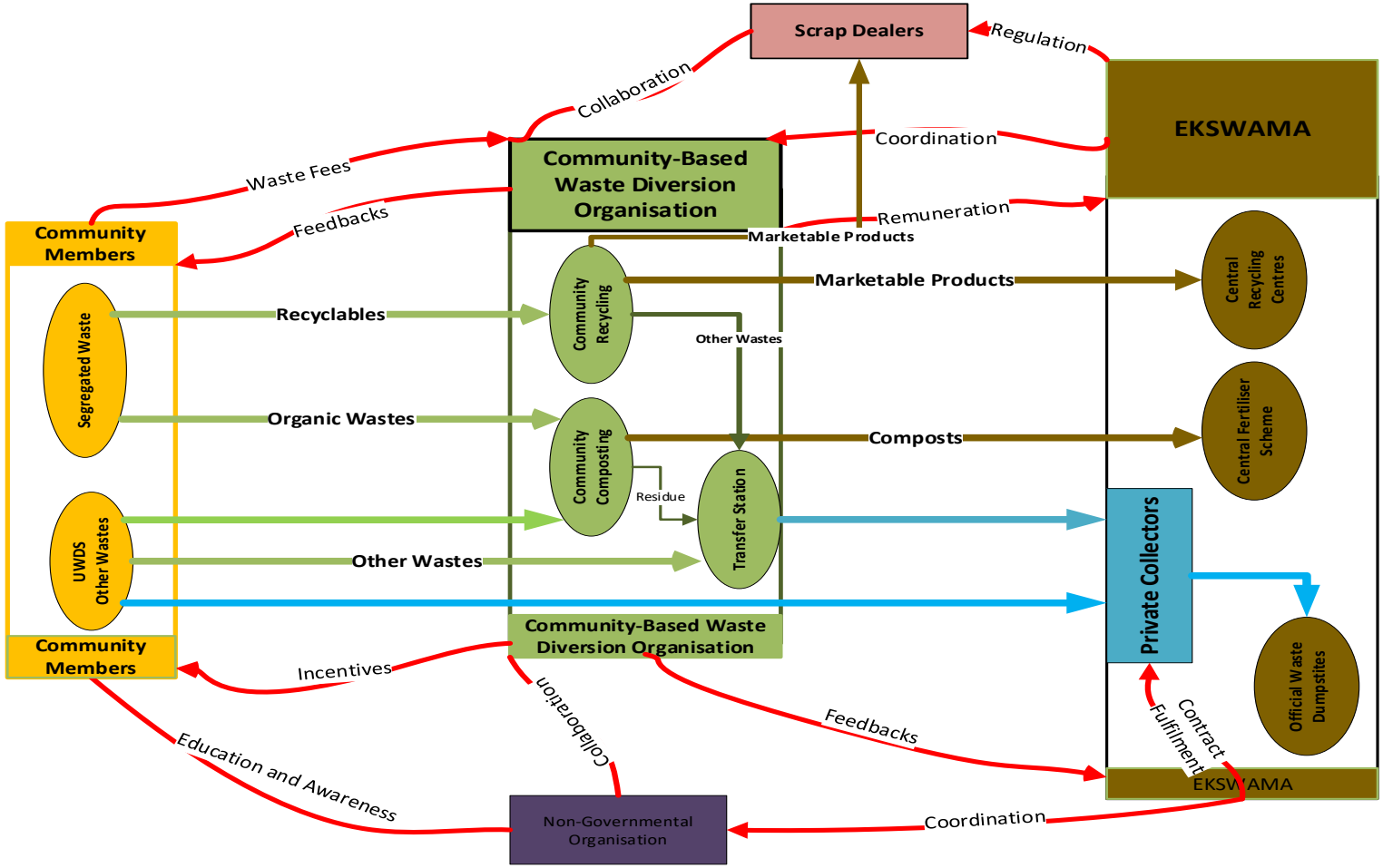


Figure 7.4: Conceptual Model of Waste Diversion Intervention developed from the interventions assessed by the stakeholders. The model depicts the interrelationship among the stakeholders in the diverting wastes from OWDSs and UWDSs.

The various community groups identified in this research, such as LTA, MWA, YDCA, the churches, and mosques, represent key human resources through which waste diversion intervention can be sold to the community members and successfully implemented. The leaders in these community groups represent key influencers in the communities for any community projects to be successful (Martiskainen, 2017) and it is thus deemed significant in this research that these groups constitute the waste diversion organization to influence the community members to participate effectively in managing wastes in the communities. Martiskainen, (2017) highlighted the role of community leaders as motivators in community-based action towards SWM. He added that they played an active role in guiding the community participation with patience and providing appreciation. The community leaders should be able to work with community members, addressing their concerns with the organisation.

Community-based waste management organisation in Ado-Ekiti is non-existent based on the findings of this research. Community-based organizations in waste management are a crucial entity for fostering community cooperation, unity, and social cohesion among community members toward a common goal. It thus shows that no common goals can be realized without uniting individuals in a common structure or organization. The development of UWDSs in Ado-Ekiti is partly driven by a lack of public participation in SWM aided by the absence of community-based organizations as explicated in Chapter 5 of this thesis. It is, therefore, important that community-based organizations are structured in line with waste diversion interventions to allow and stimulate community participation and engagement focused on the waste management scheme.

Blakeley et al. (2015) stated that the simplest form of an established community organization is usually an offshoot from an existing organization social network in a community. In Indonesia, Waste Sadaqah, a community-based waste management organization was initiated from the Islam religious networks through which community participation were tailored towards waste management (Yandri et al., 2023). In this respect, identified community groups in Ado-Ekiti communities provide a good starting point for the institution of the community-based waste-diversion programme which can stimulate active community participation in proper waste segregation, timely disposal and environmental awareness. The community leaders, as well as the clerics in churches and mosques, are good candidates for committees through which community participation in waste diversion schemes can be stimulated and expanded. The churches and mosques are platforms that record large congregations of people in the communities where environmental awareness campaigns can be promoted (Kiptoo,

2015). The main responsibility of the committee of the community-based organization is to oversee the waste diversion schemes vis-à-vis community composting and community recycling schemes in the community, including staffing, waste collection, and the collection of waste fees in coordination with the EKSWAMA.

According to the model, the three tiers of the waste diversion organization are the waste collection team, the waste recycling team, and the composting team. The three teams are under the waste diversion organization's staffing prerogative. The waste collection team can be volunteers in the community or service providers employed directly to collect segregated waste from the community's households. Studies, including those of Isreal et al. (1998), have shown that unemployed youths in the community are good volunteers for community-based waste actions. This is also supported by participants during the INFGD given the growing rate of unemployed youths in Nigeria.

The waste recycling team are charged with taking waste records and sorting the emanating wastes from the community into marketable wastes. The significant proportion of useful materials in UWDSs and households wastes can be recovered by the team and processed for onward transfer as marketable products. The composition of the team depends on the scale of the community recycling. However, the inclusion of women in the communities is vital for community cohesion among the team and the whole community. Asteria and Herdiansyah, (2022) posited that women act as social capital in their active role in SWM in fostering community participation. Additionally, the waste pickers in the community provide a ready pool of human resources that can be tapped into and trained in line with the workings of the recycling operation.

The composting team manages the composting facility, takes stock of the organic waste coming from the community, and processes it into compost. The composting facility should at least have a manager/sales record/administrator and at least two assistants depending on the scale of the facility (Zurbrügg et al., 2004). The assistants take the waste and transfer it to the composting plant or area. Since the most cost-effective method of community composting is windrow composting, it is expected that assistants are the only ones required in the area of composting. In this respect, the assistants are involved in the turning of the compost while the manager deals with the administration and sale of produced compost. The community members can act in a capacity as the manager and the assistants. The unemployed youths in the community can be trained in composting to foster much more engagement among other youths.

The non-governmental organizations can work hand in hand with the waste diversion organization to provide educational programmes and training workshops on waste diversion for the community members. The NGOs have been found to complement the efforts of the government in creating awareness and provide environmental education for the public, leading to significant waste reduction (Ahsan et al., 2012). However, the present involvement of NGOs in the management of waste in Ado-Ekiti is quite limited. Only one outfit was identified in this research to have supported waste management in the city. This limitation is still a reflection of low public awareness of waste management in the city, which informs the proposed implementation of the waste diversion intervention in the city. The openness of the government in presenting waste management business as a collaborative affair can equally stimulate the engagement of the NGOs in waste management in the city. The NGOs can play an active role in providing training to both composting and recycling teams. In India, NGOs are an integral part of SWM, providing awareness and education towards SWM initiatives in Thoubal and Bishnupur municipality (Singh and Dey, 2015).

Scrap dealers play a crucial role in engaging directly with the waste diversion organization to buy marketable waste from them. By having direct access to reliable sources of recyclables without having to deal with the informal way of securing these resources, the challenge of securing streams of recyclables can be removed.

### 7.4.2 Material Flow of the Waste Diversion Intervention Model

The various strategies under the material flow of the waste diversion intervention model have been broadly categorized under three themes, which include source segregation, community-based waste diversion schemes, and integration into existing waste management systems. These depict the flow of valuable materials through the relationships among the key stakeholders in the diversion of wastes from the UWDSs.

#### 7.4.2.1 Source Segregation

The increasing municipal waste generation in Ado-Ekiti in the face of limited resources and poor public participation has practically driven the development of UWDSs in the city. Waste diversion intervention represents an effective approach within the framework of integrated solid waste management to the management of unofficial waste disposal wastes in Ado-Ekiti. Source reduction and source segregation present viable strategies at limiting the volume and type of wastes that are discharged for disposals whether into the UWDSs or the OWDSs. The assessment of the waste profile of the UWDSs in Ado-Ekiti revealed that major constituents of the waste can be diverted from disposals either through composting or recycling. It is therefore

pertinent that source segregation of wastes by community members would be vital to waste management efforts targeted at diverting valuables resources for reuse, composting and recycling in the city. For Instance, organic wastes constitute 49% of the waste profile of UWDSs which if separated at source could potentially be valuable for the production of organic fertilizers and biogas (Kabasiita et al., 2021). The indiscriminate disposal of organic wastes presents a threat to the environment by the emission of greenhouse gases from the anaerobic digestion of such wastes in the soil.

The assessment of source segregation in Ado-Ekiti communities in Chapter Four of this research shows that there is poor practice of source segregation. Only 25% of the participants in the questionnaire show that they practice waste sorting at home. The significant barrier to source segregation from IFGD highlighted poor awareness and education. While some participants are aware of the practices, some householders are completely unaware and cannot even relate to the significance of the practice to waste management. INTFG09 showed that a much waste sorting, practiced at the level of households are not voluntary action but are coerced by retailers whereby primary packaging products such as glass bottles of beverage drinks are made to be returned. The vast majority of organic and recyclable wastes in the waste streams of OWDSs reveal that significant and decisive efforts need to be taken at the level of household source segregation for significant progress to be recorded in diversifying the wastes from prevalent unofficial wastes sites in the communities of Ado-Ekiti.

Hence, identifying key intervention strategies for the adoption of source segregation is deemed vital in this research to promote source segregation for community-based waste diversion intervention in managing the development of UWDSs in Ado-Ekiti. Figure 7.4 shows three key intervention strategies pertinent to the sustainable implementation of source segregation of wastes in communities. These intervention strategies include (i) provision of waste storage bins for segregation, (ii) Education and Awareness, and (iii) Incentivisation. Deficiencies in infrastructural development for waste management has been known to impact on the sustainable waste management in developing countries. A popular aspect of such inadequacies is the absence of appropriate waste collection bins, which have also partly driven indiscriminate dumping of waste in Ado-Ekiti. It is evident that in high-income areas such as the GRA, the provision of waste collection bins has not only facilitated house-to-house waste collection but also significantly reduced the development of UWDSs. Many studies have reported that the provision of dedicated bins for waste segregation has promoted source

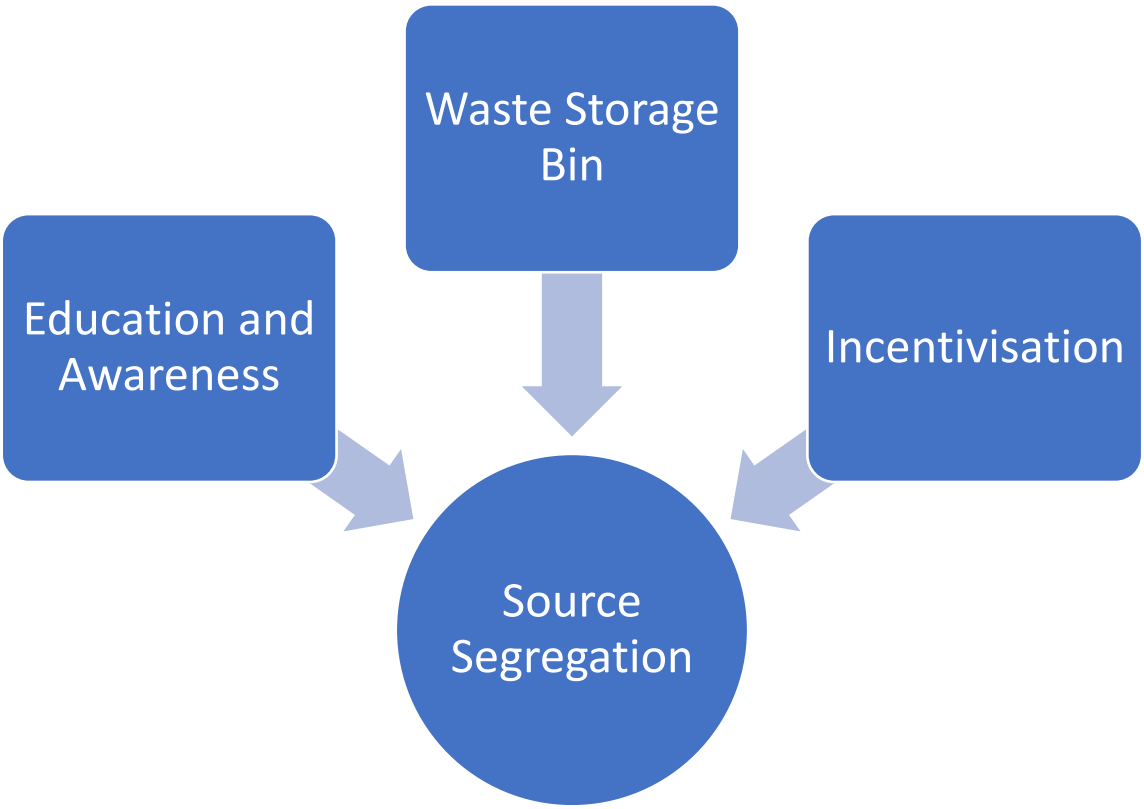


Figure 7.5: Identified Component Strategies for Source Segregation in Community-Based Waste Diversion Intervention

segregation at community levels (Khanal et al., 2023). In Tehran, household behaviour towards source segregation has been improved through provision of appropriate waste recovery bags which have in turn led to a high source separation and recovery rate (Amanidaz et al., 2019).

The classification of wastes under source segregation schemes is usually into three broad categories which include organic wastes, recyclables, and residual wastes. It is therefore important that the commission of waste diversion intervention in Ado-Ekiti Communities should be accompanied by the provision of dedicated waste bins for the three categories of waste at the start until progress is made in the adoption, compliance, and expansion of the source segregation schemes in the city. The organic wastes, which include food wastes, fruit wastes, and tuberous peels in the waste streams, which are valuable for community composting for the production of fertilizers, should be collected in designated waste containers. The recyclables which constitute marketable wastes such as glass, plastics, metals, papers, cardboards in the waste streams should be stored and collected separately. The residual wastes which neither fall within the organic wastes nor recyclable wastes should be collected separately. Dedicated bins for segregated waste are legibly addressed so that a mix-up can be effectively prevented. In the UK, recycling bins are colour-coded and labelled with dedicated wastes to prevent misrepresentation of wastes which constitutes additional cost for recycling

(Rispo et al., 2015). Most reports have shown that designated bins for organic wastes are generally coloured in green (Sato et al., 2020) while designated containers for recyclables can vary greatly depending on the type of waste being collected. Some source segregation schemes may ensure paper and cardboard are collected separately from cans, metals and plastics and accordingly have different colour codes for the associated containers.

The government can make provision of such dedicated bins freely for community members or at a subsidized rate. However, the participants of the focus group discussion suggested that the provision of the source segregation bins should be provided for free to encourage adequate participation of community members in the waste diversion intervention.

Education and communication have been shown to be key from a number of studies (Zulkipli et al, 2022; Jiang et Al., 2024; Conti et al., 2024). Typical communication channels include leaflets, advertisements and social media. These routes to awareness raising that are often unsatisfactory in developing countries (Zulkipli et al., 2022). Lack of knowledge not only discouraged public participation in waste management but also increased detrimental practices of waste dumping and burning. It is essential that adequate provision is given to education and awareness of the public through every aspect of waste management plans. Trushna et al. (2024), in their review of informational interventions for source segregation, reveal that educating and providing awareness for public on source separation of wastes can be geared toward behavioural change for source segregation practices by focusing on the communicator (stakeholder), the message (Information content and delivery mode), and the audience (community members). Accordingly, awareness and education of the public should take a direct approach with elements of persuasion. Aspects of the education and awareness programme by EKSWAMA in Ado-Ekiti are delivered through mass media using television and social channels and occasional street campaigns. There is no record of direct engagement of the public in waste management sensitization programmes. The institution of community-based waste diversion schemes provides an opportunity for community members to be directly engaged by familiar and respected communicators other than mass media channels.

Trushnal et al. (2024) identified three elements of persuasive communication, including authority, credibility, and social attractiveness, which are crucial to driving the needed behavioural change in advancing household source segregation schemes. In this respect, influential and familiar members of the community can collaborate with NGOs to be part of the education and awareness team to sensitize the community members on the practices of source segregation. Community-based education which strives to target women and youth in

the community is recognised a key factor in improving household waste management practices because of the significant role women actively play in community waste management.

Findings in this research show that incentivizing community members to participate in waste source segregation actively, is deemed crucial for effective waste diversion intervention in Ado-Ekiti. Participants in the focus group intervention pointed out that incentives and rewards are pertinent to sustain dedicated participation from the community members especially where lack of environmental awareness and abdication of waste responsibilities have fostered development of UWDSs in the city. Previous researchers have highlighted the significance of employing different approaches to incentivize commitment from community members towards waste management initiatives (Asare et al., 2020; Trushna et al., 2024). Financial incentives have been shown to play a dual role in waste management, acting as both rewards and penalties to motivate individuals to adhere to waste management policies (Abila & Kantola, 2019). Asare et al. (2020) found out that economic incentives can effectively promote waste reduction and recycling behaviours among community members.

Table 7.2 highlights different incentives proposed by the participants of the intervention focus group discussion. Three incentives were proposed by the participants of the intervention focus group discussion which include composts, plastic containers, and discounts on waste fees. The provision of a discount on waste collection fees is more acceptable than the provision of plastic containers in exchange for unwanted waste among the participants. The provision of plastic containers used to be a common practice that was identified with the informal workers but deemed unsustainable. Issock et al. (2020) reported the significance of providing direct rebates on waste collection fees in encouraging households to engage more in waste segregation practices. Bonuses in the form of discounts and vouchers as a major intervention to induce waste segregation among households have been found effective and documented by many studies (Hosono and Aoyagi, 2018; Xu et al., 2018; Asare et al., 2022). A study undertaken by Asare et al. (2022) revealed that prize rewards present a cost-effective incentive option for stimulating participation in waste segregation. Accordingly, it is suggested that 30% of the saleable recyclables are given to each participating household in the community as a bonus or discount or vouchers.

Another form of incentives considered is the provision of composts. The provision of compost from composting facilities is also favoured by participants of the intervention focus group discussion with 11 votes. INTFG04 submitted that the composts initiative would effectively garner support from farmers, who constitute the majority of community members in many

communities without access to waste management services, such as the Ureje Community. Apart from farmers, the women in the communities are fond of engaging in backyard gardening. The composts initiative will be a suitable means of improving the yield of their stock without spending more on fertilizers. From Table 7.2, it is suggested that providing 5kg of compost to the 10 most participating households in the scheme on a monthly basis may stimulate and encourage participation in the scheme. While incentivizing community members with compost seems to be a favoured option, INTFG02 pointed out that not everyone might be interested in composts as incentives and suggested there should be an alternative. Providing coupons and vouchers that can be exchanged for goods in major shops in the community is another way to incentivize community members in engaging waste separation practices.

Table 7.2: Proposed Incentives for Source Segregation by Participants of Intervention Focus Group Discussion

| **Incentive Options** | **Costs (₦)** | **Management Options** | **Percentage In Agreement (%)** |
|---|---|---|---|
| Plastic Containers | 500-2000 | Varying sizes of bowls depending on the quantity of recyclables provided by each household. | 17 |
| Composts | 1200 | 5kg composts given to 10 households with the highest recyclables monthly | 92 |
| Discounts on Waste Fees | 30% | 30% bonus on saleable recyclables for each household. This can also be presented as discounts on waste fees or vouchers. | 42 |

### 7.4.2.2 Community-Based Waste Diversion Scheme

The community-based waste diversion scheme proposed in this research within the framework of integrated solid waste management can be divided into two: the community composting scheme and the community recycling scheme.

#### 7.4.2.2.1 Community Composting for Organic Waste Diversion

According to Sewark et al. (2021), community composting remains a sustainable waste management practice that engages community members in decentralized sorting and treatment of organic wastes within the neighbourhoods or local communities. The significance of community composting is not limited to actively engaging community members in the diversion of organic wastes from waste sites but also produces composts that impact soil microbial activities in enhancing soil health and fertility (Alves et al., 2023). The Waste

Framework Directive (EU) 2018/851 highlights the composition of biowaste relevant for community composting to include biodegradable garden wastes, park wastes, food and kitchen waste. The compositional analysis of the UWDSs in Ado-Ekiti communities reveals that 49% of the waste profile constitutes organic wastes, including food wastes and fruit wastes.

Successful adoption and implementation of community composting hinges on a number of factors that have to be considered. Some of these factors are connected to questions addressed raised during the intervention focus group discussions. These factors include composting sites, storage and collection, composting technology, and marketing.

**Community Composting Sites**

As identified in the SWOT analysis, land availability presents a critical factor in adopting composting methods for waste diversion intervention. According to Asomani-Boateng (2007), the availability of lands in suitable locations and tenure rights are pertinent factors to put into consideration for composting. Tenure rights fall within the purview of the state, private and customary ownership in Ado-Ekiti. Formal arrangements to procure land for community composting can be facilitated through direct engagement with the authorities as they also represent a key stakeholder in the waste diversion scheme. Another factor to consider is the suitability of such lands for community composting. One point to consider in this regard is the proximity of composting sites to the community whose organic wastes are to be collected and converted to composts. This is important not only for the reduction of transportation costs but also to create sense of ownership for the community through which community engagement can be driven (Pai et al., 2019; Pleissner, 2019).

However, it is expected that many community members may be opposed to the location of such sites close to their residences due to possible attendant foul smells from composting activities. Such objection was raised during the focus group discussion as many participants would expect such composting sites should be located remotely within their communities. Similar results were uncovered when responses were elicited from participants in the questionnaire survey on their perception of the location of UWDSs in their communities. Pai et al. (2019) identified community buy-in along with other factors such as the volume of organic wastes to be processed and accessibility as key factors that may impact the location of local community composting sites.

INTFG02 opined that many locations where existing UWDSs are located can be converted to composting sites. Such sites have proved to be accessible to community members receiving

wastes from the community and should not be difficult to be embraced by the community members especially where the situations with waste have become problematic to be managed. Bruni et al., (2020) submitted that it is vital that a demonstration of composting is done to remove preliminary objections usually raised on account of foul smells emanating from composting. Asomani-Boateng (2007) emphasized the significance of pursuing demonstrating community composting to facilitate the inclusion of uneducated community members as such awareness created from such programmes can foster community-wide participation.

**Organic Waste Collection**

According to Pai et al. (2019), there are two major models for community composting waste collection: the pick-up service and drop-off schemes. The drop-off collection scheme is when community members are directly in charge of dropping off their organic wastes at local composting sites while the pick-up service models imply service providers are engaged to pick the organic wastes from community members at their doorsteps or at kerbsides. Studies have shown that the participation rate with drop-up schemes can be as low as 10% depending on the distance that community members had to travel (Pai et al., 2019). Therefore, it is important that service provision for pick-up of organic wastes is implemented, especially at the nascent stage of the waste diversion programme, until the community members are well educated and driven to the purpose and significance of waste diversion through composting. The waste pickers in the community provide a ready pool of workforce to be engaged for organic waste pick-up operations. The preference for this group of people is that they are already involved informal waste recycling by going from place to place to look for recyclables. The waste diversion scheme provides an opportunity for them to be registered and regulated in the community with easy access to recyclables, which removes many challenges associated with their day-to-day operation. The rigor and uncertainty associated with the itinerant nature of their operation is removed since they can know where and what to do and they are being paid for it.

**Community Composting Technology**

The choice of composting technology is another important factor to consider when considering community composting. The technology available for community composting systems can be broadly classified into the in-vessel systems and windrow system.

In-vessel systems, also known as bioreactors, involve enclosed reactors where composting takes place. These systems are highly controlled and are often used in modern composting technologies. Many demonstrative and full-scale composting in-vessels reactors use rotating drums, and these systems have reported efficient performances. Rotating drums are particularly

effective at managing large volumes of organic waste, maintaining optimal conditions for composting, and producing high-quality compost. The in-vessel systems have some advantages in terms of limited land space requirements and reduced odour and vermin attraction. These advantages promote in-vessel systems over Windrow systems. However, studies have shown that in-vessels systems require extensive training of personnel for continued operation of the systems (De Boni et al., 2022). Moreso, the deployment of in-vessel systems is associated with higher operational and maintenance cost. These downsides may not make in-vessel systems ideal for community composting in a community struggling with finances.

The windrow composting systems involve the accumulation of compost piles formed into elongated, windrow-shaped mounds typically between 1.5–2 metres high. These systems can be further subdivided based on the method of aeration which include the turned windrow and forced air windrow. The turned windrow is a conventional system where compost piles are manually or mechanically turned and reconstructed periodically to facilitate aeration and mixing. The turning process helps to maintain adequate oxygen levels throughout the compost pile, which is essential for aerobic microbial activity and efficient decomposition. Meanwhile the forced air windrow is a system where aeration is achieved without physically turning the piles. Instead, air is either forced upward through the composting mass or pulled downward through it using mechanical aeration systems. This method ensures that oxygen is distributed evenly throughout the pile, maintaining aerobic conditions and enhancing the composting process.

Windrow systems are commonly employed for community composting in developing countries because they are not capital-intensive and can handle relatively large volumes of organic waste (De Boni et al., 2022). In Ghana, the demonstration of community composting through Windrow system have fostered community participation as volunteers from the community are available to help with turning and relate with the principle of composting (Asomani-Boateng (2007).

**Composts Marketing**

Marketing constitutes an essential element in the promotion, implementation, and sustainability of community-based waste diversion intervention, especially as it relates to creating market demand and promotion for the use of composts. In Nigeria, the demand for compost is relatively poor compared to the demand for chemical fertilizers. Sridhar et al. (2013) attributed the lack of promotion for composts largely to the underdevelopment of composting schemes in the country and poor education on composting activities. Similarly, in Ado-Ekiti, the share of composts in the mix of soil enrichment and treatment is equally low. Many farmers are not even aware of organic farming and are restricted to conventional farming by using chemical fertilizers.

However, the recent Ukraine-Russian war has resulted in rising cost of inorganic fertilizers in Nigeria. Most inorganic fertilizers are imported products which competes with local production that is subjected to seasonal factors. Harir et al. (2015) reported that over 80% of fertilizers used in Nigeria are imported and account for a 70% subsidy rate on the part of the government. This is an opportunity for attention to be diverted to composts which costs relatively less than inorganic fertilizers. The present demand for chemical fertilisers can be converted to create market for composts. It is therefore important that Government devotes attention to marketing promotion of composts using various media such as TV, radio and social media along regulatory framework to facilitate the implementation of community composting in Ado-Ekiti.

#### 7.4.2.2.2 Community Recycling Schemes

The share of recyclables in the waste stream of the UWDSs in Ado-Ekiti communities is just as much as its organic components (Figure 4.8). This represents valuable resources that could be captured and diverted from UWDSs to support the manufacturing sector of the country. The implementation of a community recycling scheme as detailed in the waste diversion intervention model is to promote source separation of these recyclable materials in the households and businesses in the communities and are collected to depot centres where it is sorted into marketable products. The essence of the community recycling scheme is not only to divert the recyclables but to foster community participation in waste management. Hence, the overseers of the scheme are the community members themselves who come together to form a waste diversion organisation and take responsibility for the management of their waste.

Many studies have explicated on the significance of community recycling schemes in the diversion of useful resources from waste streams, fostering community participation in waste reduction, reducing the cost of transportation of wastes, and lessening the waste load in local

landfills and dumpsites (Pradanang et al., 2023; Fatmawati et al., 2022). The implementation of the recycling scheme requires collaborative efforts from the stakeholders including the community members, the collectors, and the recycling team as explicated in the waste diversion governance structure. Under the scheme, the recyclables are collected directly from the households and businesses in the communities and are transferred to the recycling centres where they are weighed, recorded, and sorted into marketable products. It is possible that some items are wrongly separated at the source, this constitutes contaminants along with other residues which are transferred to the waste transfer skips to be transported to the OWDSs.

#### 7.4.2.2.3 Waste Transfer Station

Poor road access to waste collection vehicles has been established in this research as one of the drivers of UWDs in some communities in Ado-Ekiti. The nature of this problem could have been resolved if transfer stations or waste collection skips were provided at strategic locations accessible to these waste collection vehicles. Bosompem et al., (2016) explicated on the significance of transfer stations as they play a crucial role in the efficient management of solid waste. These facilities act as intermediaries between waste collection points and treatment facilities, allowing for the consolidation and transfer of waste to larger transport vehicles for more efficient transportation. They are particularly important in urban and rural areas, serving as key components of modern waste management systems (Washburn, 2012). The significance of waste transfer stations extends beyond waste management efficiency. Studies have shown that the use of transfer stations can lead to reduced greenhouse gas emissions by optimizing waste collection and transport processes (Eisted et al., 2009).

Transfer stations constitute an integral part of the implementation of waste diversion intervention to enable the transfer of residual wastes from households and businesses in communities without access to house-to-house waste collection to the OWDSs. While organic wastes and recyclables are collected separately, the residual wastes are also collected separately and transferred to these stations. Before the introduction of house-to-house waste collection in Ado-Ekiti, waste collection skips were placed in strategic locations to serve market areas which often produce lots of waste on a daily basis. However, adoption of such skips was condemned on account of poor management as they were often neglected to be removed with overflowing wastes, constituting nuisances in the community.

It is therefore important that re-introduction of such waste transfer skips should come with a proper management system whereby they are equipped with covers and are promptly removed regularly. Communities without access to house-to-house waste collection system such as

Ureje, Omisanjana, Ido-Olofin communities can utilize those waste transfer skips in collecting their residual wastes under the waste diversion programme. This is necessary to avoid possible renewal of open dumping of such wastes.

#### 7.4.2.3 Integration with Existing Waste Management System.

Studies have shown that many community-based waste management schemes have been financially unsustainable due to challenges with paying staff and maintenance costs, low participation of community members, institutional agreement and lack of market for products (Furqan, 2013; Kubota et al., 2020). Most of these community-based schemes were modelled on self-sufficiency, which outright proved unsustainable. It is essential that community-based waste management schemes are integrated with the existing municipal waste management such that challenges with financing, marketing and regulation can be removed. The waste diversion scheme in this research is integrated with the existing waste management structure in Ado-Ekiti. In addition to providing resources to sustain the scheme, they can monitor and evaluate the performance of the schemes. Kubota et al. (2020) demonstrated the significance of integrating community-based waste bank programmes with municipal solid waste management in Makassar in providing the link between the waste banks and the recyclers such that the problem of price negotiations is removed.

The waste diversion intervention is modelled to be integrated with the existing MWM structure in Ado-Ekiti to address some of the challenges identified in this research that perpetuated the development of UWDSs and possible challenges that can ensue on implementing the waste diversion scheme. These challenges include non-payment of waste fees by community members, non-provision of waste collection services, marketing challenges for recyclables and composts in the study area. Most importantly, the collaborative effort of the government is needed to address the financial concerns raised by the participants of intervention focus groups especially in terms of start-up fees. The pilot recycling scheme currently undertaken by EKSWAMA shows the commitment of the government to promote the capturing of valuable resources from waste streams and hence, the community recycling scheme can be driven by the government to divert resources that would otherwise be dumped in the UWDSs.

The collection of waste fees is conceived in the waste diversion intervention to be directly collected by the waste diversion organization since they are closer to the community members to effect regular payments of the fees and are in charge of staffing, operation and maintenance for the diversion schemes. The waste fees, in addition to the revenue from the sale of the products in this regard, will be utilized to sustain the programme and undertake community

development projects. A remittance can be made to the government to cater for the collection of the residual wastes from the transfer stations. Such an arrangement will be effective to open a regime of transparency for the community members who can directly engage with waste diversion organisations and be able to share concerns about service provisions contrary to the present situation.

Additionally, the marketable products and composts from the waste diversion schemes can directly go to the government's central recycling centre located close to the dumpsites and the central fertiliser scheme respectively. The central fertilizer scheme is the platform through the state government provides fertilizer for the farmers in Ekiti State at a subsidized rate. By diverting attention to composts produced from the diversion schemes, the government will save some funds and equally encourage continued output and participation from the waste diversion schemes in the communities as they can be paid directly by the government for composts delivered to them.

The existing retrieval scheme for capture of resources from the OWDSs by the central recycling scheme is useful for capturing any missed materials from the waste diversion schemes at the level of the communities. It is possible that community members may have sorted their household wastes wrongly and valuable materials may end up with residual wastes. The retrieval of such materials from OWDSs translates to reduction of wastes for ultimate disposal and income generation for the municipal authority.

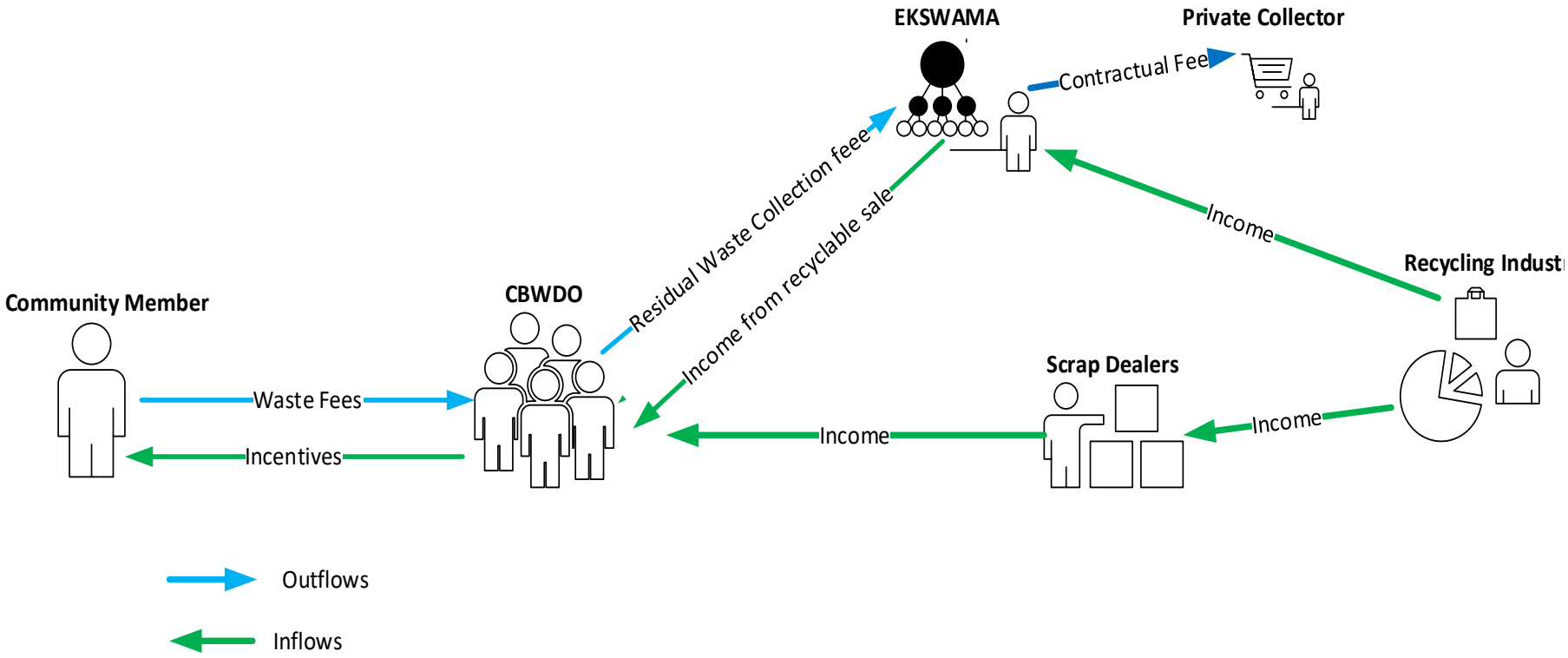


Figure 7.6: Financial Flow for the Waste Diversion Intervention among the Stakeholders (Recyclables)

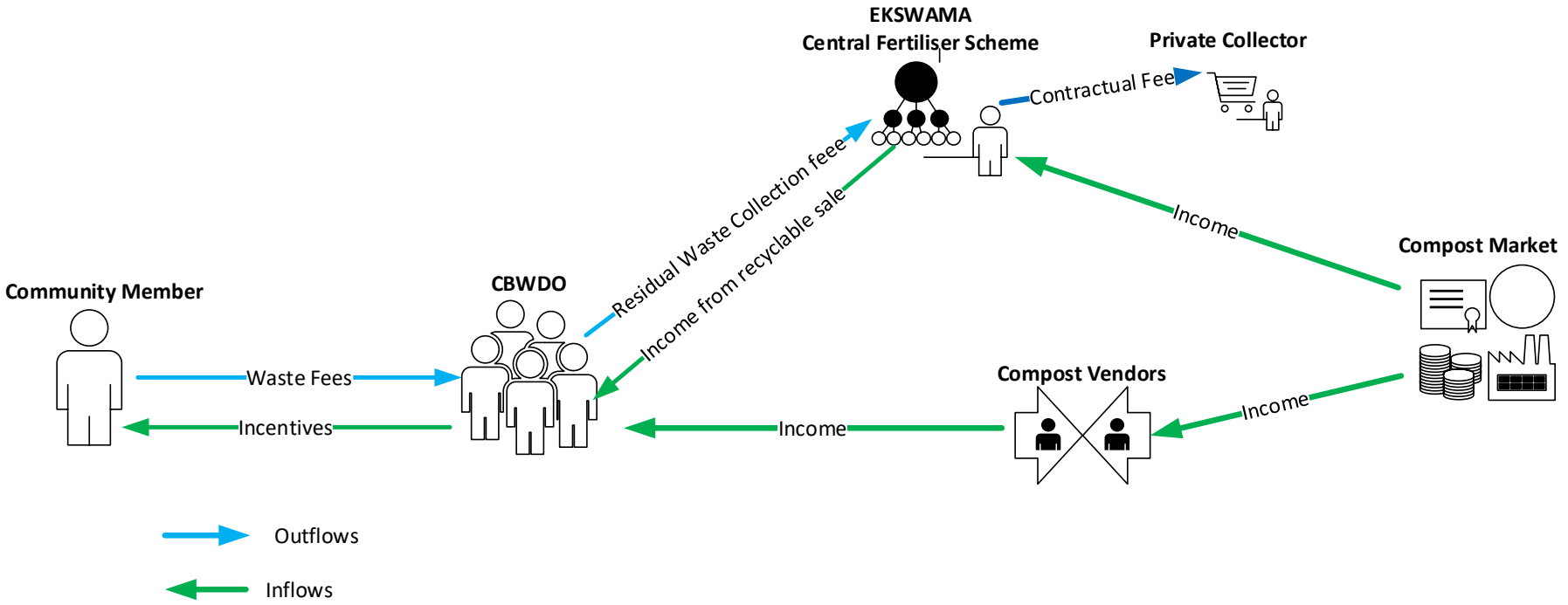


Figure 7.7: Financial Flow for the Waste Diversion Intervention among the Stakeholders (Composts)

### 7.4.3 Financial Flow of the Waste Diversion Intervention Scheme

Figures 7.5 and 7.6 depict the financial flow of the waste diversion intervention scheme for recyclables and composts respectively. These encompass the inflows and outflows of funds among the key stakeholders of the waste diversion schemes. The waste diversion scheme modelled to be overseen by the Community-Based Waste Organisation (CBWDO) can be seen to be sustained by many inflows, which include waste fees from the community member, proceeds from the sale of composts and recyclables to the central fertilizer scheme, and central waste recycling scheme respectively managed by the EKSWAMA and proceeds from the alternative sale of recyclables to the scrap dealers.

Table 4.3 shows the existing waste fee payment scheme introduced recently by EKSWAMA, which has been rebuffed by many residents, accounting for poor public participation in waste management, the palpable practice of open dumping, and the attendant loss of income for waste management operations. The delegation of the CBWDO to oversee the collection of waste fees gained much acceptance from the participants of the intervention focus group. One major advantage of the initiative is that many more residents can easily be accommodated in the tax net since there is much more control within communities to effect payment of dues, unlike when such responsibility is delegated to outsiders without ties to the community.

The successful implementation of payment schemes in respect of community projects, such as improved power project schemes and improved community security, attest to the influence of the community association in managing and influencing other community members to pay for shared concerns. The attendant effect of an effective system for instituting economic instruments such as waste fees is that palpable practices of open dumping, especially in low-income communities and middle-income communities, are reduced effectively since members who are paying can look out for their communities to arrest defaulters.

Siritorn et al. (2020) reported that the significance of instituting waste fees culminates in decreasing waste production within the cities of Songkhla and Hat Yai. This is particularly important for the city of Ado-Ekiti, as the municipal authority currently struggles with financial capacity to drive sustainable waste management. The increasing waste generation precipitated by the increasing population and rural-urban migration in the city can be effectively tackled by effectively managing waste fees through the community-based waste diversion organisation.

Proceeds from the sale of composts and recyclables serve as additional income towards the sustainability of the waste diversion scheme. The EKSWAMA and scrap dealers are key

stakeholders for the CBWDO to rely on. Hence, it is vital that transparency in pricing negotiations and accessibility to marketable products is prioritized to ensure continued collaboration among the stakeholders. The absence of cooperation with the informal sector in Ado-Ekiti culminates in several challenges and barriers identified in this research, which include social stigma and lack of social acceptance by the community members. By regulating and incorporating the formal sector within the waste diversion intervention scheme, sustainable flow of materials and funds to and fro among other stakeholders can be assured.

The major financial outflows of the waste diversion intervention pertain to the collection of waste. Other than the operational and maintenance financial outflow for effective collection of the segregated waste, the major financial outflow is the remuneration to the EKSWAMA in respect to residual waste collection from waste transfer points in the community. Since EKSWAMA and the private collectors are already under a contractual agreement for the collection of waste in Ado-Ekiti, remuneration is made to the EKSWAMA for services rendered by the private collectors in the collection of residual wastes from the community without access to house-to-house waste collection in the city.

The present contractual agreement by the private collectors with EKSWAMA is a 20/80 sharing formula for the waste collection fee. This means that 20% of the income from the waste fees collection goes to the government while 80% goes to the private collectors, but 50% of the 80% (40%) should be earmarked for the services of the vehicles while the other 40% is set for paying staff and profits. Meanwhile, under the waste diversion scheme, the responsibility of the private collectors is limited to the collection of the residual waste from the transfer points in the communities and as such the remuneration to the government on that basis should be low compared to the existing contractual agreement they have with private collectors. This is important as it is expected that the inflows from the government to the waste diversion scheme should considerably outweigh the outflows from the scheme to the government to sustain the scheme beyond financial challenges. Hence, it is proposed that half of the waste collection costs for transferring the residual wastes from the community members to the waste transfer points should be allocated to the private collectors as remuneration to EKSWAMA. This is justified by considering that much effort is devoted to community collection of residual wastes from points to points on a daily basis compared to scheduled transfer of the transfer skips to the OWDSs.

## 7.6 SUMMARY OF CHAPTER.

This chapter provided insights into waste diversion intervention for the management of UWDSs and future wastes from communities in Ado-Ekiti. The analysis of the compositional profile of the UWDSs and the SWOT analysis of community diversion schemes has provided the basis for the development of the strategies explicated through a conceptual waste diversion model. The governance structure of the waste diversion schemes establishes the relationship between the identified stakeholders specified in this research that can collaborate to address the diversion of resources from the waste streams towards building a healthy and productive community. The material flow analysis of the model highlights the three components of the diversion intervention including source segregation, waste diversion scheme, and integration into the existing waste management structure of Ado-Ekiti.

# CHAPTER EIGHT: RESEARCH CONCLUSION AND IMPLICATIONS

## 8.1 INTRODUCTION

This research has been undertaken with the aim to study the role community and other stakeholders play in managing development of unofficial waste disposal sites in developing countries by drawing evidence from Ado-Ekiti. The research aim was achieved through five objectives which include,

i. Identify UWDSs/waste dumps according to set criteria,
ii. Investigate the current Urban Solid Waste Management (USWM) system within the case study region,
iii. Evaluate drivers of UWDSs in the case region,
iv. Evaluate stakeholder-based targeted interventions at phasing out UWDSs,
v. Develop a community-based SWM model based on evaluated interventions for adoption as part of local waste management strategies in phasing out the development of UWDSs.

These objectives were achieved through review of literature and adoption of appropriate research methodologies discussed in chapters two and three respectively. The research conclusions on the each of the objectives are presented in this chapter below.

## 8.2 RESEARCH CONCLUSION

### 8.2.1 Identification of UWDSs in the Case Study Region.

This finding of this research has identified 29 UWDSs in the case study region through a combination of urban transect method of sampling and cross-sectional method of survey with the aid of a selection protocol. The spatial distribution of the UWDSs indicates a wide development of the phenomenon across the case study region. This research concludes that the UWDSs present as active, long-standing waste repositories with varying material composition, architecture and located close to human inhabitation. The UWDSs are mostly low-lying, located along the roads, ranging in height from 0.2 to 2 metres. The findings of this research revealed that the UWDSs are characterised by diverse composition ranging from plastic bags, food wastes, cans, cassava peels paper and cardboard which aligns with the compositional profile of the UWDSs analysed for the study area.

### 8.2.2 The Current USWM System in the Case Study Region

The findings of this research identify four distinct aspects of waste management practice which highlights the present urban solid management system in Ado-Ekiti. This includes solid waste storage and source segregation practices, waste collection and disposal. The findings of this research reveal that primary storage of waste is still undertaken in an unsustainable manner through items such as sacks, woven baskets, plastic bags and buckets. The use of wheelie bin in the case study region is largely concentrated in the high-income areas with the means to procure them. Source segregation of waste is still at a very low level and mostly unorganised. Survey results revealed that only 25% of the respondents practice source segregation owing to lack of public awareness. The findings of this research also reveal that waste collection in the case study region is undertaken through various means which include house-to-house waste collection, urban central waste collection and urban street sweeping. Research findings revealed that only 29% of the participants have access to the house-to-house waste collection which is mostly irregular in some places. Survey results revealed that users of central waste collection points are preponderant in low-income areas (58%) and middle income (39%) communities compared to high-income communities (4%).

Furthermore, research findings reveal that there is currently no sanitary landfill in the case study region as disposal of wastes is officially undertaken in two OWDSs located in Omiriin and Ilokun communities. The OWDSs are open dumpsites which are been managed through open burning and thus constitute environmental and health risks to the inhabitants. In addition to the OWDSs, disposal of waste is undertaken through UWDSs located across the study area which indicates palpable practice of open dumping. The research findings on the current USWM systems in Ado-Ekiti which features the preponderant use of unsafe means of waste handling, poor waste storage and unsafe waste disposal concludes that measures need to be fashioned to provide for acceptable waste storage, collection and disposal by addressing the waste management structures and engagement of the stakeholders of waste management in the case study region.

### 8.2.3 Drivers of UWDSs in the Case Study Region

The findings of this research reveal that the drivers of UWDSs in the case study is manifested through many factors that were categorised under two major themes. These include waste management practice and public engagement. The waste management themes encompassed sub-themes such as inadequate staffing, inadequate finance, inadequate equipment, poor enforcement of waste regulations, non-provision of public waste containers and increasing

waste generation. The other sub-theme (public engagement) includes poor road access, irregular waste collection, non-payment of waste fees, lack of organised recycling and composting programmes, poor awareness on waste management, poor public attitude and non-inclusiveness of community members in SWM decisions. This research concludes that these factors collectively drive the development on UWDSs in the case study region with disregard to environmental and public safety. This presents challenges to effective urban solid waste management in Ado-Ekiti.

### 8.2.4 Stakeholder Interventions at Phasing out UWDSs

The research findings in this study consider the incapacity of the local authority to provide sustainable waste management system and poor public engagement in SWM and concludes that communities and other relevant stakeholders can play a crucial role in interventions targeted at forestalling the development of UWDSs in the case region. Hence, community-based waste reduction and utilisation interventions within the context of ISWM were considered. In this regard, stakeholder-based analysis of compositional profile of UWDSs and SWOT analysis of proposed interventions were carried out. The waste compositional profile analysed for this study revealed the resource potential of UWDSs in Ado-Ekiti, which, by extension, reflects the consumption profile of Ado-Ekiti residents. The organic contents of the UWDSs are significant, at 49.03%, compared with the findings of Ngumah et al. (2013). The recyclable content (49.07%) equally represents a potential to develop secondary resource recovery in the case-region.

Accordingly, the research findings on the SWOT analysis of the proposed interventions concludes that both community composting and recycling schemes present opportunities to divert wastes from UWDSs and OWDSs through effective engagement of community members in source segregation, composting and recycling of household wastes.

### 8.2.5 Development of Community Based SWM Model

The development of UWDSs in Ado-Ekiti may not be stopped as long as the factors driving it continue to manifest. However, it can be managed through the lens of ISWM, which identifies the role of the stakeholders as well as the waste elements for the sustainability of the chosen strategy. Accordingly, the waste diversion intervention model conceptually developed in this study identifies the roles of the stakeholders; authority (EKSWAMA), community groups and members, NGOs and informal workers in Ado-Ekiti can play in the diversion of waste in Ado-Ekiti to mitigate the development of existing UWDSs and prevent any further development in the region. The governance structure identified the significant roles of the EKSWAMA,

community members, community leaders of association groups such as the LTA, market women, and youth groups, NGOs, and scrap dealers in sustaining the diversion of waste from the UWDS through community-based source segregation and waste collection for communal composting and community recycling schemes. The model relies on the adequate education of the community members and provisions of incentives such as bonuses as discounts on waste fees or vouchers and the distribution of composts to stimulate effective participation in diversifying wastes from the UWDSs such that their risks are mitigated, and further development is prevented.

### 8.3 RESEARCH LIMITATION

The research was limited by a number of factors. The emergence of COVID-19 during the data acquisition impacted on the full coverage of the study area as the researcher was constrained by time and costs. Moreover, secondary data was used for the compositional analysis of this study because the ethics approval given to the researcher did not cover direct access to the sites.

### 8.4 RESEARCH IMPLICATIONS FOR PRACTICE

The implementation of waste diversion initiatives in Ado-Ekiti is expected to drive effective and efficient USWM in Ado-Ekiti through the reduction of waste in the waste streams, reduction of transportation costs for disposal, and effective engagement of the community in waste management. Lack of involvement of non-state actors in the management of waste has partly driven the development of UWDSs in Ado-Ekiti. This research has been able to identify relevant stakeholders including state and non-state actors whose roles are deemed significant to management of the development of UWDSs in the study area. Implementing the diversion model in the study area is expected to foster the inclusion and collaboration of all the stakeholders in the SWM policy strategies.

Lack of community engagement in waste management was uncovered as part of the findings of this research to drive various challenges associated with development of UWDSs in the study area. The findings of this research recommend a bottom-up approach which places significance on community participation in waste management to foster and strengthen the education of community members in understanding their responsibilities to waste management.

Poor financing of the USWM in Ado-Ekiti fosters many challenges with the provision and maintenance of equipment for waste collection of disposal and development of education programmes in the study. It is recommended that developing strong internal funding through effective collection of waste fees may augment the funding gaps identified in this study.

Therefore, the waste diversion model developed in this research is targeted to promote efficient collection of waste fees by CBWMO to foster adequate capture of the community members in the tax net.

## 8.5 RESEARCH IMPLICATION FOR FURTHER RESEARCH

The waste diversion model in this study has been conceptually developed for policy and practice implications. However, this research did not undertake the financial implications of the waste elements. Further research into the economic analysis of the development of community composting and community recycling schemes would inform policy decisions on appropriate funding and implementation of the model.

The provision for incentives to support positive behaviours in waste separation and recycling has been provided in this research as part of the waste diversion model. However, the cost effectiveness of the suitable incentives was not carried out due to insufficient data. It is recommended that research into the most cost-effective incentive options for waste recovery is carried out to inform policy decisions on prioritizing incentives for source separation of waste in community composting and recycling.

## REFERENCES


Abas, M. A., & Wee, S. T. (2014). Sustainable solid waste management in Malaysia: The concept of multi-stakeholder governance in solid waste policy implementation. *Public Policy and Administration Research*, *4*(10), 26-35.

Abd El-Wahab, E. W., Eassa, S. M., Lotfi, S. E., El Masry, S. A., Shatat, H. Z., & Kotkat, A. M. (2014). Adverse health problems among municipality workers in Alexandria (Egypt). *International journal of preventive medicine*, *5*(5), 545.

Abdulnabi Ali, A., Golbert, Y., Reksa, A. F. A., Kretzer, M. M., & Schweiger, S. (2023). Transformative solutions in the global south: addressing solid waste Management Challenges in Jakarta Through Participation by Civil Society Organizations? In A. Triyanti, M. Indrawan, L. Nurhidayah, & M. A. Marfai (Eds.), *Environmental Governance in Indonesia* (pp. 329-351). Cham: Springer International Publishing.

Abila, B., & Kantola, J. (2019). The perceived role of financial incentives in promoting waste recycling—Empirical evidence from Finland. *Recycling*, *4*(1), 4.

Aboyeji, O. S., & Eigbokhan, S. F. (2016). Evaluations of groundwater contamination by leachates around Olusosun open dumpsite in Lagos metropolis, southwest Nigeria. *Journal of Environmental Management, 183*, 333-341. doi:10.1016/j.jenvman.2016.09.002

Abur, B. T., Oguche, E. E., & Duvuna, G. A. (2014). Characterization of municipal solid waste in the Federal Capital Abuja, Nigeria. *Global Journal of Science Frontier Research: H Environment & Earth Science*, *14*(2), 1-7.

Abubakar, I. R., Maniruzzaman, K. M., Dano, U. L., AlShihri, F. S., AlShammari, M. S., Ahmed, S. M. S., ... & Alrawaf, T. I. (2022). Environmental sustainability impacts of solid waste management practices in the global South. *International journal of environmental research and public health*, *19*(19), 12717.

Addaney, M., & Oppong, R. A. (2015). Critical issues of municipal solid waste management in Ghana. *Jenrm*, *2*(1), 30-36.

Adebayo, B. (2008). Evaluation of cuttability of selected rocks in South-Western Nigeria. *Aust. J. Tech*, *12*(2), 126-129.

Adebo, G. M., & Ajewole, O. C. (2012). Gender and the urban environment: Analysis of willingness to pay for waste management disposal in Ekiti-State, Nigeria. *American International Journal of Contemporary Research*, *2*(5), 228-236.

Adedibu, A. A. (1983). Solid waste characteristics and management in Ilorin. *Journal of the Nigerian Institute of Town Planners*, *3*(1), 33-41.

Adedibu, A. A. (1988). Measuring waste generation in third world cities: a case study of Ilorin, Nigeria. *Environmental monitoring and assessment*, *10*, 89-103.

Adekola, P. O., Iyalomhe, F. O., Paczoski, A., Abebe, S. T., Pawłowska, B., Bąk, M., & Cirella, G. T. (2021). Public perception and awareness of waste management from Benin City. *Scientific Reports*, *11*(1), 306.

Adekunle, I. M., Adekunle, A. A., Akintokun, A. K., Akintokun, P. O., & Arowolo, T. A. (2011). Recycling of organic wastes through composting for land applications: a Nigerian experience. *Waste management & research*, *29*(6), 582-593.

Adelegan, A. E., & Itesi, N. S. (2019). Economic instruments for environmental sustainability in the Nigerian Oil and Gas Sector. *Saudi Journal of Economics and Finance*, *3*(12), 610-619.

Adeniyi, T. D., Achukwu, P. U., Abubakar, A. A., & Adekomi, A. D. (2019). Heavy metals obtained from waterways induced neurodegeneration in the prefrontal cortex of Wistar rats. *Eur. j. anat*, *23*(1), 65-76.

Adeoye, P. A., Sadeeq, M. A., Musa, J. J., & Adebayo, S. E. (2011). Solid waste management in Minna, North Central Nigeria: present practices and future challenges. *Journal of Biodiversity and Environmental Sciences*, *1*(6), 1-8.

Adzawla, W., Tahidu, A., Mustapha, S., & Azumah, S. (2019). Do socioeconomic factors influence households' solid waste disposal systems? Evidence from Ghana. *Waste Management & Research, 37*, 51-57. doi:10.1177/0734242X18817717

Afon, A. O. (2007). Informal sector initiative in the primary sub-system of urban solid waste management in Lagos, Nigeria. *Habitat International*, *31*(2), 193-204.

Agamuthu, P. (2013). Landfilling in developing countries. *Waste Management & Research*, *31*(1), 1-2.

Agbefe, L. E., Lawson, E. T., & Yirenya-Tawiah, D. (2019). Awareness on waste segregation at source and willingness to pay for collection service in selected markets in Ga West Municipality, Accra, Ghana. *Journal of Material Cycles and Waste Management*, *21*, 905-914.

Agbaeze, E. K., Ofobruku, S. A., & Chukwu, B. I. (2021). Influence of entrepreneurial innovation on sustainable solid: Waste recycling in Abuja, Nigeria. *Periodica Polytechnica Social and Management Sciences*, *29*(1), 10-20.

Ahmed, A., A Obanore, S., & A Paul, P. (2022). Waste Management Regulations Enforcement: Lead Way to a Healthy Environment in Nigeria. *Lupine Publishers. J Trends in Civil Engineering and its Architecture, 4*(3), 673-677. Retrieved from https://eprints.leedsbeckett.ac.uk/id/eprint/9196/

Ahsan, A., Alamgir, M., Imteaz, M., Nik Daud, N., & Islam, R. (2012). Role of NGOs and CBOs in Waste Management. *Iran J Public Health, 41*(6), 27-38.

Ajayi, V. O. (2017). Primary sources of data and secondary sources of data. *Benue State University, 1*(1), 1-6.

Ajega, P., & Genga, P. (2019). Strategy Implementation Practices on Performance of Solid Waste Disposal Management in Informal Settlements in Nairobi, Kenya. *International Journal of Current Aspects*, *3*, 131-149.

Akinluyi, M. L., Awe, F. C., Adeleye, O. O., Oso, O. M., & Taiwo, A. A. (2022). Theoretical Issues In Housing Affordability, Quality And Satisfaction In Ekiti-State, Nigeria. *Journal of Positive School Psychology*, 1689-1706.

Akpeimeh, G. F., Fletcher, L. A., & Evans, B. E. (2019). Exposure to bioaerosols at open dumpsites: A case study of bioaerosols exposure from activities at Olusosun open dumpsite, Lagos Nigeria. *Waste Management*, *89*, 37-47.

Akyıldız, S. T., & Ahmed, K. H. (2021). An overview of qualitative research and focus group discussion. *International Journal of Academic Research in Education*, *7*(1), 1-15.

Alagbe, E. E., Alagbe, O. A., Sophia, O. D., Ojewumi, M. E., & Ayeni, A. O. (2021). Influence of Livelihood Assets on Attitude Towards Solid Waste Sanitation: A Case of Okobaba, Lagos, Nigeria. In *IOP Conference Series: Materials Science and Engineering* (Vol. 1107, No. 1, p. 012104). IOP Publishing.

Ali, Z., & Bhaskar, S. B. (2016). Basic statistical tools in research and data analysis. *Indian journal of anaesthesia*, *60*(9), 662-669.

Ali, S. M., Pervaiz, A., Afzal, B., Hamid, N., & Yasmin, A. (2014). Open dumping of municipal solid waste and its hazardous impacts on soil and vegetation diversity at waste dumping sites of Islamabad city. *Journal of King Saud University-Science*, *26*(1), 59-65.

Ally, N. (2021). *Integrating planning and environmental legislation within municipal planning in South Africa: a case study in Durban eThekwini Metropolitan Municipality* (Doctoral dissertation).

Almanaseer, N., Abbassi, B., Dunlop, C., Friesen, K., & Nestico-Semianiw, E. (2020). Multi-criteria analysis of waste-to-energy technologies in developed and developing countries. *Environmental Research, Engineering and Management*, *76*(1), 32-43.

Alves, D., Villar, I., & Mato, S. (2023). Community Composting Strategies for Biowaste Treatment: Methodology, Bulking Agent and Compost Quality. *Environmental Science and Pollution Research, 31*(7), 9873-9885. doi:10.1007/s11356-023-25564-x

Amaechi, C. F. (2023). Cost Benefit Analysis of Composting As a Waste Management Strategy In Lagos State Southwestern Nigeria. *Journal of Environment and Sustainable Development (JESD)*, *2*(1), 57-82.

Amanidaz, N., Yaghmaeian, K., Dehghani, M. H., Mahvi, A. H., & Bakhshoodeh, R. (2019). Households' behavior and social-environmental aspects of using bag dustbin for waste recovery in Tehran. *Journal of Environmental Health Science and Engineering*, *17*, 1067-1076.

Amasuomo, E., & Baird, J. (2016). Solid Waste Management Trends in Nigeria. *Journal of Management and Sustainability, 6*(4).

Amuda, O. S., Adebisi, S. A., Jimoda, L. A., & Alade, A. O. (2014). Challenges and possible panacea to the municipal solid wastes management in Nigeria. *Journal of Sustainable Development Studies*, *6*(1).

Anderson, T. W., & Finn, J. D. (2012). *The new statistical analysis of data*. Springer Science & Business Media.

Anschütz, J., IJgosse, J., & Scheinberg, A. (2004). Putting integrated sustainable waste management into practice. *Waste Netherland*, 1-102.

Antwi, S. K., & Hamza, K. (2015). Qualitative and quantitative research paradigms in business research: A philosophical reflection. *European journal of business and management*, *7*(3), 217-225.

Antwi, S. (2016). *A sociological study on solid waste management practices in the Birim North District, Ghana* (Doctoral dissertation, University of Cape Coast).

Alshenqeeti, H. (2014). Interviewing as a data collection method: A critical review. *English linguistics research*, *3*(1), 39-45.

Asare, W., Oduro–Kwarteng, S., Donkor, E. A., & Rockson, M. A. D. (2020). Recovery of Municipal Solid Waste Recyclables Under Different Incentive Schemes in Tamale, Ghana. *Sustainability, 12*(23), 9869. doi:10.3390/su12239869

Ashikuzzaman, M., & Howlader, M. H. (2020). Sustainable solid waste management in Bangladesh: issues and challenges. *Sustainable waste management challenges in developing countries*, 35-55.

Asomani-Boateng, R. (2007). Closing the Loop: Community-Based Organic Solid Waste Recycling, Urban Gardening, and Land Use Planning in Ghana, West Africa. *Journal of Planning Education and Research - J PLAN EDUC RES, 27*, 132-145. doi:10.1177/0739456X07306392

Asteria, D., & Herdiansyah, H. (2022). The role of women in managing waste banks and supporting waste management in local communities. *Community Development Journal*, *57*(1), 74-92.

Atta, A. Y., Aminu, M., Yusuf, N., Gano, Z. S., Ahmed, O. U., & Fasanya, O. O. (2016). Potentials of waste to energy in Nigeria. *J Appl Sci Res*, *12*(2), 1-6.

Awe F., C., & Akinluyi M., L. (2022). Urbanization and Housing Typologies in an Urbanizing City: Ado-Ekiti, Nigeria as a Case Study. *International Journal of Architecture, Arts and Applications, 8*(2), 91-99. doi:10.11648/j.ijaaa.20220802.16

Awosusi, A. O. (2010). Assessment of environmental problems and methods of waste management in Ado-Ekiti, Nigeria. *African Research Review*, *4*(3).

Awosusi, O. O., & Jegede, A. O. (2013). Challenges of sustainability and urban development: A case of Ado-Ekiti, Ekiti State, Nigeria. *International Education Research*, *1*(1), 22-29.

Awosusi, A. I., Oriye, O., & Owoeye, J. O. (2012). Waste management and enterprise development in slum communities of Ado-Ekiti, Nigeria. *Mediterranean Journal of Social Sciences*, *3*(11), 579-590.

Ayeni, G. O. (2016). Spatial Pattern OF intra-Urban Poverty of Ado-Ekiti, South Western Nigeria. *European Journal of Social Sciences Studies*. 1(2), 23-35

Ayiti, O. M. (2023). The Effects of Inadequate Drainage System on Access Road and People Living in the Street, A Case Study of Selected Streets In Ado-Ekiti. *3*, 7. doi:10.5281/zenodo.7553356

Ayuba, K. A., Manaf, L. A., Sabrina, A. H., & Azmin, S. W. N. (2013). Current status of municipal solid waste management practise in FCT Abuja. *Research journal of environmental and earth sciences*, *5*(6), 295-304.

Azevedo, B. D., Scavarda, L. F., & Caiado, R. G. G. (2019). Urban solid waste management in developing countries from the sustainable supply chain management perspective: A case study of Brazil's largest slum. *Journal of cleaner production*, *233*, 1377-1386.

Bettis, P. J., & Gregson, J. A. (2001). The why of research: Paradigmatic and pragmatic considerations. *Research pathways: Writing professional papers, theses, and dissertations in workforce education*, 1-21.

Blakeley, K. (2016). Responsible leadership: A radical view. In *Responsible Leadership* (pp. 108-130). Routledge.

Boadi, K. O., & Kuitunen, M. (2005). Environmental and health impacts of household solid waste handling and disposal practices in third world cities: the case of the Accra Metropolitan Area, Ghana. *Journal of environmental health*, *68*(4), 32-37.

Bosompem, C., Stemn, E., & Fei-Baffoe, B. (2016). Multi-criteria GIS-based siting of transfer station for municipal solid waste: The case of Kumasi Metropolitan Area, Ghana. *Waste Management & Research*, *34*(10), 1054-1063.

Bowan, P. A. (2020). A Planning Framework for Municipal Solid Waste Disposal Decision-Making. *Journal of Sustainable Development Studies*, *14*.

Brace, I. (2018). *Questionnaire design: How to plan, structure and write survey material for effective market research*: Kogan Page Publishers.

Bruni, C., Akyol, Ç., Cipolletta, G., Eusebi, A. L., Caniani, D., Masi, S., . . . Fatone, F. (2020). Decentralized Community Composting: Past, Present and Future Aspects of Italy. *Sustainability, 12*(8), 3319. Retrieved from https://www.mdpi.com/2071-1050/12/8/3319

Bučinskas, A., Kriipsalu, M., & Denafas, G. (2018). Proposal for Feasibility Assessment Model for Landfill Mining and Its Implementation for Energy Generation Scenarios. *Sustainability, 10*(8), 2882. doi:10.3390/su10082882

Calhoun, E. F. (2002). Action research for school improvement. *Educational leadership*, *59*(6), 18-24.

Blaikie, N. (2018). Confounding issues related to determining sample size in qualitative research. *International journal of social research methodology*, *21*(5), 635-641.

Castellani, P., Ferronato, N., & Torretta, V. (2022). Setting priorities to achieve Sustainable Development Goals through appropriate waste management systems in Uganda. *Environmental Development*, *44*, 100764.

Chalhoub, M. S. (2018). Public policy and technology choices for municipal solid waste management a recent case in Lebanon. *Cogent Environmental Science*, *4*(1), 1529853.

Chikwendu, M. U., Uchendu, U. I., & Kanu, C. (2020). Comparative Study on Solid Wastes Composition and Generation in Selected Hotels in Nigeria. *OUR CHANGING ENVIRONMENT AND DEVELOPMENT*.

Chavan, D., Arya, S., & Kumar, S. (2022). 2 - Open dumping of organic waste: Associated fire, environmental pollution and health hazards. In C. Hussain & S. Hait (Eds.), *Advanced Organic Waste Management* (pp. 15-31): Elsevier.

Chinwe, M. A., & Ejiofor, N. E. (2022). Solid Waste Management and its Challenges in Nigeria. *International Digital Organization for Scientific Research ISSN: 2579-0781 IDOSR JOURNAL OF EXPERIMENTAL SCIENCES, 7*(8), 8-18.

Chioatto, E., & Sospiro, P. (2023). Transition from waste management to circular economy: the European Union roadmap. *Environment, Development and Sustainability*, *25*(1), 249-276.

Christensen, D., Drysdale, D., Hansen, K., Vanhille, J., & Wolf, A. (2014). Partnerships for development: Municipal solid waste management in Kasese, Uganda. *Waste Management & Research*, *32*(11), 1063-1072.

Christiana, I. O., & Olusegun, A. S. (2014). Design, development and evaluation of a small scale kitchen waste composting machine. *IOSR journal of engineering*, *4*(04), 29-33.

Ciesielska, M., Boström, K. W., & Öhlander, M. (2018). Observation methods. *Qualitative methodologies in organization studies: Volume II: Methods and possibilities*, 33-52.

Cohen, R. R. (2006). Use of microbes for cost reduction of metal removal from metals and mining industry waste streams. *Journal of Cleaner Production*, *14*(12-13), 1146-1157.

Conti, A., Viottini, E., Comoretto, R. I., Piovan, C., Martin, B., Albanesi, B., . . . Campagna, S. (2024). The Effectiveness of Educational Interventions in Improving Waste Management Knowledge, Attitudes, and Practices among Healthcare Workers: A Systematic Review and Meta-Analysis. *Sustainability, 16*(9), 3513. Retrieved from https://www.mdpi.com/2071-1050/16/9/3513

Clarke, V., & Braun, V. (2017). Thematic analysis. *The journal of positive psychology*, *12*(3), 297-298.

Coker, A. O., Adeshiyan, R. A., Oluremi, J. R., Sridhar, M. K., Coker, M. E., Booth, C. A., & Khatib, J. M. (2008). Challenges of waste management in a Nigerian leper colony. *International journal of environmental studies*, *65*(2), 177-189.

Collis, J., & Hussey, R. (2014). Writing up the Research. In *Business Research* (pp. 297-330). Palgrave, London.

Corvellec, H., Bramryd, T., & Hultman, J. (2012). The business model of solid waste management in Sweden–a case study of two municipally-owned companies. *Waste Management & Research*, *30*(5), 512-518.

Creswell, J. W. (2021). *A concise introduction to mixed methods research*. SAGE publications.

Daas, P., & Arends-Tóth, J. (2012). Secondary data collection. *Statistics Netherlands. The Hague*.

Dada, M. A., Obaigbena, A., Majemite, M. T., Oliha, J. S., & Biu, P. W. (2024). Innovative approaches to waste resource management: implications for environmental sustainability and policy. *Engineering Science & Technology Journal*, *5*(1), 115-127.

Danthurebandara, M., Van Passel, S., Machiels, L., & Van Acker, K. (2015). Valorization of thermal treatment residues in Enhanced Landfill Mining: environmental and economic evaluation. *Journal of Cleaner Production, 99*, 275-285. doi:10.1016/j.jclepro.2015.03.021

Daramola, o., Mobolaji, d., Olatunji, S. A., & Idowu, K. (2023). Residents' Awareness and Response to Environmental Sanitation Exercise in Ado-Ekiti, Nigeria. *Fuoye Planning Journal*, *1*(1), 38-51

Darke, P., Shanks, G., & Broadbent, M. (1998). Successfully completing case study research: combining rigour, relevance and pragmatism. *Information systems journal*, *8*(4), 273-289.

Dauda, M., & Osita, O. O. (2003). Solid waste management and re-use in Maiduguri, Nigeria.

De Boni, A., Melucci, F. M., Acciani, C., & Roma, R. (2022). Community composting: A multidisciplinary evaluation of an inclusive, participative, and eco-friendly approach to biowaste management. *Cleaner Environmental Systems*, *6*, 100092.

Debrah, J. K., Vidal, D. G., & Dinis, M. A. (2021). Raising Awareness on Solid Waste Management through Formal Education for Sustainability: A Developing Countries Evidence Review. *Recycling, 6*(1). doi:10.3390/recycling6010006

Diaz, L. F. (2017). Waste management in developing countries and the circular economy. *Waste Management & Research, 35*(1), 1-2. doi:10.1177/0734242X16681406

Dladla, I., Machete, F., & Shale, K. (2016). A review of factors associated with indiscriminate dumping of waste in eleven African countries. *African Journal of Science, Technology, Innovation and Development*, *8*(5), 475-481.

Dlamini, S., Simatele, M. D., & Serge Kubanza, N. (2019). Municipal solid waste management in South Africa: From waste to energy recovery through waste-to-energy technologies in Johannesburg. *Local environment*, *24*(3), 249-257.

Dos Muchangos, L. S., Liu, Y., & Li, B. (2014). Comparative study on municipal solid waste management systems of Maputo City, Mozambique and Chongqing City, China. *African Journal of Science, Technology, Innovation and Development*, *6*(4), 323-331.

Dubey, A., Chakrabarti, M., & Pandit, D. (2016). Landfill Mining as a Remediation Technique for Open Dumpsites in India. *Procedia Environmental Sciences, 35*, 319-327. doi:10.1016/j.proenv.2016.07.012

Dutta-Powell, R., Court, C., & Clark, A. (2023). Interventions for effective waste management and segregation: evidence from a randomised controlled trial in the Changzamtog district of Thimphu, Bhutan. *Cleaner Waste Systems, 6*, 100121. doi:https://doi.org/10.1016/j.clwas.2023.100121

Dyer Jr, W. G., & Wilkins, A. L. (1991). Better stories, not better constructs, to generate better theory: A rejoinder to Eisenhardt. *Academy of management review*, *16*(3), 613-619.

Egesi, O. C., Ikeuka, P. I., Alum-Udensi, O., & Uchendu, U. I. (2016). Status of Solid Waste Management in Umuahia Municipality, Abia State, Nigeria. *IIARD International Journal of Geography and Environmental Management*, *2*(1), 104-108.

Eisenhardt, K. M. (1989). Building theories from case study research. *Academy of management review*, *14*(4), 532-550.

Eisted, R., Larsen, A. W., & Christensen, T. H. (2009). Collection, transfer and transport of waste: accounting of greenhouse gases and global warming contribution. *Waste management & research*, *27*(8), 738-745.

Elemile, O. O., Ana, G. R. E. E., & Sridhar, M. K. C. (2015). Knowledge, Attitude and PracticeSurvey of SourceSeparation of Solid Wastes among Workers of a Tertiary Institution in Nigeria. *African ournal of sustainable Development*.

Elgizawy, S. M., El-Haggar, S. M., & Nassar, K. (2016). Slum development using zero waste concepts: construction waste case study. *Procedia Engineering*, *145*, 1306-1313.

Etea, T., Girma, E., & Mamo, K. (2021). Risk perceptions and experiences of residents living nearby municipal solid waste open dumpsite in ginchi town, Ethiopia: a qualitative study. *Risk Management and Healthcare Policy*, 2035-2044.

Ezeah, C., & Roberts, C. L. (2012). Analysis of barriers and success factors affecting the adoption of sustainable management of municipal solid waste in Nigeria. *Journal of environmental management*, *103*, 9-14.

Falconer, D. J., Castleman, T., Mackay, D. R., & Altmann, G. (2000). Critical approaches to information systems planning: Refining the research agenda.

Fakoya, M. B. (2014). *An adjusted material flow cost accounting framework for process waste-reduction decisions in the South African brewery industry* (Doctoral dissertation, University of South Africa).

Farrell, M., & Jones, D. L. (2009). Critical evaluation of municipal solid waste composting and potential compost markets. *Bioresource technology*, *100*(19), 4301-4310.

Fatmawati, F., Mustari, N., Haerana, H., Niswaty, R., & Abdillah, A. (2022). Waste Bank Policy Implementation through Collaborative Approach: Comparative Study—Makassar and Bantaeng, Indonesia. *Sustainability, 14*(13). doi:10.3390/su14137974

Ferronato, N., & Torretta, V. (2019). Waste mismanagement in developing countries: A review of global issues. *International journal of environmental research and public health*, *16*(6), 1060.

Fife-Schaw, C. (2020). Questionnaire design. *Research methods in psychology*, 343-374.

Filani, M. O., & Jegede, F. J. (1992). Inter-settlement information flows pattern and nodal structures of a developing area-Case study of Ogun State, Nigeria. *NETCOM: Réseaux, communication et territoires/Networks and communication studies*, *6*(1), 243-271.

Flower, A., McDaniel, S. C., & Jolivette, K. (2011). A literature review of research quality and effective practices in alternative education settings. *Education and treatment of children*, 489-510.

Furqan, M. (2013). Supporting Indicators for the Successful Solid Waste Management Based on Community at Rawajati, South Jakarta. *Jurnal Wilayah dan Lingkungan, 1*, 245. doi:10.14710/jwl.1.3.245-250

Garcia, J. (2022). Case Selection Criteria, Methods, and Data Treatment. In (pp. 259-267).

Geissdoerfer, M., Savaget, P., Bocken, N. M., & Hultink, E. J. (2017). The Circular Economy–A new sustainability paradigm?. *Journal of cleaner production*, *143*, 757-768.

Ghisolfi, V., Chaves, G. D. L. D., Siman, R. R., & Xavier, L. H. (2017). System dynamics applied to closed loop supply chains of desktops and laptops in Brazil: A perspective for social inclusion of waste pickers. *Waste Management*, *60*, 14-31.

Giusti, L. (2009). A review of waste management practices and their impact on human health. *Waste management*, *29*(8), 2227-2239.

Godfrey, L., Ahmed, M. T., Gebremedhin, K. G., Katima, J. H., Oelofse, S., Osibanjo, O., ... & Yonli, A. H. (2019). Solid waste management in Africa: Governance failure or development opportunity. *Regional development in Africa*, *235*(10.5772).

Godfrey, L., & Oelofse, S. (2017). Historical review of waste management and recycling in South Africa. *Resources*, *6*(4), 57.

Goduka, N. (2012). From positivism to indigenous science: A reflection on world views, paradigms and philosophical assumptions. *Africa insight*, *41*(4), 123-138.

Guba, E. G., & Lincoln, Y. S. (1994). Competing paradigms in qualitative research. *Handbook of qualitative research*, *2*(163-194), 105.

Guerrero, L. A., Maas, G., & Hogland, W. (2013). Solid waste management challenges for

Guest, G., MacQueen, K. M., & Namey, E. E. (2012). Introduction to applied thematic analysis. *Applied thematic analysis*, *3*(20), 1-21.cities in developing countries. *Waste management*, *33*(1), 220-232.

Günbayi, I., & Sorm, S. (2018). Social paradigms in guiding social research design: The functional, interpretive, radical humanist and radical structural paradigms. *Online Submission*, *9*(2), 57-76.

Grix, J. (2010). Introducing 'hard'interpretivism and 'Q'methodology: Notes from a project on 'county sport partnerships and governance'. *Leisure studies*, *29*(4), 457-467.

Gusca, J., Fainzilbergs, M., & Muizniece, I. (2015). Life Cycle Assessment of Landfill Mining Project. *Energy Procedia, 72*, 322-328. doi:10.1016/j.egypro.2015.06.047

Håkansson, A. (2013). Portal of research methods and methodologies for research projects and degree projects. In *The 2013 World Congress in Computer Science, Computer Engineering, and Applied Computing WORLDCOMP 2013; Las Vegas, Nevada, USA, 22-25 July* (pp. 67-73). CSREA Press USA.

Halkos, G., & Petrou, K. N. (2019). Assessing 28 EU member states' environmental efficiency in national waste generation with DEA. *Journal of Cleaner Production*, *208*, 509-521.

Haregu, T. N., Ziraba, A. K., Aboderin, I., Amugsi, D., Muindi, K., & Mberu, B. (2017). An assessment of the evolution of Kenya's solid waste management policies and their implementation in Nairobi and Mombasa: analysis of policies and practices. *Environment and Urbanization*, *29*(2), 515-532.

Harir, A. I., Kasim, R., & Ishiyaku, B. (2015). Resource potentials of composting the organic wastes stream from municipal solid wastes compositions arising in Nigerian cities. *Journal of Geoscience and Environment Protection*, *3*(04), 10.

Haylamicheal, I. D., & Desalegne, S. A. (2012). A review of legal framework applicable for the management of healthcare waste and current management practices in Ethiopia. *Waste management & research*, *30*(6), 607-618.

Heary, C. M., & Hennessy, E. (2002). The Use of Focus Group Interviews in Paediatric Health Care Research. *Journal of pediatric psychology, 27*(1), 47-57.

Heida, H. (1989). Further Development of Remedial Action Strategies for The Volgermeerpolder Refuse Dumpsite. *Chemosphere, 18*(1-6), 1155-1162. doi:10.1016/0045-6535(89)90249-X

Hettiarachchi, H., Ryu, S., Caucci, S., & Silva, R. (2018). Municipal solid waste management in Latin America and the Caribbean: Issues and potential solutions from the governance perspective. *Recycling*, *3*(2), 19.

Hohenthal, J., Owidi, E., Minoia, P., & Pellikka, P. (2015). Local assessment of changes in water-related ecosystem services and their management: DPASER conceptual model and its application in Taita Hills, Kenya. *International Journal of Biodiversity Science, Ecosystem Services & Management, 11*(3), 225-238.

Hoornweg, D., & Bhada-Tata, P. (2012). *What a waste: a global review of solid waste management* (Vol. 15): World Bank, Washington, DC.

Hosono, T., & Aoyagi, K. (2018). Effectiveness of interventions to induce waste segregation by households: evidence from a randomized controlled trial in Mozambique. *Journal of Material Cycles and Waste Management, 20*, 1143-1153.

Hu, T. L., Sheu, J. B., & Huang, K. H. (2002). A reverse logistics cost minimization model for the treatment of hazardous wastes. *Transportation Research Part E: Logistics and Transportation Review*, *38*(6), 457-473.

Hugé, J., & Mukherjee, N. (2018). The nominal group technique in ecology & conservation: Application and challenges. *Methods in Ecology and Evolution, 9*(1), 33-41.

Inazumi, S., Ohtsu, H., Shiotani, T., & Katsumi, T. (2011). Environmental assessment and accounting for the waste disposal stream in Bangkok, Thailand. *Journal of Material Cycles and Waste Management*, *13*, 139-149.

Ingabire, J., Alinda, F., & Galukande-Kiganda, M. (2022). Promoting community participatory approach to solid waste management: strategies, challenges and recommendations. *International Journal of Management Studies and Social Science Research 4*.

Igoni, A. H., Ayotamuno, M. J., Ogaji, S. O. T., & Probert, S. D. (2007). Municipal solid-waste in Port Harcourt, Nigeria. *Applied Energy*, *84*(6), 664-670.

Ike, C. C., Ezeibe, C. C., Anijiofor, S. C., & Daud, N. N. (2018). Solid waste management in Nigeria: problems, prospects, and policies. *The Journal of Solid Waste Technology and Management*, *44*(2), 163-172.

Iriruaga, E. T. (2012). Solid waste management in Nigeria. *Waste Management*, *6*, 25-32.

Israel, B. A., Schulz, A. J., Parker, E. A., & Becker, A. B. (1998). Review of community-based research: assessing partnership approaches to improve public health. *Annual review of public health*, *19*(1), 173-202.

Issock, P. B. I., Roberts-Lombard, M., & Mpinganjira, M. (2020). Normative influence on household waste separation: The moderating effect of policy implementation and sociodemographic variables. *Social Marketing Quarterly, 26*(2), 93-110.

Jamshed, S. (2014). Qualitative research method-interviewing and observation. *Journal of basic and clinical pharmacy*, *5*(4), 87.

Jensen, P. A., & Bard, J. F. (2002). *Operations research models and methods*. John Wiley & Sons.

Jiang, S., Chen, H., Shan, P., & Wang, X. (2024). Efficacy of informational intervention on food waste: Evidence from a randomized controlled trial. *Journal of Cleaner Production, 443*, 141106. doi:10.1016/j.jclepro.2024.141106

Joardder, M. U., Hasan Masud, M., Joardder, M. U., & Masud, M. H. (2019). Foods and developing countries. *Food Preservation in Developing Countries: Challenges and Solutions*, 1-22.

Johnson, E., & Sylvia, M. L. (2018). Secondary data collection. *Critical Analytics and Data Management for the DNP*, 61.

Joseph, K. (2006). Stakeholder participation for sustainable waste management. *Habitat International*, *30*(4), 863-871.

Kabasiita, J. K., Malinga, G. M., Odongo, J. C., & Opolot, E. (2021). Factors influencing utilization of municipal solid waste compost among urban farmers in western Uganda. *CABI Agriculture and Bioscience*, *2*(1), 47.

Kain, J. H., Zapata, P., Mantovani Martiniano de Azevedo, A., Carenzo, S., Charles, G., Gutberlet, J., ... & Zapata Campos, M. J. (2022). Characteristics, challenges and innovations of waste picker organizations: A comparative perspective between Latin American and East African countries. *Plos one*, *17*(7), e0265889.

Kamberelis, G. (2005). *On qualitative inquiry* (No. 75). Teachers College Press.

Kamberelis, G., Dimitriadis, G., Denzin, N. K., & Lincoln, Y. S. (2005). The Sage handbook of qualitative research. *Focus groups: Strategic articulations of pedagogy, politics and inquiry, 3*, 887-907.

Kassah, S. (2020). *A study of factors influencing development of unofficial waste disposal sites in developing countries: A case study of Minna, Nigeria* (Doctoral dissertation, University of Central Lancashire).

Kassu Jilcha, S. (2019). Research Design and Methodology. In A.-T. Evon, M. Abdelkrim El, & H. A. H. Issam (Eds.), *Cyberspace* (pp. Ch. 3). Rijeka: IntechOpen.

Khanal, A., Aroyehun, A. R., Garba, A., Ibrahim, M. B., Adewale, P., & Giri, S. (2023). Role of informal waste workers for sustainable waste management in Nigeria and Nepal. *Journal of Environmental Informatics Letters*, *10*(1), 1-9.

Kawulich, B. B. (2005, May). Participant observation as a data collection method. In *Forum qualitative sozialforschung/forum: Qualitative social research* (Vol. 6, No. 2).

Kaza, S., Yao, L., Bhada-Tata, P., & Van Woerden, F. (2018). *What a waste 2.0: a global snapshot of solid waste management to 2050*. World Bank Publications.

Kiptoo, B. G. (2015). *The Role of the Catholic Church in Environmental Conservation in Kericho County, Kenya* (Doctoral dissertation, MA Thesis).

Kironde, J. M. L., & Yhdego, M. (1997). The governance of waste management in urban Tanzania: towards a community-based approach. *Resources, Conservation & Recycling, 21*(4), 213-226. doi:10.1016/S0921-3449(97)00037-2

Kjeldsen, P., Barlaz, M. A., Rooker, A. P., Baun, A., Ledin, A., & Christensen, T. H. (2002). Present and Long-Term Composition of MSW Landfill Leachate: A Review. *Critical Reviews in Environmental Science and Technology, 32*(4), 297-336. doi:10.1080/1064338029081346

Klundert, A. & Anschutz, J. (2000): Sustainability of alliances between stakeholders in Waste Management, working paper, UWEP/CWG, The Netherlands.

Koech, M. K., & Munene, K. J. (2020). Circular economy in Kenya. *Circular Economy: Global Perspective*, 223-239.

Kofoworola, O. F. (2007). Recovery and recycling practices in municipal solid waste management in Lagos, Nigeria. *Waste management*, *27*(9), 1139-1143.

Kubanza, N. S. (2024). Analysing the challenges of solid waste management in low-income communities in South Africa: a case study of Alexandra, Johannesburg. *South African Geographical Journal*, 1-21.

Kubota, R., Horita, M., & Tasaki, T. (2020). Integration of community-based waste bank programmes with the municipal solid-waste-management policy in Makassar, Indonesia. *Journal of Material Cycles and Waste Management, 22*(3), 928-937. doi:10.1007/s10163-020-00969-9

Kyere, R., Addaney, M., & Akudugu, J. A. (2019). Decentralization and solid waste management in urbanizing Ghana: moving beyond the status quo. In *Municipal solid waste management*. IntechOpen.

Ladan, S. I. (2014). Composting as a sustainable waste management method in Katsina Metropolis, northern Nigeria. *International Journal of Bioscience, Biochemistry and Bioinformatics, 4*(1), 11.

Lal, R. M., Nagpure, A. S., Luo, L., Tripathi, S. N., Ramaswami, A., Bergin, M. H., & Russell, A. G. (2016). Municipal solid waste and dung cake burning discolouring the Taj Mahal and human health impacts in Agra. *Environmental Research Letters, 11*(10), 104009.

Lavagnolo, M. C., Grossule, V., & Cossu, R. (2023). Landfill disposal in developing countries. In *Waste Management in Developing Countries* (pp. 23-38). Cham: Springer International Publishing.

Law, H. J., & Ross, D. E. (2019). International Solid Waste Association's "closing dumpsites" initiative: status of progress. *Waste Management & Research*, *37*(6), 565-568.

Levin, S. G., & Stephan, P. E. (1991). Research productivity over the life cycle: Evidence for academic scientists. *The American economic review*, 114-132.

Lietz, P. (2010). Research into questionnaire design: A summary of the literature. *International journal of market research, 52*(2), 249-272.

Lincoln, Y. S., Lynham, S. A., & Guba, E. G. (2011). Paradigmatic controversies, contradictions, and emerging confluences, revisited. *The Sage handbook of qualitative research*, *4*(2), 97-128.

Luhrmann, T. M. (2021). Interview methods. In *The Routledge handbook of research methods in the study of religion* (pp. 345-364). Routledge.

Lober, D. J. (1996). Municipal Solid Waste Policy and Public Participation in Household Source Reduction. *Waste Management & Research, 14*(2), 125-143. doi:https://doi.org/10.1006/wmre.1996.0013

Maalouf, A., & Mavropoulos, A. (2023). Re-assessing global municipal solid waste generation. *Waste Management & Research*, *41*(4), 936-947.

Madge, C. (2007). Developing a geographers' agenda for online research ethics. *Progress in human geography*, *31*(5), 654-674.

Mafara, S. M., & Magami, I. M. (2019). Challenges of Solid Waste Disposal in Nigeria: A Review. *International Journal of Science for Global Sustainability: A Publication of Faculty*

*of Science, Federal University Gusau, 5*, 1+. Retrieved from https://link.gale.com/apps/doc/A644651969/AONE?u=anon~dd446d7e&sid=googleScholar&xid=d6f71c2c

Maiyaki, M. A., Marzuki, A., & Ahmed, A. A. (2019). Urban solid waste development: A review of Nigeria's waste management policy. *International Transaction Journal of Engineering, Management, Applied Sciences and Technologies*, *11*(5), 1-14.

Makwana, D., Engineer, P., Dabhi, A., & Chudasama, H. (2023). Sampling methods in research: a review. *Int. J. Trend Sci. Res. Dev*, *7*, 762-768.

Malik, N. K. A., Abdullah, S. H., & Abd Manaf, L. (2015). Community participation on solid waste segregation through recycling programmes in Putrajaya. *Procedia Environmental Sciences*, *30*, 10-14.

Mann, S., & Mann, S. (2016). Research interviews: Modes and types. *The research interview: Reflective practice and reflexivity in research processes*, 86-113.

Mannie, N., & Bowers, A. (2014). Challenges in determining the correct waste disposal solutions for local municipalities-a South African overview. *Civil Engineering= Siviele Ingenieurswese*, *2014*(9), 17-22.

Manu, M. K., Kumar, R., & Garg, A. (2019). Decentralized composting of household wet biodegradable waste in plastic drums: Effect of waste turning, microbial inoculum and bulking agent on product quality. *Journal of Cleaner Production, 226*, 233-241. doi:https://doi.org/10.1016/j.jclepro.2019.03.350

Manyoma, P., Orejuela, J. P., Torres, P., Marmolejo, L. F., & Vidal, C. J. (2015). Landfill location with expansion possibilities in developing countries. *International Journal of Industrial Engineering : Theory Applications and Practice, 22*(2), 292-300.

Marinela, B., Zoltan, P., Francisc, B., & Klara, H. (2018). Implementation of Zero Waste concept in eastern Europe small communities. Case study: Sălacea village, Bihor county.

Marshall, R. E., & Farahbakhsh, K. (2013). Systems approaches to integrated solid waste management in developing countries. *Waste management, 33*(4). doi:10.1016/j.wasman.2012.12.023

Martiskainen, M. (2017). The role of community leadership in the development of grassroots innovations. *Environmental Innovation and Societal Transitions*, *22*, 78-89.

Massoud, M., Lameh, G., Bardus, M., & Alameddine, I. (2021). Determinants of waste management practices and willingness to pay for improving waste services in a low-middle income country. *Environmental management*, *68*(2), 198-209.

Matter, A., Ahsan, M., Marbach, M., & Zurbrügg, C. (2015). Impacts of policy and market incentives for solid waste recycling in Dhaka, Bangladesh. *Waste management, 39*, 321-328.

Mavropoulos, A., Tsakona, M., & Anthouli, A. (2015). Urban waste management and the mobile challenge. *Waste Management & Research*, *33*(4), 381-387.

Mavropoulos, A., & Nilsen, A. W. (2020). *Industry 4.0 and circular economy: Towards a wasteless future or a wasteful planet?*. John Wiley & Sons.

McDougall, F. R., White, P. R., Franke, M., & Hindle, P. (2008). *Integrated solid waste management: a life cycle inventory*. John Wiley & Sons.

Menikpura, S., Basnayake, B., Pathirana, K., & Senivirathne, S. (2008). *Prediction of present pollution levels in Gohagoda dumpsite and remediation measures: Sri Lanka.* Paper presented at the The 5th Asian Pacific Landfill Symposium, Sapporo.

Miezah, K., Obiri-Danso, K., Kádár, Z., Fei-Baffoe, B., & Mensah, M. Y. (2015). Municipal solid waste characterization and quantification as a measure towards effective waste management in Ghana. *Waste management*, *46*, 15-27.

Mingers, J. (2004). Re-establishing the real: critical realism and information systems. *Social theory and philosophy for information systems*, *372*(1), 372-406.

Mohee, R., Mauthoor, S., Bundhoo, Z. M., Somaroo, G., Soobhany, N., & Gunasee, S. (2015). Current status of solid waste management in small island developing states: A review. *Waste management*, *43*, 539-549.

Morais, J., Corder, G., Golev, A., Lawson, L., & Ali, S. (2022). Global review of human waste-picking and its contribution to poverty alleviation and a circular economy. *Environmental Research Letters*, *17*(6), 063002.

Myers, J. L., Well, A. D., & Lorch Jr, R. F. (2013). *Research design and statistical analysis*. Routledge.

Nabegu, A. B. (2010). An analysis of municipal solid waste in Kano metropolis, Nigeria. *Journal of Human Ecology*, *31*(2), 111-119.

Nagpure, A. S., Ramaswami, A., & Russell, A. (2015). Characterizing the spatial and temporal patterns of open burning of municipal solid waste (MSW) in Indian cities. *Environmental science & technology, 49*(21), 12904-12912.

Neuendorf, K. A. (2018). Content analysis and thematic analysis. In *Advanced research methods for applied psychology* (pp. 211-223). Routledge.

Ngumah, C. C., Ogbulie, J. N., Orji, J. C., & Amadi, E. S. (2013). Biogas potential of organic waste in Nigeria. *Journal of Urban and Environmental Engineering*, *7*(1), 110-116.

Ugwuanyi, R., & Isife, T. (2012). Urbanization and solid waste management challenges in Nigeria. *Technoscience Review*, *3*(1/2), 13-26.

Niyobuhungiro, R. V., & Schenck, C. J. (2022). A global literature review of the drivers of indiscriminate dumping of waste: Guiding future research in South Africa. *Development Southern Africa*, *39*(3), 321-337.

Njoroge, P. N. (2020). *The Impact Of Foreign Aid On Development In Africa: A Comparative Study Of Ghana And Angola* (Doctoral dissertation, University of Nairobi).

Njoroge, B. N. K., Kimani, M., & Ndunge, D. (2014). Review of municipal solid waste management: A case study of Nairobi, Kenya.

Nnaji, C. C. (2015). Status of municipal solid waste generation and disposal in Nigeria. *Management of Environmental Quality: An International Journal*, *26*(1), 53-71.

Noiki, A., Afolalu, S. A., Abioye, A. A., Bolu, C. A., & Emetere, M. E. (2021, February). Smart waste bin system: a review. In *IOP Conference Series: Earth and Environmental Science* (Vol. 655, No. 1, p. 012036). IOP Publishing.

Norris, F. H. (2006). Disaster research methods: Past progress and future directions. *Journal of Traumatic Stress: Official Publication of The International Society for Traumatic Stress Studies*, *19*(2), 173-184.

Nyaluogo, K. O. (2016). A study of solid waste management: a case study of Kisumu City (Bachelor of Science in Civil Engineering). *Nairobi: University of Nairobi*.

Nyumba, T., Wilson, K., Derrick, C. J., & Mukherjee, N. (2018). The use of focus group discussion methodology: Insights from two decades of application in conservation. *Methods in Ecology and Evolution, 9*(1), 20-32. doi:https://doi.org/10.1111/2041-210X.12860

Nzeadibe, T. C., & Ejike-Alieji, A. U. (2020). Solid waste management during Covid-19 pandemic: policy gaps and prospects for inclusive waste governance in Nigeria. *Local Environment*, *25*(7), 527-535.

Ogbu, E. E., Ojedoyin, O. E., Bakare, A. A., Olujimi, V. A., Aliu, A. O., & Odunola, B. O. (2022). Experiences of structural neglect by scavengers and pickers of waste products on work-life balance in South-West, Nigeria. *Tropical Journal of Science and Technology*, *3*, 1-14.

Ogunleye, O. S., & Uzoma, E. S. (2018). Solid Waste Generation and Management Techniques In Ado-Ekiti, South- West, Nigeria. *European Scientific Journal December 2018 edition, 14*(37).

Ogunseye, N. O., Salisu, U. O., & Adeyeni, G. O. (2017). Exploring the sustainability of composting as a solid waste management practice in Nigeria. *Journal of Research in National Development*, *15*(1).

Oguntoyinbo, O. O. (2012). Informal waste management system in Nigeria and barriers to an inclusive modern waste management system: A review. *Public health*, *126*(5), 441-447.

Ogwueleka, T. (2009). Municipal solid waste characteristics and management in Nigeria. *Journal of Environmental Health Science & Engineering*, *6*(3), 173-180.

Ojedokun, O., & Balogun, S. K. (2011). Psycho-sociocultural analysis of attitude towards littering in a Nigerian urban city. *Ethiopian Journal of Environmental Studies and Management*, *4*(1).

Ojo, O. O., & Adejugbagbe, J. A. (2017). Solid waste disposal attitude in Sango Ota, Ogun state: Implication for sustainable city development in Nigeria. *Journal of Environment and Waste Management*, *4*(3), 253-260.

Ojo-Awo, N. A., Agbabiaka, H. I., & Ilesanmi, A. O. (2018). Refuse dumpsite and its associated pollutants. *Management of Environmental Quality: An International Journal, 29*(3), 572-591. doi:10.1108/MEQ-08-2017-0077

Ojuri, O. O., Ayodele, F. O., & Oluwatuyi, O. E. (2018). Risk assessment and rehabilitation potential of a millennium city dumpsite in Sub-Saharan Africa. *Waste management, 76*, 621-628. doi:https://doi.org/10.1016/j.wasman.2018.03.002

Olorunlana, F. A., & Ogunade, A. O. (2022). Impact of Indiscriminate Solid Waste Disposal on Human Health in Akungba-Akoko, Ondo State, Nigeria. *International Journal*.

Olugbenga, T. A. a. I. K. (2015). The impact of urbanization on pattern of physical development in emerging urban fringes of Ado-Ekiti, Nigeria. *Technology-Driven Sustainable Development in Built Environment and Environmental Technology., 77*(14).

Omonijo, D. O., Uwajeh, P., & Anyaegbunam, M. C. (2019). Exploring The Traditional and Attitudinal Factors Challenging The Attainment of Sustainable Development in Nigeria. In *The 34thInternational Business Information Management Conference (IBIMA) Seville, Spain, between 13th and 14th of November*.

Omoniyi, O. J., Elemure, B. C., & Abiodun, S. A. (2019). Improving Sustainable Development and National Security through Office Technology and Management Programme in Nigeria. In *RAIS Conference Proceedings* (pp. 10-11).

Oni, O. A., Omotoso, T., & Alo, A. (2019). An Integrated Approach to the Management of Municipal Solid Waste in a Typical City in Southwest Nigeria. *waste management*, *23*, 25.

Onibokun, A. G., & Kumuyi, A. J. (1999). Ibadan, Nigeria. In *Managing the Monster: Urban waste and governance in Africa*. IDRC, Ottawa, ON, CA.

Oteng-Ababio, M. (2021). Envisioned futures of the waste industry in developing economies. *Ghana Social Science Journal*, *18*(1), 18-18.

Oteng-Ababio, M., Arguello, J. E. M., & Gabbay, O. (2013). Solid waste management in African cities: Sorting the facts from the fads in Accra, Ghana. *Habitat International*, *39*, 96-104.

Otieno, V. N., Irandu, E. M., & Morange, J. M. (2017). Public involvement in environmental decision making in nairobi county, Kenya. *International Journal of Education and Research*, *5*(10), 185-194.

Oyedele, O. (2016). Challenges of urban solid waste management in developing countries. *Journal of Solid Waste Technology & Management*, *42*(1), 632-643.

Oyelola, O. T., & Babatunde, A. I. (2008). Characterization of domestic and market solid wastes at source in Lagos metropolis, Lagos, Nigeria. *African Journal of Environmental Science and Technology*, *2*(12), 430-437.

Ozoike-Dennis, P., Spaling, H., Sinclair, A. J., & Walker, H. M. (2019). SEA, urban plans and solid waste management in Kenya: participation and learning for sustainable cities. *Journal of environmental assessment policy and management*, *21*(04), 1950018.

Pai, S., Ai, N., & Zheng, J. (2019). Decentralized community composting feasibility analysis for residential food waste: A Chicago case study. *Sustainable Cities and Society, 50*, 101683. doi:https://doi.org/10.1016/j.scs.2019.101683

Palakurthy, R., & Kesari, J. P. (2021). Solid Waste Management in Urban Areas: An Urgent Priority. *Urban Growth and Environmental Issues in India*, 253-267.

Palinkas, L. A., Horwitz, S. M., Green, C. A., Wisdom, J. P., Duan, N., & Hoagwood, K. (2015). Purposeful sampling for qualitative data collection and analysis in mixed method implementation research. *Administration and policy in mental health and mental health services research*, *42*, 533-544.

Pathirage, C. P., Amaratunga, D., & Haigh, R. (2008). The role of philosophical context in the development of theory: Towards methodological pluralism. *The Built and Human Environment Review*, *1*(1).

Platt, J. (1983). The development of the "participant observation" method in sociology: Origin myth and history. *Journal of the History of the Behavioral Sciences, 19*(4), 379-393.

Perry, C. (1998). Processes of a case study methodology for postgraduate research in marketing. *European journal of marketing*, *32*(9/10), 785-802.

Plack, M. M. (2005). Human nature and research paradigms: Theory meets physical therapy practice. *The qualitative report*, *10*(2), 223-245.

Pleissner, D. (2016). Decentralized utilization of wasted organic material in urban areas: A case study in Hong Kong. *Ecological Engineering, 86*, 120-125. doi:https://doi.org/10.1016/j.ecoleng.2015.11.021

Polasi, L. T. (2018). Factors associated with illegal dumping in the Zondi area, City of Johannesburg, South Africa.

Popoola, A. S., Adeyemi, A. A., Arohunsoro, S. J., & Aina, O. S. F. (2017). Urban Development Practices in Ado-Ekiti, Ekiti State, Nigeria. *Donnish Journal of Geography and Regional Planning, 3*(2), 010-016.

Pouliot, V. (2007). "Sobjectivism": Toward a constructivist methodology. *International studies quarterly*, *51*(2), 359-384.

Pradanang, R., Aditya, B., Rayhan, A., Winarlie, M. A., Gaol, F. L., & Matsuo, T. (2023, 2023//). *Utilization of Waste Banks System in the COVID-19 Pandemic.* Paper presented at the Inventive Computation and Information Technologies, Singapore.

Quintão, C., Andrade, P., & Almeida, F. (2020). How to improve the validity and reliability of a case study approach?. *Journal of Interdisciplinary*

*Rahman Titu. Fieb, E. M. A. (2019). Current Waste Management Practices & Issues in Uttara (Sector 10), Dhaka City (N).*

*Rakib, M., Hye, N., & Haque, A. (2021). Waste Segregation at Source: A Strategy to Reduce Waterlogging in Sylhet. 369-383. doi:10.1007/978-981-16-0680-9_24*

Reardon, T., Tschirley, D., Liverpool-Tasie, L. S. O., Awokuse, T., Fanzo, J., Minten, B., ... & Popkin, B. M. (2021). The processed food revolution in African food systems and the double burden of malnutrition. *Global food security*, *28*, 100466.

Rehman, A. A., & Alharthi, K. (2016). An introduction to research paradigms. *International journal of educational investigations*, *3*(8), 51-59.

Rominiyi, O. L., & Adaramola, B. A. (2020). Proximate and ultimate analysis of municipal solid waste for energy generation. *AJERD, 3*, 103.

Roopa, S., & Rani, M. S. (2012). Questionnaire designing for a survey. *Journal of Indian Orthodontic Society, 46*(4_suppl1), 273-277.

Rosilawati, Y., Rahmawati, F., & Hidayat, T. (2023). Engaging Stakeholders through Proper Waste Management System to Achieve a Sustainable Campus: A Case Study at UMY, Indonesia. In *E3S Web of Conferences* (Vol. 440, p. 02007). EDP Science

Rothgeb, R. D. (2008). *An exploratory study of community college Assessment-of-Learning Programs in the higher learning commission region*. Kansas State University.

Rushbrook, P., & Pugh, M. (1999). *Solid waste landfills in middle and lower-income countries: a technical guide to planning, design, and operation*. The World Bank.

Saghir, J., & Santoro, J. (2018, April). Urbanization in Sub-Saharan Africa. In Meeting Challenges by Bridging Stakeholders. Washington, DC, USA: Center for Strategic & International Studies.

Sankoh, F. P., Yan, X., & Tran, Q. (2013). Environmental and health impact of solid waste disposal in developing cities: a case study of granville brook dumpsite, Freetown, Sierra Leone. *Journal of environmental protection*, *2013*.

Sato, N., Iida, C., Nishi, C., & Karunarathna, A. (2020). Evaluation of organic and recyclable waste separation at generation source in Ratnapura and Kataragama Local Authorities in Sri Lanka. *Detritus, 12*, 176-186.

Saunders, M. (2009). Research methods for business students. *Person Education Limited*.

Saunders, M. N. (2012). Choosing research participants. *Qualitative organizational research: Core methods and current challenges*, 35-52.

Saunders, B., Sim, J., Kingstone, T., Baker, S., Waterfield, J., Bartlam, B., ... & Jinks, C. (2018). Saturation in qualitative research: exploring its conceptualization and operationalization. *Quality & quantity*, *52*, 1893-1907.

Sarkodie, S. A., & Owusu, P. A. (2021). Impact of COVID-19 pandemic on waste management. *Environment, development and sustainability*, *23*(5), 7951-7960.

Scheinberg, A. (2011). *Value added: Modes of sustainable recycling in the modernisation of waste management systems*. Wageningen University and Research.

Scott, D., & Usher, R. (2011). *Researching education: Data, methods and theory in educational enquiry*. Bloomsbury Publishing.

Sekito, T., Prayogo, T. B., Dote, Y., Yoshitake, T., & Bagus, I. (2013). Influence of a community-based waste management system on people's behavior and waste reduction. *Resources, Conservation and Recycling*, *72*, 84-90.

Sewak, A., Kim, J., Rundle-Thiele, S., & Deshpande, S. (2021). Influencing household-level waste-sorting and composting behaviour: What works? A systematic review (1995–2020) of waste management interventions. *Waste Management & Research*, *39*(7), 892-909.

Schübeler, P. (1997). Reports and reviews: International report: A conceptual framework for municipal solid waste management in developing countries. *Waste Management & Research*, *15*(4), 437-446.

Sibanda, D. (2017). *Waste management strategies employed on construction sites in Gauteng* (Doctoral dissertation, University of the Witwatersrand, Faculty of Engineering and the Built Environment, School of Construction Economics and Management).

Sileyew, K. J. (2019). *Research design and methodology* (Vol. 7). Cyberspace

Simatele, D. M., Dlamini, S., & Kubanza, N. S. (2017). From informality to formality: Perspectives on the challenges of integrating solid waste management into the urban

development and planning policy in Johannesburg, South Africa. *Habitat international*, *63*, 122-130.

Singh, C. R., & Dey, M. (2015). Role of NGO's in Solid Waste Management: A Study in Different Municipalities of Manipur, India. *Current World Environment*, *10*(1), 161.

Siritorn, K., & Permpoonwiwat, C. K. (2020). Effects of area characteristics and municipal waste collection fees on household waste generation. *Journal of Material Cycles and Waste Management*, 1-8.

Sodoke, S., Amuah, E. E. Y., Joseph, A., Osei, J. D., Douti, N. B., Fei-Baffoe, B., & Anokye, K. (2022). Market-based waste segregation and waste bin siting suitability studies using GIS and multi-criteria evaluation in the Kumasi Metropolis. *Environmental Challenges*, *9*, 100655.

Soiferman, L. K. (2010). Compare and contrast inductive and deductive. *Research Approaches, sl: University of Manitoba*.

Sotamenou, J., De Jaeger, S., & Rousseau, S. (2019). Drivers of legal and illegal solid waste disposal in the Global South-The case of households in Yaoundé (Cameroon). *Journal of environmental management*, *240*, 321-330.

Sowunmi, A. A. (2019). Municipal solid waste management and the inland water bodies: Nigerian perspectives. *Municipal Solid Waste Management*, 141.

Sridhar, M. K. C., Adeoye, G., Omueti, J., Yinda, G., & Reece, Z. D. (2013). Waste Recycling through Composting in Nigeria. *Compost Science & Utilization, 1*, 69-74. doi:10.1080/1065657X.1993.10771127

Srivastava, V., Ismail, S. A., Singh, P., & Singh, R. P. (2015). Urban solid waste management in the developing world with emphasis on India: challenges and opportunities. *Reviews in Environmental Science and Bio/Technology*, *14*, 317-337.

Steuer, B., Ramusch, R., & Salhofer, S. P. (2018). Can Beijing's informal waste recycling sector survive amidst worsening circumstances? *Resources, Conservation and Recycling*, *128*, 59-68.

Taherdoost, H. (2016). Sampling methods in research methodology; how to choose a sampling technique for research. *International journal of academic research in management (IJARM)*, *5*.

Talang, R. P. N., & Sirivithayapakorn, S. (2021). Environmental and financial assessments of open burning, open dumping and integrated municipal solid waste disposal schemes among different income groups. *Journal of Cleaner Production, 312*, 127761.

Talmy, S., & Richards, K. (2011). Theorizing qualitative research interviews in applied linguistics. *Applied linguistics*, *32*(1), 1-5.

Tanui, S. J. (2019). *Investigating The Management Of Construction Wastes In Nairobi County* (Doctoral dissertation, University of Nairobi).

Teddlie, C., & Yu, F. (2007). Mixed methods sampling: A typology with examples. *Journal of mixed methods research*, *1*(1), 77-100.

Tennakoon, M., & Kulatunga, U. (2021). *Stakeholder Management Models for Solid Waste Management Projects*.

Thabit, S., Aguinaga, G., Maroso, R., Mohn, C., Edilbi, B., Donnelly, L., ... & Berggren, H. (2020). United Nations Human Settlements Programme (UN-Habitat).

Thakur, A., Kumari, S., Sinai Borker, S., Prashant, S. P., Kumar, A., & Kumar, R. (2021). Solid waste management in Indian Himalayan region: current scenario, resource recovery, and way forward for sustainable development. *Frontiers in Energy Research*, *9*, 609229.

Tobore, I. E. (2012). Solid waste management in Nigeria. *A paper presentation on Waste Management, Lagos*, *7*.

Trimurni, F. (2018). The participation of community-based organizations on waste management in the city municipal of Medan. In *IOP Conference Series: Earth and Environmental Science* (Vol. 126, No. 1, p. 012141). IOP Publishing.

Trushna, T., Krishnan, K., Soni, R., Singh, S., Kalyanasundaram, M., Annerstedt, K. S., ... & Diwan, V. (2024). Interventions to promote household waste segregation: A systematic review. *Heliyon*. 10(2).

Tümen Akyıldız, S., & Ahmed, K. H. (2021). An Overview of Qualitative Research and Focus Group Discussion. *International Journal of Academic Research in Education,* *7*(1), 1-15. doi:10.17985/ijare.866762

Ugwu, C. O., Ozoegwu, C. G., Ozor, P. A., Agwu, N., & Mbohwa, C. (2021). Waste reduction and utilization strategies to improve municipal solid waste management on Nigerian campuses. *Fuel Communications, 9*, 100025. doi:https://doi.org/10.1016/j.jfueco.2021.100025

Unicef. (2018). Drinking water, sanitation and hygiene in schools: global baseline report 2018.

UN-Habitat (2014). The State of African Cities 2014: Re-Imagining Sustainable Urban Transitions. Nairobi: United Nations Human Settlements Program

Van Teijlingen, E., & Hundley, V. (2002). The importance of pilot studies. *Nursing Standard (through 2013)*, *16*(40), 33.

Velis, C. (2017). Waste pickers in Global South: Informal recycling sector in a circular economy era. *Waste Management & Research*, *35*(4), 329-331.

Vrijheid, M. (2009). Landfill sites and congenital anomalies–have we moved forward?. *Occupational and Environmental Medicine*, *66*(2), 71-71.

Wahab, S. (2015). Impact of social capital on community-based urban solid waste management initiative in Ibadan, Nigeria. *The Journal of Solid Waste Technology and Management*, *41*(4), 341-356.

Wahab, B., & Kehinde, O. (2014). Street sweeping in Ibadan: Urbanising Yoruba traditional environmental sanitation practice.

Wahyuni, D. (2012). The research design maze: Understanding paradigms, cases, methods and methodologies. *Journal of applied management accounting research*, *10*(1), 69-80.

Wang, X., & Cheng, Z. (2020). Cross-Sectional Studies: Strengths, Weaknesses, and Recommendations. *Chest, 158*(1, Supplement), S65-S71. doi:https://doi.org/10.1016/j.chest.2020.03.012

Warren, C. A. (2002). Qualitative interviewing. *Handbook of interview research: Context and method, 839101*, 103-116.

Washburn, B. E. (2012). Avian use of solid waste transfer stations. *Landscape and Urban Planning*, *104*(3-4), 388-394.

Wickham, H., & Wickham, H. (2016). *Data analysis* (pp. 189-201). Springer International Publishing.

Wijayanti, D. R., & Suryani, S. (2015). Waste bank as community-based environmental governance: a lesson learned from Surabaya. *Procedia-Social and Behavioral Sciences*, *184*, 171-179.

Wilson, D. C., Rodic, L., Modak, P., Soos, R., Carpintero, A., Velis, K., & Simonett, O. (2015). *Global waste management outlook*. UNEP.

Xu, L., Ling, M., & Wu, Y. (2018). Economic incentive and social influence to overcome household waste separation dilemma: A field intervention study. *Waste management, 77*, 522-531.

Xu, L., Zhang, X., & Ling, M. (2018). Pro-environmental spillover under environmental appeals and monetary incentives: Evidence from an intervention study on household waste separation. *Journal of Environmental Psychology, 60*, 27-33.

Yakubu, J. A. (2017). The Waste Management System In Low Income Areas Of Jos, Nigeria: The Challenges And Waste Reduction Opportunities: Appendices (Doctoral dissertation, University of Brighton).

Yakubu, K. N., & Mado, H. (2018). Assessment of community participation in solid waste management in Kaduna Metropolis. *ResearchGate, Research Gate*.

Yandri, P., Budi, S., & Putri, I. A. P. (2023). Waste sadaqah: a new community-based waste-management practice in Java, Indonesia. *Sustainability: Science, Practice and Policy, 19*(1), 2212510. doi:10.1080/15487733.2023.2212510

Yin, R. K. (2009). *Case study research: Design and methods* (Vol. 5). sage.

Yin, R. K. (2013). Validity and generalization in future case study evaluations. *Evaluation*, *19*(3), 321-332.

Yoshida, M. Technical and Social Factors of Dumpsite Collapse in Developing Countries and Its Consequences: Case Studies in Mozambique And Sri Lanka.

Yudoko, G. (2000). Exploring the potential of integrated municipal solid waste planning and management in developing countries, a case study in the municipality of Bandung, Indonesia with a focus on households.

Ziraba, A. K., Haregu, T. N., & Mberu, B. (2016). A review and framework for understanding the potential impact of poor solid waste management on health in developing countries. *Archives of Public Health*, *74*, 1-11.

Zorpas, A. A., Lasaridi, K., Voukkali, I., Loizia, P., & Chroni, C. (2015). Promoting sustainable waste prevention strategy activities and planning in relation to the waste framework directive in insular communities. *Environmental Processes*, *2*, 159-173.

Zulkipli, F., Nopiah, Z. M., Jamian, N. H., Ezlin, N., Basri, A., & Kie, C. J. (2022). Mean Score Analysis on Awareness of Solid Waste Management in Malaysia. *International Journal of Academic Research in Business and Social Sciences*, *12*(6), 649-658.

Zurbrügg, C., Drescher, S., Patel, A., & Sharatchandra, H. C. (2004). Decentralised composting of urban waste–an overview of community and private initiatives in Indian cities. *Waste management*, *24*(7), 655-662.