

**ASSESSMENT OF THE ROLE OF MULTIPLE STAKEHOLDERS IN SUSTAINABLE
MUNICIPAL SOLID WASTE MANAGEMENT IN ZARIA LOCAL GOVERNMENT
AREA, KADUNA STATE NIGERIA**

BY

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**A THESIS SUBMITTED TO THE COLLEGE OF POSTGRADUATE STUDIES,
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APRIL, 2025

DECLARATION

I declare that the work in this dissertation entitled “ASSESSMENT OF STAKEHOLDER’S CONTRIBUTION ON MUNICIPAL SOLID WASTE MAANGEMENT IN ZARIA LOCAL GOVERNMENT AREA, KADUNA STATE NIGERIA” was carried out by me in the Department of Geography and Environmental Management. The information derived from the literature was duly acknowledged in the text and list of reference provided. No part of this dissertation was previously presented for another degree at this or any other Institution.

Aliyu Ibrahim, Maccido

Signature

Date

CERTIFICATION

This dissertation titled “ASSESSMENT OF THE ROLE OF MULTIPLE STAKEHOLDERS IN SUSTAINABLE MUNICIPAL SOLID WASTE MANAGEMENT IN ZARIA LOCAL GOVERNMENT AREA, KADUNA STATE NIGERIA” by Aliyu Maccido IBRAHIM meets the regulations governing the award of the degree of Masters of Science in Environmental Management of the Ahmadu Bello University, and approved for its contribution to knowledge and literary presentation.

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DEDICATION

This research work is dedicated to my Father Alh. Ibrahim Maccido, my Mother Haj. Hauwa Umar Lawal, my brothers and sisters, Mustapha Ibrahim, Sani Ibrahim, Fatima Ibrahim, Isah Ibrahim, Maryam Ibrahim, Nuhu Ibrahim and my wife, BilkisuUsmanAbubakar. For making my dream becomes to reality.

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ABSTRACT

The effort of stakeholders which have not been previously investigated is a gap in knowledge which forms the bases for the study. The study therefore assessed the role of multiple stakeholders in municipal solid waste management in Zaria Local Government Area. Specific objectives of the include; examine stakeholder's roles in sustainable municipal solid waste management, examine the sustainable municipal solid waste management strategies, analyze the benefits of sustainable MSW management and assess the capacity of waste management agencies and institutions approach in sustainable MSW management in the study area. Data collection was through purposive sampling technique for both the community and the other stakeholders. Chi- square and correlation analysis were employed for the analysis. Majority (60.8%) of the community do participate in solid waste management at household level. Also, separation of recyclable waste and organic waste (50.5%), and enlightening others around to dispose waste timely and properly are means of participation. The other stakeholders mentioned waste collection & disposal (33.4%), scavenging operation, awarding of waste management contract (8.3%) and joint supervision of waste management activities (25%) as their role in the area. The study identified reuse (78.4%), selling of waste for recycling (51.5%) and burning of waste for manure as the major waste management strategies in the area. The community mentioned reduction of environmental pollution (59.7%) and environmental clean less as the major benefit of sustainable MSW management. Less awareness (41.3%) and poor cooperation (51.5%) are the major causes of poor MSW management. Environmental pollution (47.4%), disease outbreak (36.1%) and ground water contamination are the major implication of poor MSW management. The result of the chi- square and Pearson correlation analysis revealed that there is significant relationship between the stakeholders' capacity (staff and equipment or facilities) used and management of waste in the area with value 0.005 but the degree of association or relationship is weak(0.042) and moderate(0.067) of Pearson R value of staff and facilities. The study concluded that multiple stakeholder's role is significant on MSW management in the area. However, stakeholders need to improve their capacity (staff and facilities) to insure effective waste management. The study recommended that community should be enlightened on solid waste management practice such as reusing and selling of usable recyclables items to reduce waste generation at household level. Kaduna Environmental Protection Agency should provide more designated collection points in the study area to reduce improper dumping of waste.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

It is widely accepted that the management of solid waste is a global challenge. This challenge is even more pronounced in developing nations such as Nigeria where solid waste management is a major concern (Butu and Mshelia, 2014). Urban areas are at the center of an additional environmental challenge, specifically, the generation of an escalating amount and complexity of waste. It is estimated that the global production of Municipal Solid Waste (MSW) ranges from 1.7 to 1.9 billion metric tons (United Nation Environmental Programme, 2010). In numerous instances, the management of municipal waste in developing nations is inadequate, as cities and municipalities struggle to keep up with the rapid increase in waste generation. More than 50% of the collected waste is often disposed through uncontrolled land filling and about 15% is processed through unsafe and informal recycling (Chalmin and Gnillochet, 2009).

In developing nations, the challenges associated with waste management demand a radical yet collective approach to addressing them. Until recently, in most of these countries, waste management had been the sole responsibility of the government financed by public funds. In Africa for example, the public sector took monopoly of providing solid waste management in urban centers, and this has largely been blamed for the mess in the management of waste in many countries across the continent. The public sector is usually constrained owing to lack of managerial and technical capacity, cumbersome procurement procedures and inadequate financial resources (Longeet *al.*, 2009). These according to Oluwoleet *al* (2006) made government to consider the approach of Private Sector Participation (PSP) for better service delivery in waste management. These private sectors comprise multiple stakeholders.

Long term waste management has to be an integral part of a sustainable integrated resource management and requires understanding of local human interactions with natural cycles. In practice no single stakeholder can deal with management of all wastes in a sustainable way. According to Adeniran (2005) and Babatunde&Kantola (2013), Nigeria produces over 25 million tonnes of solid waste annually, averaging 0.66 kg per person per day in urban regions and 0.44 kg per person per day in rural regions, indicating that the country is approaching a crisis if this waste remains unmanaged. Solid waste is sourced from residential, institutional, commercial, agricultural, and even industrial waste, while municipal solid waste has become one of the most significant hazards generated.

Although, responsibilities for waste management lie with authorities controlling and managing cities and municipalities, many of the successful cases in waste management involve a wide range of stakeholders in their implementation. This sends a strong signal to cities and municipalities that they shouldn't attempt to handle everything on their own. Instead, the crucial factor for success is to focus on their strengths and partner with other sectors in society, including the private sector, local communities, and sometimes the informal sector, to enhance waste management services and boost efficiency and effectiveness (United Nation Habitat, 2009). The stakeholders involved in solid waste management vary from one city to another. Nevertheless, Ukoje (2011) recognized the primary stakeholders in solid waste management within developing nations as: National Government, Municipal Governments, the formal private sector, the informal private sector, Community Base Organizations, Non-Governmental Organizations, individuals and households.

According to Vincent (2000), techniques such as public-private partnerships indicate that the involvement of the private sector in waste management is becoming apparent, as the public

sector supports the private sector in delivering public services. However, the willingness of homeowners to pay for the waste they produce is still decreasing, since the payment is determined by location and type of housing rather than the volume of waste generated. Consequently, private companies limit their operations to middle- and high-income areas (Yekeen, 2010).

In many cities across Nigeria, the contribution of the informal sector in recycling and evolution of resource recovery based strategy in the management of MSW is neither being fully appreciated nor utilized. Since about a decade ago, Kaduna State Government has been expending an average one billion Naira (\$USA 5 million) annually on services of waste contractors (Hyuwa, 2010). The waste contractors are responsible for street sweeping, cutting grasses, cleaning drains, solid waste collection and its transportation to the existing waste dumps. Despite the benefits of using these waste contractors, shortcomings abound. Waste contractors are selected based on patronage with total disregard for competence and professionalism and access to services of waste contractors is limited to metropolitan road networks that can accommodate the compactors meant for modern waste management services. Also, communal bins are small and insufficient and frequently overflowed with garbage and there are no transfer stations in the metropolis, hence communities are not sufficiently motivated and encouraged to invest and participate in solid waste management in the city.

Community members and local leaders in urban communities play different roles in solid waste management. Community members can participate in solid waste management by showing proper sanitation behaviour, contributions in cash, kind or labour, participation in consultation, administration and management of solid waste services (like performance evaluation, collection of charges, engaging personnel, and administration among others), keeping in contact with the

municipality and the community. Generally, there are three phases of implementation of a Community Base Solid Waste Management system. They include: project initiation, community organization, and operation of primary collection system (Rigasa *et al*, 2017).

Achieve sustainability, is a combination of management options from multiple stakeholders is required. The performance of any integrated waste management system (IWMS) will ultimately depend on environmental burdens, cost and acceptability by local communities (McDougal *et al.*, 2001). Like any other cities in Nigeria, solid waste management is number one environmental challenge in Zaria due to the increasing rate of population; the volume of waste increases and the composition of waste changes as well as creating management issues (Akpu& Yusuf, 2011). Waste management in Zaria Local Government Area is the duty of the State Ministry of Environment in conjunction with Kaduna State Environmental Protection Authority (KEPA) but they have shown signs of weariness and fatigue necessitating the participation of other stakeholders. The efforts of these stakeholders form the bases for the study.

1.2 Statement of the Research Problem

Kaduna State government has been expending an average of one billion naira annually on service of waste contractors since 2015. The waste contractors are responsible for street sweeping, cutting grasses, cleaning drains, solid waste collection and its transportation to the existing waste dumps. Despite the benefits of using these waste contractors, shortcomings abound (Hyuwa, 2010).

Like any other cities in Nigeria, solid waste management is a major environmental problem in Zaria due to urbanization, the quantity of waste increases and the composition of waste changes as well as creating management problems(Akpu and Yusuf, 2011).

Municipal solid waste management in Zaria LGA is not new hence some other researchers have addressed some of its aspects. Ukoje (2011) conducted a research on the analysis of the determinant of participation of stakeholders (Local government councils, community base organization, KEPA, formal private collectors and informal private operators) of solid waste management in Zaria, Nigeria. The findings indicate a deficiency in acknowledgment and collaboration with stakeholders from non-public institutions within the solid waste management framework in Zaria. Stakeholders exhibit insufficient collection and disposal practices regarding solid waste. At the household level, the management of solid waste is poorly executed, as waste storage and disposal fail to meet the necessary standards for effectiveness.

The focus of Ariko and Akpu (2014) was on waste generation and management in Tudun Wada, Zaria, Kaduna State and their finding included that fruits and food remnants constituted the highest proportion of the entire waste components and open space burning was the most common method of managing waste followed by dumping of illegal open dump site.

Amasuomoet *al.* (2015) analyzed the public participation in sustainable waste management practice in Abuja and the study revealed that majority of the respondents stated that the main barrier that prevent members of the public from taking active role in waste management includes; the lack of information on how and where the wastes are to be disposed, unwillingness of the public due to waste and environmental levies, lack of adequate support from the government and other stakeholders, and poor government policies among others.

Again, Badamasiet *al* (2016) carried out a research on community based solid waste management strategies in Kaduna metropolis and revealed that households accumulate, store and dispose their solid waste mostly without sorting. Segregation is only limited to items of value (end – of –life resources). Green waste (plant residues), food waste (left overs), recyclables

(plastic and glass) and metal scraps(iron, aluminum and copper among others) are sorted by household where their value is recognized usually for exchange of other goods by itinerant buyers.

Also tankoet *al* (2018) assessed the sustainability of solid waste management in Kaduna metropolis and reported that 60% of the sample population responded that solid waste management providers provide waste bin to house hold for temporary waste collection, also service providers collected solid waste from temporary waste collection centers to the final disposal sites.

The researches of Amasuomo et al (2016); Tanko et al (2018); Akpu and Ariko (2014); and Ukoje (2011) although similar to this study, but differ on various grounds such as time, location and methodologies adopted. Tanko (2018) worked on waste generated in Kaduna metropolis. The study focused on a community and waste management providers (KEPA) and not multiple stakeholder and this creates a gap where this study intends to fill in the areas of location and respondents consulted.

Akpu and Ariko although worked in Zaria, but they focused on waste generated and its management in Tudun Wada alone which is only a ward. While this present study covers the entire 13 wards of Zaria LGA. Therefore this study further will fill the gap left unattended to the earlier study mentioned.

Ukoje(2011) unlike Akpu and Ariko(2014) used multiple stakeholders in investigating solid waste management in Zaria and Sabon gari. This study although similar to this was carried out about 10 to 11 years where the population of Zaria was not this much and the study did not also specifically included the 3 tertiary institutions (Ahmadu Bello University Congo, Federal College of Education Zaria and NuhuBamalli Polytechnic Zaria) as stakeholders. Based on

the previous literatures written with respect to waste management no study has been carried out in the institution of learning in this area and therefore this research has been done. The study therefore seeks to answer the following research questions;

1. What are the stakeholder's roles in sustainable MSW management in Zaria LGA?
2. How are the sustainable Municipal Solid Waste management strategies in the study area?
3. What are the benefits of sustainable MSW management in the area?
4. How is the capacity of waste management agencies and institutions in sustainable MSW management in the study area?

1.3 Aim and Objectives of the Study

The aim of the study is to assess the roles of multiple stakeholders in sustainable MSW management in Zaria Local Government Area of Kaduna State, Nigeria. The aim is achieved through specific objectives which are to:

- i. examine the roles of stakeholders in sustainable MSW management in the study area.
- ii. examine the sustainable Municipal Solid Waste management strategies in Zaria LGA.
- iii. analyze the benefits of sustainable MSW management in the study area.
- iv. assess the capacity of waste management agencies and institutions in sustainable MSW management in the study area.

1.4 Scope of the Study

The study assesses the role of multiple stakeholders in sustainable municipal solid waste management in Zaria Local Government Area, Kaduna State, Nigeria. Zaria has thirteen wards and only twelve constitute the spatial scope of the study. The content focuses on the stakeholders operating in the area like KEPA, government supported private sectors, informal waste recovery/scavenging operators, institutions and the community. It also includes information on role of

stakeholders in MSW management, benefits of sustainable MSW management, capacity of the stakeholders in MSW management, sustainable municipal solid waste management strategies. Since waste generation and disposal is on daily basis, the temporal scope for this work is limited to the period of study (2021-2023) for which data are collected and analyzed.

1.5 Justification of the Study

The importance of solid waste management for environmental hygiene, especially in northern Nigeria cannot be over emphasized. This is because of the persistence of poor hygiene and pollution in the region. Hence, solid waste management is a useful strategy to such problem in the northern region, including the study area. Besides, given the inability of governments in Nigeria to reduce environmental problem and create serene environment, waste management provide solution to such problem.

Waste is not just an environmental issue as many people still believe; it is a threat to human health since a dirty environment is one which infectious diseases such as malaria, cholera and many other spread and faster (Annan, 2001). It was also revealed that only about 30 – 50% of generated wastes are collected in most cities and the practice of waste recycling is minimal. In other words, the role collection and evaluation of solid waste is yet to keep pace with high rate of their generation in Nigerian cities and this therefore, constitute an environmental nuisance in the country (United Nations, 2001). Also this study will provide crucial evidence on efforts of multistakeholders in MSW management at their own level.

CHAPTER TWO

CONCEPTUAL FRAMEWORK AND LITERATURE REVIEW

2.1 Introduction

This chapter discusses the review of related literature to the study. It is divided into two major parts. The first part is concerned with the conceptual framework and the second part is literature review.

2.2 Conceptual Frame Work

2.2.1 Solid waste and municipal solid waste

Waste can be generally described as any item or material that is generated and disposed-off or intended to be disposed off by a person that has custody of it. However, in addition to considerations of legal nature and geographical location of generation, different definitions of waste exist based on conditions under which they occur (Williams, 2005).

Wastes are inevitable products of productive and domestic activities (Oluranti et al, 2013). They are unwanted or unusable materials, substances, by-products or left over that have been discarded for lack of use or less importance. Waste in general terms can be liquid or solid in nature and can be hazardous to man and his environment if not well managed. Medina, (2000) defined solid waste as materials generated from the result of human daily activities resulting from areas such as households, public places and city streets, shops, offices and hospitals. The term "Waste" was defined for the first time by European Council in their guidelines EU Directive 75/442/EEC which is amended as per new guideline published in 2008.

According to this guideline, "Any material or item that the possessor discards, plans to discard, or is mandated to discard" qualifies as waste under the Waste Framework Directive (European Directive: 2008). After a material or item has been classified as waste, it will continue to be regarded as such until it has been completely recovered and no longer presents any

potential risk to the environment or human health (European Directive: 2008). Therefore, waste encompasses all objects that individuals no longer find useful.

Municipal Solid Waste refers to the refuse generated by households, hazardous solid waste from industrial and commercial sources, refuse produced by institutions, waste from markets, yard waste, and debris collected from street cleaning (World Bank, 1994). The broader category known as Municipal Solid Waste (MSW) or urban solid waste encompasses all refuse collected and managed by the local government or municipality. This waste typically includes a combination of dust, ash, organic matter like vegetables, various types of paper and packaging, rags, glass, metals, as well as both combustible and non-combustible materials.

2.2.2 Solid Waste Management and Municipal Solid Waste Management

Benefit et al (2011) describes Solid Waste Management as an application of techniques that ensures the orderly execution and disposal of solid waste. Municipal waste management encompasses the comprehensive activities of sorting, storing, collecting, transporting, processing, recovering resources, recycling, and disposing of waste.

Solid waste management refers to the field focused on managing the generation, storage, collection, transfer, processing, and disposal of municipal solid waste, adhering to optimal public health, economic, engineering, aesthetic, and environmental principles (Daskalopoulos, 1999). In developing nations, municipal solid waste encompasses refuse from homes, institutions such as hospitals and hotels, marketplaces, street debris, and waste from industrial and commercial entities (Tam and Tam, 2008).

Kaseva& Gupta (1996) describe municipal solid waste as the waste collected by the city authorities which include refuse from household, non-hazardous solids from industrial, commercial, institutional and non-pathogenic hospital waste.

Municipal solid waste management (MSWM) involves the planning, engineering, organization, administration, financial, and legal components of activities related to the generation, storage, collection, transfer and transport, processing, and disposal of municipal solid waste (such as household trash, street litter, construction materials, and sanitation waste) in a way that is environmentally sound, while incorporating principles of economy, aesthetics, energy, and conservation (Joseph, 2002). Municipal Solid Waste Management is a multifaceted process that includes determining waste collection routes, identifying transfer station locations, developing treatment strategies, selecting treatment plant sites, and implementing energy recovery methods (Dewiet *al.* 2010).

2.2.3 Sustainability

Sustainability is understood as the aim of sustainable development, which refers to forms of economic and social growth that safeguard and improve the natural environment and promote social fairness (Diesendorf, 2000). The concept of ‘sustainable development’ gained attention in public discussions following the publication of the World Commission on Environment and Development's influential report, *Our Common Future*, in 1987. In this report, it was described as ‘development that satisfies the needs of the present while ensuring that future generations can fulfill their own needs.’ (WCED, 1987).

Sustainability and sustainable development focuses on balancing that fine line between competing needs- our need to move forward technologically and economically, and the need to protect the environment in which we and others live. Sustainability is not just about the environment, it is also about our health as a society in ensuring that no people or areas of life suffer as result of environmental legislation, and it’s also about examining the longer term effects of the actions humanity takes and asking questions about how it may be improved. The sustainable development goal eventually came up with a list of 17 items among which include;

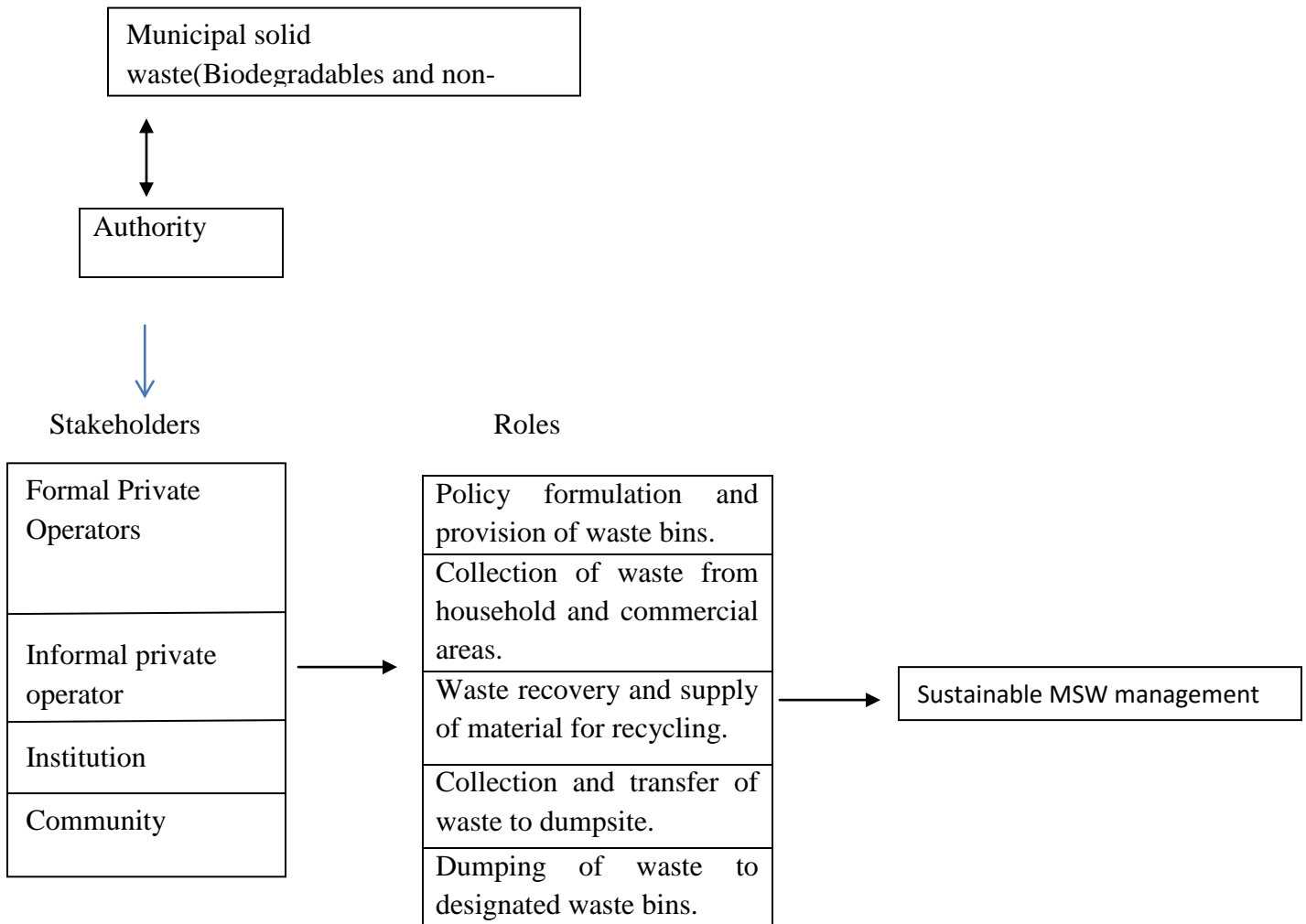
1-Sustainability to include health of the land, air and sea.

2-Through management of the environment and of consumption (for example reducing packaging and discouraging of food waste as well as promoting the use of recyclable materials).

2.2.4 Stakeholders in municipal solid waste management

Mitchell *et al.* (1997) recognize many definitions of the term of ‘stakeholders’, but declare that all these definitions share their roots from Freeman (1984) who defined this term as: “Any group or individual who can affect or is affected by the achievement of the firm’s objective”. This focus was later extended by incorporating the actions, decisions, policies, practices, or goals of the organization (Carroll and Buchholtz 2000).

Accordingly, Heidrich *et al.* (2009) determine that the main base identification of stakeholders for waste management systems could be: employees, suppliers and contractors, government (International, National or Local authorities), competitors, creditors/shareholders/insurers, consumers, trade unions/associations/professional institutions, local communities, media and NGOs.



Pattern of MSW management

2.3 Theoretical Framework

Stakeholder theory has been enhanced by a visual framework known as Freeman’s stakeholder model. Numerous well-known management models are represented in visual formats; notable examples include Porter’s Five Forces framework (Worren et al., 2002) and Mintzberg’s organizational structure. The concept of stakeholder 'management' has emerged as a significant topic in the application of business ethics to management practices and strategic approaches (Waxenberger and Spence, 2003).

The stakeholder model's framework visually represents the connections between different groups involved with the firm. Drawing from extensive literature on organizational theory and corporate strategy, along with a significant amount of research and observation, Freeman developed a fresh and straightforward concept of the firm: the stakeholder model showcased through an impactful visual synthesis.

A review of the existing literature on stakeholder theory suggests that the terminology concerning stakeholders is often used in unclear ways (Stoney and Winstanley, 2001). In fact, there are notable uncertainties in the literature regarding the fundamental concepts of the stakeholder model, stakeholder theory, stakeholders' approach, stakeholder analysis, and stakeholder management. The stakeholder approach is even regarded as "a powerful heuristic tool, meant to expand management's perspective on its roles and responsibilities beyond just profit maximization to include the interests and claims of non-stockholding groups" (Mitchell, Agle and Wood, 1997).

Particularly, Municipal Solid Waste Management is a complex process including waste collection routes, transfer station locations, treatment strategy, treatment plant location, and energy recovery (Dewi *et al.* 2010). This complexity is linked to the stakeholders analysis and in the literature review were found multiple study cases where the most common methods for stakeholders analysis suggested were applied using interviews, surveys or focus groups were applied (Reed *et al.* 2009). Most of these studies take as basis a preliminary list which is completed adding or grouping stakeholders through the participation of experts or/and stakeholders themselves (Hemmati 2002; Alameddine *et al.* 2011).

Most waste management models consider economic and environmental aspects, but very

few consider social aspects. For a waste management system to be sustainable, it needs to be environmentally effective, economically affordable and socially acceptable, Nilsson-Djerf and McDougall (2000), further added that, “for a waste management system to be effective, it must be accepted by the population”. This point is emphasized by Petts (2000) who asserts that “the most effective management of MSW has to relate to local environmental, economic and social priorities” and must go beyond the traditional consultative approaches that require the “expert” to draft the solution in advance of public involvement to a much more effective approach by involving the public before key choices have been made.

The theory can be used in this work to explain the role of multiple stakeholders operating to achieve sustainable MSW management in Zaria LGA since it shows the relationship among the various groups of actors in and around the firm.

2.4 Literature Review

2.4.1 Community roles in MSW management

Community participation in solid waste management covers a variety of types, and encompasses several forms of local involvement, including: awareness and teaching proper sanitary behaviour, cost recovery schemes, resource recovery actions, and participating in consultation, administration, and/or management functions(Yusuf, 2017).

Community members and local leaders in urban communities play different roles in solid waste management. These roles correspond to different levels of community participation as derived from the studies on management of water resources and solid waste management. Community members can participate in solid waste management by showing proper sanitation behaviour, contributions in cash, kind or labour, participation in consultation, administration and management of solid waste services (like performance evaluation, collection of charges, engaging personnel, and administration among others), keeping in contact with the municipality

and the community. Generally, there are three phases of implementation of a CBSWM system. They include: project initiation, community organization, and operation of primary collection system (Rigasa, 2017).

Successful community-based waste management (CBWM) projects need institutional support and acknowledgment. A comprehensive system that involves separating waste at the point of origin, recovering resources, and composting organic waste depends on the engagement of waste pickers and the collaboration of the community with all relevant stakeholders. Local leaders often play a significant role in managing these services or maintaining close relationships with the municipal or community management agencies. Women and teenagers can take on vital responsibilities, serving as initiators, managers, operators, political activists, educators, and community watchdogs. CBSWM can address various issues, including low household participation, management challenges, operational difficulties, financial problems, and inadequate cooperation from municipalities (Kaoje, 2017).

Long term waste management has to be an integral part of a sustainable integrated resource management and requires understanding of local human interactions with natural cycles (ISWA,2002). In practice no single disposal technique can deal with all wastes in a sustainable way. To achieve sustainability, a combination of management options is required. The performance of any integrated waste management system (IWMS) will ultimately depend on environmental burdens, cost and acceptability by local communities (McDougalet al, 2001).

The recent initiatives by certain waste management agencies in Nigeria to engage the public in waste management efforts have not received a favorable response from the community (Ogunba, 2004). It is crucial to recognize that the factors affecting public involvement and engagement in waste and environmental sanitation issues include the availability or lack of

proper facilities, policies for waste disposal, and minimal awareness of the consequences linked to ineffective waste management. Therefore, addressing the information gap and comprehending the obstacles to public engagement in sustainable waste management practices in Nigeria will aid in creating effective strategies, including behavior-modifying initiatives (Imam *et al*, 2008). This strategy may enhance and support the existing sustainable waste management plan in the nation.

In the context of solid waste management, community participation refers to the active and meaningful engagement of beneficiaries in the handling of solid waste. Typically, community involvement is confined to tasks related to the primary collection of household waste. Some of the most common activities that communities can undertake include managing waste within their homes, disposing of it from their properties, minimizing waste generation, facilitating recycling efforts, and maintaining cleanliness in public spaces within their neighborhoods (Sylvaine, 1999).

Additionally, regarding the advantages of participatory methods, when individuals engage in kind, they cultivate a sense of belonging to the community initiative; they foster leadership within the village and enhance the confidence of the community members. Furthermore, the involvement of beneficiaries ensures that the design of activities aligns with the genuine priorities of the people and that the community initiatives genuinely address and consider their voices. Participation by the community further boosts ownership, motivation, and ultimately leads to sustainability. The community initiatives become accountable to the citizens, create opportunities for learning, and support advocacy at all levels, as noted by Mlander (2008). Community leaders have a significant role in fostering participation within the community. Their duties include motivating residents to subscribe to waste collection services, ensuring timely fee payments, promoting waste separation efforts, and overseeing the effectiveness of the service

provided. Additionally, they should act as intermediaries for local authorities, oversee the operations of local government and private companies, and function as an advocacy group to secure services from local authorities (Laura, 2000).

2.4.2 Role of formal private sector in MSW management

The private waste disposal system is an agreement between individuals or groups operating waste disposal as a business and the waste producers. This approach is typically found among high and medium-income households that can bear the costs. The public waste disposal system is more traditional. In this scenario, the government creates a waste disposal agency tasked with collecting waste from generators and disposing of it at designated sites. Some cities implement a mixed system, particularly when the public method struggles to manage the waste volume; the private sector is utilized to enhance the efforts of the public system. This combined method is quite prevalent in Nigerian cities like Enugu, Port Harcourt, Aba, Owerri, Ibadan, and Kano (FMHE, 1983). The hybrid model offers numerous benefits that advocate for its use. While the public system is regulated and managed by state authorities, the private sector, driven by profit, strives to provide quality service in order to attract more clients and expand its reach. This profit-driven approach helps ensure that efficiency is maintained (Omuta, 1985).

In numerous cities within developing nations, the rates of waste collection are still low, and the quality of these services is inadequate. Waste collection services are often absent in disadvantaged areas like slums. Although there are successful cases where the private sector and local communities contribute to waste management, many cities in developing countries still lack effective solutions, involvement of these segments of society is still very limited. Hence, Oluwole et al (2006) added that, the government began to review the approach of private sector Participation (PSP) for better service delivery in Waste Management. Previously, waste

management in Nigeria was primarily handled by the public sector, specifically through local governments or waste management ministries. However, the sight of refuse accumulating in public areas such as streets, markets, and motor parks has raised concerns among many business owners who believe that the private sector could manage waste more effectively than the public sector. Early efforts from the private sector were concentrated in major cities like Lagos, Ibadan, Kaduna, Asaba, and Warri, among others. The provision of free waste disposal by public entities was being questioned due to the financial capabilities of individuals to hire waste disposal services from the private sector (Suleyman and Henry, 2018).

Formal private companies engage in various activities related to waste management systems, including waste collection, resource recovery, incineration, and landfill operations. Their involvement in waste management can take several forms: signing contracts with municipalities to provide collection, processing, disposal, or cleaning services for compensation; entering into agreements with individuals or businesses for collection services; and acting as buyers of recovered materials (Ukoje, 2011). Given that the private sector aims for profit, there are concerns that it might not serve all communities equally (Gidman et al., 1995). For instance, Lardinois (1996) noted in Guatemala that certain private enterprises choose whom they will serve on their own. Consequently, entrusting these services to the private sector can transform a public monopoly into a private one (Gidman et al, 1995). Given that the private sector lacks political accountability, there is a significant need for regulation from the public sector. However, Satterthwaite (1999) argues that the local governmental structures in the Global South are too fragile to adequately regulate private companies. Despite these concerns, there is a prevalent belief that the private sector is more effective in providing services. Therefore, governments should take an enabling stance to assist private entities in promoting equity. Some

public service providers have significantly enhanced service delivery and often lowered costs by utilizing small and micro-scale local community or private businesses to address service gaps (Harper, 2000).

Formal private companies engage in a variety of activities within waste management systems, including waste collection, resource recovery, incineration, and landfill operations. Their involvement in these systems occurs in several ways, such as securing contracts with municipalities to provide collection, processing, disposal, or cleaning services for a fee; entering into agreements with individuals or businesses for collection services; and acting as buyers of recovered materials (Ukoje, 2011).

Private sector firms typically participate in waste collection, street cleaning, material recovery, and increasingly in the development and management of landfills, incinerators, and composting facilities, acting as concessionaires or contractors for the relevant government authority. Unlike government entities, private companies do not bear direct responsibility for public sanitation or health, which limits their participation to areas where they can generate profit. If there is no revenue stream, it is unreasonable to anticipate the involvement of the private sector.

2.4.3 Role of informal private sector in MSW management

The concept of ‘informal private sector’ describes the unregulated and unregistered activities performed by individuals, families, or community enterprises that engage in small-scale value-adding tasks with low capital investment, utilizing local resources and playing a crucial role in service delivery when they are acknowledged, organized, and employ labor-intensive methods (Furedy, 1989). The informal private sector and community organizations are increasingly viewed as collaborating partners by municipalities in developing nations. In

Indonesia, urban areas collaborate with community leaders from low-income neighborhoods to coordinate collective efforts for the self-management of waste disposal at a shared depot or to employ and oversee local workers who conduct door-to-door waste collection using pushcarts. In Mexico, the municipal government granted a cooperative of waste pickers from the dumpsite the rights to operate the city landfill (Cointreau-Levine, 1994).

The informal sector, which includes the kabadi system and waste pickers, plays a vital role in the municipal solid waste management (MSWM) value chain by salvaging useful materials from waste. They assist in minimizing environmental impacts by enhancing resource recovery and decreasing the need for waste disposal. Incorporating the informal sector into the formal solid waste management system will help lower overall system costs, bolster the local recycling industry, and generate new employment opportunities. The process of integrating the informal waste sector involves various methods through which waste pickers can participate in formal waste management systems. This is achievable through a combination of formal or informal agreements among waste pickers, organizations representing them, groups collaborating with waste pickers, and local government bodies. Typically, this integration process leads to social benefits for waste pickers (Central Public Health and Environmental Engineering Organization, 2016).

In certain situations, waste pickers and recyclers have achieved formal acknowledgment from local governments by uniting and structuring their operations. These efforts are progressively legitimizing the informal roles that developed as means of survival. The ensuing enterprises, particularly in recycling, are transitioning and increasingly becoming 'formalized'. Many now function within the ambiguous zone between the formal and informal economies. A prominent example of recognized informal private sector ventures is the Zabbaleen in Cairo.

They collect approximately 2,700 metric tonnes of residential waste each day, accounting for around 50 percent of Cairo's total daily output of 6,000 tonnes (Myllyla, 2001). With some external support, they have been able to organize and expand their services, evolving from mere waste collection to establishing and managing recycling and composting operations. The Zabbaleen have also achieved formal acknowledgment from the local municipal authorities. Evidence from South America and Southeast Asia further indicates that organizing the informal sector is indeed crucial for achieving success and integration within municipal waste management systems.

For various reasons, resource recovery plays a crucial role in the management of solid waste in developing countries. Traditionally, reclaimable inorganic materials (such as metals, glass, plastics, textiles, and others) have been primarily retrieved through unregulated manual scavenging conducted by individuals in the "informal" sector. In recent years, there has been a movement towards the formalization and mechanization of scavenging through the creation of material recovery facilities (CalRecovery, 1993).

In both developing and industrialized countries, as well as in those undergoing transition, individual workers and small unregistered enterprises extract materials from the waste stream. They accomplish this through specialized collection, purchasing recyclable materials, or sifting through waste. These workers and businesses clean and/or enhance the recovered materials to sell them to intermediate processors, brokers, or manufacturers. Occasionally, informal sector workers create new products from the salvaged materials, such as making gaskets and shoe soles from discarded tires (CalRecovery, 1993).

2.4.4 Role of Local Government in MSW Management

Local governments typically oversee the delivery of services that impact individuals' behaviors, such as spatial planning, economic growth, infrastructure development, transportation, waste management, pollution control, education, awareness initiatives, and environmental information provision. Numerous persuasive documents from the 1990s that sought to foster a commitment to environmental sustainability recognized the importance of local government as a key player in this process (Addo-Fordwuor and Seah, 2021).

In least developed countries (LDCs), there is significant evidence indicating that the efficient handling of solid waste in urban settings is increasingly becoming a daunting challenge for local governments, due to issues such as low collection rates, open dumping, illegal dumping, and the open incineration of waste. For the majority of the time following 1960, when environmental and resource policies became major public concerns, the focus of discussions regarding these policies was primarily at the federal and state levels. However, in the later decades of the century, more decisions and policies that shape the quality of life for citizens are being made at the local level (Criner, 1991). It can thus be concluded that these responsibilities of local government necessitate coordination, facilitation, and regulation of municipal solid waste management activities in urban areas. Nevertheless, the provision of solid waste management services remains insufficient in numerous municipalities across the developing world, although in most cases, the ultimate responsibility for solid waste management is legally assigned to municipalities. In this context, local authorities must take initiative to play a more prominent role in leading solid waste management efforts. The legal framework that established local governments positions them as the primary entity responsible for regulating environmental concerns within the Metropolis. Legal mandates refer to the statutory provisions that create a

supportive environment for local governments to engage in environmental management. It has been stated that when local governments recognize the limits within which they can govern environmental issues, as outlined by their legal mandate, it is possible to prevent unnecessary and unproductive preemptive challenges (Pamela, 1986).

2.4.5 Benefits of MSW management

The best approach for managing waste is to minimize its generation at different phases, including product design, manufacturing, packaging, usage, and reuse. Preventing waste lowers expenses related to handling, treatment, and disposal. It also decreases leachate, air pollutants, and greenhouse gas emissions, which have a considerable effect on the environment. The next most favorable option is to recover recyclable material resources and enhance the recycling process through sorting, collection, and reprocessing to produce new items.

Urban areas can handle waste by containing it to reduce its effect on the environment, or they can aim to enhance its advantages by reusing waste through methods such as material recycling, energy generation, composting, or direct repurposing. Utilizing waste as a valuable resource provides numerous environmental advantages, including contributions to climate change mitigation, although these benefits have not been thoroughly quantified (Bogner et al. 2007).

For various reasons, resource recovery plays a significant role in solid waste management within developing countries. Recoverable inorganic materials (such as metals, glass, plastic, textiles, and others) have historically been obtained primarily through unregulated manual scavenging by individuals, commonly referred to as the “informal” sector. Recently, there has been a growing trend to formalize and mechanize scavenging via the creation of material

recovery facilities (MRFs). The reuse and recovery of inorganic materials from the waste stream is a crucial component of waste management (Nath, 1993).

Not everyone views “waste” as merely waste. Scavengers and small-scale recyclers are able to extract value from the discarded materials of others. This activity can be organized in a way that allows the informal sector involved to complement existing formal waste collection efforts instead of disrupting them. As noted in this document, scavenging is associated with significant health and social issues, but it’s important to recognize that much “waste” holds value for someone. Individuals who reclaim usable materials from the waste stream help to lower the waste disposal expenses for the entire community. In developed nations, there is a growing recognition of the importance of separating reusable and recyclable materials from the solid waste stream (CalRecovery, 1991).

Tchobanoglous et al. (1993) indicated that effective planning and management are necessary to mitigate the adverse effects of waste on the environment. Consequently, Ghiani et al. (2014) emphasized that organizing solid waste management effectively has become a crucial responsibility for environmental protection. Beranek (1992) contended that the establishment of a reliable solid waste management system is as vital as other critical services like electricity, airports, and highways. Basu (2009) noted that the rising volume of waste makes the ongoing disposal of waste in landfills unsustainable. Therefore, Basu asserts that waste processing is an essential measure required to protect public health.

The logical initial approach for effectively managing solid waste involves minimizing the amount of waste that needs to be handled, whether that handling occurs on the generator’s premises or by an external entity after the waste is disposed of by the generator. Consequently, lower waste volumes do not require collection or other management processes. The concept of

“waste reduction” refers to lowering or, ideally, eliminating waste generation at its source. Waste reduction encompasses the reuse of generated waste materials on the generator’s site or at associated locations (such as integrating industrial scrap back into product manufacturing), as well as the repurposing of items in a similar state by a corresponding group (for example, donating secondhand clothing). Waste reduction also involves decreasing either the volume or harmfulness of waste materials. Techniques for waste reduction involve averting the creation of waste in the first place (CalRecovery, 1993).

2.4.6 Solid Waste Management Strategies

Recycling refers to the method of collecting, processing, and remanufacturing materials that would otherwise be thrown away. This process significantly reduces the amount of waste from municipal, institutional, and business sources that ends up being discarded, thus conserving valuable natural resources and minimizing environmental repercussions, as well as lessening the pressure on public authorities responsible for waste management. Additionally, recycling can create revenue, which helps lower overall costs associated with municipal solid waste management (MSWM). The advantages of recycling include a decrease in the amount of waste needing handling, potential cost reductions from revenues generated by selling recyclable materials, an extended lifespan for landfills due to fewer recyclables being taken to them, a lower requirement for environmental management efforts within the economy, reduced consumption of raw materials, the provision of affordable products made from recycled materials, and opportunities for employment in the informal sector as well as for recyclers and the recycling industry. From an environmental perspective, the benefits encompass sustainable resource use, decreased energy consumption and pollution, minimized land usage for waste disposal sites, and diminished environmental impacts, including those related to climate change (CPHEEO, 2016).

Recycling involves transforming waste materials into new products. The environmental advantages of recycling come from the conservation of both raw natural resources and energy. Since the amount of natural resources conserved, energy used, and the products replaced by recycled goods varies by region, the environmental benefits of recycling also differ based on location. For recycling to take place, waste materials need to be gathered and processed, and there must be a demand for the products created from recycled materials. The recycling process has different levels of formality worldwide, but there is a growing global market for recyclable materials (Christensen 2009).

There are two main motivators for recycling: the economic value of materials and the ecological benefit. The economic value indicates the “fundamental monetary worth of materials... found in waste.” It represents the resale price of an aluminum can retrieved from the trash. This economic value propels all private recycling efforts, as these are motivated by profit. The ecological benefit refers to the “waste management capacity provided” by recycling. By removing recyclables from the waste stream, recycling reduces the amount of waste that needs to be disposed of. This diversion benefit is what drives local recycling initiatives, along with environmental concerns. In the Global South, the recycling chain is largely unregulated; private entities gather and sell recyclable materials in the market. These actions are driven by the economic value of waste, leading collectors to strongly pursue the gathering of high-value materials. In industrialized countries, recycling is primarily managed by municipalities and motivated by the goal of minimizing landfill waste (United Nation Habitat, 2010).

Reusing waste and reducing waste are two highly effective strategies for mitigating the environmental impact of waste, and both depend on changes in consumer behavior. In the U.S., “traditional practices of reuse and recycling have nearly vanished...disposal has been separated

from whatever remains of household production and entrusted to the experts who manage...sanitary landfills” (Strasser, 1999). The American household has not only stopped being a hub for material production and reuse, but the modernization of consumer goods, with its focus on convenience and style, has resulted in the development of lighter, shorter-lasting products. This, in turn, has caused an increase in the generation of more complex waste. While remnants of reuse still exist – or maybe a burgeoning movement is emerging – through garage sales and craigslist transactions, product reuse constitutes a minor avenue for waste management in the Global North. Highlighting the uncommon nature of these practices, in today’s United States, individuals “who repurpose junk in creative and innovative ways are regarded.

In stark contrast, numerous cities in the Global South act as hubs for product reuse. Although few cities maintain records of waste reuse practices and research on this subject is limited, a wealth of anecdotal evidence indicates the widespread nature of reuse behaviors in developing regions. On Sundays, the streets of Bogotá, Colombia, are filled with flea markets offering books, clocks, and clothing salvaged from waste. In a creative entrepreneurial approach, “Trashy Bags,” a company based in Accra, Ghana, compensates consumers for their discarded water sachets. These plastic bags, commonly found littering the city, are used by residents to purchase water before being thrown away. The company repurposes these bags as raw materials to create various products such as bags, raincoats, hats, wallets, and other consumer goods. By compensating consumers for their refuse, the company provides an incentive for citizens to gather their waste, resulting in a reduction of plastic bags being discarded inappropriately. In Bamako, Mali, Municipal Solid Waste is repurposed for agricultural use through a method known as Terreautage. Informal waste collectors sell partially decomposed refuse to farmers, who directly apply it to their crops. “There is a thriving market for both fresh and partially

decomposed raw waste...and serves as a source of nutrients.” However, this practice hinders the establishment of organized composting and the development of a landfill, as historical efforts allowed for complete recycling of waste. Additionally, concepts focused on reuse and repair—an idea gaining traction in industrialized countries—are still prevalent in developing urban areas. Refillable glass bottles remain common in many cities, as do repair shops that cater to a variety of items, from shoes and tires to vacuum cleaners and electronics. Nonetheless, the cultural practices of reuse and repair face challenges. The decreasing costs of consumer products, the rise of a throwaway culture, the design of items intended for obsolescence, and improvements in waste collection systems all contribute to making it more convenient for people to discard items. (UNH, 2010).

Composting is a managed aerobic process that biologically “breaks down” municipal solid waste (MSW) so it can be reused for various purposes, such as providing plant nutrients, stabilizing soil during remediation efforts, or enhancing poor soils. Composting can be performed at local levels (home composting, bin composting, box composting, vermicomposting, and in-vessel composting) or at a centralized level (windrow composting, in-vessel composting, and aerated static piles), depending on what is practical to implement. Both approaches necessitate considerable pre-processing, and only separated organic materials are suitable for composting (CPHEEO, 2016).

Composting involves the breakdown and stabilization of the organic portion of municipal solid waste carried out by a community of microbes in controlled, oxygen-rich conditions. Although composting has been practiced since the dawn of agricultural societies, it is now gaining recognition as an effective centralized waste management strategy that minimizes the amount of waste requiring disposal while simultaneously producing valuable products (Diaz et

al., 2007). In practical terms, composting systems can be either closed or open, and may operate on a household or municipal level. Almost all organic materials can undergo composting, and the end product (compost) can be utilized as a soil amendment, a fertilizer, or even as an alternative to peat (Kreith, 2002). Composting provides environmental advantages; by transforming organic waste into a beneficial product, it reduces the need for additional waste management processes (such as transport and landfill), thereby alleviating their associated environmental impacts. Additionally, by processing organic waste in an aerobic condition, composting helps to avoid the generation of methane, a potent greenhouse gas that would otherwise be released in anaerobic settings.

CHAPTER THREE

STUDY AREA AND METHODOLOGY

3.2 The Study Area

3.2.1 Location and Size

Zaria Local Government Area (LGA) of Kaduna State is located between latitudes $11^{\circ} 3'$ and $11^{\circ} 8'$ North of the equator and longitude $7^{\circ} 40'$ and $7^{\circ} 42'$ East. Its borders to the west by Giwa LGA, to the north by Sabon Gari LGA and Igabi LGA to the south. The built up area of Zaria is formed by fairly distinct urban quarters namely: Tudun-Wada, Wusasa, Gaskiya and Tukur-Tukur (Figure 3.1).

3.2.2 Climate

The climate of Zaria is the AW Koppen type of climate known as tropical continental or savanna type of climate. It has two distinct wet and dry seasons. The wet season begins around May and extends to October. Relative humidity is above 70% in the month of July and reduces to less than 50% in the month of December. Average temperature condition is 30- 35°C in wet season, with very hot conditions between March and May. The temperature is less than 20°C during the harmattan with cold conditions in December and January. The dominant wind in the area is the North East trade Wind which blows north to south. The north east trade wind blows persistently from December, carrying dry, dusty and hazy conditions from the Sahara desert known as Harmattan. The influence of the wind is felt throughout the country (Abubakar, 2012; Banbale, 2016).

Climatic elements play an important role in the decomposition of solid waste. For instance, high humidity (70%) and heat cause biodegradable waste to decompose leading to problems in handling and disposal which affect the environmental health of the waste workers

and the inhabitants. In addition, high moisture during rainy season increases the weight of the refuse which may cause difficulty in conveyance.

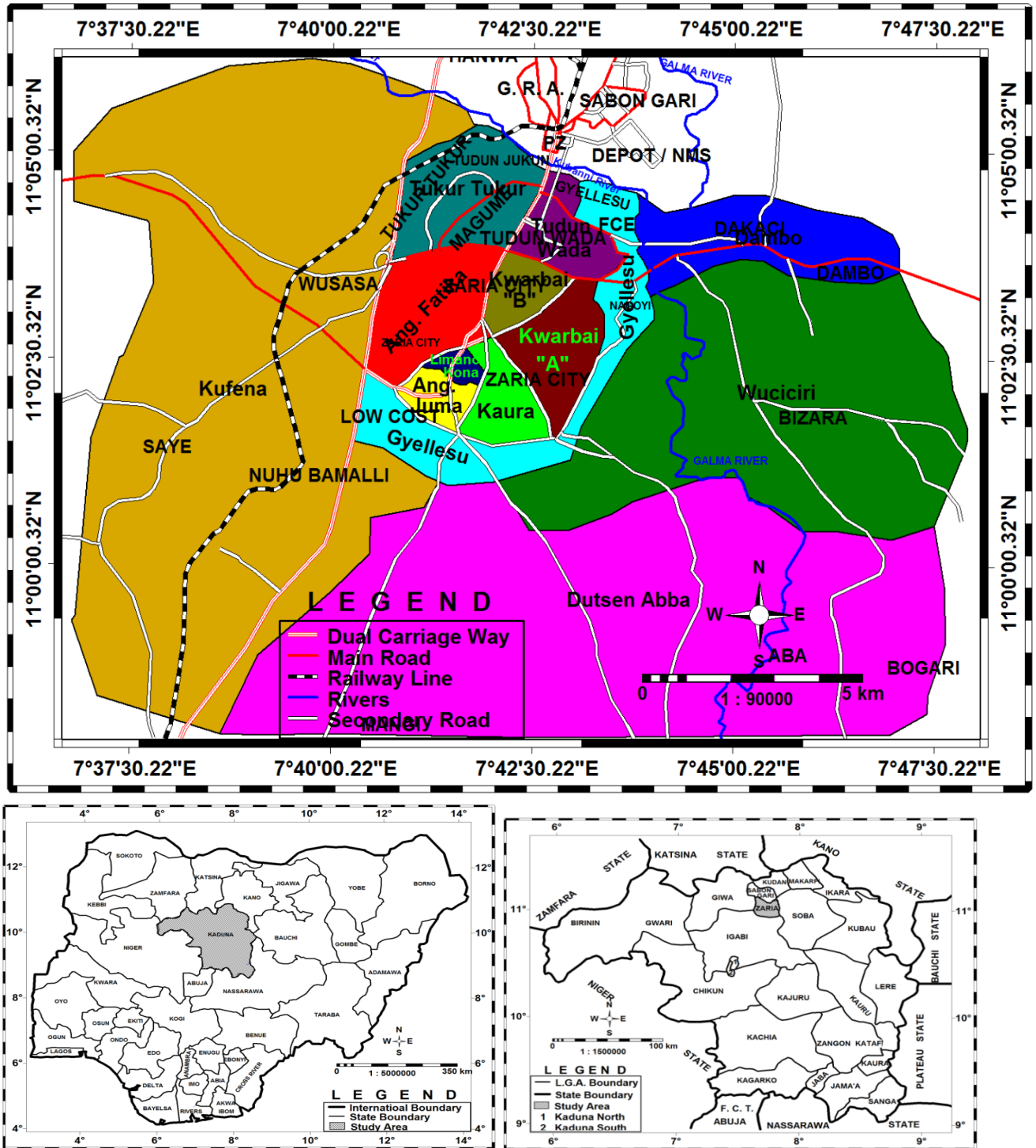


FIGURE 1: The Study Area Showing Wards.
Source: Adapted from administrative map of Kaduna state, 2022.

3.2.3 Relief and Drainage

The relief of Zaria area is dominated by high plains, popularly known as the plains of Hausa land which is between 500- 600 meters above sea level (Udo, 1970). However, rocky granites residuals forms inselbergs of varying size and shapes constitute the main local relief here and there Kufena, Madarkaci, Turunku, Tukur- Tukur and Kудару, Dutsen- wai ring complex standing out prominently (Abubakar,2012; Banbale, 2016).

On the plains are inselberg and hills in different parts of Zaria. Inselberg are found in Farakwai, Madarkaci, and Kufena. Inselberg "Bornhardts" result from lava intrusion which is later on exposed to the surface after long period of weathering and erosion. Kufenainselberg is a batholiths intrusion. It is a compound asymmetrical hill, the minor intrusion is about 850 meters and major intrusion measures 1200 meters. The inselberg is associated with secondary landforms such as lapies, exfoliation boulders, screes, tors and kopjes.

The drainage of Zaria LGA is dominated by three important rivers. Galma is a major tributary to river Kaduna, Saye and Kubanni are tributaries to the Galma in addition to numerous streams such as Niima, Kamaca and Fatika. The drainage pattern is dendritic with first and second order tributaries. Zaria is characterized by the presence of numerous lakes and ponds especially in Zaria city. There are three magnificent ponds in Zaria. The largest one is the one located between KauranJuli and Kuregu and Garuje in TukurTukur.TheKauranJuli and Kuregu ponds are estimated to be about 5000 square metres.The plains are extensively cultivated in the wet season between May to October. The flood plains formed by the three major rivers kubanni, Saye and Galma are extensively cultivated in the dry season through irrigation farming (Abubakar and Bambale, 2016).

During rainy season, most people improperly dump their solid waste in natural and artificial water ways which block it and cause flooding. However, some of the waste reach the main stream and pollute it.

3.2.4 Soil

Relief and drainage control soil formation in Zaria. In Kufena area down to Kubanni valley there is evidence of change in slope with different type of soil identified. On top of the inselberg there is thin soil formed due to weathering of rocks. Down the slopes are skeletal and stony soils. On the plains is tropical ferruginous soil and in Kubanni valley Fadama and sandy soils. The soil types are skeletal soil on top of the inselberg, weakly developed soils on slopes, tropical ferruginous soils on the plains with well-developed horizon A, B, C, D. The tropical ferruginous soil is where cultivation of crops like beans, maize, millet and guinea corn take place. Lastly in Kubanni valley is the fadama soil which is hydromorphic in nature, crumbs and platy in structure which support irrigation activities (Bello, 2002).

Farmers in the community carry soil waste from dumpsite to their farms for soil improvement which is finally washed away by rainfall to the stream and rivers thus polluting it.

3.2.5 Population and People

Zaria is one of the densely populated LGA in Kaduna State inhabited by the indigenous Hausas and other multi ethnic groups such as Yoruba, Igbo, and Nupe among others. The projected population of Zaria LGA in 2025, Based on Nigeria's population growth rate of 3.2% is approximately 602546. This will increase the volume and nature of waste generated which will eventually pose management issues.

Considering the population from 1991 to 2021 at growth rate of 2.8% there will be no doubt be monumental increase in solid waste generation in the study area which requires the effort of multiple stakeholders in sustainable management.

3.2.6 **Socio Economic activities**

Zaria, being in the heart of the Hausa land is predominantly occupied by the Hausa speaking people traditionally known as *Zage- Zagi* or *Zazzagawa*. Zaria economy is primary based on agricultural staples such as guinea corn, maize and millet and cash crops including cotton, ground nut and tobacco (Encyclopedia, 2016). There are great social and economic linkages between the villages and the metropolis (Bello, 2000). Not only is Zaria a market town for the surrounding area, it is the home of artisans from traditional crafts like leather work, dyeing Cap making, to tinkers, print shops and furniture makers (Bashir, 1995). Zaria is also a center of a textile industry that for over 2000 years has made elaborately hand embroidered robes that are worn by men throughout Nigeria and West Africa (Maiwadaet al, 2007). There is no doubt that these activities taking place in Zaria LGA increases waste generation which requires the effort of multiple stakeholders to manage it.

3.3 **Methodology**

This section discusses the method that was employed in generating data for the study. The section focuses on the type of data needed, the sources of data, the sampling design and the method of data analysis.

3.3.1 **Reconnaissance**

Reconnaissance was conducted in order to get acquainted with the area under study. During the survey, the researcher was able to make observation particularly about the stakeholders involve in MSW management and the availability of the collection points in the area. The observation from the study area provided the researcher foreknowledge about the area which help in achieving the set objectives as well as how the questionnaire was administered

within the study area. Visit was done to waste material recovery center in Dan Magaji which was found out approximately 40 tones waste materials are collected every 4 days.

3.3.2 Types of data required for the study

Types of data required will form the basis to achieve the stated objectives, among which includes data on socio- demographic characteristics which include sex, age, marital status, and level of education. Also, data on staff and facilities of stakeholders in municipal solid waste management in the area, data on forms of solid waste management strategies. Data on community participation and community assistance in MSW management were collected in the area. Data on waste management challenges were also collected and data on benefits of MSW management in the area.

3.3.3 Sources of data

Both primary and secondary source of data would be used to generate data for this study. The primary sources of data for this study constitute the administration of structured questionnaire, interview and personal observation in the course of the research. The secondary sources of data include electronics sources such as television programmed on environmental issues, textbook, documents from ministry of environment and Kaduna Environmental Protection Agency (KEPA).

3.3.4 Sample size and sampling techniques

Based on the information generated from Kaduna Environmental Protection Agency (2021), there are sixteen collection points where waste receptacles are placed across the study area. These are along Zaria- Kano express way Gwargwaje; at LEA primary school KofarKuyanbana; at WaziriLawal LEA Primary School AnguwanIya;DuruminmaiGarkeMarket;Babban Dodo U-turn and Zaria City Market. Others are in Bakin Boarder-Kaura; Parking Area Emir

Palace, Rimi Tsiwa opposite Sarkin Yamma residence, Kofar Doka Round About, Anguwan Kaya close to Bashir Sa'idu resident, Congo Campus Gate and behind FCE Zaria before bridge. The last set are located at Maje Road by Kubanni bridge Tudun Wada, Tudun Wada near Cinema, Polytechnic Gate Gaskiya. Also there is one transfer station opposite Filin Mallawa close to A-One Dual Academy Banzazzau (KEPA, 2021). These 16 collection points are distributed within only seven of the thirteen wards across the LGA.

To determine the sample size for the study, there are sixteen collection points within the 7 wards of the LGA which are considered as units of observation. These waste collection points were purposively selected for data collection because they are the only wards with waste collection points. In order to accommodate the six wards where waste collection points are not available, respondents were selected using convenient sample based on waste generation potentials of these wards. For equal representation, six wards with waste collection points and six wards without waste collection points are selected.

Waste generation among other factors depends on the population size and characteristics. This therefore was used in determining the 12 wards to be selected. In this sense the wards are ranked based on their population and the highest among those with waste collection point and those without waste collection point were selected as shown in Table 3.1. The population of each selected wards of the local government area as at 1991 census population is listed in table 3.1. The 2021 population for each wards studied is projected using the growth rate of 2.8% for Kaduna state, with the use of exponential method recommended by NPC. Therefore,

$$\text{From } P_n = P_o \left(1 + \frac{R}{100}\right)^n$$

Where P_n = Population of the future date- 2021

P_o = Base year population - 1991

n = Mehta

R =Rate of growth

N =Interval between the base year and the future year -30

The 2021 projected population of the sampled wards is also presented in Table 1.

In order to determine the sample size for questionnaire administration, Yamane was adopted as

$$S = \frac{N}{1+N(e)^2}$$

Where N is the total population of the study area

e is the error range = 0.05

The sample size is calculated based on the Yamane's formula as follows;

$$\begin{aligned} &= \frac{N}{1+N(e)^2} \\ &= \frac{672170}{1+672170(0.05)^2} \\ &= \frac{672170}{1680} \\ &= 400 \end{aligned}$$

The sample size determined above will be shared among the selected wards of the Local Government area proportionate to their populations present in table 1.

Table 3.1 Sample Size of the Wards

Wards with collection points	1991 population	2021 projected population	Sample Size	Number of collection points at each ward
Limanci	35835	96751	54	1
Kwarbai (B)	34663	93590	53	1
Tukur-Tukur	30059	81159	45	4
Gyallesu	17805	48073	28	2
Kaura	15065	40675	24	3
Kwarbai (A)	14697	39681	23	1
Tudun Wada	12998	35094	20	1
			241	
Wards without collection point	1991 population	2021 projected population	Sample size	
Dutsen Abba	26350	71145	40	
AnguwanFatika	17817	48251	25	
AnguwanJuma	15065	40675	23	
Wucicciri	15065	40675	23	
Kufena	13361	36074	21	
Dambo	13191	35421	21	
			153	
Total	248973	672170	400	

Source: Author's Computation, 2021

The number of questionnaires administered were proportionate to the population of each selected wards thus, $\text{proportion} = \frac{n}{N} \times \text{the sample size of the study}$.

Where n = population of each selected wards.

N = Total population of the selected wards.

In administering the questionnaires, purposive sampling technique was used because the research purposively selects respondents from residential, commercial and institutional uses in the study. This is to ensure the gathering of data from various stakeholders that are crucial to the study and to ensure that the sample is both representative and reasonable of the various socioeconomic groups that generate MSW in the study area.

For the other stakeholders, three set of questionnaire were developed and administered to respondents who are stakeholders from institutional, environmental and other government agencies. Based on their peculiarities, a set of questionnaire was administered to the head of environmental unit of Federal College of Education Zaria, NuhuBamalli polytechnic and Ahmadu Bello University Congo. The second set was administered to WASH department of Zaria LGA, KEPA and Zaria Metropolitan Authority. While the last set of questionnaire was administered to representative of BIA link and manager or representative of main waste material recovery centre in Dan Magaji.

3.3.5 Method of data analysis

The data collected was analyzed using different appropriate techniques. The objectives of the research will be achieved as follows;

Objective i: examined the stakeholder's roles in sustainable MSW management in Zaria LGA.

Data obtain were analyzed using descriptive statistics such as table, percentages and frequency.

Objective ii: examined the sustainable MSW management strategies in Zaria LGA. Data obtain were analyzed using descriptive statistics such as table, percentages and frequency.

Objective iii: identified the benefits of sustainable MSW management in the study area. The data collected were analyzed using descriptive statistics such as tables, charts and percentages.

Objective iv: assessed the strength, weakness, opportunity and threats in multi stakeholders approach to sustainable MSW management in the study area. Data collected were analyzed using chi- square and correlation model.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Introduction

Out of 400 respondents initially sampled for the survey 388 copies of questionnaire were properly filled and returned while 12 were missing from respondents accounting for 97% of the sampled population and this was used for the analysis. The results are presented and discussed simultaneously. After the demographic and socioeconomic characteristics of the respondents. The subsection that follow is done by objectives of the study.

4.2 Demographic Characteristics

4.2.1 Sex of respondents

Sex of respondents is very significant because of its role in decision making. Figure 4.1 shows sex of respondents in the study area.

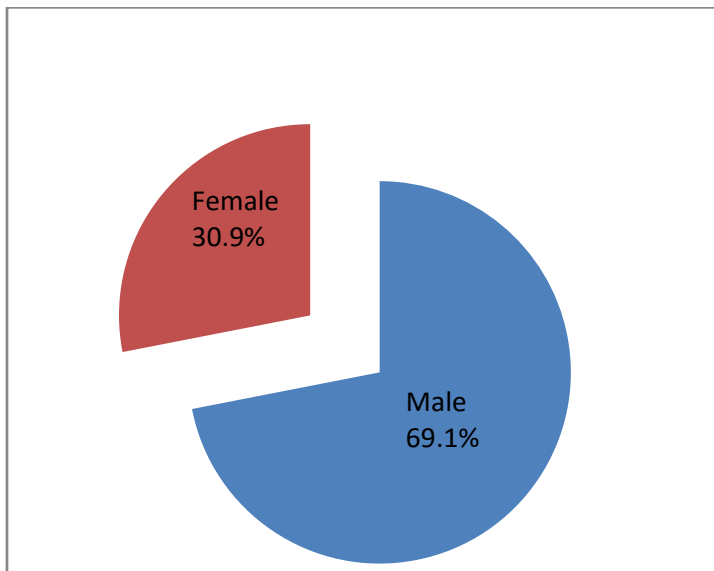


Figure 4.1: Distribution of sex by respondents

Source: Field survey, 2023

Out of the 388 respondents, the highest proportions were males with 69.1% while 30.9% were females. This variation may be due to the time when the data was collected, that is in the evening when most of the household heads are around and also due to the socio-cultural setting of the study area. This is in tandem with the research of Longe *et al* (2009) which reported 62% to 38% of male and female respondents respectively.

4.2.2: Age of respondents

Age is expected to play a significant role as maturity could affect level of awareness on environmental health and sanitation (Bradley *et al.*, 1999; Eagles and Demare, 1999). Table 4.1 contains age group of respondents participating in communal activities from 16 years to 45 years and above. This is shown in table 4.1

Table 4.1: Distribution of respondents by age Group

Age group years	Frequency	Percentage
16 - 25	44	11.3
26 - 35	108	27.8
36 - 45	136	35.1
Above 45	100	25.8
Total	388	100.0

Source: Field survey, 2023

Results in Table 4.1 shows that one third of respondents (35.1%) of respondents in the study area were aged between 36-45years followed by 27.8% of respondents aged between 26-35years followed by 25.8% of respondents aged 45years and above with 11% representing 16-25years aged group. The findings reveals that majority 35.1% and 27.% are within the labor force age group therefore likely to contribute to waste management and social communal activities. This is in line with Nanai (2019) who reported that the level of participation in social development activities tend to increase with the optimum age group, after which participation

start to decline with increase in age. This agrees with finding by Musa and Kabir (2018) in a study who reported that respondents within age 31-45 constitute the highest, (40.4%) followed by those within 16- 45 (25.5%). Others who are also within the active age are 16-25 (9.0%) and 46-60 (18.9%). This implies that there are both active people and experienced adult who can actively engage in solid waste management, initiate and engage in community services.

4.2.3: Marital status of respondents

Respondents were asked to state their marital status whether single, married, divorced or widowed. This is shown in Table 4.2

Table 4.2: Distribution of respondents according to marital status

Marital status	Frequency	Percentage
Single	24	6.2
Married	300	77.3
Widowed	12	3.1
Divorced	32	8.2
Separation	20	5.2
Total	388	100.0

Source: Field survey, 2023

Respondents were asked to state their marital status. The findings in Table 4.2 indicate that about 77.3% of respondents were married, 6.2% single, 3.1% widowed, 8.2% divorced and 5.2% separated. The higher proportion of the married couples indicate there may be high tendency of participation in solid waste management due to division of men and women roles within the house which is in line with Adesina and Bandu-ferson, (2018) who reported that married couple show a high level of participation in community development activities probably due to cooperation among them in the marriage institution in the society.

4.2.4: Level of education of respondents

If residents of a neighborhood are formally educated, organized and sensitized, they could be easily mobilized to team up and on their own become committed to development of

their neighborhood to the extent that they can on their own take decisions to clean up their neighborhoods and thus improve the processes of waste management (Chikwu and Uwadiiegwu, 2013). Respondents were asked to state their level of education and the result is in table 4.3.

Table 4.3: Distribution of respondents by their educational level

Educational level	Frequency	Percentage
Quranic	20	5.2
Primary	40	10.3
Secondary	144	37.1
Tertiary	184	47.4
Total	388	100.0

Source: Field survey, 2023

The Table indicates that majority of respondents 47.4% had tertiary education, 37.1% had secondary education, and while 10.3% and 5.2% had primary and Qur’anic education respectively. The higher proportion of tertiary education may be as a result of availability and proximity of several institutions such as ABU Zaria, FCE Zaria, NuhuBamalli Polytechnic Zaria and Amir ShehuIdris College of Advance Studies Zaria among others. Findings are contrary to Yakubu and Mado (2018) which reported educational level of majority of stakeholders in waste management is secondary education, (40.2%) then primary (25.7%) and tertiary (20.2%).

4.2.5: Household size of respondents

Respondents were asked to state all members who live in their household including parents, children and other dependents. Table 4.5 below entails majority (39.2%) of respondents had between 6-10 people, 38.1% had 11-15 people, 13.4% had household size of 16 and above only 9.3% with people below 6. The reason for large household size may be as a result of religious and cultural influence which encourages polygamous marriage and giving birth to many children. This implies high generation of waste because the more the number of household, the more the waste generated. as confirmed by Niringiye(2015) who stated that the more the number

of people in the household, the more the waste generated, hence disposal becomes a problem, therefore, it is expected to be more willing to participate in order to keep a clean environment.

Table 4.4: Distribution of household size among respondents

Household size	Frequency	Percentage
Below 6	36	9.3
6 - 10	152	39.2
11 - 15	148	38.1
16 Above	52	13.4
Total	388	100.0

Source: Field survey, 2023

4.2.6: Monthly income of respondents

Income level influence living standard of respondents which in turn determine environmental quality status. As sited in Shanghai manual the types of MSW produced change according to the standard of living in the city. Wastes generated by people in low- and middle-income cities have a large proportion of organic waste, whereas the wastes from people in high-income cities are more diversified with relatively larger shares of plastics and paper.

Table 4.5: Distribution of Respondents by Monthly Income

Monthly income(₦)	Frequency	Percentage
Below 20000	16	4.1
21000 – 40000	52	13.4
41000 – 60000	76	19.6
61000 and Above	244	62.9
Total	388	100.0

Source: Field survey, 2023

Table 4.5 indicates that 62.9% in the area earn monthly income above 60000 naira, 19.6% earned 41000-60000, 13.4% and 4.1% earned 21000-40000 and below 20000 respectively. Longe (2009) added that the average monthly income of respondents is also

considered an important variable that could influence people’s perception and attitude on solid waste management system.

4.3: Role of Community and other Stakeholders in Municipal Solid Waste Management

Community participation in solid waste management covers a variety of types, and encompasses several forms of local involvement, including: awareness and teaching proper sanitary behaviour, cost recovery schemes, resource recovery actions, and participating in consultation, administration, and/or management functions (Rigasa, 2016).

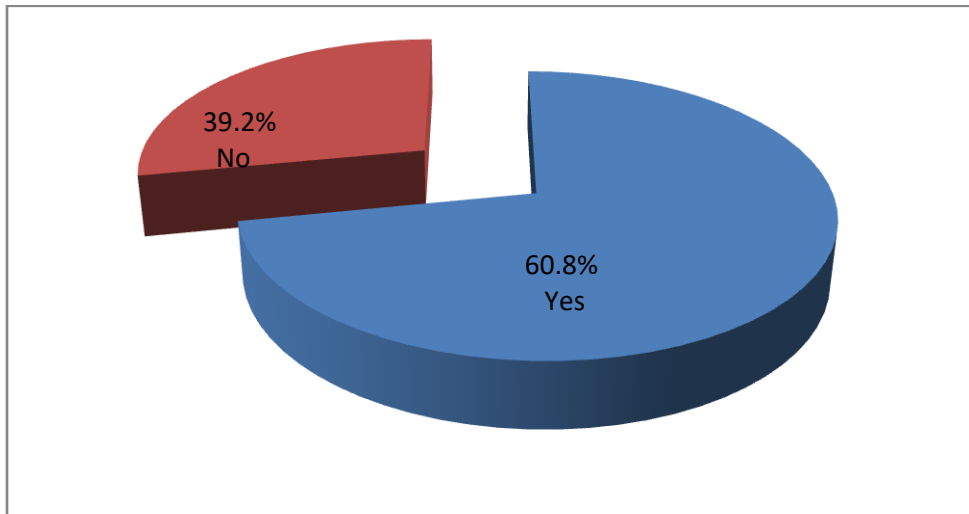


Figure 4.2: Community participation

Source: Field survey 2023

Fig 4.2 indicates that majority(60.8%) of the respondents do participate in solid waste management in their community while 39.2% said the contrary. This is contrary to the finding of Olukanni, (2020) who reported that majority of the residents are still with the opinion that waste management sanitation services are too costly and should be prerogative of the local and state government to carry out hence did not participate.

4.3.1 Availability of waste disposal at home

Majority of respondents possess waste receptacle at home. This is shown in figure 4.3.

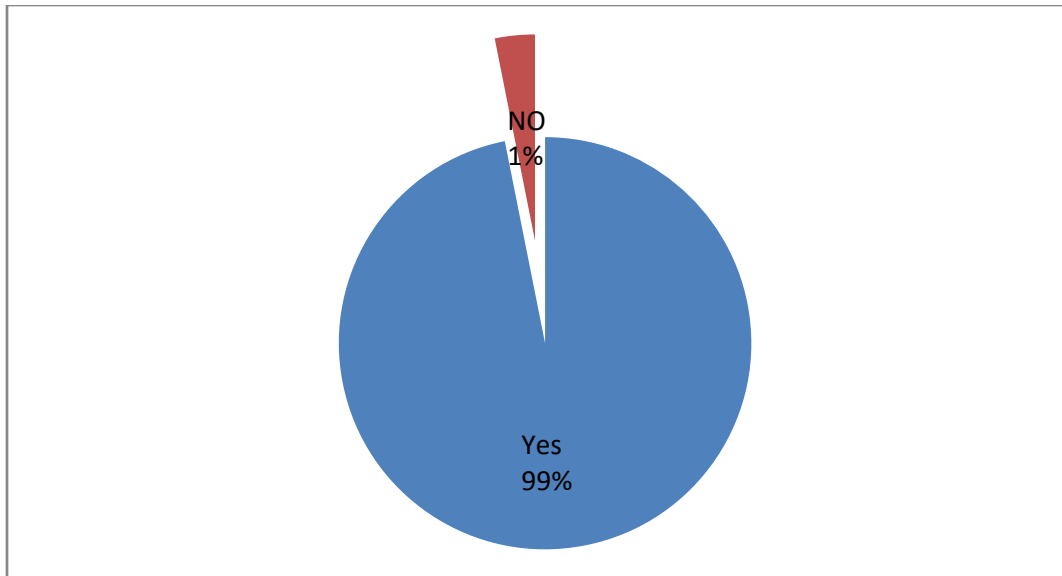


Figure 4.3: Availability of Waste disposal facilities at home

Source: Field survey, 2023

The respondents were asked if they have waste disposal facilities at home. Fig. 4.3 shows that 99% of the respondents living in the communities have waste disposal facilities at their various houses these include dust bin, drum as well as large nylon bags. Only 1% did not have waste receptacles at their residential areas. Results indicate that majority of respondents used storage facilities such as drum that can accommodate their waste due to large household size as observed by Ukoje (2006) who reported over 96 percent of the respondents in Zaria indicated the use of waste storage facilities in their homes.

Available facilities used by respondents in their various houses determine effectiveness in their various houses. Therefore, questions were asked on available facilities used for disposing waste at home as shown in Table 4.6.

Table 4.6: Available receptacles use for disposing waste at home.

Available facilities	Frequency	Percentage
Dust bin	96	24.7
Open field	104	26.8
Drum	132	34.0
Others	56	14.4
Total	388	100.0

Source: Field survey, 2023

Table 4.6 indicates that 24.7% make use of dustbin as their disposal facilities, 26.8% disposed in an open field, 34% in drums with 14.4% in other facilities. Results indicate that majority of respondents used waste storage facilities such as drums and open field due to large family size at home. This is contrary to finding of Ukoje, (2009) which reported that drums and plastics constitute 21.5% and 61.1% respectively of storage materials. The reason for the disparity may be as a result of time gap of 13 years.

Table 4.7: Area where community dispose household collected waste.

Waste disposal area	Frequency	Percentage
Collection Point	80	20.6
Gutter	36	9.3
Burning	172	44.3
Open field	100	25.8
Total	388	100.0

Source: Field survey, 2023

Table 4.7 shows where communities dispose their waste. About 20.6% of respondents dispose their waste at designated collection points because of proximity especially in places like RimiTsiwa and Babban Dodo. Another 9.3% dispose in gutter, 44.3% burn their waste due to problem such as absence of waste collection points while some purposively burn and use it as manure in the farms. Another 25.8% dispose in an open field due to absence of designated dumpsite which is finally burn and use by many farmers as manure which is shown in plate 4.1, 4.2 and 4.3 below. This reveals that majority of respondents do not dispose their waste at the designated collection point as supported by Rigasa (2016) who reported that most respondents

reported using the unofficial road side dumps for their waste. The dump sites are too far from the city. As a result, formal and informal waste managers dump waste at unofficial waste dumps. Generally, 85% of the respondents are unhappy with the status quo and expressed their desire for change. This is also in tandem with Ukoje research 2009 which reported burning of wastes (70%) constitutes the common method of waste disposal employed in Zaria. UNEP (2010) added that open dumps and open burning continue to be the primary method of MSW disposal in most developing countries.



PLATE 4.1

Source: Field survey, 2023

Plate 4.1: Burning of waste in an open field at Bizara, Dambo ward.



PATE 4.2

Source: Field survey, 2023

Plate4.2Packaging of burnt waste as manure in Bizara, Dambo ward



PATE 4.3

Source: Field Survey, 2023

Plate 4.3Already burnt waste used as manure at Nagoyi, Gyallesu ward (Field survey, 2023)

4.3.2 Community effort in solid waste management

Community participation in solid waste management covers a variety of types, and encompasses several forms of local involvement, including: awareness and teaching proper sanitary behaviour, cost recovery schemes, resource recovery actions, and participating in consultation, administration, and/or management functions(Rigasa, 2016). Question on effort of community were asked. This is shown in Table 4.8.

Table 4.8: Efforts of Community Members in Solid Waste Management.

Community efforts	Frequency	Percentage
Disposing waste and that of my neighbor at collection Point	52	13.4
Educating others around to dispose waste timely and properly	40	10.3
Separating recyclables and organic waste	196	50.5
Educating others and separating recyclable items	100	25.8
Total	388	100.0

Source: Field survey, 2023

Table 4.8 shows that 13.4% dispose their waste and that of their neighbour at collection point by paying almajirai especially in Anguwan Alkali of Kwarbai Ward, 10.3% educate other members of the community around to disposed waste timely and properly which is carried out by Bizara Youth Development Association in Bizara of Dambo Ward. Another 50.5% separate recyclables and organic waste by selling the recyclable items such as metals and plastics to scavengers. About 25.8% mentioned separating recyclables and organic waste and educating others around to dispose their waste timely and properly as their effort. The higher proportion of those separating recyclables and organic waste as community effort may be as a result recyclables items such as metals and plastics are now considered as valuable resources for exchange with resource recovery agents for recycling. This opposed the research of Yakubu and

Mado (2018) that about 72.2% of the households do not engage in waste separation they consider all waste to have similar characteristics.

Table 4.9 Role of the other stakeholders

Roles	Frequency	Percentage
Refuse disposal/Waste collection	4	33.4
Supervision	3	25
Transportation to dumpsites/Burning	3	25
Waste separation/Transportation to recycling company	1	8.3
Awarding of waste contract	1	8.3
Total	12	100.0

* **Multiple responses**

Source: Field survey, 2023.

Table 4.9 shows that one third(33.4%) carried out waste collection and refuse disposal in the area, while 25% such as KEPA, local government area and ZMA supervised waste management. Another 25% such as Bia link carried out transportation of waste to dumpsite with 8.3% such as main waste recovery centre Dan Magaji said waste separation and transportation to recycling companies while another 8.3%(ZMA) mention awarding of waste management contracts as their role. This is in line with Freemans' model adopted in the research which illustrates the relationship between various actors in and around the firm.

4.4: Benefits of Sustainable Municipal Solid Waste Management

Table 4.10: Opinion of Households on Benefits of Municipal Solid Waste Management in the area.

Benefits	Frequency	Percentage
Environmental Cleanliness	104	26.8
It reduce Environmental Pollution	132	34.0
Creation of Jobs	8	2.1
Others	144	37.1
Total	388	100.0

Source: Field survey, 2023

Table 4.10 indicates the benefits of municipal solid waste management, about 26.8% mentioned environmental cleanliness as the benefit of MSW management which led to healthy and hygienic environment free from water and airborne diseases, 34% said it reduce environmental pollution through environmental solid waste strategies like reuse and selling some recovered items to scavengers. This reduces the quantity of waste causing environmental pollution. Another 2.1% said job creation as some people both men and women are employed to carry out waste management activities while 37.1% mentioned reduction of environmental pollution and environmental cleanliness as the benefits of MSW management. Invariably environmental cleanliness and reduction of environmental pollution are the major benefits of MSW management in the area. Nath (1993) stated that the most preferred option for waste management is to prevent the generation of waste at various stages including the product design, production, packaging, use, and reuse. Waste prevention helps reduce handling, treatment, and disposal costs. It also reduces leachate, air emissions, and greenhouse gases which have significant impacts on the environment.

Table 4.11: Opinions of other Stakeholders on Benefits of MSW management

Benefits	Frequency	Percentage
Disease prevention	3	21.4
Environmental cleanliness	6	42.8
Job creation	3	21.4
Control of over floating	1	7.2
Ecosystem preservation	1	7.2
Total	14	100.0

* **Multiple responses**

Source: Field survey, 2023.

Table 4.11 shows that 21.4% mentioned disease prevention as benefit of MSW management, 42.8% said environmental clean less, 21.4% mentioned job creation as benefit of waste management. Another 7.2% said control of over floating while 7.2% mentioned ecosystem preservation.

4.5: Sustainable Municipal Solid Waste Management Strategies in the Area

Households were asked on solid waste management strategies used such as reuse in the area.

This is shown in figure 4.4

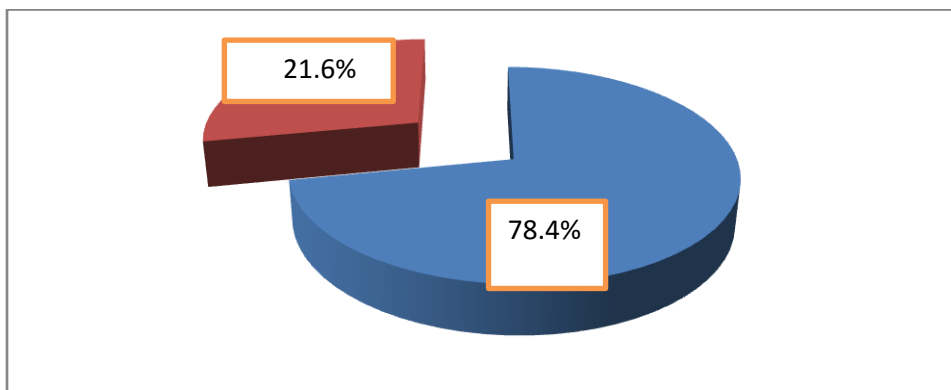


Figure4.4: Reuse of solid waste by respondents

Source: Field survey, 2023.

Figure 4.4 explain that 78.4% of respondents reused some of their items while 21.6% don't reused. The results indicate majority of respondents reuse some items such as nylon using it to package things when the need arise. They also use empty bottle to repackage homemade beverages like Tiger nut drinks (*kununaya*) and *Zobo* drinks for business and personal consumption. This reduces the volume of waste generation in the area. However, this is not similar to study of Yakubu and Mado (2018) which shows that majority (64.5%) of the respondents do not practice reuse and recycle of solid waste.

This result is for only those who claimed to be reusing waste from the outcome of Figure 4.4 hence the total is 304 instead of 388.

Table 4.12: Waste reuse by respondents.

Type of waste	Frequency	Percentage
Biodegradable	32	10.5%
Non-Biodegradable	272	89.5%
Total	304	100.0

Source: Field survey, 2023

* NO=84

Table 4.12 shows 10.5% of respondents reusing some of their biodegradable waste, 89.5% non-biodegradable waste. Results shows that majority of the waste reused are non- biodegradable material such as empty bottles which are used to store water for drinking as well as packaging local drinks and herbs for commercial reason and personal consumption. This supported the work of Ukoje (2006) which reported high level of plastics and polyethylene in Zaria waste stream reflect the increasing importance of these materials for production of household items and for packaging.

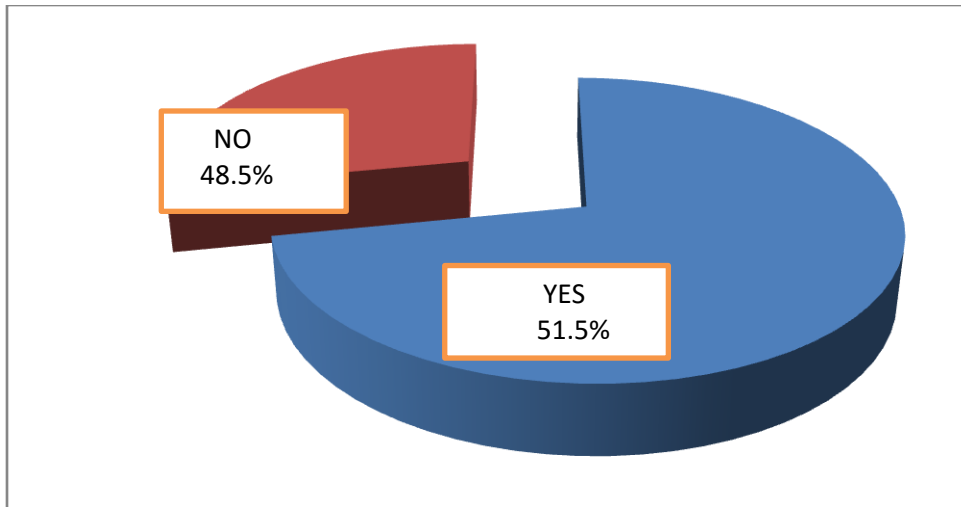


Figure 4.5: Selling of solid waste by respondents.

Source: Field survey, 2023

Figure 4.5 explains that 51.5% of respondents sell some of their waste while 48.5% claim the opposite. There is no doubt this would reduce solid waste generation in the area. Conclusion can be drawn that most of the respondents consider some of their waste as resource. These results are in line with what was reported by Amasuomu et al (2015) where their findings indicated that 71.93% of the respondents claim that they place a value on their wastes whereas the 28.07% said that they do not value wastes.

Table 4.13: Type of solid waste sold by respondents.

Types	Frequency	Percentage
Metal	104	52
Rubber	36	18
Plastic	60	30
Total	200	100.0

Source: Field survey, 2023

***NO=188**

Table 4.13 present some of the solid waste sold by respondents. Over half (52%) sold metals waste to scavengers, 18% sold rubber, while 30% plastic materials to scavengers. This indicates that majority of respondents no longer dispose most waste especially metals and plastics but

rather recognize its value for exchange with other goods with scavengers. This support the finding of Rigasa (2016) that segregation is limited to only items of value (end-of life resources). Green waste (plant residues), food waste (left overs), recyclables (plastics and glass) and metal scraps (iron, aluminium, copper among others) are sorted by households where their value is recognized usually for exchange with other goods by itinerant buyers.

4.6 Capacity of Waste Management Agencies and Institutions in the Study Area

The Chi- square test and correlation were used in achieving the fourth objectives of the study which entails assessing the capacity of waste management agencies and institution in the study area.

Table 4.14: Relationship between the Available and Required Staff of Institution/Agencies

Count		Number of Staff		Total
		Available	Required	
Environmental Unit of Institution/Agencies	A.B.U	406	424	830
	F.C.E	120	200	320
	N.B.P.Z	405	444	849
	ZLG	10	22	32
	KEPA	59	82	141
	Z.M.A	10	17	27
	BIA LINK	109	157	266
	Main Waste Resource Recovery Centre Dan Magaji	26	33	59
Total		1145	1379	2524

Source: Field Survey, 2023

Table 4.15 Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	20.220 ^a	7	.005
Likelihood Ratio	20.429	7	.005
Linear-by-Linear Association	4.403	1	.036
N of Valid Cases	2524		

Source: Field Survey, 2023

Table 4.16 Symmetric Measures

		Value	Asymptotic Standardized Error ^a	Approximate T ^b	Approximate Significance
Interval by Interval	Pearson's R	.042	.020	2.100	.036 ^c
Ordinal by Ordinal	Spearman Correlation	.040	.020	1.999	.046 ^c
N of Valid Cases		2524			

Source: Field Survey, 2023

1. H0: There is no significant relationship between the stakeholder's capacity (Staff) and Management of Municipal solid waste in the area.

The above chi-square test P-Value (0.005) which is less than 0.05 level of significance indicates there is significant relationship between the stakeholder's capacity (Staff) and Management of Municipal solid waste in the area. This implies that stakeholder's role is significant in MSW management in the area. However, the degree of association or relationship is weak (0.042) of Pearson's R value as shown in table of symmetric measures.

Table 4.17 Equipment/ Facilities

Count		Number		Total
		Facility/Equipment		
		Available	Required	
Type of Facility/Equipment	A.B.U	4	8	12
	F.C.E	202	343	545
	N.B.P.	6	32	38
	Z			
	ZLG	134	260	394
	KEPA	80	231	311
	BIA	48	103	151
	LINK			
Total		474	977	1451

Source: Field Survey, 2023

Table 4.18 Chi-Square Tests

	Value	Df	Asymptotic Significance (2-sided)
Pearson Chi-Square	16.907 ^a	5	.005
Likelihood Ratio	17.767	5	.003
Linear-by-Linear Association	6.528	1	.011
N of Valid Cases	1451		

Source: Field Survey, 2023

Table 4.19: Symmetric Measures

		Value	Asymptotic Standardized Error ^a	Approximate T ^b	Approximate Significance
Interval by Interval	Pearson's R	.067	.026	2.560	.011 ^c
Ordinal by Ordinal	Spearman Correlation	.070	.026	2.689	.007 ^c
N of Valid Cases		1451			

Source: Field Survey, 2023

H₀: There is no significant relationship between the stakeholder's capacity (Facilities/Equipment) and Management of Municipal solid waste in the area.

The above chi-square test P-Value (0.005) which is less than 0.05 level of significance indicates there is significant relationship between the staff stakeholder's capacity (Facilities/Equipment) and Management of Municipal solid waste in the area. This also shows that stakeholder's role is significant in MSW management in the area. However, the degree of association or relationship is moderate (0.067) of Pearson's R value shows in table of symmetric measures.

4.7 Challenges Associated with Waste Management in the Area

Respondents were asked to state the challenges faced on MSW management. This is shown in table 4.23

Table 4.23: Challenges associated on waste disposal by respondents.

Challenges	Frequency	Percentage
Very farCollection points	118	30.5
No collection points	212	54.6
Collection points are Insufficient	58	14.9
Total	388	100.0

Source: Field survey, 2023

Table 4.23 shows the challenges faced by respondents in disposing their waste, about 30.5% claimed that collection are very far,54.6% said they do not have collection point in their neighbourhood like Bizara area of Dambo Ward. Another 14.9% said collection point are insufficient as their challenges. Therefore one can conclude that major challenge encountered by respondents is absence of collection points which make them dump waste on any land in their area. In support of the findings, Hyuwa,(2010) reported that access to services of waste contractors is limited to metropolitan road networks that can accommodate the compactors meant for modern waste management services. Communal bins are small and insufficient and frequently overflowed with garbage as shown in plate 4.4 below in Tudun Wada ward. However, Rigasa (2016) said that solid waste management is currently handled by government engaged contractors who are paid for their services from public funds. Such contractors operate around public land uses and major roads.



Source: Field Survey, 2023

Plate 4.4: One of the collection points in Tudun Wada ward overwhelmed with waste.

Table 4.24: Causes of poor MSW management by respondents

Causes	Frequency	Percentage
Lack of Government support	28	7.2
Less awareness	160	41.3
Poor cooperation among the community	200	51.5
Total	388	100.0

Source: Field survey, 2023

Table 4.24 explain that 7.2% of respondents mentioned lack of government support by not providing waste collection points as the cause of poor solid waste management in their area. They include locations like Dambo, Dutsen Abba, Wucicciri and AnguwanFatika Wards among others. Another 41.3% claim low level of awareness by not enlightening the community on their

roles in waste management like proper dumping, reuse and recycling and implication of poor waste management. Lastly 51.5% of the respondents were of the opinion that poor cooperation among the communities as many people dump waste in water ways, road side despite the collection point being available around because of ignorance and negligence. It is revealed that low level of awareness and poor cooperation among the community are the most outstanding major causes of poor MSW management. This is in tandem with Taneja (2016) which suggest that lack of awareness is one of the barriers to community participation. The author further said that any development programmes could be effective only when people are aware of it and the benefits that will accrue to them as a result of implementing it are made clear to them.

Table 4.25: Perceived consequences of poor MSW management

Implications	Frequency	Percentage
Environmental Pollution	184	47.4
Disease Outbreak	140	36.1
Ground water contamination	64	16.5
Total	388	100.0

Source: Field survey, 2023

Table 4.25 shows that 47.4% said environmental pollution that is a consequence of poor MSW management include offensive odour from a combination of biodegradable (food waste, kitchen waste and so on) in the waste receptacles which are eventually degraded. Also the poor sight this creates to the public space is also observed especially in Kasuwan Zaria area. Another 16.5% of respondents were of the opinion that poor MSW leads to ground water contamination. This occurs when wells that are used as domestic water sources are not protected and polythene are carried by air and deposited in these open wells. Even if poor MWM as a cause of disease cannot be established through medical records, the fact that 36.1% of the respondents allude to it is a

cause for concern. Diseases like typhoid fever and other gastro- intestinal diseases are attributable to waste management. For instance all across the study area children and adults sell foods refreshment such as fruits, awara, kose and so on not far from waste dumpsites and flies from these dumpsites perch on them leading to infections. According to Achillas et al (2013) it is clear that activities of waste generation and waste treatment produce a negative impact on society that can pollute water, soil and air; it contributes to climate change and affects ecosystems and consequently human health.

Table 4.26: Challenges Identified by other Stakeholders on Waste Management

Challenges	Frequency	Percentage
Lack of equipment	4	29.6
Shortage of man power	3	21.4
Lack of fund	3	21.4
Improper supervision	1	7.2
Lack of government support/Humiliation from security personnel	2	14.2
Less dumpsites	1	7.2
Total	14	100.0

***Multiple responses**

Source: Field survey, 2023.

Table 4.26 explain 29.6% mentioned lack of equipment as the challenge they encounter, 21.4% point out shortage of man power with another 21.4% revealing shortage of funds. However, 7.2% mentioned improper supervision, 14.2% said lack of government support and humiliation from security personnel. Another 7.2% mentioned less dumpsite as the challenge they encounter.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary of Findings

Sustainable municipal solid waste management can only be achieved if stakeholders available play their role in waste management. This research is aimed at assessing the role of multiple stakeholders in sustainable municipal solid waste management. Stakeholders as used in this research are the general public represented by the respondents from the populace and some institutions and organizations represents by their staff and actors.

As regard to roles of stakeholders in MSW management, majority of the community participate (60.8%) in waste management at household level. They also play role through separation of recyclable goods from organic waste (50.5%) and enlighten others around to disposed waste timely and properly. However, the other stakeholders mentioned waste collection, disposal, buying of recyclable waste, awarding of waste management contracts and joint supervision as their role in MSW management.

On waste management strategies, reuse of waste (78.4%) such as empty plastic bottles for packaging *kununaya* and *zobo*, selling of non- biodegradable items (51.5%) to scavengers and burning of waste as manure reduce waste generation significantly in the area. For the other stakeholders, environmental cleanness (42.5%), prevention of diseases (21.4%) and job creation (21.4%) are the major benefits of MSW management in the area. The study also revealed control of over floating and ecosystem preservation as the outcome of sustainable MSW management.

On the capacity of stakeholders (staff & facilities), the study found out there is significant relationship between the stakeholders' capacity and waste management in the area

but the level of relationship are weak(0.042) and moderate(0.067) for the staff and facilities used.

5.2 Conclusion

Majority of the respondents have limited or no access to designated collection points in the study area which made them to indiscriminately dump their waste in any available open space. The study identified solid waste management strategies such as burning of heap waste in an open field as manure, reuse of non- biodegradable materials such as plastic bottles and nylons as well as selling of recyclable materials like iron, aluminum and rubber to waste recovery agents. Therefore if these strategies will be well practice in all the study area, waste generation will be significantly reduced.

The study also identified significant relationship between the stakeholders' capacity and waste management as weak and moderate for the staff and facilities used result to the current status of waste management. If the stakeholders improve their capacity, waste management in Zaria would witness further improvement.

A key focus of this work is to examine the role played by the identified stakeholders who are members of the public and representatives of selected institutions and organization. It is discovered that these stakeholders play different roles such as refuse disposal, waste collection, waste separation and transportation to recycling company, supervision and awarding waste management contracts. These roles result in the present status of waste disposal and management. It can therefore be concluded that if the stakeholders intensify these roles, MSW in Zaria will witness further improvement.

The study concluded that multiple stakeholder's role is significant on MSW management in the area. However, stakeholders need to improve their capacity (staff and facilities) to insure effective waste management in the area.

5.3 Recommendations

Based on findings made by this study, the followings recommendations are put forward.

1. Government should enlighten and encourage community of relevance of voluntary groups through media such as television and radio on M SW management. This would reduce improper dumping of waste in the area.
2. KEPA should provide more designated collection dumpsites in the study area to reduce improper dumping of waste. This would reduce well water contamination and infection like typhoid and other gastro- intestinal diseases attributed to poor MSW management.
3. State Government should come up with programme on the relevance of organic waste that can be composted and used as manure in urban farming. This would reduce reliance on in- organic fertilizer which decreases soil fertility and pollutes surface water.
4. State Government should recognize informal private sector (scavengers) through training, workshops and funds. This would encourage recycling of waste in the area.
5. State Government should impose "polluter-must-pay" principle as well as upward review of sanitation fees so as to generate revenue and ensure' adequate funding of the agency. This would reduce improper dumping of waste in the area.

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Appendix I

HOUSEHOLD QUESTIONNAIRE

This researcher aim at “ **Assessment of the Roles of Multiple Stakeholders in Sustainable Municipal Solid Waste Management in Zaria Local Government Area, Kaduna State Nigeria**”. This questionnaire intends to gather information on the above research topic for the award of Master of Science (M.Sc.) in Environmental Management. All your contribution would be treated confidentially and for the purpose of this research only.

Please tick a circle and, or fill where appropriate

1. Date _____
2. Ward _____
3. Gender of respondents.
Male () b. Female ()
4. Age of Respondents
16 – 25yrs () b. 26 – 35yrs () c. 36 – 45yrs () d. 45yrs and above ()
5. Marital status.
Single () b. Married () c. Widowed () d. Divorced ()
e. separation ()
6. Qualification.
Qur’anic () b. Primary () c. Secondary () d. Tertiary ()
7. Number of persons in the house.
Below 6 () b. 6 – 10 () c. 11 – 15 () d. 16 and above ()
8. Household monthly income.
Below 20000 () b. 21000 – 40000 () c. 41000 – 60000 d. 61000 and above
9. Do you participate on municipal solid waste management in your neighborhood?
a. Yes () b. No ()
10. Do you have waste disposal facilities at home?
(a) Yes () (b) No ()
11. If yes, what facilities do you use in disposing waste into at home?
(a) Dust bin () (b) Open field () (c) Drum () (d) Any other
specify_____
12. Do you reuse some of you solid wastes?
Yes () b. No ()
13. If yes, which of your wastes do you reused?
a. Biodegradable () b. non-biodegradable () c. none () d. any other
specify__
14. Do you sell some of your solid wastes?
a. Yes () b. ()
15. If yes, which of the solid waste do you sell?
a. Metal () b. Rubber c. Plastic () d. Any other specify

16. Where do you and others in your community dispose household collected wastes?
a. collection point () b. gutter () c. burning () d. any other specify

17. What are the challenges encountered in disposing wastes in your area?
a. collection point are very far () b. no collection point () c. collection point are
insufficient () d. any other specify _____

18. Which of the following do you think are the benefits of municipal solid waste Management in your area?

- a. environmental cleanliness () b. It reduce environmental pollution () c. creation of jobs () d. any other specify _____

19. In what way do you assist your community with regards solid waste management collection?

- a. disposing my waste and that of my neighbor to collection point ()
b. Educate others around to disposed waste timely and properly ()
c. separate recyclables and organic waste () d. any other specify _____

20. What causes poor msw management in your community?

- a. lack of government support () b. less awareness ()
c. poor cooperation among the community () d. any other specify _____

21. Which of the following do you think are the implications of poor SWM service in your community?

- a. environmental pollution () b. disease outbreak ()
c. ground water contamination () d. any other specify _____

22. Mention possible solutions to the problems of waste management in your community?

- _____ b. _____ c. _____ d. _____

Thank you for participating and your concern

Appendix II

QUESTIONNAIRE FOR KEPA, LOCAL GOVERNMENT AND ZMA ON MSWM

SECTION A: General Information of the agency

- 1. Date: _____
- 2. Name of the officer: _____
- 3. Name of the Agency _____
- 4. Date of establishment of the Agency /department: _____

SECTION B: Question on activities carry out by the Organization.

5. What are the functions of your organization with regards to solid waste management in the study area?

- a. _____ b. _____ c. _____ d. _____ e. _____

6. Are there organization other than you into SWM operation?

- a. yes () b. No ()

7. If yes, name the organization also participating in MSW services in the area.

- a. _____ b. _____ c. _____ d. _____ e. _____

8. Do you have working relationship with the mention organizations in no 7?

- a. yes () b. No ()

9. If yes to question 8, list the relationship types.

Organization	Relationship with the organization
a. _____	_____
b. _____	_____
c. _____	_____
d. _____	_____
e. _____	_____

SECTION C: Questions on strength, weakness, opportunity and threat of the Organization.

10. What are major challenges to solid waste management in your agency?

a. _____ b. _____ c. _____ d. _____ e. _____

11. How do you overcome such challenges?

a. _____ b. _____ c. _____ d. _____ e. _____

12. What is your staff strength: _____

13. Staff categorization based on qualification.

Categories

Numbers

14. Facilities possessed for solid waste management.

Facilities/ equipment

No available

No required

_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

15. What are the major benefits of solid waste management?

a. _____ b. _____ c. _____ d. _____ e. _____

Appendix III

QUESTIONNAIRE FOR ENVIRONMENTAL UNITS OF INSTITUTION

SECTION A: General information of the unit

Name of institution _____

Name of the officer _____

Name of department in charge of waste _____

SECTION B: Role of the unit on MSW

What SWM activities do you carry out?

What do you do with the waste generally collected?

Do you recycle or give recycling companies any of the solid waste collected?

What do you think are the benefits of MSW management?

SECTION C: Strengths, weakness, opportunities and threat of the department

What is your staff strength? _____

Does this number of staff cater for effective activities of the unit?

Categorization of swm collection staff in your institution based on work schedules

S/N	Nature of staff	NO available	NO required
1			
2			
3			

11. What are the facilities possessed for solid waste management by your institution.

S/N	Facilities	NO Available	NO Required
1			
2			
3			
4			
5			
6			

12. What are the major problems confronting your department and its operation

- a.
- b.
- c.

Appendix IV

QUESTIONNAIRE FOR PRIVATE SECTOR PROVIDERS

SECTION A: INFORMATION ON CHARACTERISTICS OF SWM ORGANIZATION.

Name of Organization _____

Address of organization _____

Date _____

Areas of Operation _____

Is the organization registered _____

If yes, which registration body are you registered with _____

SECTION B: Activities carried out by the organization

What aspect of swm services are you focus on?

How do you get/source your waste? _____

What organization do you collect waste from and types of waste?

Organization	Type of waste
1. _____	_____
2. _____	_____
3. _____	_____
4. _____	_____
5. _____	_____

10. Do you carry out waste separation before disposal?

11. Do you recycle collected wastes, or do you just dispose?

12. Where do you dispose the wastes collected?

13. How often do you charge your client?

a. weekly () b. fortnightly () c. monthly () d. Quarterly () e. yearly ()

SECTION C: Strengths, weakness, opportunities and threats of your organization.

14. What is your staff strenght?

15. Staff categorization.

S/N	Nature of the staff	No Available	No Required
1	Drivers		
2	Technologies		
3	Administrative officers		

16. Are you supported by government agencies or any other organizations?

17. What facilities do you possessed for solid waste management?

S/N	Facilities	No Available	No Required

18. What are the major problems confronting your organization and its operation?

19. What do you think are the major benefits of MSW management?
