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MANAGEMENT

THE ROLE OF STAKEHOLDERS IN THE MANAGEMENT OF
HOUSEHOLD SOLID WASTE IN NEW JUABEN
MUNICIPALITY, GHANA

A dissertation submitted to the Department of Environmental and Natural
Resources Management of the Faculty of Development Studies, Presbyterian
University College, Ghana in partial fulfilment of the requirement for the award
of Master of Science Degree in Environmental Health and Sanitation

BY
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DECLARATION

Candidate's Declaration

I hereby declare that this Dissertation is the result of my own original research and that no part of it has been presented for another degree in this university or elsewhere.

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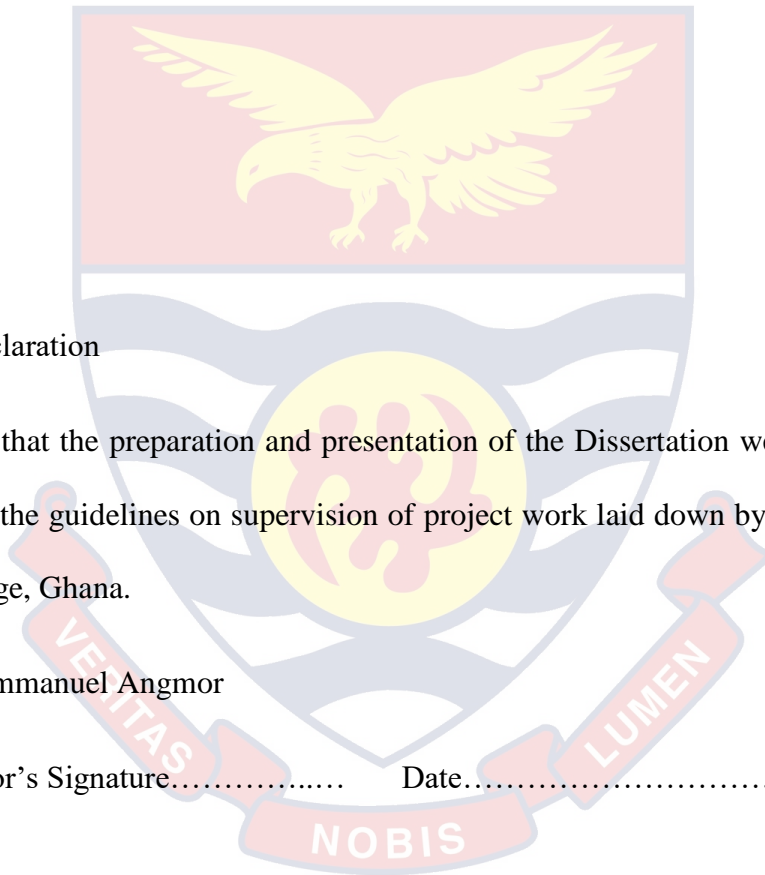
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Supervisor's Declaration

I hereby declare that the preparation and presentation of the Dissertation were supervised in accordance with the guidelines on supervision of project work laid down by the Presbyterian University College, Ghana.

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ABSTRACT

The aim of this study was assessing the role of key stakeholders in household solid waste management in the New Juaben Municipality. The study employed a mixed method approach involving the collection of quantitative and qualitative data. A semi-structured questionnaire interview was administered to 150 household heads or knowledgeable members of households. Key informant interviews were also conducted with identified key stakeholders in the municipality. Results showed that, majority of the respondents were females and the rest were males. A majority of the respondents were between the ages of 35 – 44 years. Though all of the households have bins for waste storage, majority of the respondents claimed storage of the household waste was the biggest problem they encounter. A majority of the respondents was willing to pay private companies between GHC 26 – 50.00 to manage their household solid waste on a monthly basis as about 80% of the households find their services satisfactory. Given the high willingness-to-pay by the households in the municipality, it is recommended that, households should register for household bins with a registered service provider in the municipality with the flexibility to allocate as many bins as would be required by the households for effective household solid waste management. In addition, service providers must provide trainings, public information campaigns on waste reduction at source and the need to use registered bins. Regulators should employ more proactive approaches to check compliance with storage, collection, transport and disposal of household solid waste

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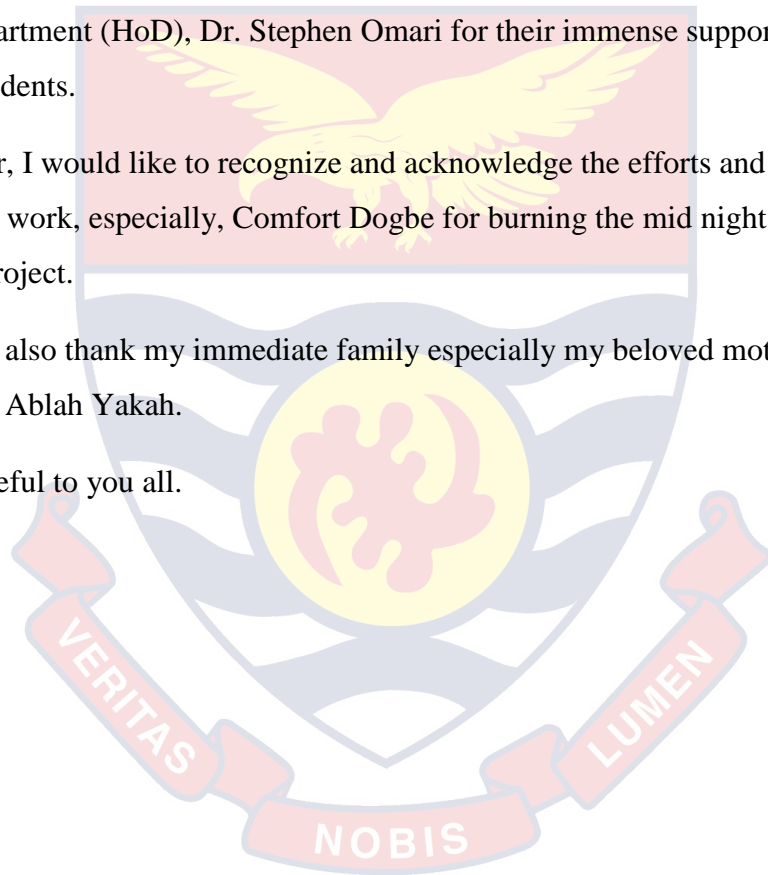
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I am grateful to you all.



DEDICATION

To my Wife, Esther Ama Aguadze, and Children, Deladem Akosua Aguadze, Eyrarn Adwoa Aguadze and Elinam Kofi Aguadze.



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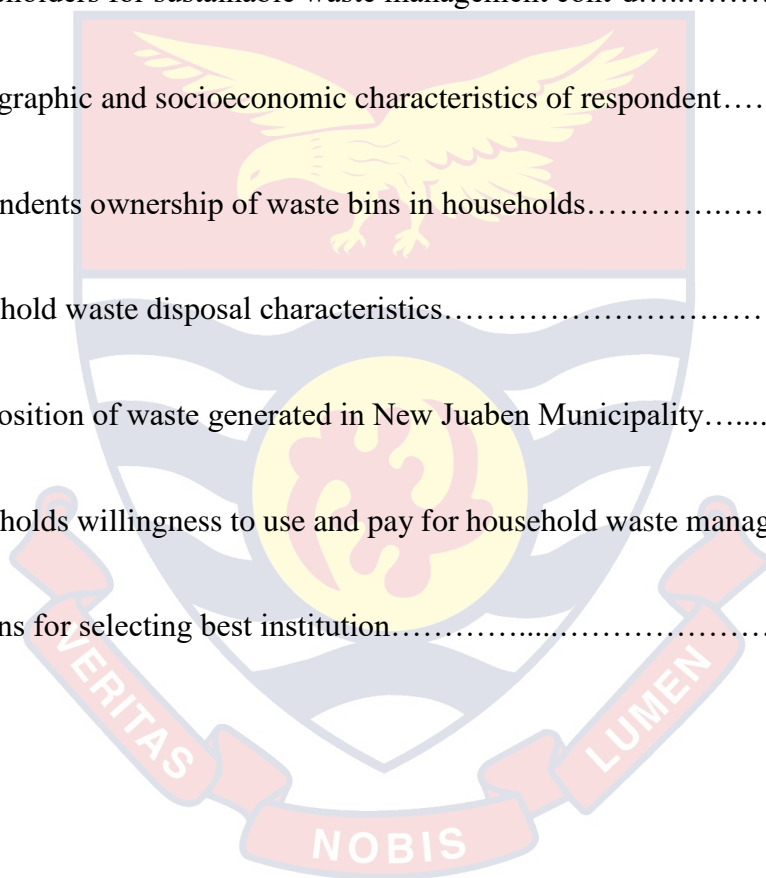
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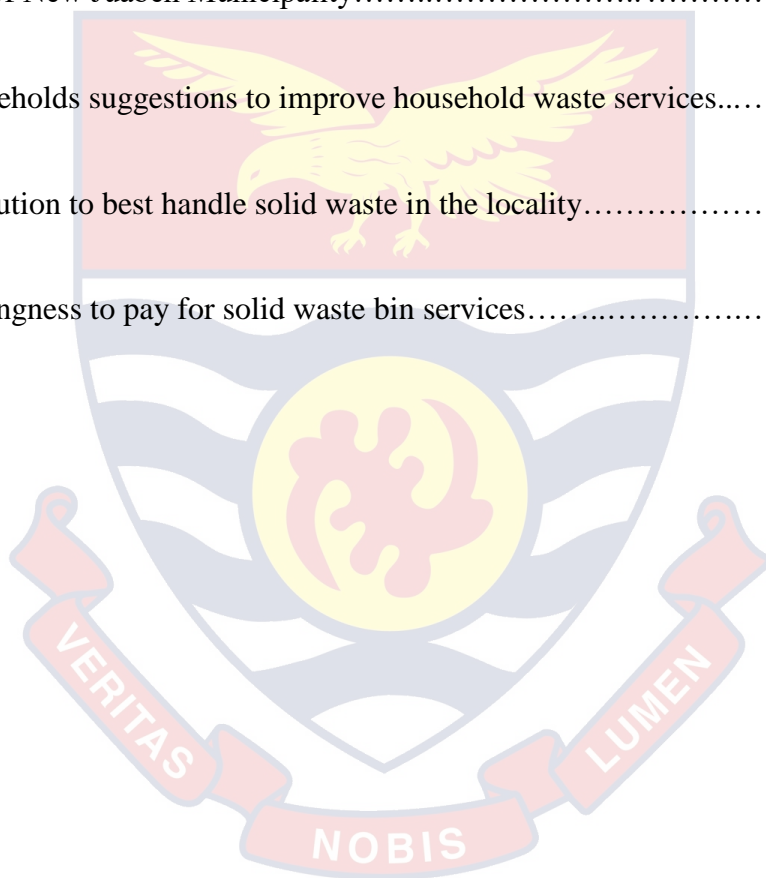
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CHAPTER ONE

INTRODUCTION

1.1 Background to the study

Solid waste management (SWM) is a major challenge in many urban cities globally, especially developing countries including Ghana. Currently, more than 2 billion people are lacking access to SWM service (Rodic & Wilson, 2017). In major towns and cities in West Africa, the issue of collection, management, and disposal of solid waste continue to feature prominently as a result of the increasing solid waste generation rate, the rising cost of waste management, and the associated environmental and health problems (Onibokun, 1999). Solid waste can be defined as the non-liquid or nongaseous products (e.g. trash, junk and or refuse) of human and animal activities that are unwanted (Leton & Omotosho, 2004). According to the World Bank (2015), “the overall goal of urban SWM is to collect, sort, treat and dispose of solid wastes generated by all urban population groups in an environmentally and socially satisfactory manner using the most economical means available”. However, the difficulty of SWM is a major source of concern in Africa and has been identified as one of the major challenges in the promotion of sustainable production and consumption in the region (Adewumi, 2006).

Waste management practices varies from country to country and from urban to rural areas. This is because of the different levels of economic activities being implemented in these areas. For instance, in urban centres with many industries, much of waste generated will be industrial and/or hazardous in nature whereas in rural settings with supposedly less industries present, about 80% of waste generated will be organic. Their management practices will be different from that of household waste that is mainly organic waste and solely the responsibility of the Local Government Authorities. However, industrial waste is mainly the responsibility

of the generator. Historically, the amount of waste generated by human population in the early ages was insignificant. This was due to lower population and partly because almost 90% of waste generated was biodegradable and these were easily decomposed and being used as manure. Moreover, most of the natural resource were not being exploited in large quantities. (USEPA, 2009). The era of industrialization changed the face of waste management with people moving to urban centres coupled with population increase resulting in increase in generation of both industrial and domestic waste. Ghana is highly challenged in the areas of solid waste collection and location of final dumpsites. While towns and cities develop because of increase in population and socio-economic activities there has not been a corresponding increase in essential facilities, logistics and personnel for effective and efficient waste management in the country (Agyepong, 2011). The generators who are supposed to be stakeholders in waste management are often left out in decisions regarding waste management (Otoo, 2013). The long distances inhabitants travel to access disposal facilities and inadequate SWM facilities has contributed to the indiscriminate disposal of waste in open dumpsite, gutters and backyards of houses and even in water sources (Otoo, 2013). Solid waste management in large urban centres and cities have evolved over the years in Ghana. Historically, household solid waste collection was not common in New Juaben Municipality. There was community dumpsite where most of the resident's send their refuse directly. The Municipal Assembly had few communal containers placed at vantage points in the city centre and these are lifted and dumped when full source of information. In 2007, the management of the solid waste was handed over to a private contractor (Zoomlion Ghana Limited) while the Assembly concentrated on liquid waste management. Privatization of waste collection is suggested as a way to effectively deal with this menace and significantly contribute to improving the environmental sanitation situation in our cities (Anarfi, 2012). The involvement

of the private sector in SWM has brought some relief to governments; yet, there is still much to be done (Boateng *et al.*, 2019).

1.2 Problem Statement

Solid waste management is a major problem to most economies, especially the developing ones such as Ghana. As expected, population growth coupled with urbanisation will mean that solid waste generation would be on the increase. This calls for increasing attention for solid waste management systems in Ghana (Adzawla *et al.*, 2019) and elsewhere. The World Bank in its quest to achieve eradication of severe poverty and maximizing shared prosperity has spent around 1.2 M USD in investments and over 55 advisory and analytical works on solid waste programmes and portfolios on about 114 sustainable and active projects within 58 countries (World Bank, 2013). Notwithstanding these interventions, developing countries have seen widening gaps in SWM. Ghana currently produces about 13,000 tons of waste daily with over 4,000 tonnes produced in Accra and Kumasi (Anarfi 2012; Monney, 2014). City authorities and waste management departments are still grappling with how best to deal with this challenge.

In the wake of the challenges, the Government of Ghana revised the Sanitation Policy in 2010 to address the limitations of the old policy published in 1999 and a result of nationwide consultation among sector stakeholders (Government of Ghana, 2010). The broad principles underlying the revised policy are the principle of environmental sanitation services as a public good; environmental sanitation services as an economic good; the polluter-pays-principle; cost recovery to ensure value-for money ensuring economy, effectiveness, and efficiency; subsidiarity in order to ensure participatory decision-making at the lowest appropriate level in society; improving equity and gender sensitivity; recognizing indigenous knowledge, diversity of religious and cultural practices; precautionary principle that seeks to

minimize activities that have the potential to negatively affect the integrity of all environmental resources; community participation and social intermediation (Government of Ghana, 2010).

Although private waste management companies have been involved in SWM for some time, the problem of SWM is far from being resolved. Waste management services are still inadequate, especially in low-income areas (Oteng-Ababio, 2011) due to inadequate financing, lax attitude of officials and residents, lack of clearly defined roles for stakeholders, poor cost recovery, and institutional weaknesses (Baabereyir, 2009). In the New Juaben Municipal Assembly, waste was solely the responsibility of the Assembly until 2007, when the management of the solid waste was handed over to a private contractor (Zoomlion Ghana Limited) while the Assembly concentrated on liquid waste management. The private contractor provided roll on/off containers, which were distributed to various communities and were evacuated to the final disposal site.

It has been observed that domestic and industrial waste are poorly managed in New Juaben Municipality giving rise to the degradation of the environment and creating breeding grounds for mosquitoes and other flies which causes diseases and other pathogens. Household waste bins have been distributed to various households with the aim of safely containing the household refuse before they are lifted. It is believed that the provision of the household bins is the important start to effective waste management in the New Juaben Municipality. Although various stakeholders including scholars and the media consistently enumerate the effects of solid wastes, analysis of the factors that influence households into the adoption of a particular waste disposal system is missing in the literature. Hence, the aim of this study is to determine the role of key stakeholders in household waste management in the New Juaben Municipal Assembly. Such analysis is fundamental to the promotion and adoption of appropriate waste disposal systems in Ghana.

1.3 Objectives

The main objective is to assess the role of key stakeholders in household waste management in the New Juaben Municipal Assembly. The specific objectives are:

1. To assess household's willingness to use household waste bin for waste collection services.
2. To determine factors preventing households to accept and pay for household waste collection services.
3. To examine the collaboration between households, the Municipal Assembly and other stakeholders in domestic waste management.

1.4 Research Questions

1. What is the level of household's willingness to use household waste bin for waste collection services in the municipality?
2. What are the factors preventing households to accept and pay for household waste bin collection services?
3. What kind of collaboration exist between household, service providers and other key stakeholders from the Assembly?

1.5 Significance of the Study

Koforidua is both the regional and municipal capital of the Eastern Region and the New Juaben Municipal Assembly of Ghana, respectively. An Akan migrant from Asanteman founded it in 1875. The completion of the Kumasi railway in 1923 saw Koforidua become an important road and rail junction. Koforidua is one of the country's oldest cocoa producing centres. It is also known for its weekly Thursday beads market. The 2000 Population and

Housing Census puts the estimated population of the municipality at 156,750 for the year 2010 (Statistical Service Department – Eastern Regional Office).

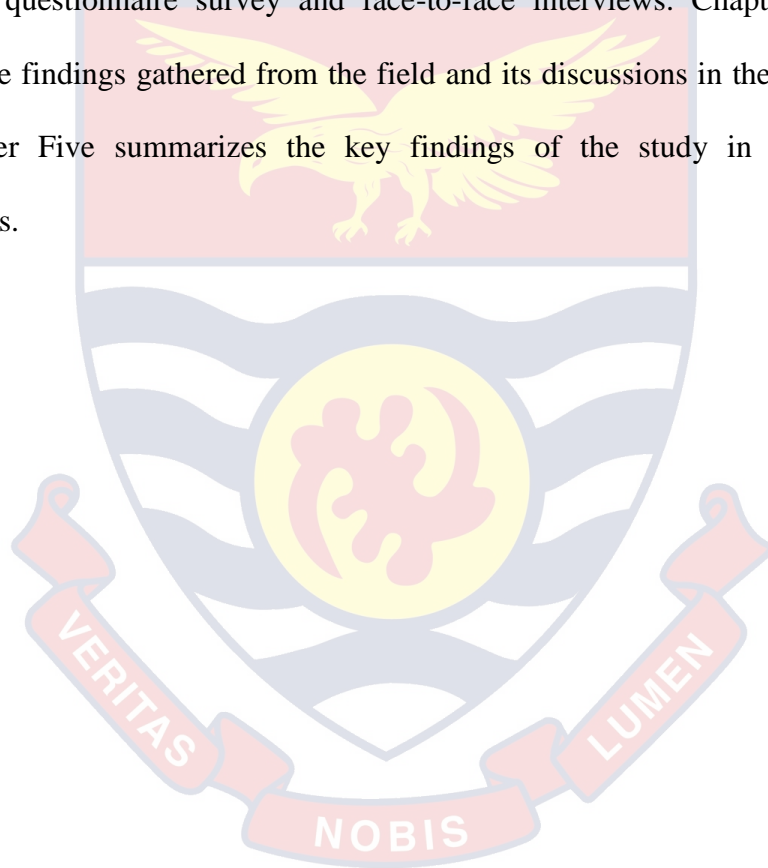
It was reported that, the New Juaben municipality was generating an average of about 40 tonnes of solid waste and 67,860 litres of liquid waste each day in 2007. This was costing the Municipal Assembly an average of about GHC 100 million monthly on waste management. With the current increase in population and urbanisation, waste management in 2019 would even cost the Municipal assembly more, leading to possible poor service delivery. Poor solid waste disposal has threatened the lives of the inhabitants of the New Juaben Municipality (Alhassan & Mohammed, 2013). There is increased pressure for dumping of household solid waste at public dump places due to increased household size, thereby straining the management capabilities of regulatory authorities, waste collectors and other resources. Currently, spilled waste on streets in the municipality is a common sight. This open dumping of waste causes foul smell, breeds diseases such as diarrhoea, skin and eye irritations, and spoils the public image of the New Juaben Municipality, especially in the selected communities. To help improve the situation, it has become important to how much households and other stakeholders are willing to collaborate efforts to do so. Hence, it is in the right direction to study the role of key stakeholders in household waste management for better/improved solid waste disposal services.

1.6 Scope and Study Limitations

The study focuses on municipal solid waste collection services and disposal systems. It was primarily limited within the boundaries of the New Juaben Municipal Assembly. The conceptual dimension brings to the front the involvement of people, which may not necessarily be in the town but are stakeholders in waste management in the municipality. This research could not be carried out in more than one municipality due to inadequate funding and personnel to assist in the work.

1.7 Organisation of the study

The study is organised into five chapters where Chapter One is dedicated to a general introduction to the study. It enumerates the extent of the problem in New Juaben Municipality and addresses the significance of the study. Chapter Two examines existing literature on solid waste management such as the concepts of waste, the processes and methods of managing solid waste. Chapter Three describes the methodology employed in gathering data from the field. These included questionnaire survey and face-to-face interviews. Chapter Four gives a description of the findings gathered from the field and its discussions in the context of other research. Chapter Five summarizes the key findings of the study in conclusions and recommendations.



CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 Introduction

This chapter explores previous literature on solid waste management. It examines key concepts, methods and problems of waste management. The chapter concludes with a conceptual framework that guides the study. The next section examines some of the concepts of solid waste management for better understanding of solid waste management.

2.2 The concept of waste

The definition of waste can be very subjective. This is because what is considered as waste to one person may represent a valuable resource to another. Gilpin (1996) defined the term waste to be “all unwanted and economically unusable by-products or residues at any given place and time, and any other matter that may be discarded accidentally or otherwise into the environment”. Waste has also been referred to as the “unwanted materials arising entirely from human activities which are discarded into the environment” (Palmer, 1998). This understanding of what waste is led to the disposal of all materials considered unwanted. Williams (2005) suggested that waste must have a strict legal definition to comply with the law. According to the Basel Convention, wastes are substances or objects that are disposed of or are intended to be disposed of or are required to be disposed of by the provision of the law (UNCED, 1992). In essence, the term waste is more recognised than defined, as something can become waste when it is no longer useful to the first owner or it fails to fulfil the purpose for which it was obtained. As such, waste is anything that has lost its usefulness to its primary owner.

The term solid waste has been defined or explained by different authors. Tchobanoglous *et al* (1993) defined solid waste as any material that arises from human and animal activities

that are normally discarded as useless or unwanted. Zerbock (2003) defines it as including non-hazardous industrial, commercial and domestic solid waste. Examples include household organic trash, street sweepings, institutional garbage and construction wastes. Solid waste is one type of waste that is generated from various sources. These sources relate to the different land uses in a community. According to a classification done by Tchobanoglous *et al.*, (1993), the sources of solid waste in a community are shown in Table 2.1

2.2.1 Waste classification

A number of criteria are usually used to classify wastes into types. Such classifications provide the basis for the development of effective and appropriate management programs. Waste can either be classified by its physical state (solid, liquid, gaseous) or by its primary use (packaging waste, food waste, etc.) or by the material type (glass, paper, etc.) or by the physical properties (combustible, compostable, recyclable) or by origin (household, commercial, agricultural, industrial, etc.) or by safety level (hazardous, non-hazardous) (White *et al.*, 1995). However, waste is classified into liquid or solid waste. For the purposes of this review, emphasis would be placed on the discussion of solid waste. Tchobanoglous *et al.* (1993) explained the types of solid waste, which include food waste, rubbish, ashes and residues, and special waste. These are explained below:

Table 2.1. Sources of solid wastes

Source	Typical location	Type of solid waste
Residential	Single-family and multifamily dwellings, low medium and high-rise apartments.	Food wastes, rubbish, ashes, special wastes
Commercial/ Municipal	Stores, restaurants, markets, office buildings, hotels, motels, print shops, auto repair shops, medical facilities and institutions.	Food wastes, rubbish, ashes, demolition and construction wastes, special wastes, occasionally hazardous wastes
Industrial	Construction, fabrication, light and heavy manufacturing, refineries, chemical plants, lumbering, mining, demolition.	Food wastes, rubbish, ashes, demolition and construction wastes, special wastes, occasionally hazardous wastes.
Open areas	Streets, alleys, parks, vacant plots, playgrounds, beaches, highway and recreational areas.	Special wastes, rubbish
Treatment plants sites	Water, wastes water, and industrial treatment processes.	Treatment plant wastes, principally composed of residual sludge
Agricultural	Field and row crops, orchards, vineyards, dairies, feedlots and farms.	Spoiled food wastes, agricultural wastes, rubbish, hazardous wastes

Source: Tchobanoglous *et al.*, (1993).

Food waste: they are all the animal, plant or vegetable residues resulting from the handling, preparation, cooking, and eating of foods (called garbage). The most important characteristics of these waste is that they are highly putrescible and will decompose rapidly, especially in warm weather. Often, decomposition will lead to the development of offensive odours. In many locations, the putrescible nature of these wastes will significantly influence the design and operations of solid waste collection.

Rubbish: These consists of combustible and non- combustible solid wastes of households, institutions and commercial activities. This excludes food wastes or other highly putrescible materials. Typically, combustible rubbish consists of materials such as paper, cardboard, plastics, textiles, rubber, leather, wood, furniture, and garden trimmings. Non-combustible rubbish consists of glass, tin cans, aluminium cans, ferrous and other non-ferrous metals, and dirt.

Ashes and Residues: These are materials remaining from the burning of wood, coal, coke and other combustible wastes in homes, stores, institutions, and industrial and municipal facilities for purposes of heating, cooking and disposing of combustible wastes. These are referred to as ashes and residues.

Special waste: Special waste includes street sweepings, roadside litter, and litter from municipal containers, catch-basin debris, dead animals and abandoned vehicles.

2.2.2 Urban household solid waste

Urban household solid waste, according to Senkwe & Nwale (2001) are those wastes from human, animal, domestic and economic activities in the urban household. These wastes could be organic substances that are biodegradable e.g., food items, peels, grass, vegetables, etc. and inorganic substances that are non-degradable e.g., plastics, bottles, metals etc. Solid wastes have been identified as one of the most important environmental problems of urbanization. Therefore, solid wastes could be defined as non-liquid and nongaseous by-products of human activities, regarded as being useless. It could take the forms of refuse, garbage and sludge (Leton & Omotosho, 2004).

2.3 Solid waste management

Solid waste management may be defined as “a process associated with the control, generation, storage, collection, transfer and transportation, processing and disposal of solid wastes in a manner that is in accordance with the best principles of public health, economic, conservation, aesthetics and other environmental considerations; and that also is responsive to public attitudes” (MNES, 2001). Waste management is regarded as a public service where efficient collection and safe disposal of wastes are essential to public health and environmental protection (Cointreau-Levine, 1994).

Over the years, it has evolved from the simple transportation of waste to landfills to complex systems, including waste prevention and waste recycling as well as several waste treatment and landfill technologies (Salhofer *et al.*, 2007) to match current needs. Improper waste management may have health, environmental and economic problems. Ecological phenomena such as water, soil, and air pollution have been attributed to improper management of solid wastes. Despite the fact that developing countries do spend about 20 to 40% of metropolitan revenues on waste management, they are unable to keep pace with the scope of the problem (Zerbock, 2003).

2.3.1 Key elements of solid waste management

The elements of solid waste management include waste generation; storage; collection; transfer and transport; processing and recovery; and final disposal.

Waste generation covers those activities for which materials are identified as no longer being of value and are either thrown away or gathered together for disposal (Momoh & Oladebeye, 2010). According to UNEP (2009), in 2006 the total amount of municipal solid waste (MSW) generated globally reached 2.02 billion tones, representing a 7% annual increase since 2003. It is further estimated that between 2007 and 2011, global generation of municipal waste will rise by 37.3%, equivalent to roughly 8% increase per year (UNEP, 2009). Storage encompasses where solid waste is stored before it is collected. It could be stored in a skip or dustbins and not thrown away indiscriminately. Storage is of primary importance because of the aesthetic consideration.

The element of collection includes not only the gathering of solid waste, but also the hauling of waste after collection to the location where the collection vehicle is emptied (Kreith, 1994). According to Kreith (1994), the most common type of residential collection services in the United States include “curbs”, “setout-setback” and “backyard carry”. According to the

USPS (2000), in the city of Thimphu in Bhutan, the collection of solid waste from households was done in concrete receptacles placed at strategic points and conveyed by trucks/tractors. Accordingly, there were concrete bins and containers provided at various locations from where the waste was lifted for disposal. Individual bins/containers were also placed alongside the shops in certain areas, which were emptied directly into the trucks/tippers. This prevents people from dumping waste indiscriminately.

According to Kreith (1994), transfer and transport involves two steps: (1) the transfer of wastes from the smaller collection vehicle to the larger transport equipment and (2) the subsequent transport of the wastes, usually over long distances to the final disposal site. The element of processing and recovery includes all the technology, equipment, and facilities used both to improve the efficiency of other functional elements and to recover usable materials, conversion products or energy from solid wastes (Tchobanoglous *et al.*, 1977). In the recovery, separation operations have been devised to recover valuable resources from the mixed solid wastes delivered to transfer stations or solid waste processing plants (Tchobanoglous *et al.*, 1977).

It is the ultimate fate of all solid wastes whether they are residential wastes collected and transported directly to landfill site. Several methods of solid waste management have evolved over the years. These methods according to the Centre for Environment and Development (2003) vary greatly with types of wastes and local conditions. This is divided into early practices of managing solid waste and contemporary methods of waste management systems.

2.4 Early practices of solid waste management

According to Tchobanoglous *et al* (1993), the most commonly recognized methods for the final disposal of solid wastes were dumping on land, canyons and mining pits, dumping in water, ploughing into the soil, feeding to hogs and reduction and incineration. Some of these

unwholesome practices of solid waste identified during the early disposal practices still exist in cities, towns and villages today. Indiscriminate dumping on opened land and dumping in gutters particularly are evident in towns and cities, while dumping in water especially people living in coastal towns is commonplace.

Burning of dumps is also common in peri-urban and rural communities in Ghana and in many other less developed countries. A study carried out in Ado-Akiti in Nigeria by Momoh & Oladebeye (2010) showed that, the methods of solid waste disposal include dumping of waste in gutters, drains, by roadside, unauthorized dumping sites and stream channels during raining season and burning of wastes on unapproved dumping sites during the dry season. This has gone to confirm that the practices of solid waste disposal in the 1950s still exist today and study area is not an exception. On the other hand, Momoh & Oladebeye's (2010), assessment of waste situation in Ado-Akiti in Nigeria is questionable, as they did not further explain what brought about the indiscriminate dumping. It could be that people dumped the waste anyhow because they were no skips or dustbins for the people to store their waste for collection. Having assessed how solid waste was disposed in the early days, the next section discusses the contemporary methods of managing solid waste.

2.5 Contemporary methods of solid waste management

In the contemporary era, the methods of managing solid waste include source reduction, sanitary landfills, composting, recycling, and incineration (Denison & Ruston, 1990). These methods are discussed as follows.

2.5.1 Source reduction

Denison & Ruston (1990) viewed source reduction as any action that reduces the volume or toxicity of solid waste prior to its processing and disposal in incinerators or landfills. This view is similar to the one given by Kreith (1994). According to him, source reduction

focuses on reducing the volume and /or toxicity of waste generated. Source reduction includes the switch to reusable products and packaging, the most familiar example being returnable bottles. According to USPS (2000) in the city of Thimphu in Bhutan to reduce waste problems in future, reduction in waste generation would be the most important factor. Examples of possible reduction at the consumption level include reuse of containers (including bags), better buying habits, and cutting down on the use of disposable products and packaging (USPS, 2000).

It is agreed that, source separation and resource recovery is an important method in waste management. This is because there is nothing like waste on this earth. Wastes that are discharged may be of significant value in another setting, but they are of little or no value to the possessor who wants to dispose of it. According to Tsiboe & Marbel (2004), Austria, the Netherlands, and Denmark developed a waste management processes to efficiently resolve the waste disposal problem by essentially coaxing their citizens to separate their domestic solid waste into glass, paper, plastic categories; thereby enabling easy collection and consequently reuse. As suggested by the three authors, one way of effectively managing solid waste is to minimise solid waste generation through source reduction.

2.5.2 Sanitary landfill

Sanitary land filling includes confining the waste, compacting it and covering with soil. It not only prevents burning of garbage but also helps in reclamation of land for valuable use (Centre for Environment and Development, 2003). The placement of solid waste in landfills is the oldest and definitely the most prevalent form of ultimate waste disposal (Zerbock, 2003). He further argued that “landfills” are nothing more than open, sometimes controlled dumps. According to him, the difference between landfills and dumps is the level of engineering, planning, and administration involved. Open dumps are characterized by the lack of

engineering measures, no leachate management, no consideration of landfill gas management, and few, if any, operational measures such as registration of users, control of the number of “tipping fronts” or compaction of waste (Zerbock, 2003).

Furthermore, landfills are one form of waste management that nobody wants but everybody needs (Kreith, 1994) According to him, there are simply no combinations of waste management techniques that do not require landfilling to make them work. Of the basic management options of solid waste, landfills are the only management technique that is both necessary and sufficient. According to Kreith (1994), some wastes are simply not recyclable, many recyclable wastes eventually reach a point where their intrinsic value is completely dissipated and they no longer can be recovered, and recycling itself produces residuals. He further highlighted that the technology and operation of modern landfill can assure the protection of human health and the environment.

In contrast to what the various authors have said about sanitary landfill as an option for waste management, they have failed to recognize that land fill in itself has some disadvantages as it is costly to construct and maintain, can pollute ground water through leaching, location is a problem in terms of availability of land particularly in the cities. Other critical factors such as gas recovery, composting, waste to energy recovery, storm water control, distance to any settlement and water body were not clearly spelt out by the authors. Therefore, there could be an alternative, which is recycling.

2.5.3 Recycling

According to Momoh & Oladebeye (2010), recycling has been viewed as a veritable tool in minimizing the amount of household solid wastes that enter the dumpsites. It also provides the needed raw materials for industries. According to them, it has been established that, it is the best, efficient and effective method of solid waste management system. However,

this may not be cost effective in developing countries like Ghana. The United States Environmental Protection Agency (USEPA) (1999) has recommended recovery for recycling as one of the most effective waste management techniques. According to USEPA, recycling turns materials that would otherwise become waste into valuable resources and, it yields environmental, financial, and social returns in natural resource conservation, energy conservation, pollution prevention, and economic expansion and competitiveness. More importantly, a sizeable portion of what is thrown away contains valuable resources—metals, glass, paper, wood, and plastic—that can be reprocessed and used again as raw materials (USEPA, 1999).

Kreith (1994) has also added that, recycling is the most positively perceived and doable of all the waste management options. According to him recycling will return raw materials to market by separating reusable products from the rest of the municipal waste stream. The benefits of recycling are many, he added. It saves precious finite resources, lessens the need for mining of virgin materials, which lowers the environmental impact for mining and processing. For example, according to the Institute of Waste Management cited by Tsiboe & Marbel (2004), UK recycles only 11% of its household waste, Italy and Spain only 3%, Netherlands 43%, Denmark 29%, and Austria 50% respectively. Having proposed recycling by different authors as the best option to manage solid waste in modern times, they have forgotten about the cost component that is key to successful implementation of any recycling project. Even developed countries are not able to successfully do it. Alternatively, it may be the best option for effectively managing solid waste in Ghana.

2.5.4 Composting

Composting process uses microorganisms to degrade the organic content of the waste. Aerobic composting proceeds at a higher rate and converts the heterogeneous organic waste

materials into homogeneous and stable humus (Centre for Environment and Development, 2003). UNEP (2009) has also defined composting as a biological decomposition of biodegradable solid waste under controlled predominantly aerobic conditions to a state that is sufficiently stable for nuisance-free storage and handling and is satisfactorily matured for safe use in agriculture. According to the UNEP (2009), composting is the option that, with few exceptions, best fits within the limited resources available in developing countries. A characteristic that renders composting especially suitable is its adaptability to a broad range of situations. According to Zerbock (2003), a low-technology approach to waste reduction is composting. He further says that in developing countries, the average city's municipal waste stream is over 50% organic material.

2.5.5 Incineration

According to the Centre for Environment and Development (2003), incineration is a controlled combustion process for burning combustible waste to gases and reducing it to a residue of non-combustible ingredients. According to the Centre, during incineration, moisture in the solid waste is vaporised and the combustible portion gets oxidised and vaporised. CO₂, water vapour, ash and non-combustible residue are the end products of incineration. Incinerators have the capacity to reduce the volume of waste drastically, up to nine-fold than any other method (Kreith, 1994). According to him, incineration can also recover useful energy either in the form of steam or electricity. He however recognised that the main constraints of incineration are high cost of operation, relatively high degree of sophistication needed to operate them safely and economically as well as the tendency to pollute the environment through emissions of carbon dioxide. Having assessed the major methods that have been proposed by the various authors, literature has further revealed that there is an alternative

method of managing solid waste effectively which is synonymous to waste reduction and recycling as mentioned earlier on.

2.5.6 Integrated solid waste management

Although considerable efforts are being made by many Governments and other entities in tackling waste-related problems, there are still major gaps to be filled in this area (UNEP, 2009). According to UNEP (2009), the World Bank estimates that in developing countries, it is common for municipalities in developing countries to spend 20 to 50% of their available budget on solid waste management, even though 30 to 60% of all the urban solid wastes remain uncollected and less than 50% of the population is served. The programme (UNEP) suggested that if most of the waste could be diverted for material and resource recovery, then a substantial reduction in final volumes of waste could be achieved and the recovered material and resources could be utilized to generate revenue to fund waste management. This forms the premise for the Integrated Solid Waste Management (ISWM) system based on 3Rs (reduce, reuse and recycle) principle. ISWM system has been pilot tested in a few locations (Wuxi, PR China; Pune, India; Maseru, Lesotho) and has been well received by the local authorities. It has been shown that with appropriate segregation and recycling system significant quantity of waste can be diverted from landfills and converted into resource (UNEP, 2009). Similarly, the United States Environmental Protection Agency (1999) has said that if a state or local government wants to plan for and implement ISWM, they have to consider a hierarchy of methods, which are, reduce, recycle, and incinerate/landfill.

2.6 Stakeholders in solid waste management

The solid waste management value chain from points of generation to disposal has several actors. These several actors form the various stakeholders. Depending on the context

and local conditions, stakeholder composition and numbers may vary. Table 2.2 (a and b) shows typical stakeholders and the proposed roles in sustainable solid waste management.

2.7 Challenges of effective managing solid waste

According to Ogawa (2005), a typical solid waste management system in a developing country displays an array of problems, including low collection coverage and irregular collection services, crude open dumping and burning without air and water pollution control. He categorised these challenges into technical, financial, institutional and social constraints. He further discussed these constraints in relation to the sustainability of solid waste in developing countries.

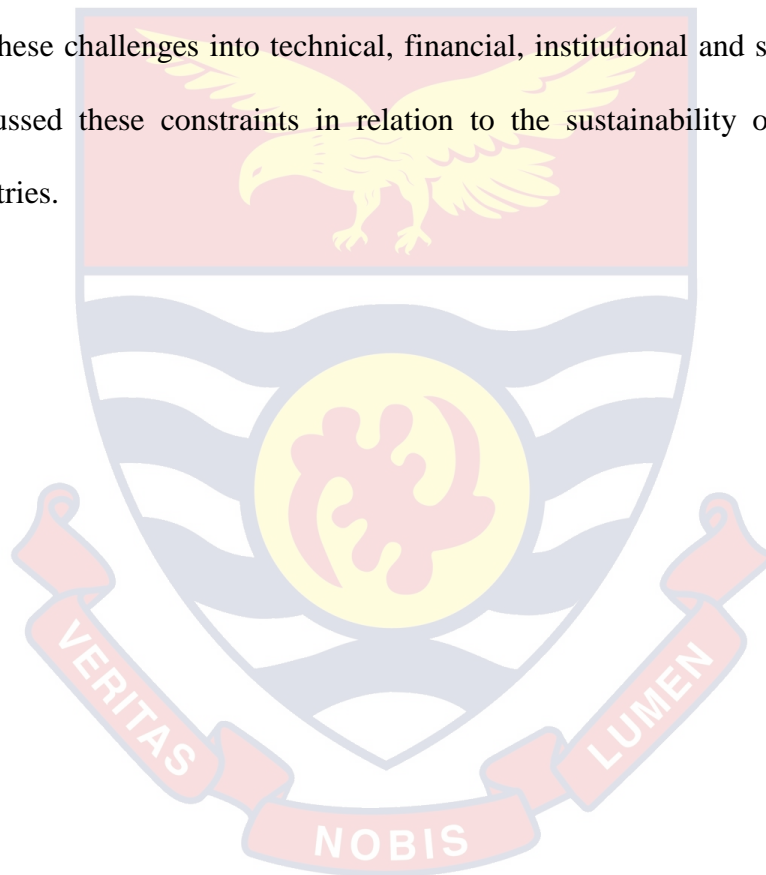


Table 2.2a. Stakeholders for sustainable waste management

No.	Stakeholders	Role
1	General public	<ul style="list-style-type: none"> - Practice source reduction and source segregation - Cooperate with civic bodies in identification of sites for waste management facilities and their operation - Pay for waste management.
2	Municipalities	<ul style="list-style-type: none"> - Keep waste management in priority - Provide infrastructural inputs and services - Have a definite organizational setup with trained staff - Implement legislation and punish violators - Compliment public/private participation - Enlist informal sector participation - Maintain an up-to-date database
3	City Planners	<ul style="list-style-type: none"> - Keep waste management in mind while developing city plans - Demarcate space for waste management facilities with ideal buffer zones
4	NGO/ Social workers	<ul style="list-style-type: none"> - Take lead in forming ward committees and community participation - Network with the other similar minded organisations in the area and integrate the efforts rather than duplicating most of the jobs - Use existing contacts with the municipality and other influential bodies to ensure maximum support - Try and involve unemployed youth in the area for various jobs - Organize/sponsor 'Clean City' campaigns
5	Teachers/ Academia	<ul style="list-style-type: none"> - Influence minds on the culture of solid waste management - Inculcate a strict discipline in the children's mind with regard to solid waste - Carry out relevant research and development

Source: Joseph (2006)

Table 2.2b. Stakeholders for sustainable waste management cont'd

No.	Stakeholders	Role
6	Senior citizens	- Help NGOs/CBOs on organizing cleanliness drives in various parts of the city
7	Unemployed youth	- Take up various opportunities of part/full time employment that the 'Clean City' would open for them such as managing collection of garbage, helping the organizers in conducting road shows and helping the promotion of the operation
8	Children/ students	- Segregate garbage - Influence/keep check on parents/domestic servants
9	Vendors/shop owners	- Ensure that the waste/litter is properly put in a nearby garbage bin
10	Hospitals	- Follow the requirements of bio-medical rules
11	Government/Mini stries/ Politicians	- Lead the 'Clean City' campaign and work in unison towards the interest of a 'Clean' city - Pressurize the municipal corporation to make the 'Clean City' issue a priority - Do not to make the 'Clean City' into a political issue
12	Corporations	- Ensure that all employees understand the gravity of the situation and not only take serious actions on the cleanliness front within the office/factory premises but they also spread the message across the city - Provide dustbins outside the office/company premises so that the passers-by do not throw garbage on the road - Sponsor 'Clean City' programmes

Source: Joseph (2006)

2.7.1 Technical constraints

According to him, in most developing countries, there are inadequate human resources at both the national and local levels with technical expertise necessary for solid waste management planning and operation. Many officers in charge of solid waste management, particularly at the local level, have little or no technical background or training in engineering or management.

2.7.2 Financial constraints

Ogawa (2005) intimated that, solid waste management is given a very low priority in developing countries, except perhaps in capital and large cities. As a result, very limited funds are provided to the solid waste management sector by the governments, and the levels of services required for protection of public health and the environment are not attained. The problem is acute at the local government level where the local taxation system is inadequately developed and, therefore, the financial basis for public services, including solid waste management, is weak. This weak financial basis of local governments can be supplemented by the collection of user service charges. However, users' ability to pay for the services is very limited in poorer developing countries, and their willingness to pay for the services, which are irregular and ineffective.

2.7.3 Institutional constraints

He indicates that, several agencies at the national level are usually involved at least partially in solid waste management. He however, indicated that, there are often no clear roles or functions of the various national agencies defined in relation to solid waste management and no single agency or committee designated to coordinate their projects and activities.

“...The lack of coordination among the relevant agencies often results in different agencies becoming the national counterpart to different external support agencies for different solid waste management collaborative projects without being aware of what other national agencies are doing. This leads to duplication of efforts, wasting of resources, and unsustainability of overall solid waste management programmes. The lack of effective legislation for solid waste management, which is a norm in most developing countries, is partially responsible for the roles/functions of the relevant national agencies not being clearly defined and the lack of coordination among them” (Ogawa, 2005).

According to him, Legislation (Public Health Act, Local Government Act, Environmental Protection Act) related to solid waste management in developing countries is usually fragmented. Zurbrugg (2009) further added that, solid waste collection schemes of cities in the

developing world generally serve only a limited part of the urban population. The people remaining without waste collection services are usually the low-income population living in peri-urban areas. According to him, one of the main reasons is the lack of financial resources to cope with the increasing amount of generated waste produced by the rapid growing cities. Often inadequate fees charged and insufficient funds from a central municipal budget cannot finance adequate levels of service. He indicated that, apart from financial constraints that affect the availability or sustainability of a waste collection service; operational inefficiencies of solid waste services such as deficient management capacity of the institutions and inappropriate technologies affect effective waste management. Zurbrugg (2009) therefore underscores the key challenges of waste management, which include financial and institutional constraints.

2.8 Solid waste management in Developing Countries

In Asia, Africa and Latin America, cities are growing rapidly, fuelled by large-scale rural-urban migration and natural increases within the cities (Songsore, 2004). Current projections show that most of the world's future population growth will take place in developing countries with more and more people in the urban areas (UN-Habitat, 2010) Solid waste disposal is becoming problematic with the increased numbers of people in urbanized areas and with the increase in quantity and complexity of waste generated compared to the decrease in available land for waste disposal. This therefore leads to the worsening solid waste situation found in urban settlements. Municipal authorities in Ghana seem unable to organize adequate collection and safe disposal of solid waste. This therefore results in posing threats to public health and the environment. A walk within town reveals visible solid waste situation such as open burning, garbage accumulation and littering. Land filling is the most commonly used method for waste disposal in developing countries (Tchobanaglou *et al.*, 1993). Landfilling involves placing wastes in large, especially designed cavity then covering them with soil each day to prevent attraction of animals and insects (Kobus, 2003). However, due to inadequate resources for the

establishment of such specialized cavities, most developing countries dump their municipal solid waste on land in an uncontrolled manner (Da Zhu *et al.*, 2008). This disposal situation deteriorates as settlements extend closer to the dump sites. In most cities in the developing world, the waste situation serves as a hindrance against the achievement of the major objective of solid waste management which is to protect human health and the environment from the hazards posed by waste (Hardoy *et al.*, 2001).

Municipal authorities of developing countries are unable to handle increasing quantities of waste which results in uncollected waste (Zahur, 2007). Municipalities are faced with financial and planning challenges to enable them cope with the increasing waste generated by the increasing population. This therefore affects waste collection and disposal services (Da Zhu *et al.*, 2008). MSWM involves huge expenditures in the collection and safe disposal of waste. In Ghana, 50-75% of municipal budgets are spent to tackle the persistently increasing waste generation while the revenues received as collection and disposal fees cannot cater for the cost incurred in managing waste (Danso *et al.*, 2006). Improvement in infrastructure and technology to overcome barriers to the safe disposal of urban waste requires new and improved forms of management practices.

2.8.1 Solid waste management in Ghana

History of solid waste management

Before 1985, incinerators were the technology used for handling waste in the urban centres of Ghana. This could not be sustained due to the lack of funds because of economic hardship in early 1980 and technical knowhow. In view of this by 1985 solid waste were dumped on all bola locations (Oduro-Kwarteng, 2010). Thereafter a special department called the waste management department (WMD) was set up in the urban centres in 1985 to manage the waste in Ghana with financial and technical assistance from the German Agency for Technical Co-operation (GTZ). The first house-to-house collection started in Accra using

animal drawn carts using donkeys in the high-income residential areas. Waste collected was dumped into central containers. Using only 15 donkeys and 10 staff the carriage could collect 3–4 trips daily, which covered 75–100 houses (Oduro-Kwarteng, 2010).

The GTZ project helped to improve the deteriorated waste management in Ghana. However, their exit saw more deterioration in level of service quality and service coverage because the public provision alone could not handle the growing urbanization of the towns and cities. This however calls for further decentralization to include the private initiative in solid waste management. The waste companies provided house-to-house and communal services. The communal service was mostly provided in the lower middle-income areas using central containers. Residents who patronize this kind of service disposed of their waste by taking it to a central containers site. These containers are lifted full of waste and disposed of at designated disposal sites (Oduro-Kwarteng, 2010). Private Sector Initiative (PSI) started in Accra and Tema in the early 1990s and later extended to Kumasi in the mid-1990. Afterwards, this initiative was extended to Takoradi and Tamale in 2000 and 2002 respectively. The year 2004–2007 saw the inclusion of more private companies in to waste business all over Ghana. The companies in Accra and Tema increased to 18 and 6 respectively by 2006. As a result, contracts were open up for competition. The first competitive bidding for solid wastes took place in Kumasi in 2007 and later in Accra in year 2008 (Oduro-Kwarteng, 2010).

The rapid population growth in Ghana has resulted in increased waste generation in the country. The amount of solid waste generated per day in Accra was 750–800 tonnes in 1994 (Asomani-Boateng, 2007); 1800 tonnes per day in 2004; 2000 tonnes per day in 2007 this figure increased to 2200 in 2010 (Oteng-Ababio, 2010). The methods for solid waste disposal in Ghana are uncontrolled dumping of refuse, controlled dumping, sanitary land filling, composting, and incineration (Danso, 2011). Open refuse dumps are most commonly located at the perimeter of major urban centres in open lots, wetland areas, or next to surface water

sources. Open dumps are generally sited based on considerations of access to collection vehicles rather than hydrological or public health considerations. In rural areas and small towns, there are often no vehicles for collection hence uncontrolled dumping occurs within the built-up areas with all its attendant health hazards and negative environmental impact (Danso, 2011). Problems from landfills in Ghana include odour, insufficient covering material, flies and other vermin infestations and smoke from open fires. The increasing amount of waste received by these landfills make it necessary to find other disposal option since constructing new landfills may be difficult due to the scarcity of land, increase of land price and demand for a better disposal system. Effective solid waste therefore calls for a competent and responsible institutions as well as sound managerial system.

The Ministry of Local Government and Rural Development (MLGRD) is the institution responsible for waste management services at the national level. This institution formulates waste and sanitation policies and also provides oversight role to the assemblies and gives subsidies for the provision of SWM services. The Ministry supervises the activities of local Assemblies and passes order as required by law to the various Waste Management Departments of the local Assemblies who are directly responsible for effective solid waste management. As part of the decentralization process in Ghana, in 1988 the waste management functions became a sole responsibility of the Assemblies (Adarkwa, 2005). About 90% of the Assemblies budget is supported by the Central Government to carry out their obligations in the locality through the various departments. The WMD is responsible for all the waste collection, disposal and monitoring of all the activities of companies engaged by the Assemblies. On the legal and regulatory frameworks for effective solid waste management, the policy, which regulates waste management in Ghana, is primarily reflective of legislation enacted at the national level and decisions made in pertinent case law. The Central Government bestows local authority status,

onto any town or city in accordance with Act 462 which come to replace the previous act enacted in 1988 (Oduro-Kwarteng, 2010).

In spite of this, the Government continues to exercise controls over the Metropolitan, Municipal, and District Assemblies (MMDAs). The Central Government usually gives directives that affect the Assemblies. The most important is the fact that, a considerable amount of the Assemblies revenue is a direct disbursement from the Central Government. This makes it very difficult for the assemblies to be free from government interference. However, the MMDAs have a constitutional mandate under the 1993 (Act 462) to effectively handle sanitation issue, which includes solid-waste management and therefore needed to operate independently to benefit the people. This responsibility is farfetched due to lack of independence. The 1960 (Act 29) of the Criminal Code of Ghana, state in no uncertain terms that whoever places or permits to be placed, any refuse, or rubbish, or any offensive or otherwise unpleasant material, on any yard, street, enclosure, or open space, except for the reason that such a place has been designated by the Assembly for such intent and purpose commits an offense.

The law requires individuals to take full responsibility for the streets, drains and space closer to their premises (Oduro-Kwarteng, 2010). In addition, the legal regime in Ghana mandate the Assemblies as owners of all the waste generated in municipalities and as a result has the mandate to collect, recycles and discards solid waste. The National Building Regulations, The 1996 (LI 1630) which is the national building regulation stipulates that a building for residential, commercial, industrial, civic or cultural use shall have a facility for refuse disposal, a standardized dustbin and other receptacles approved by the Assembly in which all the waste generated shall be stored pending final collection by the trucks to final disposal site (Oduro-Kwarteng, 2010). SWM in Ghana is greatly influenced by the Environmental Sanitation Policy of 2008. This policy is an update of the 1999 policy with the

view to meet the prevailing development objectives and address the aspirations of the principal actors in the sector after 8 years of slow implementation with very little impact (MLGRD, 2010). With reference to environmental sanitation, the policy requires the Assemblies to control environmental sanitation and check pollution in all forms (Oduro-Kwarteng, 2010). The policies tend to reflect prevailing ideas on solid waste management and give an overall evaluation of the prevailing circumstance in the country. It further ensured private sector participation and the provision of 80% of SWM in all the assemblies (Oduro-Kwarteng, 2010). The Ministry of Local Government is mandated to regulate the waste business. The regulation works to promote competition via legal restrictions and regulatory rules and controls concerning market entry and exit, the capacities of companies operating in the waste market, user charges and the service standards.

The local assemblies are mandated to outsource solid waste collection to decentralized agents service by contracts and also embark on frequent monitoring and evaluation of the service quality provided by the companies and sanction any insubordination according to the dictate of the contract. The policies and regulations and the contractual agreement that connect the assemblies with the companies are important factors that contribute to effective solid waste collection, treatment and disposal. These regulations include the Local Government Act, National Procurement Act, Local Governments By-law, Environmental Sanitation Policy, and other state conventions that provide rules for solid waste management. The Procurement Act (Republic of Ghana, 2003) requires the Assemblies Tender Boards to use competitive bidding to select companies (Oduro-Kwarteng, 2010). This call for appropriate mechanisms suitable for the local conditions from an environment, social and fiscal perspectives, and at the same time being more capable to be sustain over long period of time without reducing the resources it needs (van de Klundert and Anschutz, 2001). Based on this the conceptual framework of the study focuses on four key variables, namely: evolving practice of SWM, households'

involvement for service sustainability, private company capacity and lastly, regulatory mechanisms and control for solid waste management in relation to service quality.

Waste management practices:

Over the years, solid waste disposal in Ghana has become a major challenge to MMDAs. Because of urbanisation and increasing densities, Metropolitan Assemblies find it difficult to deal with the large quantities of solid waste generated. This is due to the fact that, people resort to indiscriminate dumping as the only means to managing their domestic solid waste thus resulting in littering and heaping of waste. This section of the review analyses solid waste management processes in Ghana with AMA and KMA as a case. These include collection and disposal as well as waste management regulation and policy in Ghana. The next sub-section discusses solid generation in AMA and KMA.

Solid waste generation

According to Mensah & Larbi (2005) based on an estimated population of 22 million and an average daily waste generation per capita of 0.45 kg, Ghana generates annually about 3.0 million tonnes of solid waste. Boateng & Nkrumah (2006) have further added that, solid waste generated daily in Accra was between 1500-1800 tonnes. According to Anomanyo (2004), about 1800 tonnes of municipal solid wastes were generated per day in the Accra Metropolis and the average waste generated per capita per day was estimated at 0.5 tonnes. He attributed this to the rate of population growth in the Metropolis, which stood at 3.5%. Waste from domestic sources include, food waste, garden waste, sweepings, ash, packaging materials, textiles and electric and electronic waste with organic waste being the major component.

This constituted about 65%. According to him, the high proportion of food and plant waste was because Ghana's economy largely depended on agricultural products for export and

domestic consumption. However, the waste rate of AMA was about 2000 tonnes a day with per capita waste generation of 0.45kg (AMA, 2009). In addition, according to KMA (2009), the current domestic waste generation in Kumasi rate was approximately between 1000-1500 tonnes a day. This was based on the projected population of 1,610,867. According to Ketibuah *et al* (2010), in Kumasi the bulk of household waste is found to be organic waste, which includes food waste and putrescible waste with an average of 55%. Having discussed the quantities and composition of waste generated in the two Metropolis, this leads the discussion on solid waste collection in the next sub-section.

Solid waste collection

According to Tsiboe & Marbel (2004), there are three methods of household waste collection in Accra:

- Waste Management Department (WMD) curb side collection by trucks directly outside each house. According to them, this collection method was provided weekly in the high-income residential areas like Roman Ridge, Airport and Cantonment by compactor trucks.
- WMD collected from communal containers to which people must bring their own waste. These were restricted to low-income areas like Nima and amounted to some 200 communal containers. Households that could not afford the house-to-house collection service took their waste to any of these 200 communal containers and from which the WMD collected the waste and disposed of it at the landfill site (Stephens *et al.*, 1994) cited in Tsiboe & Marbell (2004) and
- Door-to-door collection services in middle-income areas like Labadi.

According to Anomanyo (2004), for the purpose of effective waste collection, the city was demarcated into waste collection districts where a company was contracted by AMA to

collect waste in one district or two. Fifteen (15) waste collection companies were contracted. These include: Liberty Waste Service Company, Vicma Waste Construction, Ako Waste Management Limited, Gee Waste Limited and Daben Cleansing Construction Services Limited. The main types of vehicles used by AMA were compaction and skip trucks. The wastes were taken by road directly to the disposal sites. There were no waste transfer stations.

According to him, solid waste collection in the city was carried out both on franchise and contract basis. On the franchise basis, a house-to-house collection was done in high-income areas and the contractors charged the households some fees with weekly collection frequency. These areas were well-planned residential areas with access roads described as first and second-class areas and include areas as Airport residential area and Cantonments. Each household had plastic containers with covers. These contractors then paid a tipping fee to the AMA for the use of its dumpsite. The user fees charged form about 20% of general service to the beneficiaries whose wastes were collected. On contract bases, waste contractors were paid by AMA to perform both block and communal container collection. Block collection occurred in middle-income residential areas including Dansoman, Adabraka, Kaneshie and other parts of Accra. Approximately 75% of the waste generated was collected in these areas. Central communal skip collection occurred in low-income high population density and deprived residential areas such as James Town, Nima and other parts of Accra where houses were not well planned with poor or even no access roads (third class areas). Market places were also covered under this arrangement. Residents deposited their waste in such communal containers and the frequency of collection was at least once daily. Waste generators here did not pay user charges. He added that despite the strategies put in place for the collection of waste in Accra, maximum waste collection was not achieved. Between 65 and 75% of waste was collected per day.

According to KMA (2006), there are two modes of waste collection in the Kumasi Metropolis. These are house-to-house and communal collection. According to Metropolitan Assembly, Aryetey Brother Company Limited (ABC), Waste Group Ghana Limited (WGG), Sak-M Company Limited (SAK-Mo Meskworld Limited (ML) and Kumasi Waste Management Limited (KWML) were contracted for solid waste collection. About 33% of the population enjoys this service but payment for the service was irregular. It is on franchise basis for a monthly fee of GH¢1 to GH¢3 per house. Additionally, the communal collection was awarded to Kumasi Waste Management Limited (KWML), Waste Group Ghana Limited (WGG), Meskword (ML) and Aryetey Brother Company Limited (ABC). The total quantities collected were weighed at the disposal site and payment was based on a rate of GH¢ 9 per tonne.

From the above assessment, it can be deduced that there are basically, two main modes of waste collection in AMA and KMA. These are door-to-door or house-to-house collection and communal collection, which are carried out, in the high class and low class residential areas respectively. Unlike the door-to-door collection, which attracts some fee from households, the communal collection is carried out at no cost to the households in AMA. In the case of KMA, waste collection is charged per house. However, the door-to-door collection may not favour the poor or low-income areas and therefore there is the likelihood of poor waste collection services in these areas. Additionally, attention on collecting solid waste in these areas will be less. Therefore, there is the tendency for residents to dump waste anyhow because of poor collection service.

However, to use income as measure to stratify residential areas in a city like Accra may be misleading. This is because those living in the supposedly low-income residential areas may be well to do than those residing in the high-income areas as indicated by Stephen *et al.*, (1994) and accepted by Tsiboe & Marbell (2004). This means that Tsiboe & Marbell (2004) did not

critically examine the text before accepting it. Instead, the class of buildings, willingness and ability of the people to pay for the collection service should have been considered.

Solid waste disposal

According to Anomanyo (2004), waste disposal from households in AMA took different forms. These are represented in Figure 2.1 below.

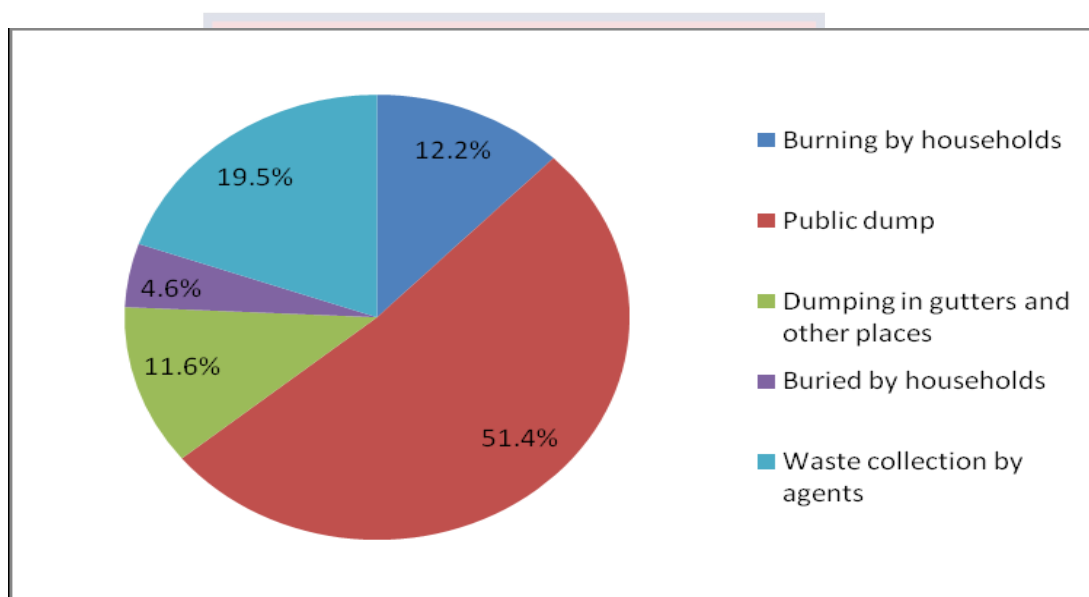


Figure 2.1: Waste disposal of households in AMA, 2004

It can thus be ascertained that out of the about 1800 tonnes of waste generated, only 19.5% was collected. Anomanyo (2004), further added that between 1991 and late 2001, the AMA’s Municipal solid waste in the Accra metropolis was deposited at Mallam, a suburb of Accra. This dumping at the Mallam site however was stopped in late 2001 as the dump capacity had been exceeded and objections from nearby residents. Waste dumping was henceforth shifted to Djanman, which unfortunately could not last as it was filled to capacity in just three months. These abandoned Mallam and Djanman sites were mountains of dumps and since they were neither landfills nor were there controls to their spread and emissions, they are of great

concern because of their threat to human health, leachate and landfill gas formation. According to him, the dumpsite was an old stone quarry at Oblogo in the McCarthy Hills of Accra. Before it began to be used in early 2002 there was an installation of clay lining. The site had no engineered containment of leachate. AMA was only able to compact the waste to guarantee some level of proper dumping and hence “this site was considered a controlled dump rather than a properly engineered landfill” (Anomanyo, 2004). He further added that since the formal systems of solid waste disposal could not cope with the ever-increasing volume of solid waste being generated in Accra, the public itself employs various means of waste disposal. Waste was thus disposed of indiscriminately especially in watercourses and drainage channels and through burning.

According to KMA (2006), a well-engineered sanitary site was used at Dompouse where waste was placed compacted and covered at the site. A weighbridge was also available and attached to a control room where the waste was weighed and inspected before being accepted into the landfill. A maintenance bay and offices were also at the site. Heavy-duty equipment were available for spreading of waste, compaction and covering. Grading and gravelling of access roads are other vital activities at the landfill site. Comparing the two Metropolis in terms of waste disposal in landfill, KMA has well designed sanitary landfill, which meets all the requirements. These include weighbridge, access roads, maintenance bay, leachate measures, and heavy-duty equipment for spreading waste, compacting and covering.

Waste management regulation and policy

According to the Ministry of Local Government and Rural Development (MLGRD) (2004), general waste management in Ghana is the responsibility of the MLGRD, which supervises the decentralized Metropolitan, Municipal and District Assemblies (MMDAs). However, the ministry indicates that, regulatory authority is vested in the Environmental Protection Agency (EPA) under the auspices of the Ministry of Environment and Science. The

Metropolitan, Municipal and District Assemblies are responsible for the collection and final disposal of solid waste through their Waste Management Departments (WMDs) and their Environmental Health and Sanitation Departments (EHSD). The policy framework guiding the management of hazardous, solid and radioactive waste includes the Local Government Act (1994), Act 462, the Environmental Protection Agency Act (1994), Act 490, the Pesticides Control and Management Act (1996), Act 528, the Environmental Assessment Regulations 1999, (LI 1652), the Environmental Sanitation Policy of Ghana (1999), the Guidelines for the Development and Management of Landfills in Ghana, and the Guidelines for Bio-medical Waste (2000). All these Acts and Regulations emanate from the National Environmental Action Plan (MLGRD, 2004).

Furthermore, the ministry has published the National Environmental Sanitation Policy (NESP) since May 1999. Accordingly, the policy looks at the basic principles of environmental sanitation, problems and constraints. The role and responsibilities assigned to communities, ministries, departments and agencies and the private sector impinge on environmental management and protection, legislation and law enforcement and the criteria for specifying services and programmes, funding, equipment and supplies. Out of the National Sanitation Policy, the MLGRD has also developed a technical guideline document titled 'The Expanded Sanitary Inspection and Compliance Enforcement (ESICOME) Programme guidelines. The programme guidelines which are implemented by the MMDA has, routinely looked at four broad areas namely; effective environmental health inspections (Sanitary Inspections), dissemination of sanitary information (Hygiene Education), pests/vector control and law enforcement. All MMDAs have developed waste management and environmental health plans to help solve the numerous sanitation problems. Generally, the National Environmental Sanitation Policy Co-ordination Council (NESPoCC) is responsible for coordinating the policy

and ensuring effective communication and cooperation between the many different agencies involved in environmental management in their respective Districts (MLGRD, 2004).

The ministry further indicates that in an effort to address the problem of waste management, Government has over the years put in place adequate national policies, regulatory and institutional frameworks. Due to this, the Environmental Sanitation Policy (ESP) was formulated in 1999. This policy has currently been amended and strategic action plans developed for implementation according to the report. Various relevant legislations for the control of waste have also been enacted. These include the following.

- Local Government Act, 1990 (Act 462)
- Environmental Assessment Regulations, 1999 (LI 1652).
- Criminal Code, 1960 (Act 29).
- Water Resources Commission Act, 1996 (Act 522).
- Pesticides Control and Management Act, 1996 (Act 528).
- National Building Regulations, 1996 (LI 1630).

The Ministry also collaborated with the Ministry of Environment, Science and Technology (MEST), EPA and the Ministry of Health have prepared the following guidelines and standards for waste management:

- National Environmental Quality Guidelines (1998)
- Ghana Landfill Guidelines (2002)
- Manual for the preparation of district waste management plans in Ghana (2002)
- Guidelines for the management of healthcare and veterinary waste in Ghana (2002)
- Handbook for the preparation of District level Environmental Sanitation Strategies and Action Plans (DESSAPs).

It is observed from the above that, despite the numerous sanitation regulations and policies that have been put in place by the MLGRD to deal with the solid waste menace in the country, there has not been any improvement in the area of solid waste management. Rather it has moved from bad to worst and therefore has failed to achieve its goal of clearing filth in the country. Secondly, drawing from the views given by the Sanitation Country Profile Ghana and the National Report for Waste Management in Ghana, it can be said with certainty that MMDAs are the primary authorities to manage solid waste at the local level.

2.9 Conceptual framework

From the review, it has been identified that solid waste management is not a municipal issue that has to be carried out by the local government only. There is a need for a more comprehensive package of measures, which will take into consideration integrating efforts of relevant stakeholders for environmental management.

The conceptual issues that will be tackled include the role of stakeholders in the provision of domestic solid waste management facilities, collection, disposal of domestic solid waste, and the capacity of the institutions responsible for managing domestic solid waste as well as performing stakeholder analyses to improve participation managing household waste in New Juaben Municipal Assembly. With regard to the stakeholders, the study will focus on three groupings of stakeholders namely; waste generators, service providers and service regulators as described in the Figure 2.2.

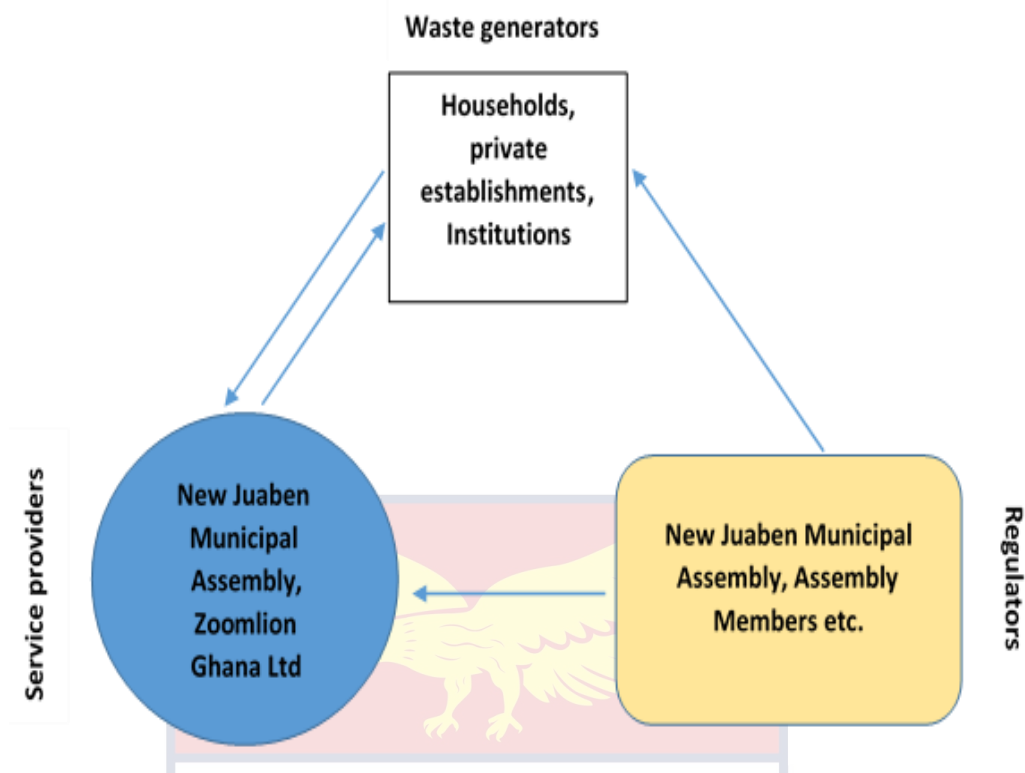


Figure 2.2 Stakeholders in household solid waste management in New Juaben Municipality

These issues will therefore serve as the conceptual framework for the study of New Juaben Municipality to identify some of the issues pertaining to solid waste management, as they affect the quality of the environment and public health.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter describes the appropriate methodology that was developed to collect data to respond to the research questions enumerated above. In light of this, the study gathered data from primary sources using questionnaire administration.

3.2 Study Area

The New Juaben Municipal Assembly (NJMA) is located in the Eastern Region of Ghana. The Municipality covers an estimated area of 110 km², constituting 0.57% of the total land area of the Eastern Region. It shares boundaries with the East Akim Municipal Assembly on the North-Eastern side, the Akuapim North District bordering the East and South sides while Suhum Kraboa Coattar District borders the West side (Figure 3.1). Koforidua is both the municipal and regional capital and it is 85 km from the national capital, Accra. The proximity of NJMA to other municipalities as well as to the national capital had been a major factor contributing to the rapid urbanization in the municipality. This is because NJMA is more resourced in terms of infrastructural facilities and services than its neighbours hence attracting more inhabitants especially the active labour force with their dependants. This situation has created a high demand for essential services with its attendant problems in the area.

The 2010 Population and Housing Census indicated that the NJMA has a population of 183,727. Comparing this with the 2000 population of 136,768 it can be seen that the municipality is growing at a rate of 0.34%. As such, there is the need to put in structures to alleviate the challenges that would be associated with rapid urbanization. Females outnumber males in the municipality, constituting 51.5% while Males constitute 48.5%.

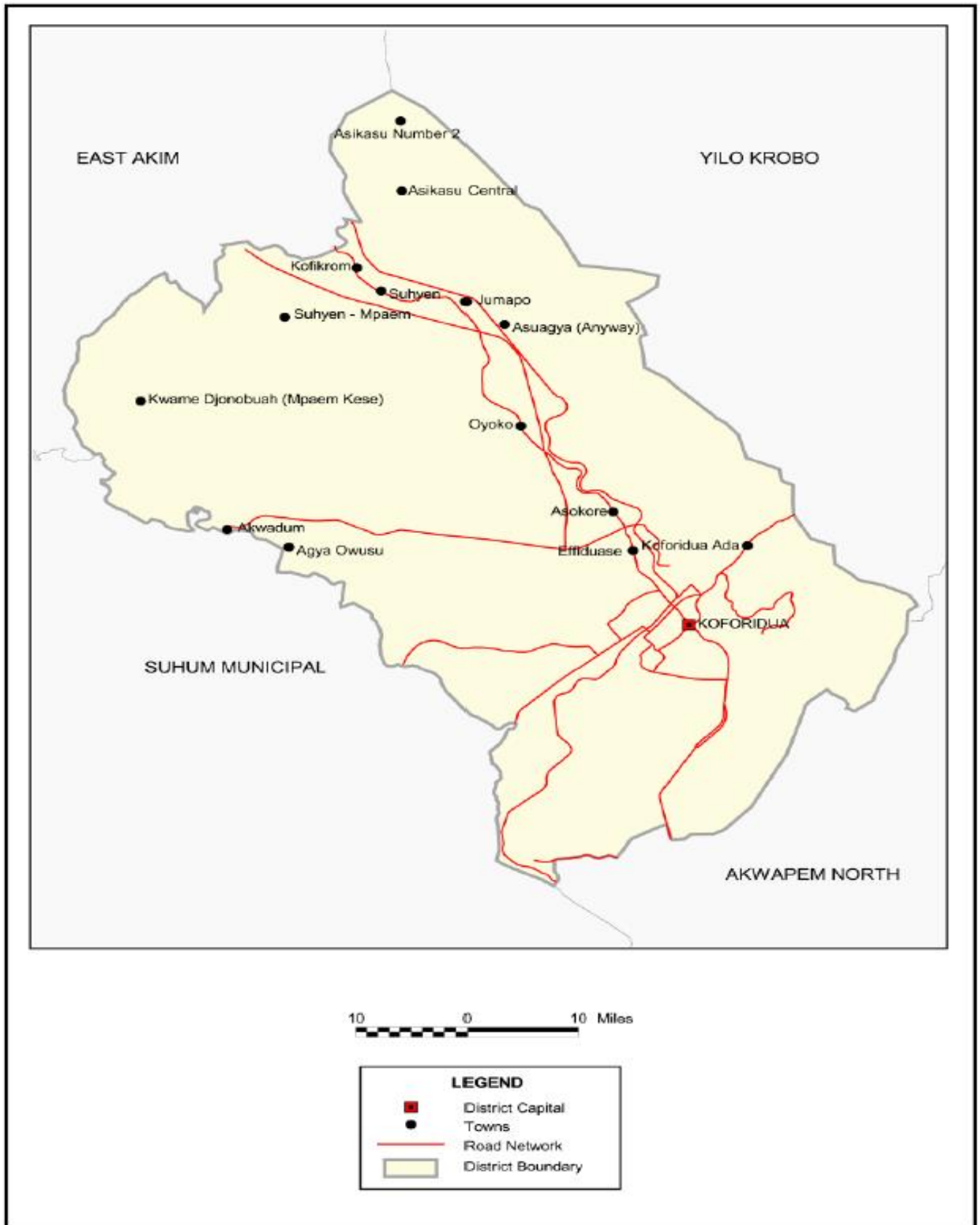


Figure 3.1 Map of New Juaben Municipality. Source: GSS (2014)

According to the 2010 Census, people aged < 15 years constitute 35% of the population; those between 15 – 64 years constitute 60% while those > 65 years constitute 5% of the population. This signifies that NJMA has a young population with a dependency ratio of 64.7% in the 15 – 64 age brackets.

The key sectors of the municipal economy are the services sector, which constitutes 39.9%, industrial manufacturing and processing 26.7%, agriculture 26.1% and other socio-economic activities constituting 7.3%. While majority of industrial establishments are found in the central business area of the municipality, agricultural production is carried out in the smaller settlements and the peri-urban localities. The most widely used method of solid waste disposal is public dumping into containers accounting for 61.3%. About one tenth of households in the municipality dispose of their solid waste in open space public dumps. A 1.8% of households dump their solid waste indiscriminately. House-to-house waste collection accounts for 5.1%.

3.3 Study Design

This study employed a mixed method approach involving the collection of quantitative and qualitative data. The combination of the strengths of each data was used to assess the role of stakeholders in household solid waste management in NJMA.

This technique focuses on the quality of data rather than its quantity. This method was used in collecting key informant information from stakeholders who consisted of NJMA officials (the Municipal Chief Executive, the Municipal Coordinating Director, Municipal Environmental Health Officer and Municipal Planning Officer), the Presiding Member and Assembly members, Zoomlion Ghana Limited and the heads of households (clients) within the municipality.

3.4 Study population

The study population consisted of all households in the New Juaben Municipality and relevant stakeholders in the waste management sector mentioned above. A representative sample of these households was randomly selected for the study while a purposive selection was employed for the other stakeholders in the waste management sector.

3.5 Sampling

3.5.1 Sample size determination and sampling procedure

According to the 2010 Population and Housing Census, the municipality has 49,474 households and an average household size of 3.5. To obtain an optimal sample size for the study, Yamane's formula was used (Yamane, 1973). The required minimum sample size to be interviewed was estimated as follows:

$$n = N / (1 + (e)^2)$$

Where

n = required minimum sample size

N = Number of households in the study area (540)

e = margin of error (10%)

By computation, $n = 49,474 / (1 + 0.1^2) = 100$ households. This minimum number of households was increased to 150 for the study. Ten households were randomly selected from each of the 15 locations indicated in the map of the study area. The rest of the stakeholders were purposively selected or by snowball sampling.

3.6 Data Collection

The study obtained primary data to respond to the research questions. Primary data was collected from households and officials in the study area while secondary data was collected from institutions and organisations involved in waste management activities in the municipality.

For the primary data, a structured questionnaire (Appendix I) made up of both closed and open-ended questions was administered to household heads or knowledgeable members of households in a face-to-face interview. Key informant interviews were also conducted with identified key stakeholders in the municipality. The identified stakeholders included the Municipal Chief Executive, the Municipal Coordinating Director, the Municipal Environmental Health Officer and the Municipal Planning Officer from the Assembly. The other stakeholders were the Presiding Member and Assembly members, Zoomlion Ghana Ltd, opinion leaders in the community as well as religious leaders like pastors and imams within the various communities on prospects and challenges in ensuring improved household solid waste management.

3.7 Data Analysis

All completed questionnaires were checked for consistencies and errors to ensure that data obtained was clean. The data was analysed using the Statistical Package for the Social Sciences (SPSS) version 21.0 and the results were presented using tables and figures. Where appropriate, the analysis used modelling techniques to analyse for relationships between collected data. Other analysis such as correlation and chi-square tests were used where necessary. For the qualitative part of the study, the data were first transcribed after which it was coded for constructs that were relevant for the study. These codes were then analyzed and conclusions drawn.

3.8 Ethical considerations

The following steps were taken to protect the interest of respondents in this study. The use of informed consent was meant to give respondents the choice of whether to take part or not. The consent message was given and explained to the respondents. In addition, the researcher fully discussed the issue of anonymity and confidentiality with respondents and assured them that their identities would not be disclosed in the study findings or any study-related publications.



CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Introduction

This chapter describes the findings of the study and discusses with them within the context of previous work.

4.2 Demographic and socioeconomic characteristics of the respondents

Out of the 150 households contacted and interviewed, the average size of a household was 4.8 (Min = 1, Max = 8) with an average number of dependents being 3.0 (Min = 1, Max = 7). The characteristics of the respondents is presented in Table 4.1. From the 150 respondents, 75% were females and the rest were males. Almost 40% of the respondents were between the ages of 35 – 44. These results were similar to finding by Alhassan & Mohammed (2013) when they carried out similar studies in the New Juaben Municipality in 2013. There was a high response rate from females because traditionally women's responsibilities in the household have been cleaning, food preparation, family health, laundry and domestic maintenance (Woroniuk & Schalwyk, 1998) and so would be the ones directly involved in waste management as well. A majority of the households (46.2%) earned gross monthly incomes between GHC 1,001 – 2,000.00.

4.3 Willingness to use household waste bins

Table 4.2 details the responses of households on the ownership and use of waste bins. All the households (100%) use waste bins comprising mainly the 240L bins (92.3%) and 120L (7.7%) for waste storage. However, only 36.5% of respondents owned their own bins. Out of the number that owned their bins, 42.1% actually purchased the bins while 31.6% and 26.3% got theirs from government distribution and other sources, respectively. Overall, 62% respondents used communal/compound level bins while 38% were used at the individual household levels.

Table 4.1. Demographic and socioeconomic characteristics of respondents (n=150)

Characteristics	Frequency	Percent (%)
Gender:		
Male	37	25.0
Female	113	75.0
Age:		
Under 24	3	1.9
25 – 34	31	20.8
35 – 44	59	39.6
45 – 54	45	30.2
55 – 64	9	5.7
Over 65	3	1.9
Head of household:		
Yes	58	38.6
No	92	61.4
Marital status:		
Married	112	75.0
Single	19	12.5
Otherwise	19	12.5
Religious affiliation:		
Christian	144	96.5
Muslim	6	3.5
Traditional	0	0.0
Other	0	0.0
Level of education:		
None	42	28.1
Primary	58	38.6
Secondary	16	10.5
Tertiary	34	22.8
Monthly gross household income:		
Less than GHC. 1,000		
1,001 – 2,000	49	32.7
2,001 – 3,000	69	46.2
3,001 – 5,001	14	9.6
	14	9.6
5,001 and Above	3	1.9

Source: Field data, 2020

Table 4.2 Respondents ownership and use of waste bins in households (n=150)

Responses	Frequency	Percent (%)
Do you use a waste bin?		
Yes	150	100.0
No	0	0.0
If yes, what is the system of use?		
Household level	57	38.0
Compound level	93	62.0
Other	0	0.0
What is the size of the waste bin?		
240L	138	92.3
120L	12	7.7
100L	0	0.0
80L	0	0.0
Do you own a waste bin?		
Yes	55	36.5
No	95	63.5
What is the nature of ownership?		
Government distribution	48	31.6
Self-purchase	63	42.1
Other	39	26.3

Source: Field data, 2020

These results show that the respondents are already familiar with the concept and importance of household waste bins even though a majority did not actually own the bins themselves. Despite this, all households have expressed a high willingness (100%) to own and use a household waste bin (Table 4.5).

4.4 Factors affecting acceptance and payment for household waste collection

4.4.1 Household waste characteristics and disposal

Respondents dispose of their waste on the average of 2.35 times in a week (Table 4.3). All the respondents dispose of their waste with private collectors who collect the waste 1.0 time per week on average (though, it ranges between 1 – 4 times per week) and pay on average GHC 27.20 per month. The range of payment is between GHC 7.0 – 35 per month for the collection

services. The 1.0 time per week would mean some households would need additional waste bins as indicated above to store more waste as they wait for collection.

Table 4.3 Household waste disposal characteristics

	How often do you dispose your waste in a week?	How much do you pay for this service per month?	How many times is your waste collected per week?
Mean	2.35	27.20	1.14
Median	2.00	35.00	1.00
Mode	1.00	35.00	1.00
Std. Deviation	1.70	10.41	0.49

Source: Field data, 2020

The average composition of waste is shown in Table 4.4. While organic waste is the biggest component of their waste stream, e-waste and metals are the least components. The major problems respondents encounter in managing household solid waste are means of storage (66.7%), followed by means of collection (18.8%) and then means of disposal (14.6%). Which means that, having accessibility to more waste bins at the individual household level could lead to an improvement in the management of solid waste.

Table 4.4 Composition of waste generated in New Juaben Municipality

Waste type	Composition
Organic	65%
Paper	12%
Plastics	9%
Cans	7%
Textiles	2%
Glass	1%
E waste	1%
Others	3%

Source: Field data, 2020

This may have informed the suggestions by respondents that more trucks were needed to improve the current situation (Figure 4.1). In General, about 18% of the respondents find the services of the private collectors somewhat satisfactory while 80% find their services satisfactory.

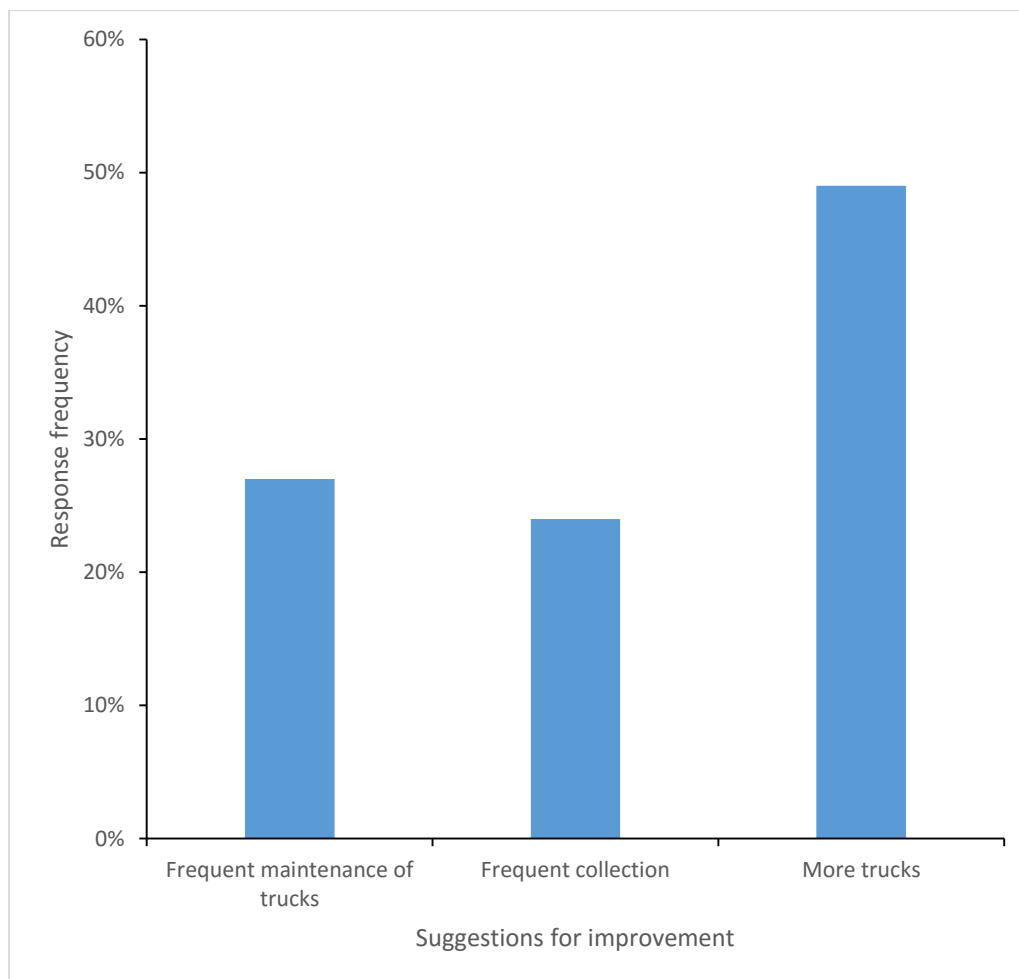


Figure 4.1. Households suggestions to improve household waste services. Source: Field data, 2020

4.4.2 Willingness to pay for household bins and collection services

Table 4.5 show results of households’ willingness to use and pay for household waste management services. While all households were willing to use and pay for household bins, 83.9% of the respondents from the survey indicated households should be responsible for the

cost of waste management in the municipality while only 3.6% said the Municipal Assembly should be responsible (Table 4.5). Despite the general knowledge that government should or is responsible for waste management in Ghana, the respondents did not seem to trust government to do a good job. Sixty-two percent (62.7%) of the respondents prefer private companies to manage their waste, followed by almost 20% showing both government and private companies to work together in the municipality (Figure 4.2).

Table 4.5 Households willingness to use and pay for household waste management

Responses	Frequency	Percent (%)
Are you willing to use household bins?		
Yes	150	100.0
No	0	0.0
Are you willing to pay for household bins?		
Yes	150	100.0
No	0	0.0
If Yes, how much are you willing to pay?		
GHC 0 – 25	58	38.8
GHC 26 – 50	92	61.2
GHC 51 – 100	0	0.0
GHC 101 – 150	0	0.0
GHC 151 – 200	0	0.0
Frequency of payment		
Weekly	23	15.4
Monthly	127	84.6
In what form will you like to pay?		
With electricity bill	3	1.8
On its own	58	38.6
Other	90	59.6
Which of the following is the best institution to handle household waste management?		
Municipal assembly	27	17.6
Private companies	94	62.7
Both	29	19.6
Who should be responsible for bearing the cost of household waste management?		
Municipal assembly	6	3.6
Households only	126	83.9
Other	18	12.5

Source: Field data, 2020

They believe such collaboration can only lead to efficient waste management as currently all of the households say they are not getting any solid waste collection or disposal services from government. The reasons they ascribed to preferring the private companies are stated in Table 4.6.

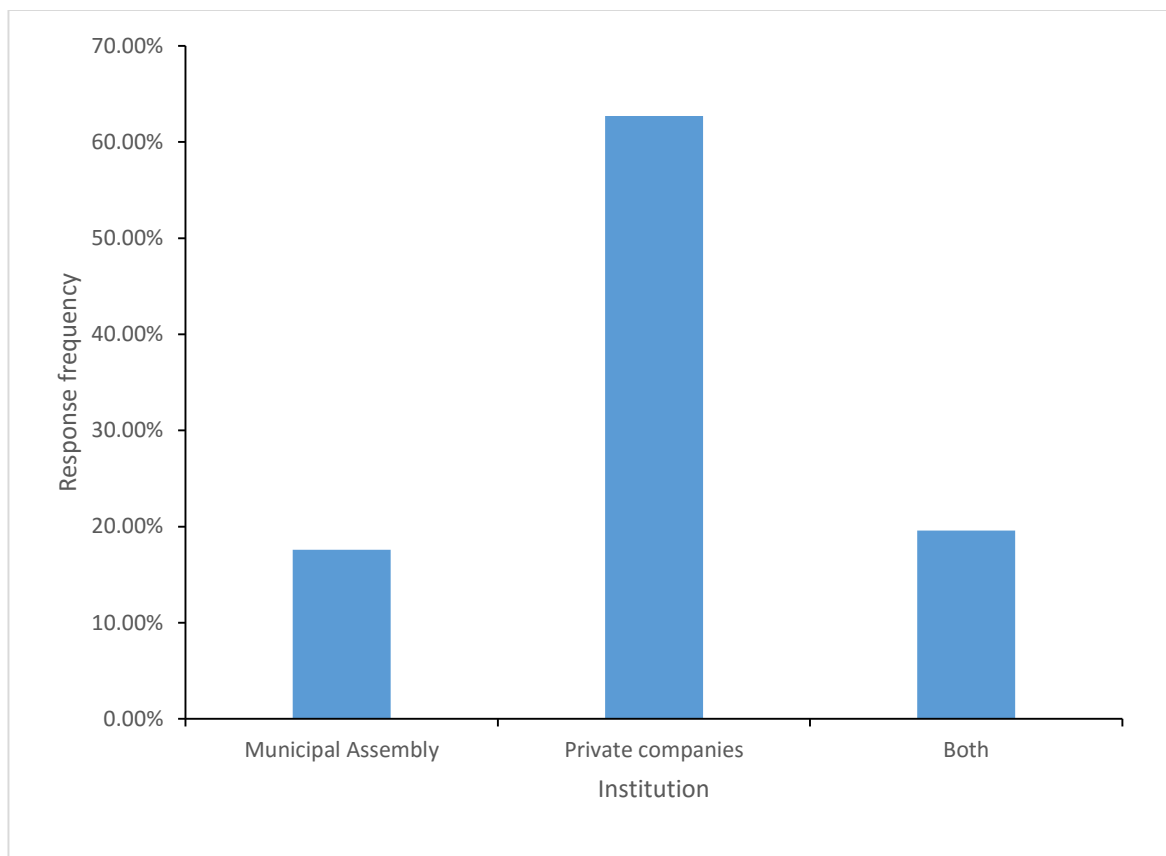


Figure 4.2. Institution to best handle solid waste in the locality. Source: Field data, 2020

Table 4.6. Reasons for selecting best institution

Reasons	weights
Municipal Assembly	
- Quick response and proper disposal of waste	33.3%
- Satisfaction in service	11.1%
- Good supervision	22.2%
- They are effective	11.1%
- They are reliable	11.1%
- They do neat work	11.1%
Private companies	
- They do proper job because of effective supervision	26.5%
- Customer satisfaction guaranteed	11.8%
- They are effective	17.6%
- Quick response to issues and proper disposal of waste	14.7%
- They are reliable	8.8%
- They are efficient	5.9%
- Provide good service and follow schedule	2.9%
- They ensure proper hygiene	2.9%
- They do neat work	8.8%
Both	
- They enhance good supervision	28.6%
- It will enhance healthy competition	14.3%
- Waste management is a shared responsibility	42.9%
- Some areas cannot be captured by the municipal assembly so the private can serve those places	14.3%

Source: Field data, 2020.

4.5 Collaboration between stakeholders in household waste management

The study revealed that the stakeholders being the households and the Municipal assembly considered household waste management as a problem in the New Juaben Municipality. From Tables 4.5 and 4.6, it is clear from the study that, households do recognize the role of local government in waste management however, they do not perceive the involvement of the Municipal Assembly in decision making concerning waste management in the municipality even though the assembly has oversight responsibility. It could also mean that there is little or no collaboration among households as clients and government as original service providers. These findings do not agree with earlier findings of Adongo *et al.*, (2015). For sustainable waste management to thrive in a municipality there has to be an integrated strategy in waste

management requiring participation at all levels: government, industries, public and the waste management concessionaires (Zaini *et al.*, 2002).

According to the study, partnership among stakeholders could help improve waste management in the municipality. The study shows that information channels among the stakeholders are not properly established. From the study, the households have expressed a high willingness to pay for service (Table 4.5). About 39% of the respondents are willing to pay between GHC 0 – 25.00 for household bins while the majority are willing to pay GHC 26 – 50 (Figure 4.3). According to the findings, more females preferred to pay for the service via other forms of payment such mobile money other with electricity bills. This finding could influence policy decisions in designing payment forms for some of these services.

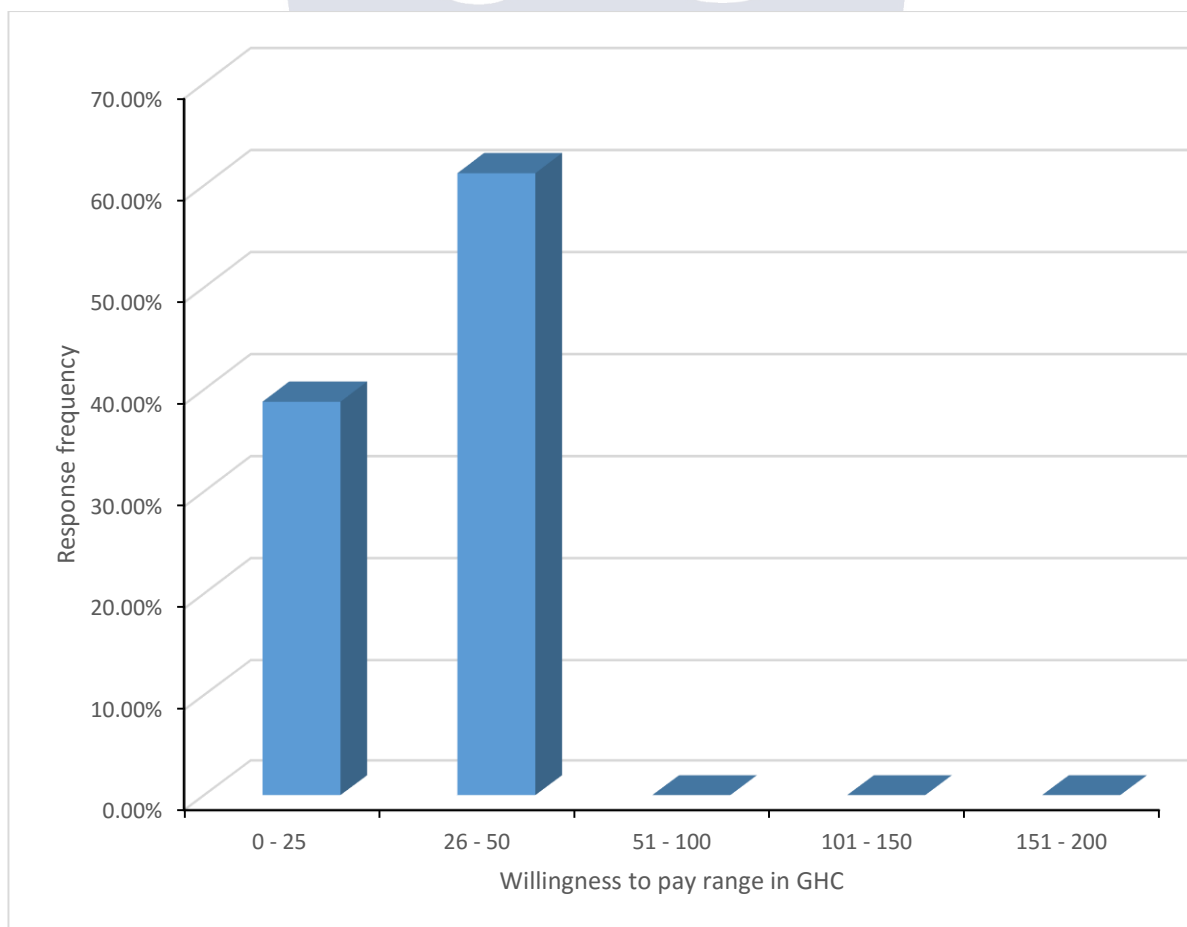


Figure 4.3. Willingness to pay for solid waste bin services. Source: Field data, 2020

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary

The aim of this study was to assess the role of key stakeholders in household solid waste management in the New Juaben Municipal Assembly. It was found that, 75% of respondents were females and almost 40% of the respondents were between the ages of 35 – 44 years. Though all of the households have bins for waste storage, 66.7% of the respondents claimed storage of the household waste was the biggest problem they encounter. A majority was willing to pay private companies between GHC 26 – 50.00 to collect their waste on a monthly. Given the high willingness-to-pay by the households in the municipality, it is recommended that, they should register for household bins with a registered service provider in the municipality with the flexibility to allocate as many bins as would be required by the households for effective household solid waste management.

5.2 Conclusion

In conclusion, the findings from this study revealed that though all of households have bins for waste storage, 66.7% of the respondents claimed storage of the household waste was the biggest problem they encounter. This could be due to the average once in a week collection which could be too low a frequency for some households and so would prefer to either have additional waste bins at home or the service provider acquiring more trucks. Lower collection waste collection frequencies could let lead to indiscriminate dumping in the environment. Despite the assertion that government is/or should be responsible for waste management, the respondents do not trust the municipal assembly to do a good job with household waste management. A majority of the respondents (approximately 61%) are willing to pay private companies between GHC 26 – 50.00 to manage their household solid waste on a monthly basis.

5.3 Recommendations

To improve stakeholder participation in delivering improved household waste service delivery in New Juaben municipality, the following recommendations have been made: Following findings from the study on improving stakeholder collaboration in delivering improved household waste service delivery in New Juaben Municipality, the following recommendations have been made:

Waste generators (Households)

1. Households should form Associations with representatives to lead in dialogue with service providers regarding waste pick-up points, schedule of collection and setting up neighbourhood service standards.
2. Households should register for bins with a registered service provider in the municipality with the flexibility to allocate as many bins as would be required by the household for waste storage.
3. Households must be compliant to bye-laws of the Assembly regarding fee fixing for the collection and management of solid waste.

Service providers (Private companies)

1. Service providers must provide trainings, public information campaigns on waste reduction at source and the need to use registered bins.
2. Service providers must follow an agreed schedule of collection and must regularly collect waste without reasonable excuse.
3. Service providers must comply with the bye-laws of the Assembly regarding the collection and management of solid waste.

Regulators (Municipal Assembly)

1. The Municipal Assembly must implement proactive approaches to check compliance with storage, collection, transport and disposal of solid waste at household levels.
2. The Municipal Assembly must be actively involved in fee fixing for waste collection.
3. The Municipal Assembly must provide training seminars and workshops as well as other public information dissemination programs.



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APPENDIX

Appendix I: Questionnaire

PRESBYTERIAN UNIVERSITY COLLEGE, GHANA

FACULTY OF DEVELOPMENT STUDIES

Questionnaire to ascertain household's willingness to use household waste bin services

Introduction

As part of the partial fulfilment of the requirement for the degree of MSc. Environmental Health and Sanitation, students of the Presbyterian University College, Ghana are required to solve social and environmental issues relating to their study. It is in view of this that the following questionnaire is prepared to help identify problems relating to household's willingness to use waste bin services at the household level to improve solid waste management. Your co-operation is therefore highly needed.

Identification

Date _____ Enumerator name _____

Interview start time _____ end time _____

District _____ Name of locality /community _____

Name of Respondent _____; Contact number _____

Section A: Particulars of respondents

Gender of respondent	Male [<input type="checkbox"/>] Female [<input type="checkbox"/>]
Age of respondents (in years)	
Head of household	Yes [<input type="checkbox"/>] No [<input type="checkbox"/>]
Marital status	Married [<input type="checkbox"/>] Single [<input type="checkbox"/>] Otherwise [<input type="checkbox"/>]
Religious affiliation	Christian [<input type="checkbox"/>] Muslim [<input type="checkbox"/>] Traditional [<input type="checkbox"/>] Other [<input type="checkbox"/>]
Level of education(highest)	None [<input type="checkbox"/>] Primary [<input type="checkbox"/>] Secondary [<input type="checkbox"/>] Tertiary [<input type="checkbox"/>]
Occupation	
Number of household members (including yourself)	

Number of dependents	
Total monthly gross household income (GHS)	Less than GHC. 1,000 [] 1,000 – 2,000 [] 2,001 – 3,000 [] 3,001 – 5001 [] GHC. 5001 and Above []
House/Land Tenure	Owner [] Tenant []

Section B: Household waste bin use

- B1. Do you use a waste bin? Yes [] No []
- B2. If Yes, what is the system of use? Household level [] Communal level [] Other []
- B3. Do you own a waste bin? Yes [] No []
- B4. If Yes, what is the nature of ownership? Government distribution [] Purchased with own money [] Other []

Section C: Household waste characteristics and disposal

- C1. How often do you dispose your waste in a week? _____
- C2. What kind of waste do you generate? Plastic [] Metal [] Wood (Bamboo) [] Other (specify) _____
- C3. What are the problems you encounter in managing solid waste? Means of storage [] Means of disposal [] others (specify) _____
- C4. How do you dispose of your solid waste?
- a) Take it to the nearby secondary storage receptacle (communal dumpster) []
 - b) Digging a hole around the house/in the locality to bury or burn it []
 - c) Throw it out in open space or on the street []
 - d) Throw it out into nearby water bodies []
 - e) Private collectors []
 - f) Other (specify) _____
- C5. If the answer is “E” go to Question C6 - 23
- C6. How much do you pay for this service per month? _____
- C7. How many times do they collect your waste per week? _____
- C8. Are you satisfied with their service? _____
- C9. Is your household getting the services of solid waste collection or disposal from the Government? Yes [] No []
- C10. Are you satisfied with the existing solid waste collection and disposal service provided by the organization? Yes [] No []
- C11. What do you suggest to improve this condition? _____
- C12. Who should be responsible in bearing the cost of managing solid waste? Municipal Assembly [] Households only [] Other []

C13. Which of the following do you think is the best institute to handle solid waste management in your locality? Municipal Assembly [] Private companies [] Both

C14. What are your reasons for choosing the above answer? _____

Section D. Household's willingness to use and pay for waste bin services

D1. Are you willing to use household bins? Yes [] No []

D2. If Yes, what will be your motivation to use? _____

D3. If No, what will discourage you from using? _____

D4. Are you willing to pay for household bins? Yes [] No []

D5. If Yes, how much are you willing to pay in the following GHs categories? 0-25 [] 25-50 [] 50-100 [] 100-150 [] 150-200

D6. How often are you willing to pay for the service? Weekly [] Monthly [] Yearly [] Other []

D7. In what form would you like to pay for the service? With water bill [] With electricity bill [] On its own [] Other (specify) _____