

UNIVERSITY OF CAPE COAST

MUNICIPAL SOLID WASTE DISPOSAL PRACTICES IN THE WA
MUNICIPALITY

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.

Candidate's Signature:.....Date:.....

Name: Joseph Gbaara

Supervisor's Declaration

I hereby declare that the preparation and presentation of the Dissertation were supervised in accordance with the guidelines on the supervision of Dissertation laid down by the University of Cape Coast.

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ABSTRACT

Rapid urbanization in Ghana has resulted in poor environmental conditions in most urban settlements in the country. Household solid waste disposal by residents, in particular, has become an overwhelming problem in the Wa municipality. The study analysed the underlying factors affecting effective solid waste disposal and ultimately household solid waste management in the municipality and suggested possible measures to resolve the problem.

The study used data collected from household residents in Wa municipal, and data from Wa Municipal Assembly, and the office of Zoomlion waste management company. The study gathered data from two main sources namely: secondary and primary sources. Three main techniques were employed in gathering the primary data: preliminary field investigation, interview schedule survey and face-to-face interview.

The results of the study show that there is no adequate supply of storage facilities, household residents used inappropriate solid waste disposal methods, there is irregular collection of solid waste in the municipality, and there are inadequate resources for waste management institutions to effectively carry out their mandate.

In the light of these problems enumerated above, the study recommended these among others, adequate supply of skips, regular collection of waste, pragmatic sanitary health education, and proper disposal of solid waste by residents and adequate resourcing of the waste management institutions.

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DEDICATION

This piece of work is dedicated to my loving wife Sarah Basaaking and my lovely children Maaluu, Mwinnommo and Mwinsumo Gbaara.

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LIST OF ABBREVIATIONS AND ACRONYMS

Abbreviation/Acronym	Full Meaning
AMA	Accra Metropolitan Assembly
BPEO	Best Practicable Environmental Option
CSIRO	Commonwealth Scientific and Industrial Research Organization
DELM	Department of Environment and Land Management
DACF	District Assembly Common Fund
EPA	Environmental Protection Agency
GSS	Ghana Statistical Service
JHS	Junior High School
IGF	Internally Generated Fund
ISWM	Integrated Solid Waste Management
IWM	Integrated Waste Management
KMA	Kumasi Metropolitan Assembly
Ltd	Limited
MLGRD	Ministry of Local Government and Rural Development
MMDAs	Metropolitan, Municipal and District Assemblies

MSW	Municipal Solid Waste
NGO	Non-Governmental Organisation
SPSS	Statistical Package for Social Sciences
SWM	Solid Waste Management
TAMA	Tamale Metropolitan Area
UNEP	United Nations Environmental Programme
USEPA	United States Environmental Protection Agency
WMD	Waste Management Department
WCED	World Commission on Environment and Development
WRF	World Resource Foundation

CHAPTER ONE

INTRODUCTION

Background to the study

Urbanisation and its attendant benefits and challenges including environmental problems such as solid waste generation and disposal, pose a complex issue that provides opportunities and benefits for countries. However, major challenges to city authorities associated with the process are problems of social, economic and environmental issues.

Globally municipal and domestic solid waste generation has been increasing with each passing year due to population increases, changing lifestyles, use of disposable materials and excessive packaging, (Environmental Protection Agency, 2008). It has been estimated that between 2003 and 2006 domestic solid waste increased by 7% annually reaching 2.02 billion metric tons in 2006 (Global Waste Management Market Report, 2007). It is further estimated that between 2007 and 2011, global generation of municipal waste rose by 37.3%, equivalent to about 8% increase per annum. According to a UN world report (2004), China is the biggest generator of domestic solid waste in the world. Municipal solid waste generation in the United States of America in 2008 amounted to 250 million metric tons. According to the United States

Environmental Protection Agency (US EPA), 55 to 65% of this figure was from households and 35 to 45% came from Hospital and business. Unlike the 1960s, when 80 to 90% of this waste was disposed off in the landfills, currently the government is focusing on source reduction, recycling and re-uses (US EPA, 2008). In countries around the world, one major environmental problem that confronts municipal authorities is solid waste disposal (Pacione, 2005). Pacione (2005) again observed that city authorities are confronted with serious problems dealing with the collection and disposal of solid waste. In high-income countries such as the United States of America (USA), United Kingdom UK, Germany and France, the problems usually centres on the difficulties and the high cost of disposing of the large volume of waste generated by households and businesses. However, in lower-income countries like Ghana, Bangladesh and Nigeria the main problem relates to collection and disposal. In Third World cities, between a-third and half of all solid waste generated remain uncollected (Pacione, 2005).

Recent studies in Africa have shown that the problem of waste management has become perverse and threatens to dent the efforts of most city or urban authorities (Songsore, 2003). Kironde (1999) has also observed that the city or urban environment in most developing countries is characterised by heaps of garbage, overflowing waste containers, chocked drains, clogged streams and stinking gutters. Hardoy (2001) have, therefore, rightly described this environmental situation in the third World urban areas as “among the most health and life threatening of all human environments” unable to provide adequate waste disposal and other environmental services within their entire

jurisdictions. Municipal authorities in most developing countries tend to concentrate their waste collection efforts in official and wealthy areas while the poorer areas receive little or no service for waste removal even though waste collection operations is usually funded with public resources (Lohse, 2003). Besides, waste disposal facilities, which are usually poorly maintained are frequently sited in the neighbourhoods of the poor and other vulnerable population groups, this resort in a shift of environmental burdens on to the poor.

Rapid, uncontrolled urbanization in Ghana has burdened the country's cities with problems of physical, socio-economic and environmental nature. Besides the physical problems of poor infrastructure, inadequate housing, congestion and poor accessibility, major cities in the country such as Accra, Kumasi, Takoradi and Tamale are confronted with socio-economic challenges including increasing levels of unemployment and poverty, social exclusion and rising crime and violence (Songsore, 2003). Furthermore, environmental conditions in the cities and big towns are appalling due to inadequate provision for services such as water supply, sanitation and waste disposal. These problems constitute obstacles to the socio-economic development of the country and therefore, hinder improvements in the lives of the people (Songsore, 2003). Songsore (2004: 138) rightly captures the situation when he observes, "in virtually every urban centre in Ghana, from regional capitals to district centres and small towns, many people live in neighbourhoods with little or no provision of infrastructure, services and facilities that are essential to good health". Many urban residents, therefore, live in health and life

threatening conditions (Hardoy et al, 2001) and Ghana cannot take comfort in the United Nation's observation that urbanization is a constructive feature and cities offer the best opportunity to escape poverty (UNFPA, 2007).

Among the many problems that confront cities in Ghana, solid waste disposal is a particularly serious issue that seems to overwhelm the city authorities. Gilpin (1996:68) defines waste, which is better recognised than defined, as "all unwanted and economically unusable by-products or residuals at any given place and time, and any other matter that may be discarded accidentally or otherwise into the environment". Drawing from his definition, solid waste is a type of waste in solid or semisolid form (Surreywaste.info, online, 2010.18/12/2010). In fact, the solid waste disposal problem appears persistent and can be likened to a 'monster' staring the authorities in the face while they look on helplessly (Kironde, 1999). Tamakloe (2006) has referred to it as "a nightmare" and it would seem that many of the Millennium Development Goals (MDGs) are far from being achieved by the target year of 2015, this is because solid waste disposal affects most of the issues to be addressed by the MDGs including child health and mortality, maternal health, incidence of malaria and other diseases and environmental sustainability. (Goals 4, 5, and 7 respectively).

Statement of the study problem

The exploitation of environmental resources by humankind, which have also resulted in the solid waste management problem, has been a global concern over the years. The environment serves as depository for waste since

waste in the environment is taken care by natural processes. However, population increase coupled with increase in human consumption, excessive packaging and the use of synthetic materials make it difficult and impossible for waste to undergo natural processes. As a result, the situation has attracted both national and international attention. The solid waste management problem is no different in Ghana. The situation has attracted attention from the Government and its officials such as Ministers of State, Parliamentarians, Municipal Chief Executives and the populace who have expressed concern about the state of solid waste management in the urban centers of the Country.

The solid waste problem is also receiving frequent media attention on waste disposal issues in the Newspapers, Television and on Radio discussions. Further, several Non-Governmental Organisations (NGOs), institutions and individuals have also expressed similar concerns about the solid waste menace in the Wa municipality. It is very common to see heaps of waste in almost every available space in the Wa Municipality. A cursory observation within the municipality indicates visible aspects of accumulated garbage, street litter, waste-clogged drains, stinking gutters and waste polluted water bodies.

Consequent to this, some strategies were outlined to tackle the waste problem in the Municipality, which included improving the stock of existing sanitary equipment, improving monitoring and supervision of waste collection and disposal, promoting private participation in waste management, promoting sanitary health education, and encouraging community participation in waste management. Yet, solid waste management is still a major problem in the Municipality due to the existence of indiscriminate dumping by residents,

irregular collection of waste by the waste management companies and inadequate resources.

This study is therefore undertaken to examine household solid waste disposal practices in the Wa Municipality in order to gain understanding of the challenges and issues involved in solid waste practices in the Municipality.

Objectives of the study

General objective

The general objective of the study is to examine household solid waste disposal practices within the study area and how they affect the urban environment.

Specific objectives

Specifically, the study seeks to:

1. Assess the types of solid waste generated in the Wa Municipality.
2. Examine the means of waste disposal by households.
3. Analyse the mode of solid waste collection.
4. Assess the institutional arrangements for solid waste management in the Wa Municipality.

Research questions

In order to achieve the set objectives, the following research questions guided the study.

1. What type of solid waste do residents in the municipality generate?
2. What are the means of solid waste disposal by households?

3. Is the mode of solid waste collection favorable to residents?
4. What are the institutional arrangements for waste management in the municipality?

Significance of the study

This study is expected to inform the inhabitants of Wa Municipality about the relevance of proper waste management to the development of the area. It would also be relevant to stakeholders in solid waste management which would serve as a basis upon which further studies can be conducted to examine the areas of interest that have not been dealt with by this study. In addition, the study would contribute to existing knowledge on Municipal solid waste management in the region and the country as a whole.

Organization of the study

The study is organised into five chapters. Chapter One looks at the background of the study, statement of the problem, objectives of the study, research questions, significance of the study, and organization of the study. Chapter Two discusses literature review in related areas such as waste, classification of waste, concept of waste management, methods of municipal solid waste disposal, management challenges of municipal solid waste. Chapter Three looks at the methodology of the study, which includes the research design, the target population, the sample size, sampling procedure, the research instrument, administration of the instrument and data analysis. Chapter Four discusses the findings of the study while Chapter Five draws conclusions on

the major findings of the study, outlines areas for further research and ends with some recommendations.

CHAPTER TWO

LITERATURE REVIEW

Introduction

The chapter explores literature on solid waste management, key concepts, methods and problems of municipal solid waste management. The overview of this chapter looks at the following areas: classification of waste, concept of waste management, composition of municipal solid waste, Methods of municipal solid waste disposal, problems associated with solid waste management and the conceptual framework.

Defining waste

Waste is more easily recognised than defined. The Longman Dictionary of Contemporary English (2008:1612) defines waste as “the unwanted material or substance that is left after you have used something”. Gilpin (1996:68) provides a more elaborate definition of the term waste by indicating that the concept of waste embraces “all unwanted and economically unusable by-products or residuals at any given place and time, and any other matter that may be discarded accidentally or otherwise into the environment”. Gilpin (1996) also suggests that what constitutes waste must occur in such a volume, concentration, constituency or manner as to cause a significant alteration in the environment. Thus, apart from waste being an unwanted substance that is discarded, the amount of it and the impact it makes on the environment also

become important consideration in defining waste. Palmer (1998), Freduah, (2004), Muller & Schienberg (1997) together agree that, there is no constellation of properties inherent in any lump, object or material, which will serve to identify it as waste; rather an item becomes waste when the holder or owner does not wish to take further responsibility for it. Drawing from the views expressed by the authors, waste is seen as any substance (liquid, solid, gaseous or even radioactive) discarded into the environment because it is unwanted, which causes significant nuisance or adverse impact in the environment.

Classification of waste

A number of criteria are usually employed to classify wastes into types; these include their sources, physical state, material composition and the level of risk associated with the waste substances. Such classification of waste provides a basis for the development of appropriate waste management practices. Source classification of waste is based on the fact that, waste originates from different sectors of the society such as residential, commercial and industrial sources.

A good example of waste source classification is provided by the World Bank (1999) in a study in Asia which identified the sources of waste as residential, commercial, industrial, municipal services, construction and demolition, processing and agricultural sources. The UK Environment Council (2000) also employed source classification to identify the major sources of waste as municipal sources, commerce and industry, agricultural sources, demolition and construction activities, dredged spoils, sewage sludge and

mining and quarrying operations. Classifying wastes by their sources is a useful way of determining the relative contributions of the different sectors of society to the waste stream and how to plan for their collection and disposal. Often, the material composition of the waste stream is also used to classify wastes into such types as organic waste, paper and cardboard, plastic, glass, ceramics, textiles, metal and inert waste. The Surrey County, UK conducted an example of waste classification based on material composition in 2002/2003. An analysis of household waste streams in the county identified nine main types of materials; paper/card, plastic film, dense plastic, textiles, miscellaneous combustibles, glass, ferrous metal, garden waste and food waste (Surrey waste, 2010). Using the physical state of waste substances, the materials in the waste stream can also be categorised into liquid, solid, gaseous and radioactive wastes. Examples of the physical state of waste substances are illustrated as follows:

Liquid waste: Sewage sludge, wastewater from bathhouse and kitchens

Solid waste: Food waste, paper, plastic, metal, debris etc.

Gaseous waste: Factory smoke, vehicle exhaust smoke, fumes from burning waste dumps.

Radioactive waste: Radiation, uranium, plutonium, excess energy etc.

Furthermore, the potential health or pollution risk of waste materials is used to classify wastes into hazardous or non-hazardous waste. Hazardous waste refers to waste with properties that make them potentially harmful to human health or the environment (US EPA, 2008). According to Cunningham and Cunningham, (2004), this is any discarded domestic solid material that

contains substances known to be; (1) fatal to humans in low doses (2) toxic, carcinogenic, mutagenic, or teratogenicity to humans or other life-forms (3) ignitable with a flash point less than 60C (4) corrosive; or (5) explosive or highly reactive (undergoes violent chemical reactions either by itself or when mixed with other materials). These waste include ; medication, e-waste, paints, chemicals, light bulbs, fluorescent tubes, spray cans, fertilizer and pesticide containers, batteries, shoe polish. As explained by the US EPA (2008), hazardous wastes can be liquids, solids, contained gases, or sludge and can be the by-products of manufacturing processes or simply discarded commercial products like cleaning fluids or pesticides. Because of their potential pollution danger, hazardous waste materials require rigorous and cautious means of disposal (DELM, 2003). In the US EPA's Hazardous Waste Listings (2008), the categories of hazardous wastes include ignitable waste, corrosive waste, reactive waste, toxicity characteristic waste, acute hazardous waste and toxic waste. Special waste is one type of hazardous waste that is usually so dangerous to treat, keep or dispose of that it requires special disposal arrangements (US EPA, 2008). Examples include hard clinical waste such as human parts.

On the other hand, non-hazardous waste does not pose danger and can be dealt with easily, examples being inert materials such as uncontaminated earth and excavated waste such as bricks, sand, gravel and concrete slates (Environment Council, 2000). Waste can also be classified by whether it is biodegradable or non-biodegradable. Biodegradable waste typically originates from plant or animal sources and can easily be broken down by bacterial action

or by other living organisms, which gives such waste and a relatively short lifespan in the environment. This type of waste is commonly found in municipal solid waste as food waste, yard waste and paper. Other biodegradable waste materials include and kitchen waste, green waste; (can also be recycled), human excreta, animal droppings, sewage and slaughter waste (Lapidos, 2007). There are others such as inert waste as construction and demolition waste, dirt, rocks, debris; composite wastes including waste clothing, Tetra Parks, waste plastics such as toys and domestic hazardous waste also called "household hazardous waste" or toxic waste. In contrast with biodegradable waste, non-degradable waste, which includes most plastic, metal and ceramics, are waste substances that cannot be broken down by natural processes or living organisms (Lapidos, 2007).

The classification of waste into types is very important for waste management planning. Among other things, it provides useful information that assists municipal authorities to organize waste management operations including the frequency and means of collection, and appropriate disposal methods. The developed countries have made great advances in waste data generation and analysis that have enabled them to improve upon waste management over the years. In most developing countries, however, even the most basic data on waste such as the quantities generated and composition of the waste stream are lacking, making it difficult to organise waste management effectively (Hardoy et- al, 2001).

Concept of waste management

Waste management involves the collection, transport, processing, recycling or disposal and monitoring of waste materials. The term usually relates to materials produced by human activity, and is generally undertaken to reduce their effect on health, the environment or aesthetics.

The Commonwealth Scientific and Industrial Research Organization (CSIRO, 2008) Salequzzaman, et-al (2005), and Gbekor (2003), see waste management as all activities pertaining to the control, collection, transportation, processing and disposal of waste in accordance with the best principles of public health, economics, engineering, conservation, aesthetics and other environmental considerations. The law of waste management of Macedonia (2004, No.6) explains that: “Waste management shall mean avoidance and reduction of waste generation and of its negative impact on the environment and human life and health, including waste handling. The fundamental objectives of waste management programmes are to minimise the pollution of the environment as well as utilizing the waste as a resource (Salequzzaman et al, 2005; Khairuzzaman et-al 2001). Jerry (2009) and Salequzzaman et-al (2005) further contend that waste management practices differ for developing nations, for urban and rural areas, and residential and industrial producers.

Management of non-hazardous residential and industrial waste in metropolitan areas is usually the responsibility of local government authorities, while management for non-hazardous commercial and industrial waste is usually the responsibility of the generator. Brunner and Fellner (2007) add that

waste management systems that are presently applied in affluent countries may not be appropriate solutions for waste management in less developed regions. It is recommended that each region first determines its economic capacity for waste management and then designs its waste management system according to this capacity and the goals of waste management.

Ambat (2003) and Sylvaine (2000) agree that one of the main problems of solid waste management is communities' low priority and willingness for solid waste management. Waste management agencies could provide the necessary facilities to communities and educate them on how to use such facilities. Waste management requires training the operators, educating all users of the system, and performing diligent maintenance. UNICEF (1998) puts forward that waste and general sanitation issues can be dealt with using two approaches, namely: the hardware approach and the software approach. The hardware approach is the total package of sanitary conditions and facilities available whilst the software approaches are the activities aim at promoting sanitary conditions through practice. Most waste problems have been created because sufficient attention has not been paid to educating the public about effects of waste and poor sanitation on health service.

Tannerfeldt and Ljung, (2006) suggest that hygiene and education are crucial in making waste management systems work. In situations where there is high turnover of both employees and visitors, continuous training and education would be essential. In the 21st century, the concept of integrated waste management (IWM) has become popular as a new approach to waste management. As defined by the World Resource Foundation (WRF, cited in

Environment Council, 2000), IWM refers to the use of a range of waste management options rather than using a single option. In other words, IWM is an approach that relies not only on technical solutions to the waste problem, but also on a wide range of complementary techniques in a holistic approach. The approach involves the selection and application of appropriate technologies, techniques and management practices to design a programme that achieves the objectives of waste management (Tannerfeldt, & Ljung, 2006).

As argued by Rhyner et al. (2000), a single choice of methods for waste management is frequently unsatisfactory, inadequate, and not economical. Use of an integrated approach to managing solid waste has therefore evolved in response to the need for a more holistic approach, to the waste problem. In this approach, all stakeholders participating in and affected by the waste management regime are brought on board to participate in waste management. Further, issues such as social, cultural, economic and environmental factors are considered in the design of an IWM project (Tchobanoglous et al, 2002; Rhyner et al, 2000; Schubeller et al, 2005). These elements commonly associated with integrated solid waste management are waste prevention, waste reduction or minimization, re-use of materials and products, material recovery from waste streams, recycling of materials, composting to produce manures, incineration with energy recovery, incineration without energy recovery and disposal in landfills in that order of priority (Durham County Council, 2007)

These elements of IWM are frequently formulated into a waste hierarchy model which Girling (2005) described as a penny-plain piece of

common sense that places the various strategies for waste management in order of environmental friendliness, from best to worst. Waste prevention and reduction are placed at the top to show that the best way to deal with waste is to prevent its production and, where this is not possible, to produce less of it. At the other extreme, disposal is placed at the bottom to show that it should be the last resort among the strategies for waste management. Intergraded waste management and the waste hierarchy both inspire sustainable waste management and can reduce the environmental hazards associated with waste disposal. It is therefore important for stakeholders in the waste sector to realize that an integrated approach, which constantly strives to move up the waste hierarchy, can be useful tool for sustainable waste management. In spite of efforts by municipal authorities to improve waste management, most countries in the world still resort to strategies at the bottom of the waste hierarchy, incineration and disposal.

Other instruments that encourage good practice in waste management are the proximity principle (PP) and the best practicable environmental option (BPEO) (Environment Council, 2000). The proximity principles calls for the disposal of waste as close to its source as possible. Among other advantages, this practice reduces the time, energy and expenses involved in the transportation of waste to disposal sites, and also minimize the possibility of accidents associated with the transportation of waste. With regard to the BPEO, it encourages the use of waste management strategies that achieve the most benefits in terms of cost, energy and time, and that, which also cause the least damage to the environment.

Another important concept of waste management is ‘sustainable waste management’ (SWM). Sustainable Waste Management (SWM) is an integral part of sustainable development (the Brandt Land Commission’s approach to development that seeks to meet the needs of the present without compromising the ability of future generations to meet their own needs (WCED, 1987). The amount of waste generated and how it is managed has profound implications for the quality of the environment and for the prospects of future generations. Thus, in keeping with the objectives of sustainable development, sustainable waste management can be regarded as an approach to waste management, in addition to protecting human health and the environment; this ensures that the scarce resources of the earth are conserved for both present and future generations. It therefore becomes important to minimize natural resource extraction and consumption by recycling waste materials, and conduct waste management efficiently to curtail the environmental impacts of waste disposal and protect ecosystem services for both current and future generations (Millennium Assessment Report, 2005).

In spite of the enormous benefits associated with sustainable waste management strategies such as re-use and recycling, only a handful of countries are able to put them into practice (Songsore, 2004).

Methods of municipal solid waste disposal

According to Tchobanoglous, et al (2000), the most commonly recognised methods for the final disposal of solid wastes are dumping on land, canyons and mining pits, dumping in water, ploughing into the soil, feeding to

hogs, 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. A study carried out in Ado-Akiti in Nigeria by Momoh and 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. Burning of dumps is also common in peri-urban and rural communities in Ghana and in many other less developed countries.

Sanitary Landfill

Sanitary land filling includes confining the waste, compact it, and covering with soil. This method 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, which do not require land filling to make them work. Of the basic management options of solid waste, landfills are the only management technique that is both necessary and sufficient. 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 Kreith (1994). 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, it must be said 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.

Incineration

Incineration is a controlled combustion process for burning combustible waste to gases and reducing it to a residue of non-combustible ingredients, (Centre for Environment and Development, 2003). During incineration, moisture in the solid waste gets 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 folds than any other method (Kreith,

1994). He further explains that incineration can also recover useful energy either in the form of steam or electricity. However, he recognised that the main constraints of incineration are high cost of operation, high degree of sophistication needed to operate them safely and the tendency to pollute the environment through emissions of carbon dioxide.

Composting

UNEP (2009) defines 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 is satisfactorily matured for safe use in agriculture. 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). According to UNEP (2009), “composting is the option that, with few exceptions, best fits within the limited resources available in developing countries”. The UNEP further observed that, “a characteristic that renders composting especially suitable is its adaptability to a broad range of situations”. Zerbock (2003), see composting as a low-technology approach to waste reduction. This he says can help developing countries; because the average city’s municipal waste stream is over 50 per cent organic material.

Source Reduction

Denison & Ruston (2000) and Kreith (1994) 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. USPS (2000) observed in the city of Thimphu in Bhutan that 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. 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. Waste that is discarded may be of significant value in another setting, but of little or no value to the possessor who wants to dispose of it. 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 managing solid waste effectively is to minimise solid waste generation through source reduction.

Recycling

Recycling has been viewed as a veritable tool in minimizing the amount of household solid wastes that enter the dumpsites, Momoh & Oladebeye (2010). They also agree it is the best, efficient and effective method of solid

waste management. However, this may not be cost effective in developing countries like Ghana. The United States Environmental Protection Agency (USEPA) (2000) observed that 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. Many authors have proposed recycling as the best option to dispose solid waste in modern times, but the cost component, which is a key to successful implementation of any recycling project, is defeating this method of municipal solid waste disposal in developing countries and particularly in Ghana.

Challenges of municipal solid waste management

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 Ogawa (2005). 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.

Technical constraints

Ogawa (2005), 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.

Financial constraints

Ogawa (2005) observed 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 are irregular and ineffective. This phenomenon is evident in Ghana and particularly in the study area.

Institutional constraints

Ogawa (2005) indicates that, several agencies at the national level are usually partially involved 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 un-sustainability 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 or 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 that include financial and institutional constraints.

Attitudes and Perception

Solid waste evolves largely on individuals, the attitudes and perceptions of people are important in its managements. This fact is undoubtedly true for the generation and controlling of waste. Hussey & Skoyles (2002) identified the importance of attitudes in waste management, when they asserted that change in attitude rather than a change in technique would have a greater impact on the management of waste. However, most people in developing countries show no or little commitment towards waste management. Toe and Loosemore (2001) support this fact, when they observed that, attitudes towards waste reduction have become one of the reasons behind the difficulties of solid waste management. Even when authorities have provided the needed facilities for waste management, individuals still resort to the management practices used in the Adam and eve era, making the effective management of the systems difficult.

According to Ambat (2003), the main problem of solid waste management is communities' low priority and willingness for solid waste management. He therefore suggests that waste management authorities should

continue to provide the necessary facilities to communities and educate them on how to use them.

In conclusion, the attitudes and perceptions of people are a big challenge to the effective management of household solid waste. Therefore, it is important that authorities, device various mains of changing attitudes and perception of people toward solid waste management.

CHAPTER THREE

METHODOLOGY

Introduction

This chapter presents the methodology for the study and covers the target population, the sample and sampling technique, the research instruments, the administration of the instruments and analysis of data.

The study area

The study area is the Wa Municipality in the Upper West Region. The study focused on seven (7) residential areas, Liman-yiri, Fungo, Kanbale, Kabanye, Dobile-lowcost, Kpakuri-Estate and Jahan Residential area, in the Wa Municipality. The Wa Municipality was purposely chosen because it is densely populated; see many economic activities in the region and most buildings in the residential areas are not well laid out.

Wa is the capital of the Upper West Region. It is located south of the upper West Region (10°4N 2°30W) with a population estimate of 66,644 persons in 2000 and 80,589 (provisional figure) in the recent 2010 population and housing census (Ghana statistical service, 2011) of which 59% of the population depend on subsistence food cropping as the predominant occupation (Kunbour, 2003; upper west regional coordinating council, 2010). The township of Wa is occupied by civil servants and some private individual

business people who are mainly shop owners engaged in petty trade. Solid waste collection in the Municipality is concentrated in the township. Solid waste generation is estimated to be about 35532.9m³tonns annually with a 70% collection rate (Municipal Environmental Health Office) but this is not the case observed on the ground. Many people still resort to dumping in gutters, by the roadside and in open spaces, they can find. Figure 1 shows the map of the study areas.

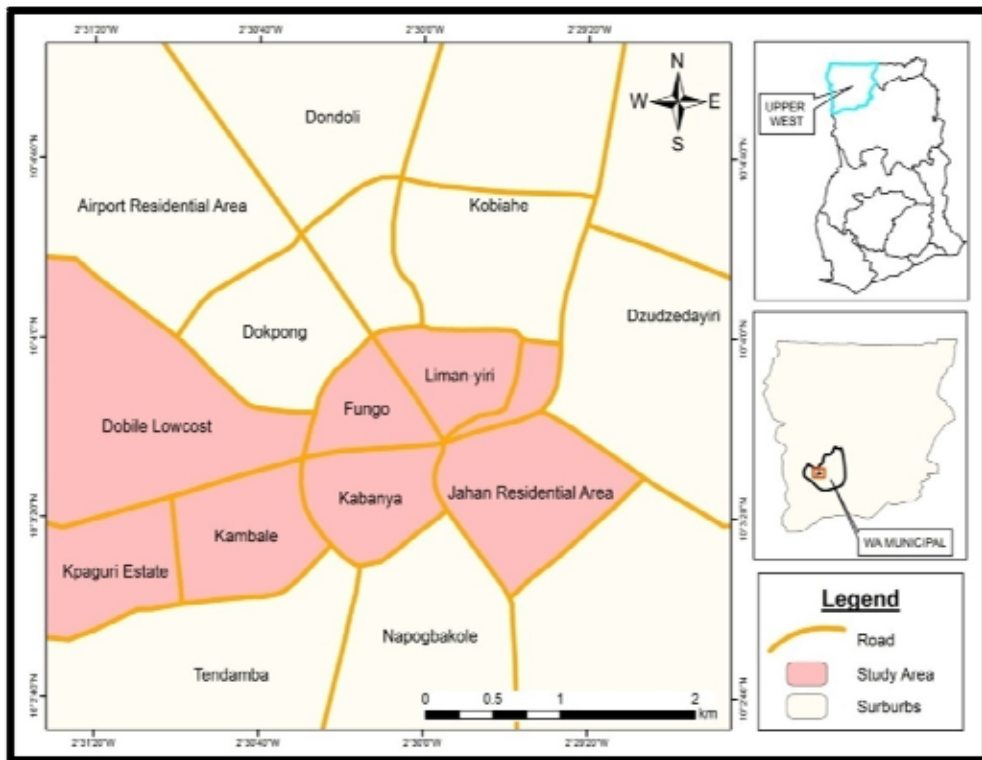


Figure 1: Map of study area

Source: Cartographic unit, UCC

Study design

The management of municipal solid waste is complex and therefore a method that enables accurate and reliable information collection is crucial. Based on the descriptive design employed, the study used the mixed method approach. According to Creswel (2003), the mixed method approach, which involves the triangulation of qualitative and quantitative data collection concurrently, is most suitable for this kind of study because it enables the analysis of both quantitative and qualitative data in a single study. Hence, interview schedule (quantitative data collection instrument), one-on-one interview, and observation (qualitative instruments) were used to collect data from the field. This enabled the researcher to obtain information from households and the key informants.

Target population

A total number of eighty thousand, five hundred and eighty-nine (80,589) population was obtained from Ghana Statistical Service (GSS) for the Wa Municipality. This represented the sample frame of the interview schedule survey.

The study specifically targeted seven areas in the Wa Municipality namely; Fungo, Liman-yiri, Kabanye, Kanbale, Dobile Low cost, Kpaguri Estate, and Jahan Residential area. Two key respondents, WMA and Zoomlion Ghana Company were included. The inclusion of Environmental Health Department and Zoomlion Company Ltd was because they are directly responsible for waste management in the Municipality. Wa Municipality was

selected based on its population size, economic activities and the amount of solid waste generated in the Municipality.

Sample size

The sample size of 156 was obtained using the following mathematical

Formula: $n = \frac{N}{1+N(\alpha)^2}$ Where n = sample size, N=sample frame (**80589**) and α

representing the margin of error which is 0.08 with confidence level of 92%.

By substituting 80589 and 0.08 into the formula: $\frac{80589}{1+80589(0.08)^2}$ **n=156**

But a sample size of 152 was considered for the study due to financial and time constrains.

Sampling procedure

From a preliminary investigation made about the class and income levels of residents in the municipality, the stratified sampling procedure was used to group the household respondents for the study into strata base on income levels (high, middle, and low income). Therefore, the sample size for the study was one hundred and fifty (150). This was to ensure that the sampled mean was closer to the population mean and minimise errors. It is however important to note that the sample size depended on financial resources and the stipulated period of the study. In the light of this, the distribution of the sample size in the study area was considered critical to the study. The study area was first zoned into three clusters, Central, east, and west wa town. Secondly,

purposive sampling was used to select seven (7) areas from the three clusters. Two (Kabanye, fongo) from Central, two (Liman-yiri, Jahan residential) from east, and three (Dobile-lowcost, Kpaguri estate, kanbale) from west of Wa town.

Due to lack of census data for the population of each area, the sample size of 150 was divided among the 7 selected areas. Ten (10) each to Kpaguri estate and Jahan residential area, twenty-five (25) each to Kanbale, Fongo, Liman-yiri and Dobile-lowcost, and thirty (30) to Kabanye.

Furthermore, systematic sampling technique was used to select houses in each selected area. Because most of the houses in the selected areas were not well planned with serial numbers, a serpentine movement was used to select every 3rd house starting from the direction of the first point of contact with any house in the selected area. With this approach, a respondent was interviewed in each third house until the required sample of 21 was obtained in each area.

In addition, the accidental sampling method was used to select the household respondents for the study. That is, the first woman to be contacted in each selected house was interviewed. If the first woman contacted was not ready, the next available person in the house was interviewed.

Finally, the Purposive sampling technique was used to select two (Wa Municipal Assembly, Zoomlion Company Limited) key informants for the study. These key informants had the necessary information, adequate knowledge and experience on solid waste management in the study area. This brought the total sample size to 152.

Research instruments

Secondary data was obtained from books, articles, newspapers and internet sources to review literature. These are analysed in chapter two. The Objective of waste management in the Wa municipality, strategies, activities, time frame, implementing agencies, collaborators and indicative cost was also obtained from the Municipal Assembly and Zoomlion.

Interview schedule, face-to-face interview and preliminary observation checklist were used to collect the necessary primary data for the study.

The preliminary observation involved scouting through the study area to assess the following.

1. Communal waste collection skips.
2. Dustbins in the selected areas of study in the municipality.
3. Dump sites.
4. Informal contacts with, WMD and ZoomLion Ghana Ltd.

During this process, pictures were taken of heaps of solid waste in dumpsites, solid waste skips overflowing with solid waste, scattered solid waste in between houses and solid waste in gutters. This was included in the analysis of data gathered from the field. This process guided the formulation of the interview schedule.

Household data was collected through interview schedule. Data collected was on the following variables:

1. Types of solid waste generated,
2. Method of disposal,
3. Availability of skips and bins for storing solid waste,
4. Mode of solid waste collection
5. Distances covered to dispose of solid waste in skips and
6. Payment for solid waste collection and many more as shown in Appendix A

The interview schedule was administered to respondents and respondents who opted to self-administer were allowed to do so.

Face-to-face interviews were used to collect data from the following key respondents as far as solid waste management is concerned in the municipality.

1. Wa Municipal Assembly (Budget Officer, environmental health officer) and
2. Zoomlion Company Limited (Assistant Regional Operations Supervisor).

The type of data collected from each key respondent has to do with:

1. Types and components of waste generated.
2. Quantity generated.
3. Mode of collection.
4. Provision of dustbins and skips.
5. Availability of waste management equipment.
6. Frequency of collection.
7. Disposal site.

8. Management options and

9. Revenue generated in a month, amount spent on waste management as well as the DACF and the amount spent on solid waste management as shown in appendix B and C.

Response rate

In all 150 questionnaires were administered to household respondents out of which 143 completed questionnaires were retrieved from the respondents. Out of the difference of seven remaining questionnaires, four were not answered and three could not be traced hence, the researcher could not use them as part of the study.

Data processing and analysis

Administered questionnaires were examined to check completeness, accuracy and consistency of responses in order to detect and eliminate errors. The Statistical Package for Social Sciences (SPSS version 17.0) was used to process the quantitative data. The data was processed into statistical tables and charts for interpretation and discussion. The one-on-one interview guide was also categorised into themes and analysed manually. Processed data was analysed both quantitatively and qualitatively.

Ethical issues

A number of ethical issues were addressed in the course of the research including informed consent, access and acceptance, and confidentiality and anonymity.

With regard to consent, all participants were informed of the objectives of the study and all aspects of the research or intervention that might reasonably be expected to influence willingness to participate. In the conduct of this study, access to all premises such as institutions, and organisations, were duly written to, informing them of the impending study and seeking their consent to visit their premises for the interview discussions. In all cases, approval and consent were obtained before the visit was made. In conducting the household questionnaire survey, permission was sought by members of the survey team to enter household premises after which the surveyors introduced themselves and the study to prospective participants. This way, the survey team avoided intrusion on any premises.

Confidentiality and anonymity issues were also addressed in the study. None of the information provided by interviewees was disclosed to other people. Where informants have provided information considered potentially injurious to them or others when disclosed, such information has been used with great caution and in a manner that would not be linked to their providers.

To achieve anonymity of the data gathered from respondents in the household survey, personal data such as names and addresses of householders who answered the questionnaires were left out in the design of the instruments.

This way, it became impossible to trace any information to a particular householder or participant.

CHAPTER FOUR

RESULTS AND DISCUSSION

Introduction

This chapter deals with analysis and discusses of the results of data collected from the field. The analysis and discussion is organised base on the following:

1. Socio-demographic characteristics of respondents
2. The type of solid waste generated by residents in the municipality.
3. The methods of household solid waste disposal by households.
4. The mode of solid waste collection in the municipality and
5. The institutional arrangements for waste management in the Wa municipality.

Socio-demographic characteristics of respondents

The Socio-demographic characteristics that were important to this study included sex, level of education and level of income,

Sex of respondents

From the 143 respondents that were sampled, females constituted the majority 80 percent as against 20 percent males. Females were targeted for the study because traditionally women were more responsible for household waste management in the study area.

Educational level of respondents

The study was interested in the formal level of education of respondents. Table 1 presents results of analysis of educational levels of respondents.

Table 1: Educational Level of respondents

Level of Education	Frequency				Tota	
	Male		Female		Frq	%
	Frq	%	Frq	%		
None	3	2	44	31	47	33
Primary/middle/JHS	2	1	23	16	25	17
Secondary/voc/tech	8	6	25	18	33	23
Post-secondary (non- tertiary)	7	5	1	1	8	6
Tertiary	8	6	22	15	30	21
Total	28	20	115	80	143	100

Source: Fieldwork, 2011

From Table 1, out of 33 percent of the respondents who had no formal education, females constituted the majority 31 percent. About 23 percent of the respondents had secondary/technical education while 21 percent had tertiary education with females contributing about 15 percent of this figure. Females constituted the majority of respondents with no formal education. This is because female education in the study area is not well promoted.

Education is a functional element of household solid waste disposal. This is rightly captured by Tannerfeldt, and Ljung (2006) when they indicated that, hygiene and education are crucial in making waste management systems work. This is because; an informed person will be in a much better position to adopt proper disposal methods.

Income brackets of respondents

Income brackets refer to the amount of money a respondent makes or earns in a month. The income range of GH¢150 and GH¢ 501 above were considered for the study. Analysis of result of income brackets of respondents is presented in Table 2.

Table 2: Income brackets of respondents

Income brackets per month (GH¢)	frequency	percentage
Low income (Less than 150-350)	66	46
Middle income (351-500)	48	34
High income (501 & above)	29	20
Total	143	100

Source: Fieldwork, 2011.

As indicated in Table 2, majority 46 percent of respondents were in the low income bracket (less than 150-350), while 20 percent of respondents were found in the high income brackets (501 & above).

The study tried to capture all income groups in the study area by stratifying them in three income groups to make it convenient to analyse. Proper waste disposal requires not only human commitment but also financial commitment. The ability to pay for solid waste service largely depends on one's income level. In most cases, persons with low-income level are found in low class residential areas and vice visa. Most often, waste collection services are concentrated in high income or high class residential areas. This is alluded by Lohse, 2003 position when he indicated that, municipal authorities in most developing countries tend to concentrate their waste collection efforts in official and wealthy areas while the poorer areas receive little or no service for waste removal even though waste collection operations is usually funded with public resources.

Type of household solid waste generated in the Wa Municipality

The study was interested in finding out the type of solid waste generated by households. Table 3 presents analysis of the type of solid waste generated by households in the Municipality.

Table 3: Type of household solid waste generated

Sex	Type of waste generated						Total	
	Food waste		Rubbish		Plastic waste		frq	%
	frq	%	frq	%	frq	%		
Female	39	34	40	35	36	31	115	80.4
Male	18	64	10	36	0	0.0	28	19.6
Total	57	40	50	35	36	25	143	100

Source: Fieldwork, 2011.

From Table 3, food waste constituted about 40 percent of the waste generated by residents, followed by rubbish 35 percent while plastic waste constitutes 25 percent of the waste generated in the Municipality. This is because, households mostly generate food waste and in most cases, plastic bags are used to store them. About 80 percent of the solid waste generated was by females. Out of the 115 females that were engaged in the study, 35 percent of them generated rubbish, while 31 percent generated plastic waste. More females were engaged in the study because the study targeted females. Culturally in the upper west region and Ghana as a whole, females are responsible for the household waste management.

Income level and type of waste generated

With the information gathered about the type of waste generated by residents, the study wanted to find out whether the income levels of respondents had anything to do with the amount of waste generated. Table 4 presents the results of analysis.

Table 4: Income level and type of household solid waste generated

Income group GH¢	Food waste		Rubbish		Plastic waste		Total	
	Frq	%	(Frq	%	Frq	%	Frq	%
Low (150-350)	24	42	24	48	18	50	66	46
Middle (351-500)	12	21	18	36	18	50	48	34
High (501 & above)	21	37	8	16	0	0.0	29	20
Total	57	100	50	100	36	100.0	143	100

Source: Fieldwork, 2011

From Table 4, out of the 57 respondents who generate food waste, about 42 percent of them are in the low-income group, while the least 21 percent is found in the middle-income group. In the rubbish category, 48 percent of respondents were in the low-income group, while 16 percent were in the high-income group. In the case of plastics, both those in the low and middle-income group generated 50 percent each. It is interesting to note that those in the low and middle-income group generated more of the waste.

Irrespective of the income group respondents found themselves, they all contributed significant amounts of solid waste to the overall household solid waste generation in the Municipality.

Level of education and type of waste generated

The study was also interested in the level of education of respondents and the type of household solid waste generated. Table 5 presents analysis of level of education and type of waste generated.

Table 5: Level of education and type of household solid waste generated

Level of education	type of solid waste generated							
	Food waste		Rubbish		Plastic waste		Total	
	frq	%	frq	%	frq	%	frq	%
None	4	13	6	20	20	67	30	21
Prim/midd/JHS	12	48	12	48	1	4	25	17
Secondary/tech/voc	11	33	12	37	10	30	33	23
Post-secondary	8	100	0	0.0	0	0.0	8	6
Tertiary	22	47	20	42	5	11	47	33
Total	57		50		36		143	100

Source: Fieldwork, 2011

From the analysis, respondents with tertiary education generated more solid waste in the food, and rubbish category making them the greatest (33%) contributors to solid waste generation in the municipality. Respondents with post-secondary level education contributed the least (6%) to the total solid waste generation. All things being equal, persons with tertiary education have secure and well-paid jobs and can therefore afford to consume more items, which ultimately end up as waste.

All things being equal education should give you a sense of need for the right thing, at what time and at what quantities. However, this was not the case when it came to respondents with tertiary education. This therefore suggest that

they either consumed more or purchased items they do not need, which eventually ended up as waste.

Methods of household solid waste disposal

Household solid waste disposal is a functional element in solid waste management therefore the study also attempted to find out the methods or place of household solid waste disposal. The analysis of results is presented in Table 6.

Table 6: Methods of household solid waste disposal

Method of disposal	Sex					
	Male		Female		Total	
	Frq	%	Frq	%	Frq	%
Dumping in communal container	18	13	39	27	57	40
Dumping in open spaces	6	4	36	25	42	29
Storing in dustbins	3	2	29	20	32	22
Incineration (Burning)	1	1	11	8	12	9
Total	28	20	115	80	143	100.0

Source: Fieldwork, 2011

From Table 6, the commonest place of solid waste disposal was the communal container (40 percent). This method was used in low class residential areas. These areas are Fongo, Liman-yiri and Kabanye. This is followed by dumping in open space (29 percent). This happened in both low and middle class residential areas. These areas are Fongo, Liman-yiri, Kabanye, and Kanbale. Storing in dustbins (22 percent) was done in the high

residential areas and the middle class areas. These areas are Jahan residential area, kpaguri estate, and dobile- lowcost. A little above 9 percent of the remaining respondents resorted to incinerating (burning). This method was mostly used in the middle class areas and some low class areas.

The inappropriate disposal methods such as dumping in open spaces, and burning, employed by residents in both low and middle class areas, resulted in littering and heaping of waste thereby making the environment filthy. Female respondents form the majority (33 percent) of respondents who choose inappropriate solid waste disposal methods; this could lead to possible skin and eye infections, cholera outbreak and other environmental related diseases. The choice of inappropriate methods for household solid waste disposal by some residents is because, there are inadequate storage facilities at their disposal, especially in the low class areas, and because filled communal containers are not attended to in time. The indiscriminate dumping is also attributed to the negative attitudes of residents towards waste disposal. This is because residents could have safely dumped the waste dumped in open spaces in an organised dumpsite for collection by Zoomlion.

Dustbins were strictly used in the high residential areas (Jahan residential area and Kpaguri estate). Therefore, in these areas the environment looked very clean and welcoming. Solid waste was not dumped indiscriminately compared to the situation in the low class residential areas. This implied that people in these areas had the capacity to pay and were committed to ensure effective and sustainable waste management.

Level of education and choice of household solid waste disposal method

Attempt was made to find out the link between level of education and choice of solid waste disposal method. Result of the analysis is presented in Table 7.

Table 7: Level of education and choice of household solid waste disposal method

Level of education	Communal container		Dustbin		Open dump		Burning		Total	
	Frq	%	Frq	%	Frq	%	Frq	%	Frq	%
Non	11	19	0	0	24	57	8	67	42	29
Pri/mid/JHS	13	23	0	0	12	29	3	25	25	18
Sec/voc/tech.	24	42	0	0	6	14	0	0	33	23
Post-secondary	8	14	0	0	0	0	1	8	10	7
Tertiary	1	2	32	100	0	0	0	0	33	23
Total	57		32		42		12		143	100

Source: Fieldwork, 2011

From Table 7, about 42 percent of those who use communal container as a place of waste disposal, had attained secondary/vocational/technical education while, 2 percent of respondents with tertiary education used the communal container. Respondents with tertiary education solely used dustbins. Fifty-seven (57) percent of respondents who adopted the open dump, as a place for solid waste disposal, had no formal education and about 14 percent of those

who did open disposal had secondary/vocational/technical education. With respect to burning as a method of waste disposal, 67 percent of respondents who used it were without formal education, while 25 percent of them had maximum of primary/middle/JHS education.

From the forgoing, it can be said that, one's level of education has a significant role to play on waste disposal. This situation supports the point made by Tannerfeldt, and Ljung (2006) who suggests that hygiene and education are crucial in making waste management systems work. The observation could possibly be that, people with formal education are more informed when it comes to environmental issues and therefore are probably more health conscious.

Income level and choice of household solid waste disposal method

The study was interested in the link between method of household solid waste disposal and income level of respondents. Table 8, present analysis of method of household solid waste disposal by income level

Table 8: Income level and choice of household solid waste disposal method

Method of disposal	Income group						Total	
	Low (150-350)		middle (351-500)		high (501 & above)		frq	%
	Frq	%	frq	%	frq	%		
Dumping in communal container	47	82	10	18	0	0.0	57	40
Dumping in open space	36	86	6	14	0	0.0	42	29.3
Storing in dustbins	0	0.0	8	25	24	75	32	22.3
Incineration (burning)	2	17	10	83	0	0	12	8.4
Total	85		30		29		143	100

Source: Fieldwork, 2011

From Table 8, respondents in the low (150-350) income group/low class areas contributed 82 percent to the total number of 57 respondents who indicated they chose dumping in communal container as a method of household solid waste disposal. As indicated in Table 8, 86 percent of respondents who chose to dump solid waste in open space, are found in the low (150-350) income group. Respondents in this income group are found in areas such as Fongo, Liman-yiri, and Kabanye where waste management services are hardly extended and when is done, the equipment is inadequate and not attended to in time. This situation leaves residents no choice but to dump their waste indiscriminately. As shown in Table 8, respondents in the high (501 & above) income group who reside in areas such as Jahan residential area, and Kpaguri estate use dustbins as a method of household solid waste disposal.

Respondents in this income group can afford to pay for solid waste collection and therefore the door-door service was extended to them. This confirms Lohse, 2003 position when he indicated that, municipal authorities in most developing countries tend to concentrate their waste collection efforts in official and wealthy areas while the poorer areas receive little or no service for waste removal even though waste collection operations is usually funded with public resources.

From the analysis, the income level of an individual influences his or her choice of solid waste disposal method. Municipal authorities in their selective nature of solid waste service delivery compound this situation.

Time spent to dispose waste in communal container or skip

The study further looked at the time spent to dispose solid waste at communal container or skip for subsequent collection by waste management institutions. Table 9 presents the analysis of the time spent to dispose waste in communal container or skip.

Table 9: Time spent to dispose waste in communal container or skip

Time Spent	Frequency	Percentage
Less than 5 minutes	23	22
5-10 minutes	37	36
11-20 minutes	12	12
21-30 minutes	21	21
More than 30 minutes	9	9
Total	102	100

Source: Fieldwork, 2011

From Table 9, 22 percent of respondents indicated that it took them less than five minutes to get to the communal container, while nine percent of respondents also travel more than 30 minutes to dump waste in a communal container or skip.

The time taken to get to a communal container or skip could be a factor why some residents resorted to dumping in unapproved places leading to littering of the environment. If too much time is spent to dump waste, it possibly could lead to indiscriminate dumping. This is because refuse is dumped usually in the morning when people had to go out to do other things.

Person responsible for household solid waste disposal

The study was also interested in finding out who was in charge of waste disposal in the household. Analysis of the results of the person responsible for household solid waste disposal is presented in Figure 2.

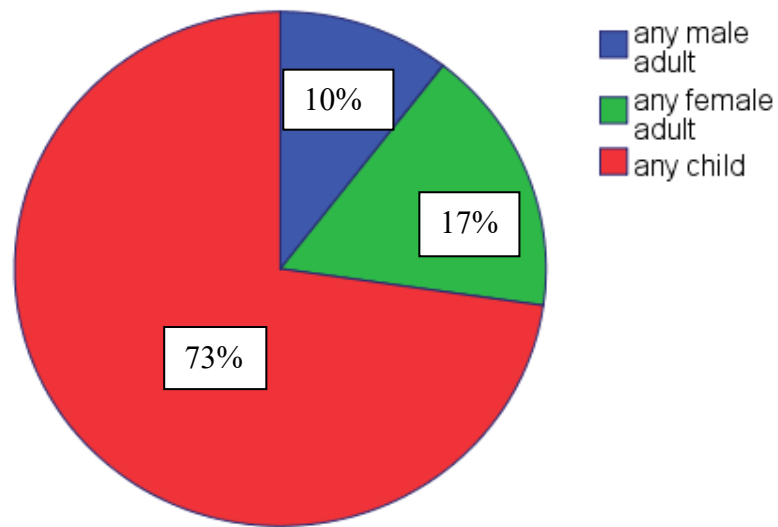


Figure 2: One responsible for household solid waste disposal

Source: Fieldwork, 2011

From Figure 2, majority of respondents (73%) indicated children between eight and twelve years old were responsible for the disposal of waste, while 10 percent of responders indicated adults were responsible for waste disposal.

Traditionally girls are usually in charge of sweeping and emptying of waste bins in the household. The possibility of the young ones dumping indiscriminately is eminent, especially when they have to walk quite a long distance to the dumpsite. This situation was quite pronounced in the low-class residential areas Such as Fongo, Liman-yiri and kabanye. Waste was dumped some distance away and around communal containers, creating heaps of solid waste scatted around. Black polythene bags could be seen carried by the wind

flying in to nearby houses. This situation could eventually result in an outbreak of communicable diseases in the affected areas.

Mode of household solid waste collection

Solid waste management includes the hauling and final disposal at a dumpsite. The study was therefore interested in finding out the mode of waste collection extended to residents. Result of the analysis is presented in Figure 3.

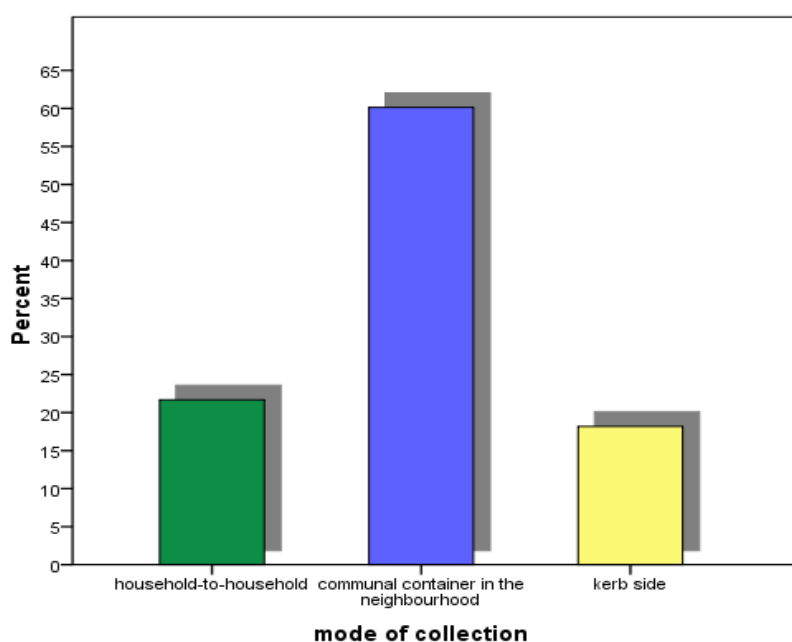


Figure 3: Mode of household solid waste collection

Source: Fieldwork, 2011

The door-to-door, curb side and communal dumpsites are the three main modes of waste collection in Wa Municipal. As shown in Figure 3, about 22 percent of the respondents indicated that, waste was collected directly from their yard, while 40 percent of respondents benefitted from communal mode of waste collection. This is due to the facts that, majority of people do not have

access to storage facilities or cannot afford the fees charged for door-door and kerb side collections. Plates 1 and 2 shows primary and secondary mode of solid waste collection respectively.



Plate 1: Primary waste collection at Jahan residential area.
Source: Fieldwork, 2011



Plate 2: Secondary mode of waste collection at Kanbale.
Source: Fieldwork, 2011

Regularity of solid waste collection

Regular collection is an important exercise in solid waste management, therefore the study took interest in the number of times in a week waste was collected in the three classified areas in the study area. The analysis of results is presented in Table 10.

Table 10: Household solid waste collection per week

No of times in a week	Low class		middle class		high class		total	
	Frq	%	Frq	%	Frq	%	Frq	%
Twice	18	25	38	76	10	50	66	46
Five times	0	0	12	24	10	50	22	15
Don't know	55	75	0	0	0	0	55	39
Total	73	100	50	100	20	100	143	100

Source: Fieldwork, 2011

From Table 10, out of 73 respondents from the low class areas, 75 percent had no waste collection; while respondents in the high-class areas had 50 percent each of waste collection twice and five times in a week.

Solid waste collections is not done in the low class areas weekly, mainly because it took more than a week for the skip to be filled. In some instances when the skip was full and overflowing, the response by Zoomlion is slow leading to heaping and ultimately burning of waste in the skips. Plates 3 and 4 shows overflowing communal containers in Kanbale and Kabanye respectively.



Plate 3: Overflowing communal container at Kambale set on fire.
Source: Fieldwork, 2011



Plate 4: Overflowing communal container at Kabanye
Source: Fieldwork, 2011

Willingness to pay

When respondents were asked if they were ready to pay for waste collection, 41 percent of them indicated they were ready whilst 59 percent were not prepared to do so. Figure 4 presents analysis of the results.

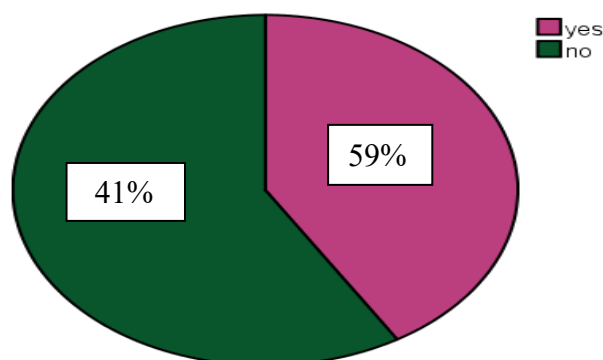


Figure 4: Willingness to pay for waste collection

Source: Fieldwork, 2011

About 78 percent of respondents with tertiary education were prepared to pay for waste collection. Respondents in this category had stable jobs, were adequately paid, and so had no problem paying for waste collection services. More than 95 percent of them were also residing in the high-class residential areas (Jahan residential area and Kpaguri estate). Residents in the Jahan residential area had free waste collection service from Zoomlion. This was done three to five times every week. An investigation revealed that, residents in this area were either heads or officers of government agencies.

This brings to light the situation observed by Lohse, 2003 when he indicated that, municipal authorities in most developing countries tend to concentrate their waste collection efforts in official and wealthy areas while the

poorer areas receive little or no service for waste removal even though waste collection operations is usually funded with public resources.

When asked why respondent in the low-class and middle class residential areas were not willing to pay for waste collection, respondents replied they pay tax and they indicated government pays for the services provided by Zoomlion therefore they did not see the logic in paying for waste collection. That notwithstanding paying for waste collection services will go a long way to improve the system.

State of the final solid waste disposal site

The final disposal site of solid waste in the Municipality was a 5-acre square dumpsite at Siiri-yiri near wale -Sombo, about 11 kilometres away from the municipal centre. A visit to the site showed that, it was not in good shape. Ideally, a sanitary dumpsite should have:

1. Weighbridge
2. Internal access
3. Well dug out cells
4. Location should be far away from human settlement and existing water body.

This was not the case with the dumpsite in Wa, as shown by observation. There were none of the facilities mentioned above and the dumpsite was located in a community called Siiri-yiri. The dumpsite was right in the community, less than a quarter of a kilometre away from the nearest house.

The site had some dugout cells, but waste dumped in the cells was not levelled and compacted as required of a sanitary dumpsite. This left a mountain of waste scattered all over the site. Worst of it all burning of waste occurred at the site with a borehole right on the site.

According to the officials of WMD and of Zoomlion, waste separation, which is one of the initial steps to reduce the volume or toxicity of waste, was not carried out before final disposal. According to officials of WMD and of Zoomlion, waste separation or segregation is important because plastic waste takes approximately 200 years to decompose. In addition, other components of waste such as metals may not decompose at all. In this case, if waste is not segregated before dumping, the intention of decomposition of waste in the dumpsite for reclamation of land for use will fail. Similarly, through waste segregating, reusable products and packaging such as returnable bottles will be diverted from the dumpsite. The financial implications were considered too high and the assembly did not have the resources to undertake such a venture. Plates 5 and 6 shows the final disposal dumpsite at Wa and indiscriminate dumping of solid waste in a drain at Liman-yiri respectively.



Plate 5: Final disposal Dumpsite in Wa.
Source: Fieldwork, 2011



Plate 6: Indiscriminate disposal of solid waste in drains at Liman-yiri.
Source: Fieldwork, 2011

Cost of managing waste by WMD and Zoomlion

An amount of GH¢ 13,092.00 was spent on solid waste by the WMD in 2010. Out of this 90percent went into fuel for collection, 10% for other administrative duties. Also, Zoomlion Ghana Ltd spent approximately GH¢ 4,950 a week on waste collection and maintenance (GH¢ 19,800 a month). An interview with the Municipal Assembly showed that an amount of GH¢ 13,092.00 was spent on waste management out of the total revenue of GH¢ 9 9,992.269 received in 2010 (That is, both Internally Generated Funds and District Assembly Common Fund). This represents 1.3 percent of the Municipal's revenue.

Ogawa (2005) rightly captures the situation when he 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. He goes on to add that, 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.

Low budget in area of solid waste management by WMA could be as a result that solid waste management has to compete with other important areas such as education, and infrastructural development. 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

residential areas, and their willingness to pay for the services that are irregular and ineffective.

Capacity of waste management institutions

An understanding of the capacities of WMD and the Zoomlion Ghana Ltd. will enable conclusions to be drawn regarding their effectiveness. With reference to equipment and technical staffing, this section will assess the capacities of the WMD and Zoomlion Ghana Ltd. Tables 11 and 12 show the capacity of the waste management institutions.

Table 11: Equipment base of Zoomlion and WMD

Equipment		No required	No available	No in use	Deficit
Skips:	WMD	18	5	1	17
	Zoomlion	18	10	9	9
Tricycles:	WMD	0	0	0	0
	Zoomlion	50	30	15	35
Dustbins:	WMD	1500	120	120	1380
	Zoomlion	1700	652	652	1048
Compacting truck:	WMD	2	0	0	2
	Zoomlion	6	1	1	5
Skip loaders:		6	4	3	3
Total		3300	822	801	2534

Source: Fieldwork, 2011

The equipment base of both WMD and Zoomlion Company Limited in areas of storage, collection and transportation revealed that, 18 skips or communal containers were required by both institutions to be supplied to the middle and low class residential areas. However, 10 were available. In effect, if this extra skips were not supplied this could result in people dumping waste at unapproved sites. In addition, about 1,700 dustbins were needed for storing waste in the high and middle class residential areas for effective service in the Municipality particularly those living in Kpguri Estate, Residency and Dobile-lowcost. This is because dustbins are the main equipment for storing waste in order to prevent dumping of waste at unapproved sites.

For waste collection and transportation in the Municipality, Oboafu tricycle, roll on- roll off and compaction trucks were mainly used. The Oboafu tricycle was used for primary collection and transferring of waste collected into a compaction truck for final disposal at the dumpsite, however they were not enough to ensure regular collection and transportation of waste to the dumpsite. For instance, about 50 Oboafu tricycles were needed for the door-door collection but only 30 were available and 15 were in good condition for use. According to Zoomlion this was due to frequent break down. Also only one compaction truck used for door-door collection was available in the Municipality.

Table 12: Staff base of Zoomlion and WMD

Staff	No required	No available	Deficit
Management personnel			
Zoomlion	3	3	-
WMD	3	2	1
Technical personnel			
Zoomlion	4	1	3
WMD	4	1	3
Total	14	7	7

Source: Fieldwork, 2011

The observation made by Ogawa (2005) in respect of the inadequate human resource and technical expertise of local authorities is equally observed on the staffing situation of the two institutions (WMD and Zoomlion); they both had high calibre of personnel at the top management position but lacked the required technical personnel as indicated in Table 12.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Introduction

This chapter contains a summary of the key findings and the conclusions drawn. Recommendations have also been made for effective waste management practices in the Wa Municipality.

Summary

The study set out to examine solid waste disposal practice in the Wa Municipality. The study employed purposive, serpentine, accidental and stratified methods. Questionnaire and interviews were used as methods for data collection with a sample size of 143.

1. Females constituted the majority 80 percent of respondents in the study.
2. Respondent's age ranged between 20-60 years.
3. Respondents with non-formal and formal education at all levels were involved. About 33 percent of respondents had no formal education, about 46 percent had primary, JHS, technical/vocational and secondary education while 21 percent had tertiary education.

4. It was observed that food waste, rubbish and plastic waste were the main types of waste generated in the Wa Municipality with food waste topping the list.
5. Dumping in open spaces, dumping in communal containers, and incineration (burning) were the methods used in waste disposal in Wa Municipal.
6. Educational level attained by respondents was found to have significant influence in respondents' choice of waste disposal methods.
7. Level of income had no significant influence on waste generation in the Municipal.
8. The time spent to dump waste was found to be a likely reason for the indiscriminate dumping of waste. About 42 percent of respondents had to travel between 10 – 30 minutes to dump waste.
9. About 73 percent of those who take charge of the household waste disposal were children between 8 & 12 years old.
10. Communal collection, door-door and kerbside collections were the mode of solid waste collections in the Municipality.
11. Communal collection of waste was found to be the most popular mode of waste collection maybe because residents were not charged for dumping in a communal container.
12. The waste management institutions in the Municipality lack financial, human and capital resources to effectively manage household solid waste in the Municipality.

13. The final disposal site was found not to be in good shape. It was situated in the community and was poorly managed.

Conclusions

In the study, the following objectives were set to be achieved. The first objective was to assess the types and components of solid waste generated in the Wa Municipality. Therefore, the study established that the types of solid waste were food waste, rubbish and plastic. The second objective was to examine means of waste disposal by households (place of disposal). The study revealed that the commonest place of waste disposal in the Municipality was the communal container. However, this was inadequate.

Finally, the study was also to assess the effective management of waste by the management institutions in the Municipality. This has to do with the mode and frequency of solid waste collection, final disposal, and the physical resources to effectively manage waste in the Municipality. The commonest mode of waste collection is communal. On the other hand, the collection was irregular. Waste collected was finally disposed at a dumpsite. However, the dumpsite was in a poor state. The main equipment used for waste storage and collections were: dustbins, skips, Obofo tricycle, compaction trucks and roll on-roll off trucks. However, this equipment was not enough to ensure effective waste collection and disposal.

Therefore, all the objectives set were achieved. With regard to the main objective of the study it can be concluded that the following are indeed the key factors affecting effective waste management in the Wa Municipality. These include inadequate skip and dustbins supply for storing waste; lack of routine collection of waste, poor methods of waste management practice by residents and inadequate resources for waste management institutions to effectively collect the waste generated.

Recommendations

Based on the key findings and conclusions the following recommendations are put forward:

1. Adequate storage facilities especially communal containers should be provided by both zoomlion and the Wa Municipal Assembly to help reduce the time spent to get to a communal container.
2. Collection of waste should be stepped-up especially in the low class areas.
3. Residents should adopt better and proper methods of solid waste disposal
4. Residents should consider dumping of solid waste in the evening instead of the morning when they are in a haste to get to their work places.

5. Authorities, Wa Municipal Assembly, EPA and non-Governmental Organisations concerned with waste management should intensify the monitoring and education of sanitary health education in the region especially in the study areas.
6. By-laws should be enacted at the community level to enforce best solid waste disposal practices. The unit committee and assemblypersons could be charged with this task.
7. Staircases should be provided to enable both children and people who cannot reach in to the communal containers to use.
8. Authorities should see to the proper management of the dump-site
9. The introduction of the Integrated Solid Waste Management model (ISWM) recommended, as being the best standard of practice by the Ministry of Local Government and Rural Development (1999) of Ghana, will go a long way to improve the solid waste problem in the Municipality and the region as a whole.

If the above stated recommendations are well taken and implemented, it will go a long way to ensure effective municipal solid waste management; ensure a clean environment and curb any possible outbreak of communicable diseases in the Wa Municipality.

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APPENDIX A

INTERVIEW SCHEDULE FOR HOUSEHOLDS

Municipal solid waste disposal practices in the Wa Municipality

Sir/Madam,

This interview schedule seeks information on aspects of solid waste disposal within the Wa Municipality.

The information is required purely for academic purpose. Any information provided will therefore be treated with the utmost confidentiality it deserves. You are free to opt out of the study at any stage you wish to do so.

Kindly be candid with your responses. Thank you for agreeing to be part of this study.

SECTION A: demographic characteristics of respondents

INSTRUCTION: *Please tick [✓] or respond appropriately.*

1. Sex (a) Male [] (b) Female []
2. Age (a) Less than 19 years [] (b) 20 – 25 years []
(c) 26 – 30 years [] (d) 31 – 35 years [] (e) 36 – 40 years []
(f) 41 – 45 years [] (g) 46 – 50 years [] (h) 51- 55 years []
(i) 56 – 60 year [] (j) 61 and above years []
3. Indicate the community in which you live? (a)Fungo []
(b) Liman-yiri [] (c) Dobile-lowcast [] (d) Kanbale[]
(e) Jahan Residential area [] Kpaguri estate [] (f) Karbanya[]
4. Please indicate your highest level of education?

- (a) None [] (b) Primary/ Middle/Junior high []
- (c) Secondary/Voc/technical [] (d) Post-secondary/non Tertiary []
- (e) Tertiary []
5. Occupational status? (a) Unemployed [] (b) Farmer []
- (c) Trader [] (d) Artisan [] (e) Civil /public servant []
- (f) Housewife [] (g) Retiree []
- Others (specify):.....
6. Marital status? (a) Single [] (b) Married []
- (c) Divorced [] (d) Separated [] (e) Widowed []
7. Which of the following income brackets per month will you place yourself?
- (a) Less than GH 50 [] (b) GH 50 – 100 [] (c) GH 101 – 200 []
- (d) GH 201 – 300 [] (e) GH 301 – 400 [] (F) GH 401 -500 []
- (g) GH 501 and above []

Section B: Household solid waste management practices

8. How much solid waste do you generate in a day (bucket size 34)?
- (a) $\frac{1}{4}$ [] (b) $\frac{1}{2}$ [] (c) $\frac{3}{4}$ [] (d) 1 []
- (e) More than one []
- Others (specify):.....
9. Which of the following types of waste do you generate most in your home?
- (a) Food wastes [] (b) Rubbish [] (c) Ashes [] (d) Plastic waste []
- Others (Specify):.....
10. Which container does your household use for storing solid waste?
- (a) Metal container [] (b) Plastic container [] (c) Carton container []

(d) Plastic bag [] (e) We do not have a container []

Others (specify):.....

11. Who usually takes the container with its waste contents out to be emptied? (a) Any male adult [] (b) any female adult [] (c)

Any child between the ages of 10 and 17 [] (e) any adult []

Others (specify):.....

12. Where is your container taken to be emptied? (a) Container placed beside the road [] (b) Communal container in the neighbourhood []

(c) backyard [] (d) Open dump in the neighbourhood []

(e) Final disposal site []

13. If your container is emptied into a communal container in the neighbourhood, how often is that container emptied? (a) Once a week []

(b) twice a week [] (c) Once every two weeks [] (d) Once every

three weeks [] (e) Once every month [] (f) Don't know []

Others (specify):.....

14. How many minutes does it take you to get to the dump site?

(a) Less than 5 minutes [] (b) 5 – 10 minutes [] (c) 11 – 20 minutes []

(d) 21 – 30 minutes [] (e) More than 30 minutes []

15. Who collects the waste from the communal container, or pile?

(a) Local Government [] (b) Municipal Assembly []

(c) Neighbourhood group [] (d) Private company [] (e) Don't know []

Others (specify):.....

16. Are you concerned about whether the final disposal site is environmentally safe and acceptable?

- (a) Very concerned [] (b) Concerned [] (c) Not concerned []
 (d) Not at all concerned []

Section C: Residents' attitude and perceptions

17. What is the most serious environmental problem in your community?
 (a) Toilet [] (b) Noise [] (c) Air Pollution []
 (d) Water [] (e) Solid waste [] (f) Liquid waste []
 Others (specify):.....
18. Do you consider solid waste as a serious problem in your community?
 (a) Yes [] (b) No []
19. How concerned are you in dealing with the solid waste problem?
 (a) Very concerned [] (b) Concerned [] (c) Not concerned []
 (d) Not at all concerned []
20. Why do some people in your locality dispose of waste at un-authorized places?
 (a) Inadequate bins [] (b) No dump sites []
 (c) Long distance from dump sites [] (d) Don't know []
 Others (specify):.....
21. What sanctions are given to people who throw waste indiscriminately in the Municipality?
 (a) Fine [] (b) Imprisonment [] (c) Both fine and imprisonment []
 (d) don't know []
 Others (specify):.....
22. Do you organise clean-up exercise in your community?
 (a) Yes [] (b) No []
23. How involved are you during clean-up exercise?

(a) High [] (b) Moderate [] (c) Low []

Section D: Residents' willingness to pay

24. Are you provided with waste collection services in your locality?
(a) Yes [] (b) No []
25. Do you pay for the waste services provided to you?
(a) Yes [] (b) No []
26. If yes, how much do you pay?.....
27. What is your level of satisfaction with the waste collection services rendered to you? (a) Very unsatisfied [] (b) Unsatisfied []
(c) uncertain/undecided [] (d) Satisfied []
(e) Very satisfied []
28. If you are not satisfied with the service, would you state your primary reason? (a) Collection not frequent [] (b) inadequate collection bins []
(c) Poor attitude of workers [] (d) smaller size of collection bins []
(e) Long distance between my house and disposal site []
Others, (specify):.....
29. Do you want the services to continue? (a) Yes [] (b) No []
30. Are you willing to pay more for improved services render to you?
(a) Yes [] (b) No []
31. If you are not willing to pay what is your reason?
(a) I am not working [] (b) I pay tax [] (c) My income is less []
(d) I don't see the need [] (e) It is the responsibility of government []
Others (Specify):.....

Section E: Institutional arrangement for solid waste management

32. Which waste management institution collects waste in your area for disposal? (a) Zoom Lion [] (b) The Municipal Assembly []
(c) None [] (d) don't know []
Others, (Specify):.....
33. How many times is the waste collected in a week? (a) Two times []
(b) Four times [] (c) Five times [] (d) throughout the week []
(e) I don't know []
34. What is the mode of collection of waste in your community? (a)
Household-to- household [] (b) Communal [] (c) Container in the
Neighbourhood [] (d) Container in the street []
35. What are your suggestions for improvement of solid waste in the
Municipality?
.....
.....
.....

APPENDIX B

Municipal solid waste disposal practices in the Wa Municipality

INTERVIEW GUIDE FOR WA MUNICIPAL WASTE MANAGEMENT

DEPARTMENT AND ZOOMLION

Date of interview.....

Place of interview.....

Respondent's gender.....

Respondent's position/title.....

This questionnaire seeks information on aspects of solid waste disposal within Wa Municipality.

The information is required purely for academic purpose. Any information provided will therefore be treated with the utmost confidentiality it deserves. You are free to opt out of the study at any stage you wish to do so.

Kindly be candid with your responses. Thank you for agreeing to be part of this study

Please record answers in the spaces provided.

Q1.What is the quantity of waste generated in a day in tonnes? (In figures):

.....

Q2.What is the quantity of waste generated per capita in a day in tonnes? (In figures):.....

Q3. What are the common types of waste generated in the area? (List them)

1..... 2..... 3.....

4..... 5..... 6.....

Q4. Do you separate the waste before disposal? (Either into plastic, wood, metals, glass, food waste among others) Yes [] No []

Q5. If yes, indicate the reasons.....

.....

Q6. What are the major components of waste generated in the Wa municipality? (Indicate their percentages in the table provided below).

Waste Components	percentage %
------------------	--------------

Food waste

Plastic waste

Rubbish

Ashes

Q7. What is the mode of collection and the number of times waste is collected per week in the following listed sections in the Municipality?

Area	Mode of collection	Number of times per week
------	--------------------	--------------------------

Fungo

Liman-yiri

Kabanye

Kanbale

Dobile-lowcost

Kpaguri estate

Jahan Residential area

Q8. What is the cost of collection per week? Indicate the amount in GH¢.....

Q9. Where do you dispose off the waste collected from the various sections?
(Final disposal site).....

Q10. What is the distance covered to final disposal site? (in kilometres)

Q11. Is the distance a problem? Yes [] No []

Q12. If yes, indicate the problems.....
.....
.....

Q13. How do these problems affect the frequency of waste disposal at the site?

1.....

2.....

3.....

Q14. What methods do you use in managing the solid waste generated in the area? (If more than one indicate them)

Composting []

Recycling []

Incineration []

ISWM (Reduce, Reuse and Recycle/landfill/incinerate) []

None []

Other, (specify):.....

Q15. Why do you choose to use any of the method(s) for managing solid waste above? (Indicate the reasons in the spaces provided below).

1.....

2.....

Availability of Resources for Managing waste

Q16 waste collection and disposal equipment (indicate number available and number needed)

Equipment	Number available	Number needed
Dustbins		
Communal container/skip		
Oboafu tricycle		
Motorist tricycle		

Graders

Skip loaders

Compaction trucks

Roll on/roll off trucks

Bulldozers

Others

Q17. Availability of qualified personnel for managing waste (Technical Staff)

Personnel	Number	Qualification
-----------	--------	---------------

1.

2.

3.

4.

5.

6.

Q18. In your view what are some of the problems facing the department in terms of managing waste? (List at most four)

1.....

2.....

3.....

4.....

Q19. How can the problems be solved? (State them briefly)

1.....

2.....

3.....

4.....

APPENDIX C

QUESTIONNAIRE FOR WA MUNICIPAL ASSEMBLY

Please record answers in the spaces provided

Q1. How much revenue do you generate in a month? Indicate the amount in GH¢.....

Q2. How much do you spend on waste collection? Indicate the amount in GH¢.....

Q3. How much do you spend on acquiring waste management equipment? Indicate the amount in GH¢.....

Q4. Amount spent on maintaining waste management equipment. Indicate the amount in GH¢.....

Q5. How much common fund did you receive last year? Indicate the amount in GH¢.....

Q6. How much of that is spent on waste collection? Indicate the amount in GH¢.....

Q7. How much of that is spent on acquiring waste management equipment? Indicate the amount in GH¢.....

Q8. How much was on maintaining waste management equipment? Indicate the amount in GH¢.....

