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THE PERFORMANCE OF ZOOMLION IN URBAN SOLID WASTE MANAGEMENT IN WA MUNICIPALITY

BY

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DECLARATION

I hereby declare that with the exception of references to the work of others, which has been duly acknowledged, this work is the result of my own research and that it has neither in part or whole been presented else where for other degrees. This work was under the supervision of Mr. Shamsu-Deen Ziblim

10th June, 2011

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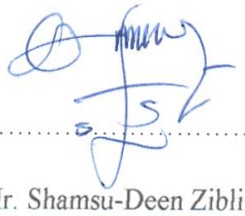

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ABSTRACT

Waste management is one of the major challenges confronting most rapidly growing economics and urban cities in the world over. This is especially so in developing countries including Ghana. The main problems associated with waste management in developing countries include; poor waste management systems, inadequate sites and facilities for waste management operations, inadequate equipment, and operational funds to support waste management. These problems have become more multifaceted in recent years as the volume and type of wastes being generated are increasing at frightening rates. This situation is a direct result of the high population growth and enhanced standards of living of our people. Urban waste management is drawing increasing attention, as citizens observe that too much garbage is lying uncollected in the streets, causing inconvenience and environmental pollution, and being a risk for public health. Although government authorities apply all the means at their disposal, the piles of wastes only seem to grow from day to day. In an era of shrinking municipal budgets and a restriction of the scope of municipal government jurisdiction, the problem is likely to intensify unless alternate approaches can be developed. In the quest for Ghana to find a lasting solution to waste management, Zoomlion, a private waste management company which started its operations in Ghana in 2006, was contracted to manage the waste in all our municipalities. But does this provide an alternative to the public sector management of waste which has been practiced since independence? This dissertation assesses the performance of Zoomlion in urban solid waste management using the case study of the Wa municipality. In pursuance of this research objective both quantitative and qualitative research methods of data collection were applied; where it was found that Zoomlion has improved the waste situation in the municipality but does not use the appropriate policy and approach to waste management, and also lacks the needed capacity to effectively manage urban solid waste.

The researcher recommends among others that Zoomlion should: formulate a policy to guide its operations in urban solid waste management in addition to their objective of providing services which seek to prevent environmental pollution and safeguarding public health; use the integrated approach to urban solid waste management and not the conventional approach; and employ planners and engineers to boost their staff technical capacity to manage urban waste.

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DEDICATION

To my Mother Joan Baawone;

An extraordinarily exceptional woman

Who has given me strength, fortitude, love; and been my life wire.

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LIST OF ABBREVIATIONS

APDA	Accra Planning Development Program
CBD	Central Business District
CCEIR	Center for Continuing Education and Inter-Disciplinary Research
EEA	European Environment Agency
EPA	Environmental Protection Agency
GHG	Greenhouse Gas
GSS	Ghana Statistical Service
LUP	Land Use Planning
MEU	Municipal Environmental Unit
MSW	Municipal Solid Waste
PHC	Population and Housing Census
SDC	Swiss Development Cooperation
SPREP	Secretariat of the Pacific Regional Environment Programme
SWM	Solid Waste Management
UMP	Urban Management Programme
UN	United Nations
UNEP	United Nations Environment Programme

UWEP	Urban Waste Expertise Programme
WHO	World Health Organisation
WMA	Wa Municipal Assembly

CHAPTER ONE
INTRODUCTION

1.0 Background

Rapid population growth and uncontrolled industrial development are seriously degrading the urban environment in many countries in the South. One of the most serious environmental consequences of the process of urbanisation is the ever-growing amount of solid and liquid wastes generated by cities (UNCHS, 1994).

In much of our history it had been assumed that the environment was so large that it could act as a huge rubbish bin for our unwanted materials. It is now understood that this is not the case; the ability of the atmosphere, rivers, seas, and land to absorb our waste with no detrimental effect is limited and beyond that limit, any additional waste will have a damaging effect on the environment.

As the world's population continues to increase, it is becoming increasingly urban. Whilst this is a global trend, urbanisation rates are particularly high in the South. Between 1950 and 1990 the urban population doubled in developed countries. During the same period the growth was five fold in the developing countries. In many parts of the world the urban population already exceeds that of the rural (e.g. many countries in Latin America 73%, Industrialised countries 75%, (UN, 1998 in O'Meara, 2001) and it is predicted that this will be a global pattern within a few years (Hofny-Collins, 2006).

According to official data and the 2005 Revision of World Urbanization Prospects (UN, 2006), by 2030, half or more of the African population is expected to live in cities. In Ghana, 43.8 % of the population already lives in cities and by 2030; it is expected to reach over 70 % of the population. Ghana has experienced rapid urbanisation over the past four decades. The population of Accra for instant in 1960 was 450000, which doubled by the 1970 census and reached 1.3

million in 1984 (APDA, 1992; Ghana Government, 1984). By 1990 the estimated population of the city was 1.6 million (Leitman, 1993) and in the year 2000, the metropolis had an estimated population of 2 million (GSS, 2000). Population growth in Accra has led to the rapid expansion of the city which has resulted in urban sprawl and uncontrolled expansion from the municipal boundary of Accra into marginal lands (Benneh *et al.,* 1993 in Kwasi and Markku, 2003). Also, the population of Wa in 1970 was 17825, which almost doubled by the 1984 census to 36067 and in 2000 census the population of Wa was 66644. The current projected population of Wa is 130123 and the urban population growth rate averaged in Ghana is 4.2 compared to an average of 3.8 for Africa (GSS, 2003).

Often a discrepancy exists between the growing population and the increasing - demand for sanitation and solid waste collection services on one hand and the capacity of the local government to provide these services on the other hand (UWEP, 2001).

Despite a trend towards waste management in the last few years, an increasingly consumer - oriented society continues to generate great quantity of waste. This, waste, and its disposal, has an ever increasing effect on our lives, threatening our health, and the quality of our environment and placing a growing burden on business and national economies.

A rising quality of life and high rates of resource consumption patterns have had an unintended and negative impact on the urban environment - generation of wastes far beyond the handling capacities of urban governments and agencies. Cities are now grappling with the problems of high volumes of waste, the costs involved, the disposal technologies and methodologies, and the impact of wastes on the local and global environment (CityNet, 1998).

Urban waste management is drawing increasing attention, as citizens observe that too much garbage is lying uncollected in the streets, causing inconvenience and environmental pollution, and being a risk for public health. Although government authorities apply all the means at their

disposal, the piles of wastes only seem to grow from day to day. In an era of shrinking municipal budgets and a restriction of the scope of municipal government jurisdiction, the problem is likely to intensify unless alternate approaches can be developed.

Plate 1-1 Open dumping site at Fongo

Plate 1-1 Open dumping site at Fongo

Source: field survey, September 2010

One of the most pressing concerns of cities in the South is the problem of solid, liquid and toxic waste management (Onibokun and Kumuyi, 1999; Asomani-Boateng and Haight, 1999).

Whilst the amount of waste produced is more voluminous in the countries of the North, it is more visible in the South. The sight of uncollected or indiscriminately dumped waste piling up along roadsides, on unused land and in drains and water bodies is commonplace in cities in the South. Landfill sites are often un-sanitized and unlined open dumps inappropriately sited near residential areas and/or waterways.

In developing countries and countries with economies in transition, waste management often emerges as a problem that endangers human health and the environment. To make matters worse, waste management usually has a low priority on the political agenda of such countries, as

they are struggling with other important issues such as hunger, heath problems, water shortages, unemployment and even civil war. In such situations, it is easy to understand why waste problems have a tendency to grow steadily (UNEP, 2003).

In the developing world, millions of people are living without a waste management system. A first step to improving this situation is to work out a phased technical and legal framework for waste management and then start the collection and disposal process, with the objective of continuously improving the system.

By almost any form of evaluation, solid waste management is a growing environmental and financial problem in developing countries. Despite significant efforts in the last decades, the majority of municipalities in the developing countries cannot manage the growing volume of waste produced in their cities (Van de Klundert and Lardinois, 1995).

Improperly managed waste poses a risk to human health and the environment; uncontrolled dumping and improper waste handling causes a variety of problems, including contaminating water, attracting insects and rodents, and increasing flooding due to blocked drainage canals or gullies. In addition, it may result in safety hazards from fires or explosions. Improper waste management also increases greenhouse gas (GHG) emissions, which contribute to climate change (USA EPA, 2002); planning for and implementing a comprehensive program for waste collection, transport, and disposal—along with activities to prevent or recycle waste—can eliminate these problems.

The lack of proper land use planning in most cities in Ghana hinders effective sanitation and waste management practices. Due to the lack of comprehensive planning, and the absence of planning controls, most cities are reeling under indiscipline, haphazardness, and the lack of

Adequate and well maintained infrastructure in the urban and industrial development processes. The absence of properly laid down streets and too narrow, and un-tarred roads, particularly, in slums, make it difficult for waste collection vehicles to reach some parts of the city. Also,

uncontrolled expansion has resulted in an increase in the average travel distance to be covered by collection vehicles and additional cost to waste management authorities (Kwasi and Markku, 2003).

The perception of people about solid waste as an unwanted material with no intrinsic value has dominated the attitude of its disposal. In spite of efforts by the Municipal Authorities to manage solid waste in our municipalities, various types of solid waste can still be found dumped in bushes and on parcels of land. This style of waste disposal that the inhabitants of our municipalities have resorted to is described by a renowned environmentalist, Coleman (1985), as being governed by the philosophy 'out of sight, out of mind'. Though this is a bad practice it is accepted in many places. These practices cause problems associated with health and in sanitary conditions. Human and animal welfare is reduced by ill-health and pre-mature mortality. They cause numerous infections; largely diarrhoea, malaria and measles account for 18 per cent of all death (World Environmental and Development Report, 1992).

Most local governments and urban agencies have, time and again, identified waste management as a major problem that has reached proportions requiring drastic measures. In most cities in the Ghana waste collection is inadequate and poor, leaving waste uncollected in streets, dumped in vacant lands, drains and surface water, and burnt in the open air.

Urban solid waste management in most cities in Ghana is at present delivered in an unsustainable manner. Due to uncontrolled urbanisation, large quantities of waste are generated daily, and this exerts much pressure on an over strained solid waste management systems. Coupled with weak institutional capacity, and lack of resources, both human and capital, the city authorities face difficulties in ensuring that all the waste generated in the city is collected for disposal. Home collection of waste is limited to high and, some middle income areas while the poor are left to contend with the problem on their own. This leads to indiscriminate disposal of waste in surface

drains, canals and streams, creating unsanitary and unsightly environments in many parts of the city (Kwasi, 2003).

By almost any form of evaluation, waste management is a growing environmental and financial problem in Ghana. Despite significant efforts in the last decades, the majority of municipalities in Ghana cannot manage the growing volume of waste produced in her cities. This inability to manage urban solid waste consists of failures in the following areas such as inadequate services, inadequate financing, inadequate environmental controls, Poor institutional structure, inadequate understanding of complex systems and Inadequate sanitation.

These inadequacies are receiving increasing attention, and are gaining in priority both in Ghana and in the international donor community. The attention to sustainable development also means that sustainable waste management systems will increasingly come to be the goal of waste policy.

The provision of municipal waste services is a costly and vexing problem for local authorities everywhere. In the Wa municipality, service coverage is low, resources are insufficient, and uncontrolled dumping is widespread, with resulting environmental problems. Moreover, substantial inefficiencies are typically observed. All attempts so far made at dealing with the present situation of solid waste handling in Ghana and other African cities have either failed or only met with moderate success. One solution commonly proposed to overcoming waste management problems is to contract service provision with the private sector in the belief that service efficiency and coverage can be improved and environmental protection enhanced. Since the 1980s there has been a trend towards decentralisation and privatisation of the waste management operations in many cities in the South. This trend is in line with the resurgence of market-oriented prescriptions globally (Beall, 1997 in Hofny-Collins 2006), and has been implemented to fit with Structural Adjustment Programmes and the often associated Economic Recovery Programmes adopted by many governments. More recently (during the 1990s and

presently) civic/community engagement and stakeholder participation have been added as themes to the debate on waste management.

In the efforts of urban authorities to find a lasting solution to our poorly managed waste, it is critical to adopt a broad approach in developing a working framework for waste management. This should cover the social, economic, technology, political and administrative dimensions. For example the social dimension of waste management involves waste minimization; the economic dimension of waste management involves waste recycling; the technology dimension of waste management involves waste disposal; and the political and administrative dimensions cuts across all the three issues of minimization, recycling and disposal (Hari, 2008).

In countries where local authorities are not able to adequately address the solid waste problem, private companies fill this gap. This is especially the case in Africa, where municipalities are often unable to fulfil their service mandates. Modern, efficient, economically, environmentally and socially sustainable waste management systems are frequently beyond the reach of developing country municipal governments acting alone.

Zoomlion, an affiliate of Zoomlion China started its operations in Ghana in 2006 and has a vision to be at the forefront of Ghana's environmental services industry by introducing and using simple but modern technologies and methods of waste management at competitive rates; and a mission to develop and grow as the leading fully integrated waste management company in the country by 2015. Zoomlion is the only private waste management company that operates in all metropolitan, municipal and district assemblies in Ghana.

According to the Upper West Regional Coordinator of Zoomlion, Zoomlion and the Municipal Environmental Unit of the Wa Municipal Assembly (WMA) have a very cordial relationship. Zoomlion works directly with the Municipal Environmental Unit (MEU), by providing support

for its field operations; to assess what is on going on in the field regular meetings are held between the Environment Health Unit and Zoomlion staff.

Zoomlion manages all the waste in the Wa municipality except the main market which is managed by the Municipal Environmental Health Unit of the Wa Municipal Assembly. There are 103 communal containers placed at vantage points within the Municipality for solid waste storage; 50 of these containers are owned by the Zoomlion whiles the remaining 53 are owned by the Municipal Assembly. Door to door collection of waste is practiced in most parts of the municipality with a current coverage of 518 households. The estimated quantity of waste generated in the Wa municipality in a month is 31264.48 m^3. All the waste collected in the municipality are transported by skip trucks, roll-on roll-off truck and compactor trucks to an un-engineered dumping site located at Siiriyiri, which is 6 km away from Wa, where the waste is finally disposed untreated.

1.1 The Problem Statement

Waste management is one of the major challenges confronting most rapidly growing economies and urban cities the world over. This is especially so in developing countries such as Ghana. The main problems associated with waste management in these countries include; poor waste management systems, inadequate sites and facilities for waste management operations, inadequate equipment, and operational funds to support waste management. These problems have become more complex in recent years as the volume and type of wastes being generated are increasing at alarming rates. This situation is a direct result of the high population growth and improved standards of living of our people (EPA of Ghana, 2002).

In an effort to address waste problems, the Government of Ghana has over the years put in place national policies and regulatory frameworks. These policies and regulatory frameworks include:

- National Environmental Policy, 1991.
- Local Government Act, 1990 (Act 462).
- Environmental Protection Agency Act, 1994 (Act 490).
- Water Resources Commission Act, 1996 (Act 522).
- National Building Regulations, 1996 (LI 1630).
- Environmental Sanitation Policy, 1999.
- Environmental Assessment Regulations, 1999 (LI 1652).

Despite the implementation of the above mentioned national policies by the municipalities in Ghana, waste management is still a serious problem in the country. In the quest for Ghana to find a lasting solution to waste management, Zoomlion, a private waste management company which started its operations in Ghana in 2006, was contracted to manage the waste in all our municipalities. But does this provide an alternative to the public sector management of waste which has been practiced since independence? On the premise of the preceding therefore, the following research questions are formulated:

1. Which of the policy options is Zoomlion applying in urban solid waste management?
2. What approach does Zoomlion use to ensure effective solid waste management in the Wa municipality?
3. What are the solid waste disposal options available to Zoomlion in the Wa Municipality?
4. Does Zoomlion have the capacity to manage urban waste?
5. How does land use planning affect the operations of Zoomlion in the Wa municipality?

1.2 The Research Objective

In pursuance of the solution to the problem identified, the main objective of the study is to assess the performance of Zoomlion in solid waste management in the Wa Municipality.

The Specific objectives of the study are:

1. To identify and describe the policy options Zoomlion applies in urban solid waste management in the Wa municipality
2. To examine the approach Zoomlion employs to ensure effective solid waste management
3. To examine solid waste disposal options available to Zoomlion in the Wa municipality
4. To assess the capacity of Zoomlion to manage urban solid waste in the study area
5. To examine how land use planning affects Zoomlion's operations in the study area
6. To suggest measures to ensure effective solid waste management in the Wa municipality

1.3 Justification of the study

Assessing the performance of Zoomlion in urban solid waste management will help unravel the bottlenecks that are still in the waste management system to enable Municipal Authorities, Zoomlion, other private waste management companies and policy makers find lasting solution to the waste problem in Ghana.

The result on the policy Zoomlion is using to manage urban waste will help Zoomlion Ghana Limited and policy makers decide on the best policy option to be implemented in Ghana for effective solid waste management.

In addition, the identified approach employed by Zoomlion in urban waste management will guide Zoomlion and policy makers on the approach to be used in Ghana for effective solid waste management.

Furthermore, the assessment of the capacity of Zoomlion to manage urban waste will bring forth the right capacity needed for urban solid waste management in Ghana.

Also, the results on waste disposal options available to Zoomlion will enable Zoomlion and policy makers decide on environmentally friendly methods of solid waste disposal in Ghana.

Lastly, the examined effects of land use planning on the operations of Zoomlion will guide the Town and Country Planning Department and other policy makers in their regeneration plans of the Wa municipality.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter comprises the review of relevant literature to the study. Literature would be reviewed in the following areas:

- Solid waste
- Solid waste management in theoretical perspective
- Types of solid waste management studies
- Managing urban solid waste in Developing countries
- Urban Solid Waste Management Policies
- Approaches to Urban Solid Waste Management
- Capacity needed to manage urban Solid waste
- Solid Waste Disposal Options
- Land use Planning and Solid Waste management

2.1 Solid waste

Solid waste or refuse is generated through human activities (Cotton and Fraceys, 1991; Furedy, 2002, 1997). The management of this waste often seems impossible in most of the cities of the South (Gilbert *et al.*, 1996: 3; Demanya, 2006). Throughout history, cities and towns have struggled with how to collect and dispose of the refuse generated by their populations (Doan, 1998). The increasing complexity and costs of waste management are making it difficult for local authorities in many developing countries, to handle the process efficiently and effectively. Connected to this problem is the issue of inadequate funding and poor cost recovery for solid waste management. Virtually all urban, authorities in developing countries have failed to devise

effective response, mechanisms; to mitigate the problem of low cost recovery. In addition, several factors negatively affect contributions to a proper delivery of the service such as the non enforcement of physical planning and planning regulations, erratic land use policies, administrative bureaucracy, corruption, attitudes of residents towards solid waste management, and ineffective supervision and monitoring measures by the local authority as well as residents (Batley, 1996; Baud, 2000; Baud *et al.*, 2000, Hasan, 1998; Obirih-Opareh and Post, 2001; Server, 1996; Wekwete, 1995; Demanya, 2006). However, the management of solid waste is one of the challenges facing any urban area in the world. An aggregation of human settlements has the potential to produce a large amount of solid waste; the collection, transfer and disposal of that waste has been generally assumed by municipal governments in the developed world. The format varies, however in most urban areas garbage is collected either by a government agency or private contractor, and this constitutes a basic and expected government function in the developed world (Zerbock, O. & Candidate M. S, 2003). According to Lee, solid waste management continues to be a major challenge in urban areas throughout the world, particularly in the rapidly growing cities and towns of the developing world.

2.2 Solid waste management in theoretical perspective

2.2.1 Concept and definitions

Furedy (1997) defines waste as residual materials that are considered to be of no use and must eventually be disposed off typically by dumping or incineration. In her deliberations, Furedy uses words like "would-be-waste" to conceptually qualify waste as a resource with economic value, *i.e.* to show its potential as a resource for reuse, recycling or composting. Otherwise, waste is something to be discarded or thrown away (Demanya, 2006). According to Skinner (1995: 11), solid waste management in its broadest sense means integrated systems for waste generation, gathering, storage, collection, transportation, recycling, energy recovery, treatment and disposal. Solid waste management practices include all domestic refuse, commercial and

institutional waste, street sweepings and construction debris (UNEP, 1994, 1992; Cointreau-Levine, 1994). Thus, Solid waste management is concerned with how actors get organized for the collection, transport and disposal, reuse, recycling, and composting of solid waste materials (Obirih-Opareh, 2002). From all these definitions and characterizations of solid waste management in the literature, it is clear that, solid waste management includes the cleaning and sweeping of public areas and streets, as well as the primary and secondary collection, transfer and final disposal of solid waste. Primary collection is the collection of solid waste at the source (from households, businesses, institutions, etc.) or from street containers, and its transportation to points of transfer. Secondary collection is the collection of the waste from transfer points for transport to the final disposal site. A further distinction can be made between house-to-house collections, where materials are collected from the doorsteps of homes, against central/ communal container collection, where citizens have to bring their waste materials to indicated points. Solid waste management also involves waste recovery (at the source, through final disposal), and public education to encourage the population to develop attitudes and practices, which are sensitive to waste issues such as source separation or waste minimization. Waste recovery represents the removal or rescue of waste for some type of reuse, recycling or composting (Mustapha, 1993). This often implies its separation, sorting and eventual processing for use.

Finally, recycling can be defined as a method to reprocess waste in order to recover an original raw material; and composting in simple terms, means turning organic waste into manure for agricultural purposes. These processes make a fairly important contribution to reducing the amount of waste finally disposed off by the municipality even though the exact quantity usually cannot be determined with any degree of accuracy in most developing countries (Baud, 2002; and 1993: 356).

2.2.2 Types of solid waste management studies

Research on urban solid waste management in developing countries in general, and in particular Africa, have been developed from two main concerns: from a public health perspective (normally referred to as public management approach), and from a contribution to sustainable development approach (including reuse, recycling and composting) (Demanya, 2006). Historically, the primary objective of solid waste management is that of public health. Solid waste accumulating in densely populated urban areas posed epidemiological health hazards, which local authorities sought to control by providing effective collection, transport and safe disposal services (Baud *et al.*, 2000: 2).

According to Obirih-Opareh (2002), in more recent times, efficient collection and disposal of municipal solid waste is recognized not just as critical for maintaining a healthy environment but also as an important indicator of the level of development of a nation. Accordingly, cities in the developed world have devised complex procedures for handling waste and have established a variety of institutional mechanisms to ensure that these procedures are adhered to. Doan (1997) also points out that in the United States of America for example, many cities have adopted stringent regulations to govern their waste management. These include the kinds of materials that can be thrown away by a household or business, the type of storage containers and the kind of equipment to use to pick up waste. It also indicates the exact procedure for disposing waste in a sanitary landfill, the specifications for liners, covers, and aeration procedures for those landfills, and the proportion of the cost of this service to be paid by the consumer. This is hardly the case in many developing countries. Whilst the rate of waste generation increases very rapidly, resources to manage it grow very slowly, at times negatively. Solid waste collection has always remained an area of concern for cities around the world because of the public health dangers of poor collection practices. Also, solid waste is mostly managed as a public service, which is often provided for through one of four main forms of service provision arrangements. This may

include complete municipal involvement (public provision), a management contract, franchises and full private sector operations (Doan 1997; Roth, 1987; Savas, 1977).

Furthermore, many solid waste management studies focus on public health challenges through community participation (Van Naerssen, 2001). They acknowledge the close interrelationship between urban health and the urban environment. An example is the WHO "Healthy Cities Project" for the period 1995-1999, which aimed to improve the urban environment and health conditions by raising awareness and mobilizing community participation through partnerships with local (municipal) agencies and institutions, thereby helping them to deliver effective environmental and health services (Van Naerssen, 2001). Other studies focus on how public health can be improved or how to do more with the same amount of money (Potney, 1997; Lee, 1997). Most of the privatization approaches in solid waste collection in Africa for example, are based on this idea.

Another area is that of livelihood and poverty-based studies which seek to improve employment opportunities and reduce poverty for the people working with waste (see Baud, 2002). The focus on livelihood has not been based on public health and private management perspectives. It has been inspired more by alternative development views that started from people's own initiatives (bottom-up). These studies recognize the economic potentials of waste, while simultaneously streaming the positive impacts on the environment.

Clearly, solid waste management in developed and developing countries has undergone substantial changes over the last two decades as a result of increasing attention to solid waste management by donors and academics alike (Savage and Diaz 1995). In African cities especially, the problem has become more visible with the decline of services due to the structural adjustment programmes (SAPs) that have been adopted for the restructuring of economies since the 1980's.

2.3 Managing urban solid waste in Developing countries

In an overview of municipal solid waste in the developing world, it is worthwhile to note that the amount of solid waste generated in many cities in the developing world, has been increasing rapidly over the years, mainly as a result of increases in population, and urbanization amongst other factors. Rapid population growth in developing countries has direct implications for human living patterns, leading to a greater concentration of people mostly organized in the form of urban centers. In urban Asia alone, 760,000 tons of wastes are produced daily (Hoornweg and Thomas, 1999). While in Latin America, 240,000 tonnes of waste are generated daily (Moreno *et al.*, 1999).

In developing countries, the approach to managing waste has mainly focused on getting rid of the trash, with very little or no attention paid to waste minimization or recovery efforts (Poerbo, 1991; Cointreau, 1982). If a household can find a nearby site simply to dump the waste, it has solved its disposal problem, regardless of the cost this dumping may impose on others. Thus, low collection is a major problem in most developing countries in general, and throughout Africa in particular, contributing to ecological degradation and health hazards. Even public sector organizations in charge of garbage disposal are inclined to ignore formal guidelines, since waste disposal is often among the worst hit by government financing problems due to the low status associated with waste collection activities by relevant authorities within the government hierarchy. Over the past two decades, these problems have persisted and in some cases even worsened.

Threats to both human and ecological health have also persisted due to technical, financial, legal, social, and institutional inadequacies that have emerged from the use of current solid waste management approaches. Several researches have ascertained this (See table 2-1 following).

Table 2 - 1: Problems of municipal solid waste management in developing countries

ASPECT OF MANAGEMENT	PROBLEM/ CONSTRAINT
Technical	• Lack of support in source separation • Inadequate landfill sites • Uncontrolled open dumping • Operational inefficiencies • Accumulation of uncollected waste • Environmental and public health risks from waste
Social	• Culture • Lack of public awareness and insufficient public education • Limited community/public participation • Affordability of service
Financial	• Lack of funds • Low cost recovery • Foreign currency exchange
Legal	• Lack of appropriate legislation and insufficient enforcement
Institutional	• Lack of planning • Narrow view of waste management • Lack of coordination among agencies and government bureaucracies • Lack of experts and trained personnel • Lack of interest of municipal authorities in recycling efforts
External	• Imposition of inappropriate foreign waste management technology and practice • Privatization of solid waste management services without appropriate management capabilities. • World Bank, IMF and European Union grants and loans conditioned, incompatible BOTs, incinerators, and landfills

Source: Adapted from Yudoko, 2000: 19-21; Demanya, 2006

2.3.1 Solid Waste Generation and Management challenges in Developing Countries

One of the most pressing concerns of cities in the South is the problem of solid, liquid and toxic waste management (Onibokun and Kumuyi, 1999; Asomani-Boateng and Haight, 1999). It is the solid fraction of the urban waste stream which is primarily considered in this study. Causal factors seem to fall into two broad areas; volume and composition:

- The amount of waste generated from Southern cities is constantly growing as a result of rapid urbanisation coupled with changes in lifestyle. The changing consumption patterns, accompanying rapid urbanisation have contributed to increases in the waste generated per capita.
- The changing nature of the wastes is also of concern. Whilst waste streams in the South used to be mainly organic and non hazardous this has gradually been changing over recent years, with a move towards higher concentrations of hazardous wastes. Examples include more packaging and plastic, and more car related wastes such as exhaust fumes, waste oils and rubber tyres.

Whilst the amount of waste produced is more voluminous in the countries of the North, it is more visible in the South. The sight of uncollected or indiscriminately dumped waste piling up along roadsides, on unused land and in drains and water bodies is commonplace in cities in the South. Landfill sites are often un-sanitized and unlined open dumps inappropriately sited near residential areas and/or waterways. Furthermore, toxic wastes are often disposed of in an inappropriate manner. Apart from the odours, unsightliness and risk of flooding from blocked drains, there are serious environmental degradation and health implications of such action, through contaminated waterways containing toxic substances and waterborne diseases, and disease-carrying fly and rodent infestations (Schertenleib and Meyer, 1992; Jalan *et al.*, 1995; Beall, 1997 in Hofny-Collins A. H, 2006)). Scavenging animals and humans are at a particularly high risk of injury and of catching and spreading diseases. Canadian International Development Research Centre (IDRC) (1998:8) has estimated that *"each year 5.2 million people including 4*

million children, mostly in cities, die from diseases caused by improper disposal of sewage and solid waste".

Municipalities are hard pushed to manage this growing problem. Of all operational costs of municipal services, the collection and transportation of household waste is usually the highest (Deelstra, 1989; Jalan *et al.,* 1995). Cities usually manage to keep the business districts and main roads clean, whilst in residential areas, particularly in slums, wastes accumulate in the streets and at transfer stations. In 1997 Eitrem and Tomqvist estimated that 20-50 percent of the solid waste generated remains uncollected in cities in the South. This is even though as much as 30-60 percent of municipal expenditure frequently goes towards waste collection. Schertenlieb and Meyer (1992/93) reflect that *"usually, not even the operation costs of the collection services are covered by adequate feed and the available budgets are insufficient to finance adequate levels of service to all segments of the population."* In Accra the proportion of solid waste collected is in the region of 50-60%. Clearly, an important reason for the failure to tackle the waste problem is a lack of financial resources by local governments, typically operating within Structural Adjustment Programmes and with insufficient tax bases. However, apart from financial constraints, inadequate organisational structures and policy responses, coupled with poor management and technical skills are also contributory factors to failures in meeting the increasingly complex challenge of urban waste management. Collection also proves problematic in many residential areas because of narrow and poor roads that are largely inaccessible. Moreover, land for new and expanded landfill sites is scarce and as cities grow, the distances to dump sites grow, leading to increased transportation costs (Hofny-Collins, 2006).

There is considerable variation in the levels of waste generation between countries at differing levels of socio-economic development. Generally, the more developed and urbanised a country is, the more waste per capita is produced (Deelstra, 1989). Estimates from cities vary considerably, and under situations where much of the waste remains uncollected and where urbanisation is rapid estimates cannot be anything but crude.

countries each inhabitant generates between a quarter and half a kilogram household waste per day. This compares with an estimated 1.4 kg per person per day in Western Europe (European Environment Agency, 2005) and 2 kg in USA (United States EPA, 2003a).

The urban waste stream in the South is made up of a whole range of materials, originating from a variety of sources, including those listed in Table 2 - 2. Of these, household waste constitutes the bulk and certainly the vast majority of the waste collected by municipalities.

The types of waste from cities in developing countries also differ from that of industrialised country cities. Whilst in the West the organic fraction of the total solid urban waste tends to be between 15 and 50 percent and contains a high proportion of paper (typically around 30%), in developing countries the organic fraction of the waste stream tends to be significantly higher, comprising anything between 50 and 80 percent of urban waste with the proportion of paper typically as low as 2-3%. The high proportion of organics in the urban waste stream of developing countries is partly due to the extensive informal salvage and recycling systems which exist for materials of value such as metals, glass and cardboard, partly the lower level of industrialisation and packaging used. A relatively new feature of the waste stream in cities on the South is the rapid increase in plastics as a result of a trend towards more convenience foods and packaging in the larger cities in the South (e.g. School of Public Policy *et al.*, 1998).

Table 2 - 2 Urban Waste Characteristics

Sources of urban waste	Types of solid wastes in the urban waste Stream
• Households • Markets • Street refuse and sweepings • Commercial and institutional (e.g shops, offices and restaurants) • Livestock producers • Slaughterhouses • Human wastewater and sewage • Agro-industrial (e.g. sawmills, food processing plants etc) • Heavy Industrial waste (e.g. mechanical, construction)	• Organics, including fruit and vegetable wastes, garden wastes, and fish and meat wastes and various agro-industrial wastes such as hulls, husks and fruit pulp, sawdust, fish processing waste. • Plastics • Paper • Cardboard • Glass • Metal • Textiles • Sand, stones and ash dust from road and yard sweeping • Livestock manure • Livestock carcasses (bones, horns, skin) • Night soil • Toxic waste such as batteries and biomedical waste • Sawdust • Miscellaneous combustible waste • Miscellaneous inert/non-combustible waste

Source: Adapted from Hofny-Collins, 2006

The constituents of the waste stream not only vary from country to country, but also between neighbourhoods and seasons. In Accra, for example, waste from poor and medium income areas

tends to contain a lower proportion of organic material than that from the more wealthy areas. A lot of the better quality organic material is often recycled as animal feed leaving the collected waste with high concentrations of carbon rich organics (such as coconut husks, leaves etc) and inert materials such as sand from street and yard sweeping.

The waste management systems developed and used in the West rely heavily on engineering solutions for waste collection, transportation, storage and treatment. These systems have been copied in the South, frequently with limited success (Byrne, 1995 (South Africa); Asomani-Boateng and Furedy, 1996 (Ghana); Deelstra, 1989; Jalan*et al.*, 1995 (India); Furedy, 1992; Lardinois and van de Klundert, 1994; Ali, 1997; Schertenlieb and Meyer, 1992). This experience is similar to that of many other cases of technology transfer from the West, from agriculture (see Chapter 2) through to telecommunications (Collins, 1999), and in common with many of these, there is growing recognition that the Western waste management systems are largely inappropriate to cities in the South.

Western systems tend to be too expensive. For example, mechanised refuse trucks and lorries are imported requiring a high capital outlay of foreign exchange.

They also demand complex and costly maintenance which typically needs the importation of spare parts. Schertenleib and Meyer (1992:4) note that *"it is quite common that governments are paying back long-term loans for vehicles grounded after two to three years of operation"*, and that *"typically less than 50 percent of the vehicle fleet is in operational condition"*.

It is not just the capital-intensive nature of Western waste management technologies that renders them inappropriate in the South. They are designed for different situations and are often not suited to the conditions of cities in the South. For example, in areas of seasonally high rainfall, large, heavy waste collection vehicles are often rendered inoperable, and they cannot be used in urban and periurban slum, or low-income areas, with narrow unpaved, pot-holed lanes. This is a frequently cited reason why municipalities fail to provide waste management services in slum areas (Deelstra, 1989; Schertenleib and Meyer, 1992; Baker, 1997; Perla, 1997).

Furthermore, sophisticated compactor trucks, bought by, or given to many municipalities, were developed to save transportation costs and are suitable to conditions where waste has a low bulk density as is the case in the West where much of the domestic refuse is made up of packaging. In cities in the South, where due to the high proportion of organic waste and inert materials such as sand and dust, the bulk density is typically 2.5 times higher, the whole purpose of using

Many professionals within the waste management and urban planning sectors suggest that:

- There is a need for decentralised systems and ways to integrate public and private initiatives. In this respect, the importance of the informal sector is slowly recognised and valued (Lardinois and van de Klundert, 1994b). Waste pickers and itinerant waste buyers play a crucial role in waste management in many urban areas of the South. Waste picking fulfils a service gap in the solid waste management and is a survival strategy for a large number of the poor. It is also a significant employment sector in the urban economy (Ali, 1997).
- Local communities need to be involved and assume some responsibility. They can play a role in separation and primary collection and such efforts can be combined with both the regular waste system and private-sector recycling (Furedy, 1992).
- Alternative waste management strategies involving some or all of the above components could be particularly important for women. Because of their responsibilities within the household, they are most likely to participate in community waste recovery activities (Lardinois and van de Klundert, 1994b). Experts suggest that waste management improvement projects have a greater chance of success if they are attuned to women (Deelstra, 1989).

Jalan *et al.* (1995:17) argue that *"the development of waste management systems and processes should take cognisance of the prevailing situation in terms of its techno-socio-economic factors, the roles and capabilities of various 'actors' involved in the management of solid waste ,and*

their dynamic interplay. This will generate flexibility in the management process to cope with the dynamically changing socio-economic scenario, to create a more adaptive and responsive waste management system. Such a flexible waste management system will keep a dynamic balance among the various alternative approaches of disposal recycling and utilisation of solid waste and will be more integrative and innovative in character". Similarly, Karki *et al.* (1997:4) in their paper on municipal solid waste in Kathmandu argue that although *"managing solid waste is the primary function of every municipality and should be their main concern, the involvement of the community is a pre-requisite for sustainability for such efforts. Different actors such as local bodies and community-based organisations and NGOs have to play a collaborative role with municipalities and government".* This sentiment is echoed in reports on experiences throughout the developing world. Deelstra (1989:21) suggests that *"public authorities could support self-planned activities and the initiatives and suggestions of district and neighbourhood organisations and environment groups. They may consider themselves as sponsors and partners of the people who are building up, improving and maintaining their own surrounding".*

It is important that robust governance capacities are in place. In relation to the waste management issue in Africa, Onibukun *et al.* (1999:5) stress the need for appropriate governance along with techno-financial solutions. They point out that *"an increasing interest in public-private-communitive partnerships is evident in the sector, but this is often related to a concern with technical and financial issues, rather than with the political, sociological and environmental relationships involved'.* The authors go on to argue that *"efficient and effective service delivery depends on several key elements, the most important of which are managerial and organisational efficiency, accountability, legitimacy3, and responsiveness to the public, transparency in decision-making, and pluralism or policy options and choices" (ibid*:6). Batley (2001) uses the examples of waste collection and waste disposal to point out that the difference in the functions of supply of these services. There are differences which have implications for the case for public responsibility for service provision. He argues that waste

disposal has attributes which approximate a public good, whereas solid waste collection does not. It is in principle possible to charge people for waste collection and exclude non-payers. However, the high negative impact of uncollected waste indicates a need for some degree, or form of public sector involvement. It may be argued that there is a need for public sector intervention to ensure that collection takes place, out me operation or service can be contracted out to firms or communities. Waste disposal on the other hand, is different. According to Batley, it has public good characteristics in that it is difficult to exclude non-payers and one customer's disposal space hardly restricts that of others. Furthermore, the service has some features of a monopoly in that once established, the cost of extending it to additional users is low. Waste disposal is best provided through the public sector as (1) land acquisition for disposal sites is difficult other than through compulsory purchase, and (2) there are negative impacts on those living near disposal sites which can only be compensated by some government intervention in charges and re-allocation of benefits. The differences in the functions of supply of these services illustrates the need for (the appropriateness of) combining the private and public sectors in various organisational arrangements.

2.3.2 Private Sector and Waste Management in Developing Countries

Increasingly, the private formal sector is seen as a key participant in the full range of urban waste management activities, including collection, transportation, treatment, processing, separate collection, recycling, composting, and disposal of waste.

According to Cointreau-Levine and Coad, there are three important roles for the private sector in waste management. First, where existing public service delivery is either too costly or inadequate, private sector participation offers a means of enhancing efficiency and lowering costs through the introduction of commercial principles and greater attention to customer satisfaction. Second, in situations where local public funds for investment are in chronically

short supply, the private sector may be able to mobilize needed investment funds. Third, the private sector is well situated to draw on local and international experience in the waste management field and introduce proven and cost effective technologies along with management expertise.

Field studies conducted by the World Bank and others tend to substantiate these claims that the private delivery of municipal waste services can be successful in terms of greater efficiency, coverage and quality of service. Keys to successful private sector involvement in municipal waste management include creating contestable markets, establishing an appropriate regulatory framework and operations standards for contractors, and strengthening local government capacity to negotiate contracts and monitor performance. In the simplest terms, the focus must be on competition, transparency, and accountability.

Since the 1980s there has been a trend towards decentralisation and privatisation of the waste management operations in many cities in the South. This trend is in line with the resurgence of market-oriented prescriptions globally (Beall, 1997 in Hofny-Collins, A. H. 2006), and has been implemented to fit with Structural Adjustment Programmes and the often associated Economic Recovery Programmes adopted by many governments. More recently (during the 1990s and presently) civic/community engagement and stakeholder participation have been added as themes to the debate on waste management. According Hofny-Collins, evidence is mounting that a decentralised integrated approach, integrating the efforts of the private sector, scavengers and local communities, holds promise of making a considerable contribution towards urban solid waste management. Current thinking in waste management incorporates the following principles:

- Privatisation
- Decentralisation
- Community involvement
- Participation of different stakeholders

- Appropriate cost-effective technology options, (many of which invariably are small-scale)
- Involvement of people already familiar with waste handling, i.e. build on existing systems
- Plurality of approaches

2.4 Urban Solid Waste Management Policies

According to Guro Fjellanger (2000), the Minister of the Environment for Norway, Everything that we throw away because we don't want it anymore, or because we can't use it anymore, becomes waste — the leftovers from our production and our consumption. In 1996 there was a little less than 1.4 million tons of household waste, over 4 million tons of industrial waste and about 650 000 tons of special waste in Norway. In addition to this there was about 18 million tons of rubble, stones and gravel which is also waste but which does not make any significant contribution to the environmental problems. Waste is one of several sources of today's environmental problems. It is when the waste undergoes its final treatment at the landfill or in the incinerator that the most important environmental problems arise.

When waste is disposed of on landfill methane gas is formed. The United Nations climate panel has rated methane as having a climatic hazard potential that is 21 times greater than CO_2. Methane emission from the dumping of waste contributes to 7 percent of total Norwegian emissions of climatic gasses. Seepage from municipal landfills has high concentrations of a number of damaging substances amongst others organic materials, nitrogen, iron, primeval organic salts, heavy metals and toxic organic combinations. Seepage from about half the landfill waste leaks out untreated. Pollution from landfills can continue for many hundreds of years after they have ceased to be operational. In this way we are pushing the environmental problems over onto future generations.

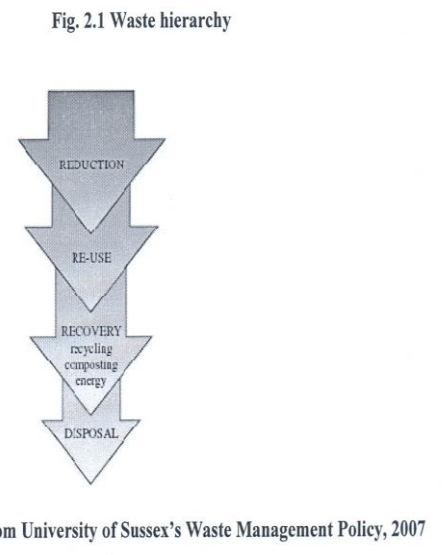
The incineration of waste leads to the atmosphere being polluted by environmentally hazardous chemicals. Dust and acid are also formed from the incineration of waste. The most important environmental consequences are emissions of heavy metals like cadmium, mercury and lead and poisonous chlorine organic combinations such as dioxides.

Waste facilities take up space, even after they are closed down, and they lead to obnoxious smells, noise and risks of transmitting diseases via birds or rats.

2.4.1 Waste Hierarchical Approach

Developed countries adopt the principles of the 'best practicable environmental option' in the delivery of their waste management services. According to the University of Sussex, Nations should apply a ‘waste hierarchical approach’, to reduce, reuse, recycle and recover waste products in preference to the disposal of waste to landfill. Waste hierarchy lists the different ways of dealing with waste in order of preference:

Fig. 2.1 Waste hierarchy



Source: adapted from University of Sussex’s Waste Management Policy, 2007

2.4.1.1 Reduce

Since all waste disposal options have some impact on the environment, the only way to avoid impact is not to produce waste in the first place. Reduction is the most important part of the 3R's of solid waste minimisation: reduce, reuse, and recycle. Reduction avoids unnecessary use of resources (materials, energy, water) and keeps materials out of the waste stream. It aims at eliminating waste before it is produced and reducing its quantity and toxicity. Reducing the quantities of waste we produce lessens some of the resources and money spent on waste collection and disposal. Methods to reduce waste include changing packaging, substituting reusable items for disposable ones and developing products that are more durable or at least repairable.

Packaging is a major component of the waste stream so it is important to bring about changes in packaging practices. It may be necessary to reject excess packaging. Recyclable packaging or a reduction in the volumes and types of packaging should be encouraged. Our purchasing patterns for both contents and packaging may need to change.

2.4.1.2 Re-use

Repeated use of a product in the same, similar or different ways; before discarding an item check that someone else cannot make use of it; examples include furniture, computers and peripherals.

2.4.1.3 Recovery

Recovery refers to the use of waste materials so as to recover some residual value, for example the use of waste oil as a supplementary fuel, and composting of green waste. Waste recycling is a long established practice whereby waste is converted back to reusable material. Wherever possible waste should be recycled; the citizenry need to be fully engaged in this process to ensure that the recycling units are used and that only waste that cannot be recycled goes into the bins — and therefore to landfill.

2.4.1.4 Disposal

Waste sent to landfill is the worst option in environmental terms and waste Managers should strive to keep this to a minimum.

2.4.2 Polluter Pay Policy

Industry and individuals are responsible for whether the manufacturing waste that arises in a company or waste generated by individuals are recycled or delivered for safe treatment. In addition industry is given increasing responsibility for its own products when they end up as waste (Norway's Ministry of Environment, 2006).

2.5 Approaches to Urban Solid Waste Management

The first step to any waste management strategy is to develop an accurate waste inventory or database on the different types of waste that are generated both at the national and regional levels. This inventory provides the designers the necessary baseline information they need to effectively formulate their Strategy (SPREP, 2006).

According to Demanya (2006), there are three (3) main approaches to solid waste management and service delivery identified in the urban management literature by various researchers:

1. The Conventional Approach with its collect —transport and dispose set up
2. The Non-conventional Approach, and
3. The Integrated Approach.

These approaches were developed in the developed countries of Europe and the United States and were then transferred to Africa and the developing world. In fact, these approaches are still very widely in use in the western world as much as they are in Africa; continuing in the heritage of the colonial ties to planning for urban waste management in African cities. The conventional approach which is the most widely practiced to date, has been the predominant approach to managing solid waste. It predates the intervention programs under the urban management

approach. However, the non-conventional and the integrated approach in particular have developed and come into prominence since the early 1980's as urban management has gained in popularity through the various programs sponsored by the international agencies throughout African cities. Even with these attempts, the conventional approach still remains the most widely practiced throughout Africa (Demanya, 2006).

2.5.1 The Conventional approach

The conventional approach, primarily focuses on the collection and disposal of waste, and ignores other aspects such as waste generation, and the alternative practices of recycling and reuse. Thus, the approach struggles to cope with the nature, quality, and complexity of waste produced, as in most developing countries; the essential components of this approach are storage, collection and disposal (Cointreau, 1982; Oluwande, 1984; UNCHS, 1988). Of these, the disposal practice carries the greatest threat to human health. The prevalent disposal type in African cities under this approach is the open pit dumping with no leach ate control, no application of cover material to limit odor, exposure to particulate, flies and refuse being blown, and no control of methane emissions. Further, the option of incineration is unpopular with city managers because of the high organic content of the urban waste stream in African cities, which accounts for a high financial cost of incineration.

With their top-down approaches to planning, the conventional approach has been the most commonly employed in developing countries (Furedy, 1993). Even with its main objective being operational efficiency, Furedy (1984; 1994; 1995), has noted that the approach has been increasingly unable to cope with the complex problems of urban solid waste planning and management. The approach has been noted to be both expensive and unsustainable (Sicular, 1992). Many cities that adopt this approach spend between 30 to 50 percent of their operating budgets on managing their waste (Arlosoroff and Bartone, 1987). Also, the approach suffers from a lack of public participation (Soerjani, 1984; Sinha, 1993).

2.5.2 The Non-Conventional Approach

The non-conventional approach on the other hand regards waste as a resource (Furedy, 1992; 1994). It focuses on accommodating informal activities in waste recovery and recycling, Promoting source separation, and developing community partnership (Furedy, 1992). However the adoption or this approach has been low in African countries due to the entrenchment of the conventional approach, a lack of expertise, research, financial resources and interest. This approach developed primarily in response to the overlooking of the widespread informal waste handling set ups that had proliferated throughout African cities, in a bid to help alleviate some of the problems that the conventional approach could not deal with. Also, it is an approach that has been encouraged under the *enabling approach* to urban management with an aim to make the informal sector more productive and responsible for waste management in African cities.

2.5.3 The Integrated Approach

The integrated management approach is the only one of the three that comes closest to departing from the traditional environmental approach. It is based on the premise that to solve the complex problems of managing solid waste in African countries, the formal and informal sectors of managing urban solid waste would have to operate in a complementary manner so as not to conflict with each other (Ali, Coad, and Cotton, 1996). Such a multi-sectoral approach is distinctive for its engagement of partnerships. Thus, cooperation amongst stakeholders and the spirit of shared responsibility are considered critical in this approach. Even with its partnership focus, attempts at implementing this approach has been bogged down by problems of mistrust between policy-makers, governing officials and residents, expense, time, and difficulty of sustaining commitment.

The conventional, non-conventional and integrated solid waste management approaches as shown in the preceding discussion, have not only been unsuccessful in dealing with the solid waste issues of cities in Africa, but also lack an explicit consideration for environmental

monitoring within their framework. The urban management approach's international initiatives, such as the Healthy Cities Programme, the Sustainable Cities Programme, and the Mega-cities project, under which these waste management approaches, have gained prominence, all seek to generate fresh ideas and innovative methods to enable African cities improve on their environmental situation. However, these approaches have failed to comprehensively deal with the challenges that managing urban solid waste in African cities present, fundamentally because they approach the issue from synoptic planning and environmental analysis perspective.

2.6 Capacity needed to manage urban Solid waste

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, the breeding of flies and vermin, and the handling and control of informal waste picking or scavenging activities. These public health, environmental, and management problems are caused by various factors which constrain the development of effective solid waste management systems. They can be categorized into technical, financial, institutional, economic, and social constraints.

2.7 Solid Waste Disposal Options

According to the United States Environmental Protection Agency, many cities have no controlled system for waste disposal. Waste is burned in pits, dumped in random locations, or disposed of in uncontrolled dumps without any further management. All these actions harm public health and the environment. Controlled waste disposal can help improve and protect the health of local populations and preserve valuable environmental resources, such as groundwater and drinking water. You have two options for waste disposal: operate a properly designed, constructed, and managed landfill or burn the waste in a controlled facility that converts waste to energy.

2.7.1 Uncontrolled Dumping and Burning

Most uncontrolled dumps are many years old, having grown over time from small dumps to large, unmanaged waste sites. Uncontrolled dumps have significant environmental impacts. As the waste decomposes, it creates leachate - a mix of toxic and nontoxic liquids and rainwater - which may get into local water supplies and contaminate the drinking water. Uncontrolled dumps also release gases that are explosive and flammable. In some instances, waste is burned at these dumps, which poses a direct safety threat because of the danger of explosion. The air pollution created by burning harms local communities. Improper waste disposal also produces greenhouse gases (GHGs), which contribute to climate change. In contrast, properly designed, constructed, and managed landfills aim to prevent or minimize health and environmental impacts. They have liners and leachate collection systems that protect groundwater, and gas collection systems that contain or safely burn methane from landfills.

2.7.2 Properly Designed, Constructed, and Managed Landfills

To protect human health and the environment, communities should discourage the use of existing open dumps and establish a managed site for solid waste disposal. Safe, well-controlled waste placement distinguishes a landfill from an open dump.

A trained landfill manager should be hired to properly operate and manage the site. Before any waste is disposed of, the manager should develop a plan to serve as the operational guide for the site. It should specify, in detail, where on the site waste is to be placed, how the site will be operated, at what points the garbage will be covered by soil, and how environmental problems (e.g., animals, litter, fires, gas, leachate) will be addressed. The plan also should provide details of equipment, materials, and staff needed to operate the site; list the environmental agency's required monitoring and reporting activities; and clearly describe when and how each part of the site will be covered and maintained once it has reached its capacity.

2.7.3 Burning Waste in a Controlled Facility

Combustion, or the controlled burning of waste at high temperatures to produce steam and ash, is another waste disposal option and an alternative to land filling. Waste combustion reduces the volume of solid waste to be disposed of by approximately 90 percent. This is especially attractive in crowded cities that do not have enough land available for landfills.

In addition, solid waste can provide a continuously available source for generating energy through combustion. When steam-driven turbines convert the thermal energy from combustion into electrical energy, the process is called "waste-to-energy" (WTE).

Steam or hot water produced during combustion also may be sold directly for industrial processes or space heating, or it may be used to generate chilled water for air conditioning. Selling the recovered energy or water in one of these forms helps offset the high costs of construction and operation of waste combustion facilities, but it does not cover them entirely

2.8. Land use Planning and Solid Waste management

Land use planning at the local level has been a human activity since time immemorial. However, formalization of its methodological aspects for application in developing countries is rather recent (Sombroek, 2008).

Land Use Planning (LUP) is an iterative process based on the dialogue amongst all stakeholders aiming at the negotiation and decision for a sustainable form of land use in rural areas as well as initiating and monitoring its implementation. Land use planning provides the prerequisites for achieving a sustainable form of land use which is acceptable as far as the social and environmental contexts are concerned and is desired by the society while making sound economic sense.

Wherever groups of people use land and its resources, land use is planned, being aware of it or not. Land use does not consider production only, but also land functions such as protected areas, land recreation, road-building, waste disposal sides and use-restricted areas such as buffer zones

for exhaust gases, areas for regenerating groundwater, buffer zones for traffic noise pollution, etc.

Land use planning (LUP) is not only practised when national authorities intervene or as a result of development co-operation projects. LUP happens in every society, even if the term is not used.

Land use planning creates the prerequisites required to achieve a type of land use, which is sustainable, socially and environmentally compatible, socially desirable and economically sound. It sets in motion social processes of decision making and consensus building concerning the use and protection of private, communal or public areas.

Land use planning is orientated to local conditions in terms of both method and content.

Planning approaches often fail because global models and implementation strategies are applied and taken over automatically and uncritically. But LUP is not a standardised procedure which is uniform in its application world-wide. Its content is based on an initial regional or local situation analysis (Amler *et al*, 1999).

2.9 Effective Solid Waste Management

Effective solid management systems are needed to ensure better human health and safety. They must be safe for workers and safeguard public health by preventing the spread of disease. In addition to these prerequisites, an effective system of solid waste management must be both environmentally and economically sustainable. This forms the fundamental assumption underlying the conceptual framework for this study:

- Environmentally sustainable: It must reduce, as much as possible, the environmental impacts of waste management.
- Economically sustainable: It must operate at a cost acceptable to community.

Clearly it is difficult to minimise the two variables, cost and environmental impact, simultaneously. There will always be a trade off. The balance that needs to be struck is to reduce

the overall environmental impacts of the waste management system as far as possible, within an acceptable level of cost.

An economically and environmentally sustainable solid waste management system is effective if it follows an integrated approach i.e. it deals with all types of solid waste materials and all sources of solid waste. A multi-material, multi-source management approach is usually effective in environmental and economic terms than a material specific and source specific approach. Specific wastes should be dealt with in such a system but in separate streams. Figure 2 - 2 below is the conceptual framework of an effective solid waste management system.

Figure 2 - 2 Conceptual framework of Effective Solid Waste management Systems

Source: Author's construer, September 2010

An effective waste management system as shown in figure 2 - 2 should include one or more of the following:

- Waste collection and transportation.

- Resource recovery through sorting and recycling i.e. recovery of materials (such as paper, glass, metals) etc. through separation; and also through waste processing i.e. recovery of materials (such as compost) or recovery of energy through biological, thermal or other processes.
- Waste transformation (without recovery of resources) i.e. reduction of volume, toxicity or other physical/chemical properties of waste to make it suitable for final disposal.
- Disposal on land i.e. environmentally safe and sustainable disposal in landfills.

CHAPTER THREE

STUDY AREA AND RESEARCH METHODOLOGY

3.0 Introduction

This chapter focuses on the geo-physical characteristics of the study area; and the methods and techniques used in gathering information for this study. The physical characteristics include: the location and size; Relief, Drainage, and Topography; Climate and Vegetation; Soils; Population Size, Growth Rate and Density; Education; Health; and Economic Activities of the Area.

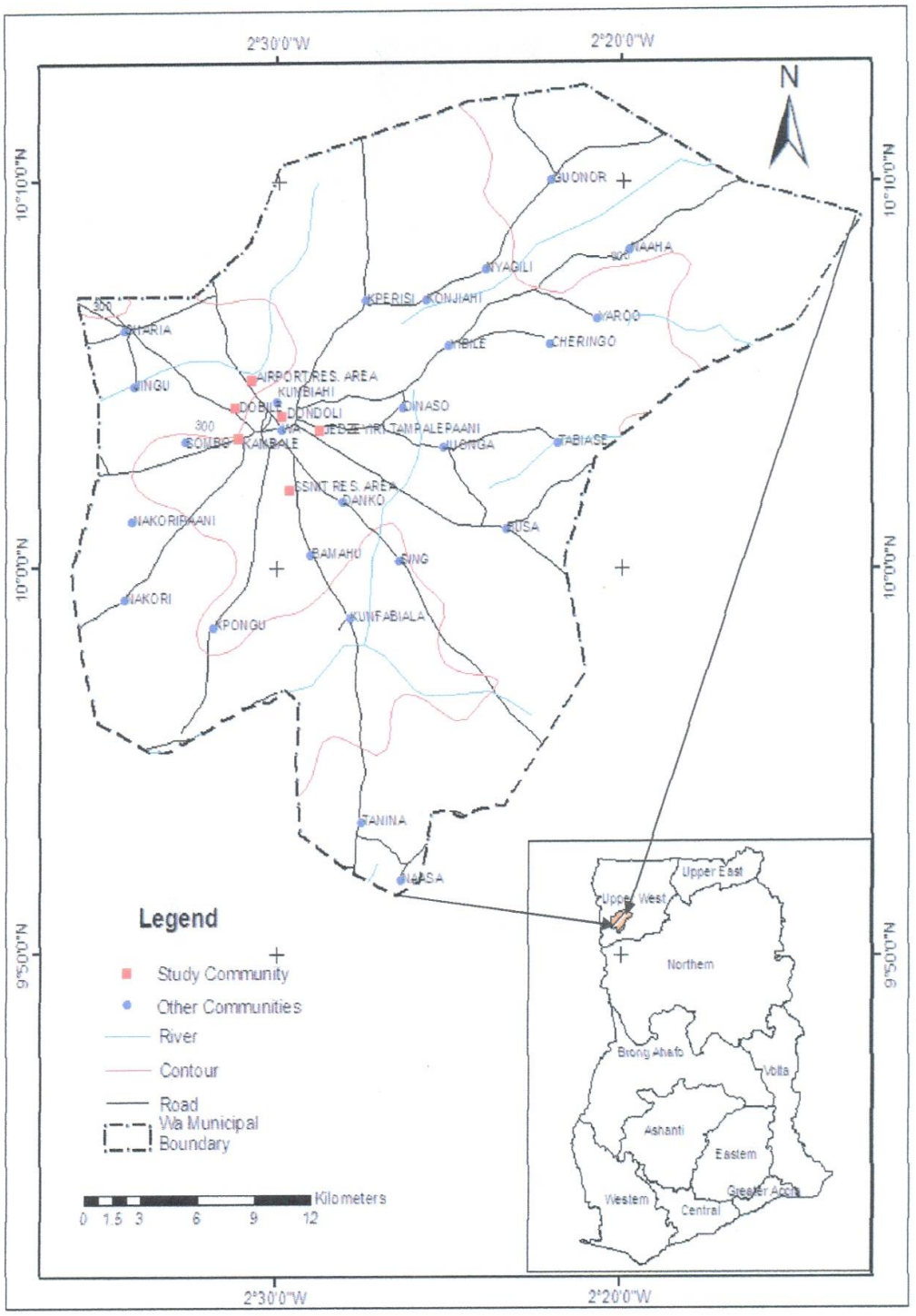
3.1.0 Study Area

3.1.1 Location and size

The Wa Municipal Assembly (WMA) is the only Municipality out of the nine Assemblies in the Upper West Region. It is bordered to the north by the Nadowli District, to the east by the Wa East District, to the west by Wa West District and to the South by both Wa East and West Districts. It lies within latitude 1°45'*N* to 2°45'*N* and longitude 9°32' to 10°20'*W*. It has a land mass area of approximately 234.74 sq kilometres, which is about 6.4% of the region. According to the 2000 Population and Housing Census (PHC), the Wa Municipality has a total population of 98,675 (Ghana Statistical Service); Wa town alone has a population size of 66,441. By projection from 2000 PHC figures, the current population for the municipality (2009) is 130,123.

Figure 3 - 1: Wa municipal Map indicating the sampled communities in the study area

Figure 3 - 1: Wa municipal Map indicating the sampled communities in the study area



Source: Aabeyir, 2010

Source: Aabeyir, 2010

3.1.2 Relief, Drainage, and Topography

The Municipality lies in the savannah high plains, which generally, is gently undulating with an average height between 160m and 300m above sea level. The gentle rolling nature of the landscape implies that the topography is no barrier to agriculture and other physical development.

The municipality has two main drainage systems; Sing-Bakpong and its tributaries to the south and Billi and its tributaries to the north. The streams a seasonal i.e. they dry up during the long dry season thereby reducing available water for agriculture, domestic, industrial and constructional uses. This require the provision of dams and dugouts and also rainwater harvesting. Also, these drains are sometimes choked with solid waste which leads to the flooding of the communities around the drainage systems.

The main types of rock which underlies the municipality are predominantly Pre-Cambrian granite and metamorphic rocks that have seen lesser weathering than similar rock elsewhere in the country due to low rainfall, high evapo-transpiration and less vegetation. Nevertheless, water harvesting from boreholes has been successful because the rocks have well developed fracture systems. The rocks are also said to have mineral deposits and this promotes prospecting for gold and small mining activities with their negative socio-economic and environmental impacts.

3.1.3 Climate and Vegetation

The vegetation of the Guinea Savannah grassland type, made up of short trees and shrubs of varying heights and luxuriance, with grass ground cover in the wet season. Commonly occurring trees sheanut trees, dawadawa, kapok, Cashew and baobab. Cashew and mango are exotic species growing well in the area. It may be noted that parts of the natural tree vegetation are disappearing due mainly to human activities in the form of cultivation, construction, overgrazing, bush fires and charcoal burning, particularly at the suburbs of the municipality. Nevertheless the vegetation supports livestock-rearing including; cattle, sheep and goats but overgrazing should

be controlled by the construction of pens, kraals and other forms of animal housing and the use of animal fodder.

Generally the municipality has two marked seasons namely, the wet and dry seasons. The South-Western Monsoon winds from the Atlantic Ocean bring rains between May and September, whilst the North-Eastern Trade Winds from the Sahara Desert bring the long dry season between October and April. The mean annual rainfall varies between 840mm and 1400mm. most of the rainfall occurs between June and September, and is generally low and unreliable both in it timing and duration. One feature of the rainfall pattern is that it turns to occur in heavy downpours thus, encouraging run-off rather than soil retention.

However, it is not unusual to have very heavy rainfall figures concentrated in a few rainy days. This erratic rainfall regime is clearly shown in the water balance, which is a reflection of the poor soil moisture condition in the area. It has been calculated that there are four humid months, in terms of soil moisture conditions which is only adequate for the cultivation of crops such as millet, guinea corn, yam, groundnut and beans.

On account of the unreliable rainfall, it is not unusual for drought to occur during critical periods in plant growth, thereby drastically affecting the harvest from year to year. This indeed underscores the importance of irrigation systems. The long dry season and the erratic rainfall pattern hinder all year round farming and rather tend to facilitate bush burning and desertification. This has a negative effect on the fauna and flora of the area. There is therefore the need to consciously manage both the natural and the built environment through re-aforestation and tree planting Programme.

3.1.4 Soils

The most extensive soil type is the laterite soil, followed by the savannah orchrosols, found along the Black Volta. The soil is generally shallow and gravelly on the undulating terrains. The

soils support a variety of crops especially cereals and tubers in other to achieve high crop yields soil conservation; composting and use of manure should be encouraged.

3.1.5 Population Size, Growth Rate and Density

According to the 2000 Population and Housing Census (PHC), the Wa Municipal has a total population of 98,675 (Ghana Statistical Service). Wa town alone has a population size of 66,644. The growth rate of the Municipality varies between the rural (2.7%) and the urban (4%). Using the two growth rates, the projected population for the Municipality in 2006 was 119,626 with Wa town recording about 83,000. By implication, there is a high density of population in Wa and consequently pressure on land and socio-economic infrastructure.

The high population concentration is as a result of perceived high growth rate of 4%. Both natural factors and net in-migration has accounted for their growth rate. By projection from 2000 PHC figures, the current population for Wa town (2009) is 130,123.

3.1.6 Education

There has been significant improvement in the education sector over the past years. The number of primary and junior high schools in the Wa municipal assembly have increased steadily; the number of primary schools in the municipal assembly increased from 53 in the 2004/2005 academic year to 62 in the 2009/2010 academic, also, the number of junior high schools increased from 35 in the 2004/2005 academic year to 43 in the 2009/2010 academic year. Similarly, enrolment numbers increased in the primary schools from 483 in the 2004/2005 academic year to 554 in the 2009/2010 academic year; enrolment numbers in the junior high schools also increased from 304 in the 2004/2005 academic year to 555 in the 2009/2010 academic year (GES, 2010). About 80-85% of the population has access a primary school facility within 4-5 km

The Municipality can boost of two technical schools, four senior high schools, one Polytechnic and a campus of the University for Development Studies. It is anticipated that they will provide the youth the necessary self-employable and employment skills.

3.1.7 Health

The regional hospital is located in the Wa municipality and provides services that meet the health needs of residents of the municipality. However, over the past four years sanitation related diseases such as malaria have been on the increase; total out patients department malaria attendance in the regional hospital together with other health facilities not including private health facilities were 22673, 24806, 36089, 43672 for the years 2006, 2007, 2008, and 2009 respectively (GHS, 2010). Though the entire out patients in these facilities may all not reside in the municipality because of the regional hospital being a referral hospital, these high numbers recorded in the municipality can be attributed to bad solid waste management practices; choked gutters and stagnant waters which are the breeding grounds for mosquitoes are found everywhere in the municipality.

3.1.8 Economic Activities of the Area

The structure of the economy of the Municipality has not changed since 2002 and is still dominated by agriculture followed by commerce and industry. Other key sectors of the economy are transport, tourism, communication and energy. Peoples' sources of income for livelihood depend on the economic activities they undertake, the diversity and technology or know-how used. Comparatively, the diversity of the economy of the Municipality is very limited and dominated by agriculture, which is equally not diversified. Wa municipal falls within the Rural Savanna Zone where poverty has been above the national average.

However, the economic activities in the municipality being dominated by agriculture, commerce and industry indicate that the municipality has residential, commercial, industrial and agricultural

sources of waste generation. The knowledge of the sources of waste generation will assists stakeholders in carving out policies and strategies to manage waste in the municipality.

3.2.0 Research Methodology

3.2.1 Introduction

This chapter focuses on methods and techniques used in gathering information for this study. The methods and techniques include the following: type of research, source of data, data collection methods, sampling techniques, method of analyzing data, research design, sample size selection, and Limitation of the study.

3.2.2 Type of Research

The researcher applied both qualitative and quantitative methods of data collection in the study.

- **Qualitative research**

The qualitative data generated from the various research activities was analysed using a thematic categorisation. Data from the Semi Structured Interviews, group discussions and informal interviews and chatting were grouped and coded according to pre-identified and emerging themes.

- **Quantitative research**

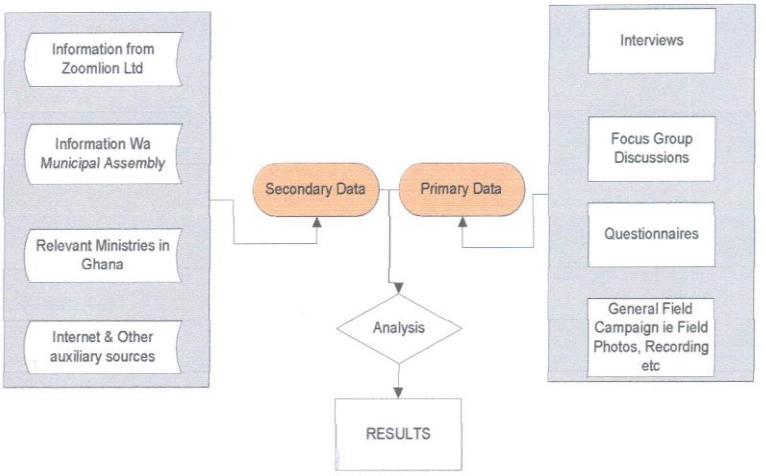
Data gathered from the survey and structured interviews were processed and analysed using SPSS package 16 for windows. The analysis carried out was descriptive, using frequencies, means and percentages of relevant variables to identify and illustrate general patterns in the data

3.2.3 The Research Design

In general, figure 3 - 2 shows a summarised chart of all the information that were collected and used for the study.

Figure 3 - 2: Summarized data collection and general approach to research work

Figure 3 - 2: Summarized data collection and general approach to research work



Source: field work, September 2010

Source: field work, September 2010

The study adapted an interpretive approach in research using exploratory research strategy because it aimed to know more about the phenomenon of urban solid waste management. Interpretive was the necessary research philosophy for this study because it allowed the search, of the 'details of the situation, to understand the reality or perhaps a reality working behind them' (Remenyi *et al.*, 1998). From the interpretive perception, it is necessary to explore the subjective meanings motivating people's actions in order to understand their actions. This research strategy was used as the study involved literature review, interview of experts in the field, and survey of respondents.

The approach in the study employed both quantitative and qualitative methods. As such, Primary and secondary research was conducted in the study.

Aside from survey, a secondary research was conducted in the study. Sources in secondary research included previous research reports, newspaper, magazine and journal content, the Internet and books.

The selection of different sources of information and data collection methods was guided by the principle of 'triangulation'. This enabled cross-checking to ensure that a dependency on one type of person, or one source of information, or one set of tools, did not occur. The use of multiple methods strengthens the validity of the findings from the qualitative research methods (Denzin & Lincoln, 2000).

3.2.4 Population Description

The research area which was identified was the Wa Municipality. The study area was chosen as a result of diversity in environmental problems and accessibility to information regarding the research objectives of the study. One of the reasons too is that, this study area represents a "model village" for the entire region regarding environmental challenges.

The municipality has a total projected population of about 130,123 (GSS, 2009). The population for the research comprise of residents of different parts of the municipality.

The municipality is a heterogeneous one in terms of occupation and for that matter respondents of different locations of the municipality were selected. Residents in this municipality are made up of many ethnic groups. Dominant ones are the Walaas and the Dagaabas among others.

3.2.5 Sample Size Selection

Six residential areas were selected through the simple cluster sampling method namely, Kambale and Dondoli; Airport Residential and Dobile Residential; and SSNIT and Jdzedayiri - Tampalepani Residential areas to represent two each of the low, middle and high income

residential areas respectively in the Wa municipality. The following sample size formula was used to select the sample size:

$$n = \frac{N}{1 + Ne^2}$$

Where,

N = *Target population (Total number of households in Wa Municipality)* = 11,369

e = *margin of error* = 0.05

n = *sample size* = 386

However, because of financial and time constrains, the researcher took a sample size of 180 respondents; 120 for household respondents (20 respondents each for the six residential areas), 30 respondents for business/shop owners in and around the central business district; and 30 market traders respondents. Key informants and focus groups in the study area were also involved in this study through interviews but not with use of questionnaires.

3.2.6 Sampling Techniques

According to Manheim (1977), a sample is a part of the population which is observed in order to make inferences about the whole population. In other words, sampling is use where the research design requires that information is collected from a population which is large or so widely scattered as to make it impractical to observe all the individuals in the population. A sample reflects the characteristics of the population.

In undertaking this research the researcher used probability sampling method.

Probability Sampling

Probability sampling is a sampling process where each individual is drawn or selected with known probability (Domingo in Librero, 1993). Parel, *et al*, (1966) considers a sample to be a

probability sample when every individual in the population is given a non-zero chance of being chosen for the sample.

The following are the methods under probability sampling that are used in this research:

- **Cluster Sampling**

This method of sampling is used to improve the sampling procedure when there is a reason to believe that other methods of sampling might leave some groups unrepresented (Kwabia, 2006). Zoomlion operates two methods of solid waste collection in the Wa municipality; door-to-door collection and Central Communal Container collection methods. The service delivery method in a particular area depends on the ability of the residents to pay for the collection of their solid waste. The municipality was clustered into three clusters; low, middle, and high-income areas for household respondents. This enabled the researcher to sample residents who depend on both the door-to-door collection method and the Central Communal Container collection method since the collection method depends on the income levels of the residents.

- **Simple Random Sampling**

According Kwabia (2006), simple random sampling ensures that every individual in the population has a chance to be included in the sample selected. It is used in the selection of all the other probability samples. Simple random sampling was used to select two residential areas to represent the low, middle and high income areas in the study area for the household respondents. Simple random sampling was also used to select commercial and market traders' respondents.

The table below (table 3-1) indicates how the simple cluster sampling was used to select household respondents.

Table 3 — 1: simple cluster sampling of household respondents

Table 3 – 1: simple cluster sampling of household respondents

CLUSTER	RESIDENTIAL AREAS	SAMPLED RESIDENTIAL AREAS
LOW INCOME	Kabanye, Limanyiri, Dondoli, Zongo, Sawaba, Kambale, Mango, Kunta	Kambale and Dondoli
MIDDLE INCOME	Dokpong Residential area, Dobile residential area, Airport Residential Area, Wa Sec. Residential Area	Dobile Residential Area and Airport Residential Area
HIGH INCOME	Jdzedayiri Tampalepani Residential Area, SSNIT Residential Area, Kpaguri Extention, Kpaguri – Tendamba Residential area	Jedzedayiri - Tampalepani Residential Area and SSNIT Residential Area

Source: field survey, 2010

Source: field survey, 2010

- **Purposive Sampling**

Purposive sampling is used where the researcher targets a particular segment of the population. In this study, the number of residential areas classified under low income was many; therefore the researcher used his discretion to select seven residential areas for the low income cluster. The research was targeted at households, commercial entities (shops) and market traders in the study area. Also, purposive sampling was used to select key informants and focal groups for interviews and discussions.

3.2.7 Data Collection Methods

In undertaking this research the researcher sourced information from both primary and secondary data

Primary Data sources

Primary data was sources from the following categories using the following relevant tools:

- **Interviews**

The research employed detailed semi-structured interviews with senior officials and junior staff of Zoomlion, the Environmental Protection Agency (EPA) and Wa Municipal Assembly to obtain information on the laws, policies and strategies that are use to govern the urban environment in Ghana and Wa municipality in particular. Interviews were also conducted in several localities throughout Wa, to account for the different income and density levels present throughout the municipality, a characteristic which according to Fobil, (2002: 107), can alter results significantly.

- **Key Informants**

Key informant interviews such as street sweepers of Zoomlion, Assembly Members and technical people in waste management in the Wa municipality were conducted to get their opinions on the performance of Zoomlion in solid waste management in the municipality.

- **Questionnaires**

According to Librero (1993), a questionnaire is a set of questions, arranged in sequence and designed to be self-administered. The instructions in the questionnaire are directed to the respondent. Questionnaires were designed for the residents of the Wa municipality, business/shop owners, market traders, officials of Zoomlion in the municipality and WMA. The questionnaire was used for these respondents because it ensures some amount of uniformity from

one measurement situation to another because of its standardized wording, order of questions and instructions for recording responses, and also because in completing questionnaires, respondents may have confidence in their anonymity so that they feel freer to express their views. Both closed and open ended questionnaires were used in the study. The open-ended questions were intended to invite general comments, and a sharing of knowledge and experiences (Palmer and Cochran, 1988: 73 in Demanya, B. K., 2006). Although their analysis proved slightly more difficult, open-ended questions were used to give insight on the thoughts of respondents. The table below indicates the number of questionnaires that were administered to the various respondents.

Table 3 –2: Questionnaire distribution

Community/Respondents	Income level	Number of Respondents
Kambale	Low Income	20
Dondoli	Low Income	20
Airport Residential Area	Middle Income	20
Dobile Residential Area	Middle Income	20
SSNIT Residential Area	High Income	20
Jdzedayiri - Tampalepani Residential Area	High Income	20
Business/shop Owners	-	30
Market Traders	-	30
Total		180

Frantic efforts were made to obtain the household numbers from the WMA to help me select the sample size for the household respondents but to no avail; Ghana Statistical Service in the

municipality did not also have data on household numbers of the municipality, so the researcher use his discretion to select 20 household respondents each for the household respondents.

- **Field Observation**

According to Yin (1982), observations are a form of evidence that do not depend on verbal behaviour, and the method enables the investigator to observe the phenomenon under study directly. Miller and Brewer (2003:213) have categorised observation into 'unobtrusive observation' and 'participant observation' based on the degree of participation by the researcher, and into 'covert' and 'overt' observations based on the level of awareness subjects have of being observed.

The phenomenon under study, solid waste, is one which lends itself to direct field observation. Thus, in addition to questionnaires and interviews, the researcher also conducted field observation as part of the data collection exercise. This involved the observation of waste situations and other conditions that could affect waste management in the study areas such as the layout of settlements and road access within residential communities. Waste disposal sites were also observed to gather data on such things as standard of maintenance and environmental quality in the surrounding or nearby communities. In the course of the field observation, photographs were taken of waste scenes such as street litter, waste storage containers, the transportation and final disposal of waste. The researcher participated in waste collection tours with waste labourers as they went about their work in some parts of Wa. The exercise enabled me to gain first-hand knowledge of the waste situation in the municipality including the waste disposal habits of the residents, the level of waste disposal services available to residents, the collection, transportation and disposal of waste and the management of final waste disposal sites in the Wa municipality.

The field observations undertaken to collect data for this study were largely unobtrusive. The situations observed were mostly waste scenes like street litter, choked drains, waste containers

and disposal sites and this was done in ways that did not usually attract the attention of people around. Also, since the observations covered the effects of human action e.g. street litter) and not human action itself (e.g. littering), the reactive actions of people were largely avoided. Even where the observations covered human actions such as people throwing litter around, they were usually unaware of the observation although there were some exceptions where I directly made people aware of my observations. However, part of my field observation can be properly referred to as participant observation such as when I joined the waste labourers on their collection tours in the municipality. These labourers were very much aware that their activities were being observed as I interacted with them and told them about my research project. In effect, the field observations can be said to cover all the four types identified by Miller and Brewer (2003) — they included both participant and unobtrusive observation, and were both covert and overt in nature. The field observations were used to compare the actual waste situations in the municipality with the information gathered through interviews, household questionnaire survey and documentary analysis.

- **Focus Group Discussions**

Focus group discussions were also held with community leaders, carpenters, construction workers and women groups on the current operations of Zoomlion and how Zoomlion could improve upon its service delivery. These discussions were organised through the leaders of these associations.

- **Secondary Data**

Secondary data was obtained from the following sources

- Journals
- Reports from EPA, Zoomlion and Wa municipal Assembly
- Books
- Archives

- Desktop
- News papers
- Internet

3.2.8 Method of analyzing data

The information gathered was analyzed with SPSS package 16.0, basically with descriptive statistics such as tables, simple percentages, averages, charts, and graphs to illustrate the findings.

3.2.9 Limitations

The researcher faced some challenges in undertaking this research. The first was lack of adequate funds to carry out the study. In fact, the researcher had a lot of difficulty in mobilizing funds for printing of questionnaires, cost of transportation to the field to gather the data and related expenses. This was because the researcher had no scholarship to undertake this research but depended on his personal funding. The limited time for research was also a challenge.

Furthermore, the rate of literacy was another major challenge to the researcher; some of the respondents in the study were illiterates. Therefore, in some cases, the assistance of a field assistant especially in correcting translating some sections of the questionnaires was employed to ensure smooth answering of questions. Also, the data collection period was at the time of the torrential rains in northern Ghana and this affected the movement of the researcher to gather data.

CHAPTER FOUR

DATA PRESENTATION, ANALYSIS AND DISCUSSION

4.1 Introduction

Data collection was implemented concurrently (quantitative, and qualitative at the same time), prioritized equally, and integrated after analyzing. Specifically, qualitative data in the form of responses to open-ended questions from the interview questionnaires, and narratives from focus group discussions, were collected to examine the issues of how respondents and participants assess Zoomlion in urban solid waste management.

In pursuing this, interviews from the field survey were reviewed to draw out themes from the questionnaire responses of participants. The analyses of responses were done through the aggregation of all the responses from the various stakeholder groups sampled (households, business/shop owners, market traders and government officials), into respective files. For instance, all responses from household respondents were aggregated in one file, the households' file for each case study area. The same was done for business/shop owners, market traders and government officials in Wa. This approach to analyzing the data collected facilitates a discussion of trends, relationships and themes based on a particular theme, at a particular study area. This allows for a relationship analysis of awareness levels within the various groups, and between the groups (e.g. government officials versus residents).

Thus, the analysis afforded comparison of similar stakeholder groups from the Wa municipality, allowing for at least two different levels of explanation and understanding of the trends and relationships that manifest. After analyzing the data, the results were integrated and used to help answer the study's research questions. This is characteristic of mixed methods studies, as according to Creswell *et al.*, (2003), in mixed methods studies, data analysis and integration may occur at any point in time.

4.2 Data Analysis

Both quantitative and qualitative data were gathered for the study using questionnaires, interviews, field observation and documentary sources. After cleaning up the data from the questionnaire surveys and correcting the few mistakes that were detected in the filling of the questionnaires, the data were coded and fed into SPSS 16.0 for Windows. Analysis was undertaken to generate a descriptive picture of the data gathered on such themes as household waste generation and handling practices, services available to households for waste disposal and householders' satisfaction with the quality of service. This also covered question items relating to the funding of waste disposal and environmental concerns of waste disposal. Simple percentages and means (central tendencies) were used to analyse the quantitative data obtained from the household questionnaire administration.

The qualitative data from interviews conducted with all other categories of respondents were analysed manually by making summaries of the views of the respondents and supporting these with relevant quotations that captured these views, supported with data from documentary sources and my own field observations of the waste situations in the municipality.

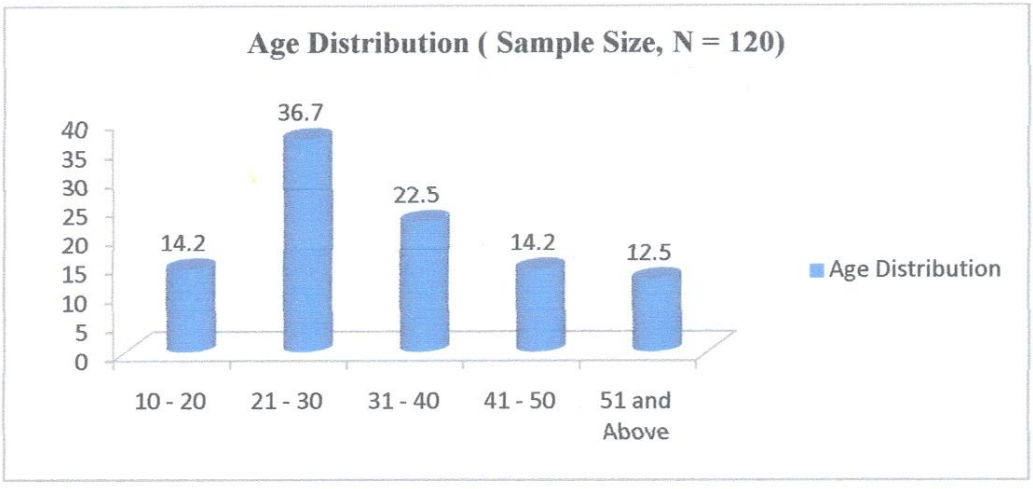
4.2.1 Household Respondents

Six residential areas; Kambale and Dondoli; Airport Residential and Dobile Residential; and SSNIT and Jdzedayiri - Tampalepani Residential areas, representing low, middle and high income residential areas respectively with 20 respondents each were sampled for the study.

Age Distribution of Household Respondents

The histogram (figure 4-1) below shows the age distribution of the household respondents

Figure 4 – 1: Age distribution of the household respondents

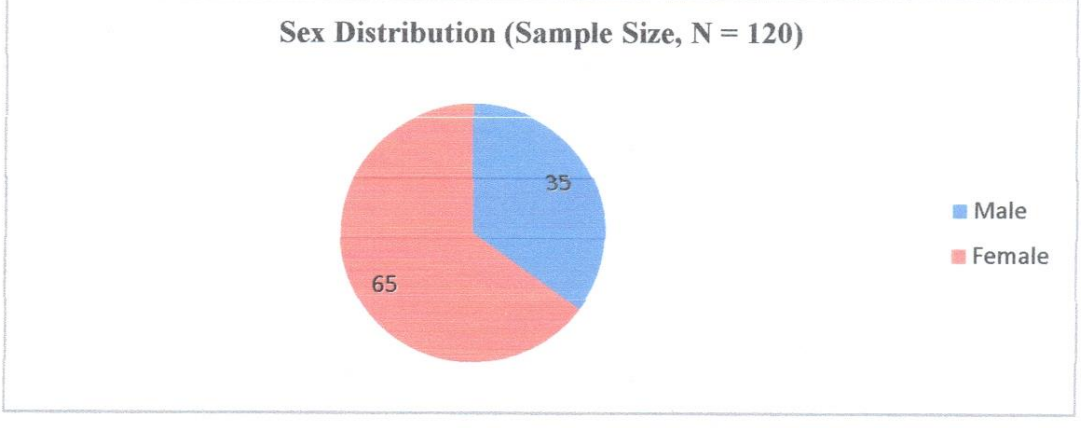


Most of the household respondents as can be seen on the histogram above were between the 30 age group (36.7%) whiles the lowest number of household respondents was between 51 above age group (12.5%). During my field work it realised that those between age groups of 20 and 20 – 30 were mostly responsible for domestic solid waste management, espec disposing waste into the communal containers

Sex Distribution of Household respondents

The pie chart (figure 4 - 2) below shows the sex distribution of residential respondents

Figure 4 – 2: Sex distributions of household respondents

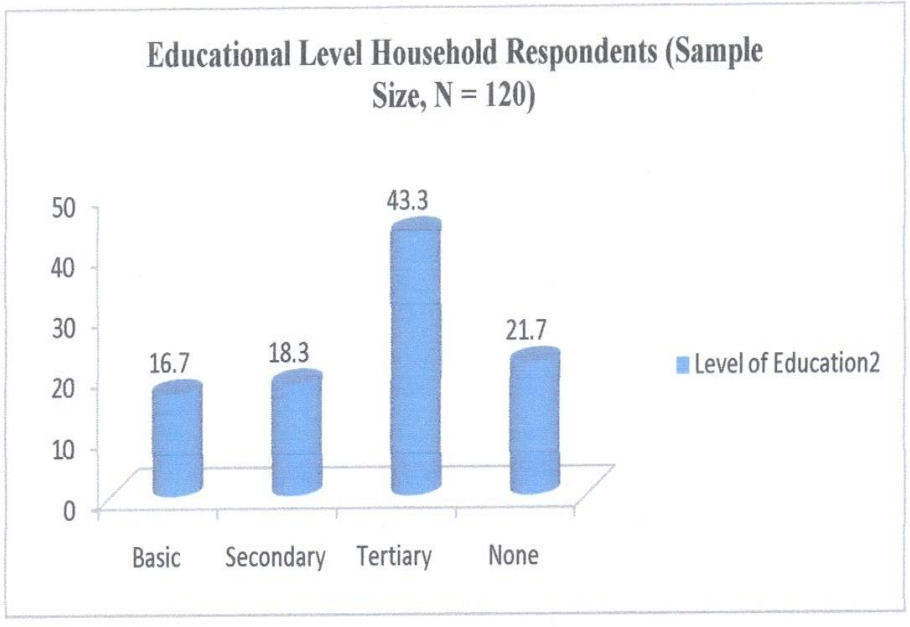


Majority of the household respondents were female (65%) and the remaining percentage of 35% were male. From the researcher's field survey, it was realised that in low and middle income residential areas domestic solid waste management was perceived to be the responsibility of women while in the high income residential areas domestic waste management was to not assigned to any particular sex; it was seen as collective responsibility.

Level of Education of Household Respondents

The histogram (figure 4 - 3) shows the educational level of the residential respondents

Figure 4 — 3: Educational levels of the household respondents

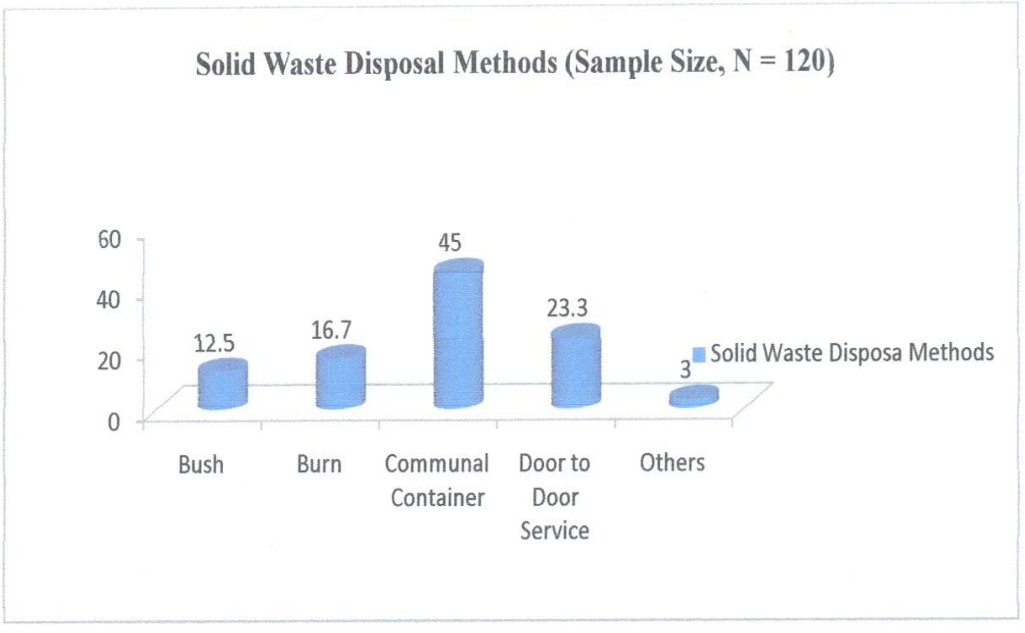


The highest educational level of most of the household respondents was tertiary (43.35%) and the lowest education level being 16.7 percent. During the researcher's field studies, it was recognized that a lot of the household respondents were exposed to solid waste management issues and understand the risk that improperly managed waste pose to human health and the environment. Thus, with proper education, Zoomlion together with the municipal assembly could change the residents' attitude of dumping waste in bushes and on parcels of land.

Household respondents' solid waste disposal methods

The residents of the municipality have resorted to different modes of solids waste disposal. The histogram below (figure 4 - 4) shows the percentages of solid waste disposal methods of the household respondents of the study.

Figure 4 – 4: Solid waste disposal methods by household respondents



as a means of waste disposal, 23.3% of the household respondents are covered by Zoomlion door to door collection service and remaining percentages; 16.7%, 12.5% and 2.5% have resorted to burning, throwing of waste into the bush and other improper waste disposal methods respectively, which pollute the environment and have detrimental effect on humans and animal welfare. The total percent of 32.2 of household respondents resorting to inappropriate methods of solid waste disposal is an indication that waste managers in the municipality have failed to educate the public on proper waste disposal methods.

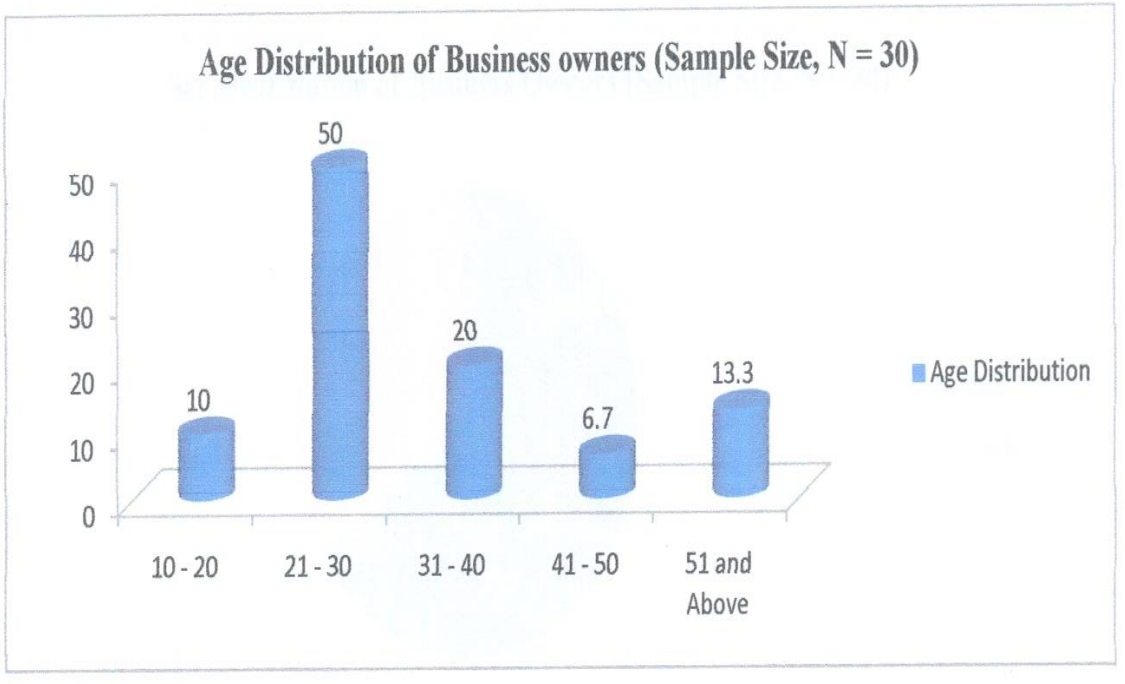
4.2.2 Business/Shop Owners Respondents

30 business/shop owners in and around the central business district (CBD) were sampled.

Age Distribution of the business/shop owners Respondents

The bar graph below (figure 4 - 5) shows the age distribution of the business/shop owners' respondents.

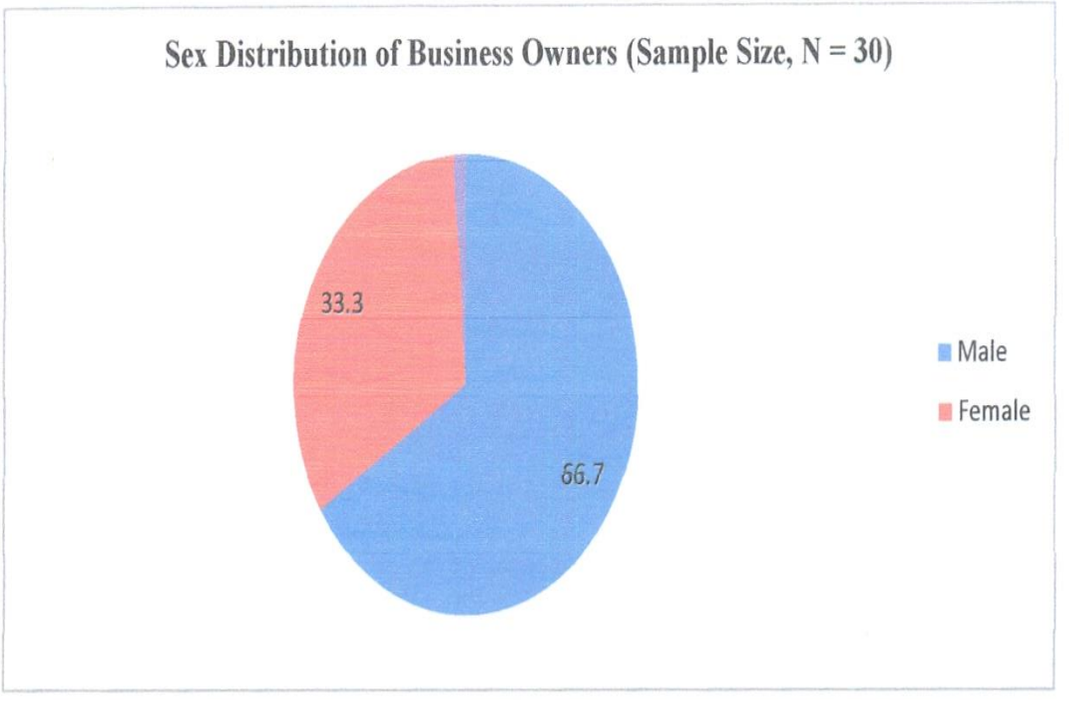
Figure 4 – 5: Age distribution of the business/shop owners' respondents



Sex Distribution of Business owners' respondents

The pie chart below (figure 4 - 6) indicates the sex distribution of the business/shop owner's respondents

Figure 4-6: Sex distribution of the business/shop owners' respondents

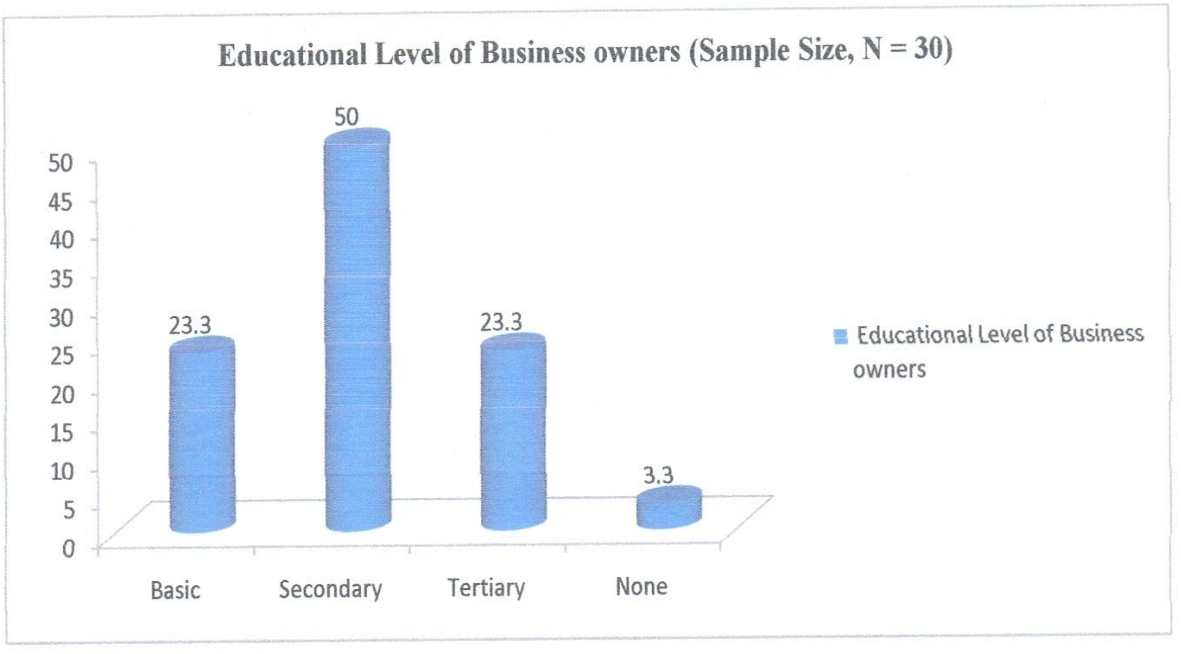


During the field survey, the researcher realised that most of the indigent women who were managing businesses did not own them. This explains why in fig. 4 - 6 above most of the business/shop owners sampled were men (66.7% and 33.3% for male and female respectively).

Educational level of business/shop owners' respondents

The bar graph below (figure 4-7) indicates the educational level of the business/shop owners' respondents

Figure 4 – 7: Educational level of the business/shop owners' respondents

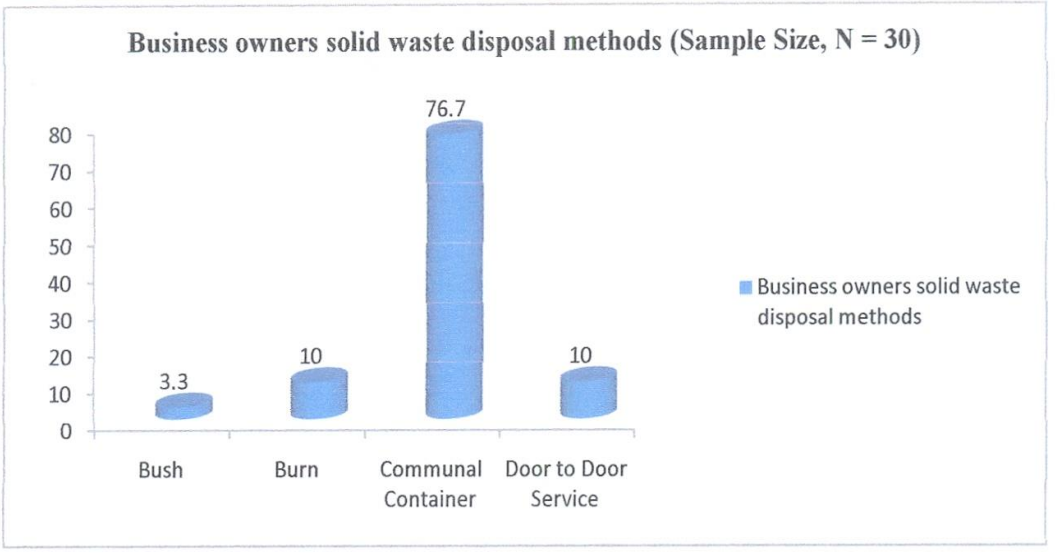


Thus, as shown in fig. 4-7, there is high literacy rate among the business/shop owners' respondents, and with proper education, business/shop owners in the municipality could adopt best solid waste disposal methods.

Business/Shop Owners solid waste disposal methods

The histogram below (figure 4 - 8) shows the percentages of the various modes of solid waste disposal methods practiced by business/shop owners

Figure 4 – 8: Solid waste disposal methods practiced by business/shop owners



Majority of the business/shop owners (76.7%) depend on the communal collection system of solid waste. However, during the researchers field work it was realised that most of the businesses in and around the central business district were accessible to collection vehicles and as such could be covered by the door to door service.

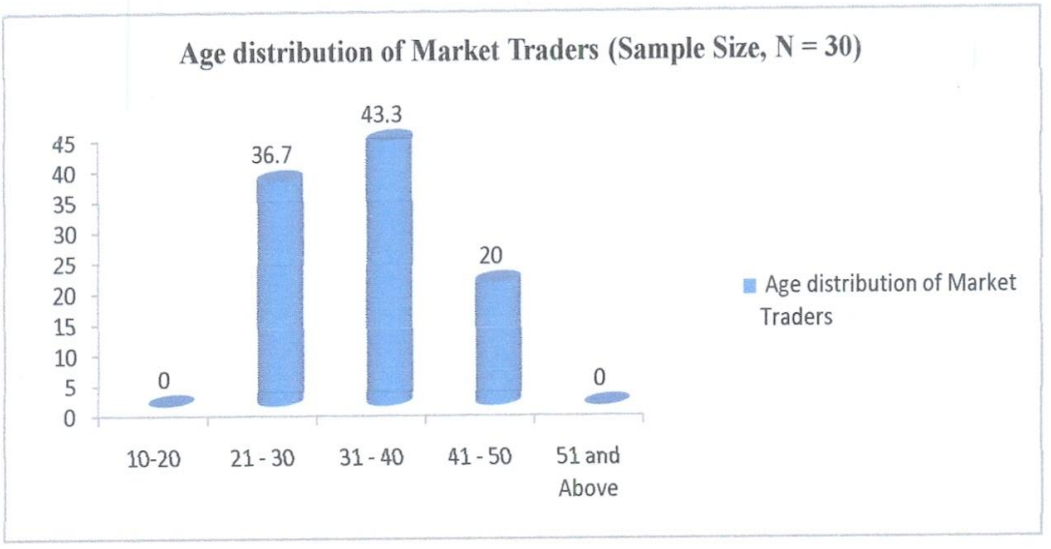
4.2.3 Market Traders Respondents

30 respondents from the two markets (Fadama and Kejetia) were sampled for the study.

Age Distribution of the Market Traders

The bar graph below (figure 4 - 9) indicates the percentages of the age distribution of the market traders' respondents.

Fig. 4 – 9: Age distribution of the market traders' respondents

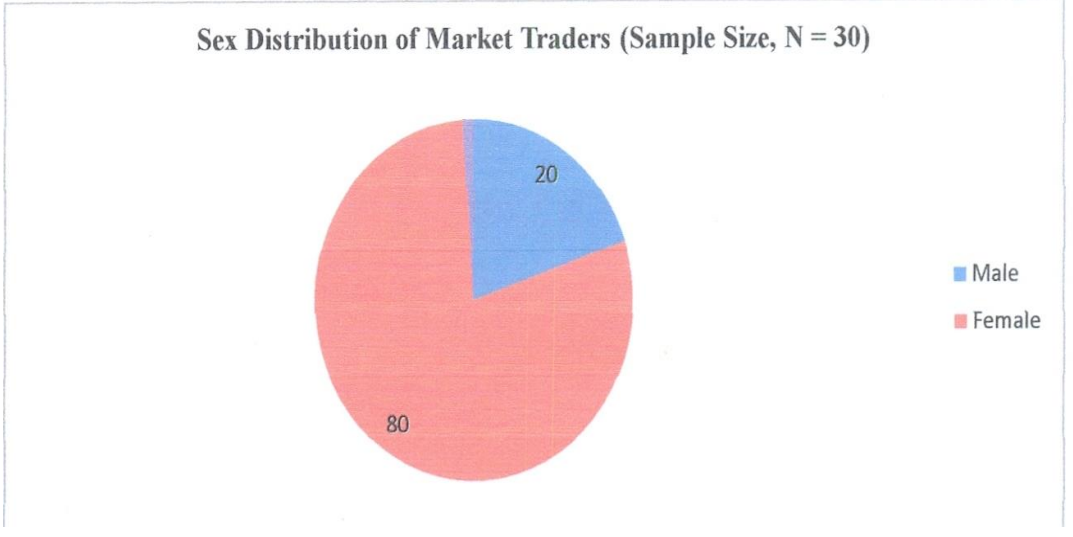


Unlike the other two respondents (household and business owners') majority of the of the market traders respondents were in the 31-40 age group. Mostly in Ghana most market traders are usually middle aged and elderly.

Sex Distribution of Market Traders

The pie chart below (figure 4 -10) shows the percentages of the sex distribution of market traders sampled for the study.

Figure 4 -10: Sex distribution of market traders

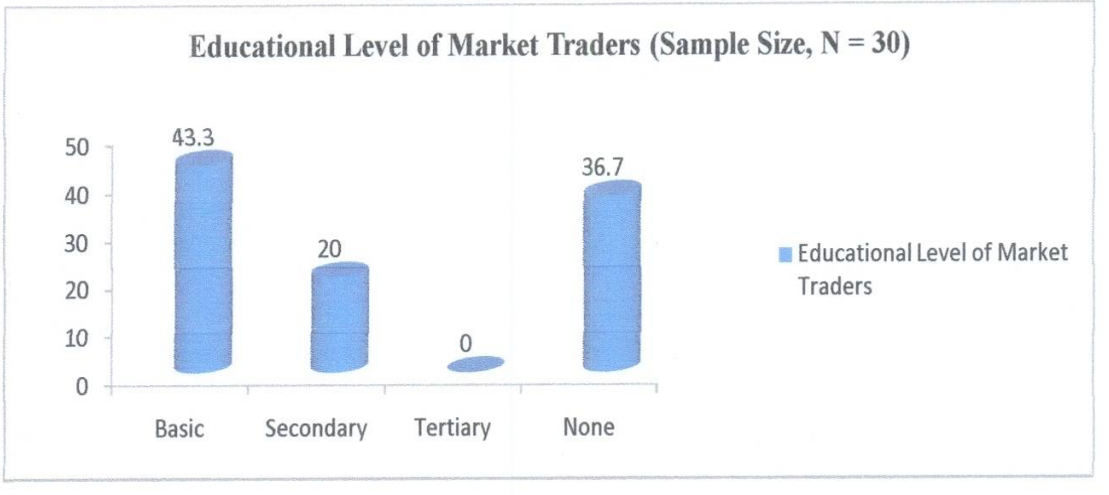


Majority of market traders in Ghana are usually women; this explains the high percent of 80 being female and the remaining percent of 2 being male for the market traders' respondents. Field studies showed that indiscriminate defecating is wide spread in the market; most market women bring their children to the market and allow them to defecate any where especially around where the communal containers are sited.

Educational level of Market Traders

The bar graph below (figure 4-11) shows the percentages of educational levels of market traders

Figure 4 -11: Educational levels of market traders

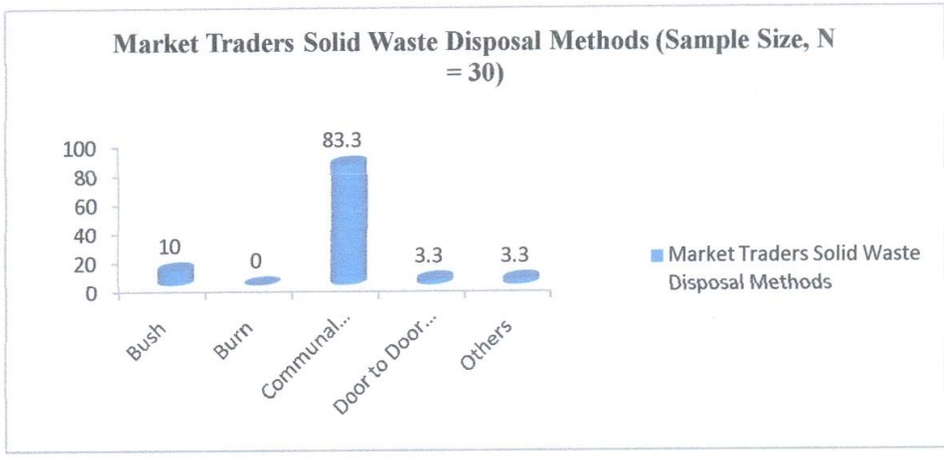


drop outs. This explains percentages of 43.3 and 36.7 representing basic and none for the educational level of the market traders. The low level of education of the market women can negatively affect their perception about solid waste and its management

Market Traders Solid Waste Disposal methods

The bar graph below (figure 4 - 12) indicates the ways that market traders dispose their solid waste

Figure 4 – 12: Market traders' solid waste disposal methods



Majority of the market traders (83.3%) depend on the communal collection method of waste. This can be attributed to their long stay in the market and the availability of the communal containers in the market.

4.3 Summary and discussion of the research findings

The following summary and discussion of the research findings are based on the four objectives that guided the study.

4.3.1 Policy Options Zoomlion Applies in Urban Solid Waste Management in the Wa Municipality

The first objective of this study was to identify and describe the policy options Zoomlion applies in urban solid waste management in the Wa municipality. In line with this objective, fieldwork was undertaken in the municipality to collect primary data on Zoomlion waste management policies. Analysis of the data showed that Zoomlion does not have a very clear policy to solid waste management. According to the Regional Environmental Sanitation Supervisor of Zoomlion, Zoomlion's waste management policy is the provision of services

which seek to prevent environmental pollution and safeguarding public health; it is however not clear how this policy is or would be implemented. Zoomlion needs to adopt the principles of the 'best practicable environmental option' in the delivery of their waste management services; a policy such as the 'waste hierarchical approach'; to reduce, reuse, recycle and recover waste products in preference to the disposal of waste to landfill could be adopted as a waste policy.

4.3.2 Approach Zoomlion employs to ensure Effective Solid Waste Management in the Wa Municipality

The second objective of the study was to examine the approach Zoomlion employs to ensure effective solid waste management in the Wa municipality. In the pursuance of this objective fieldwork was again undertaken in the municipality to collect primary data on Zoomlion's approach to waste management. Analysis of the collected data showed that Zoomlion employs the conventional approach to waste management, which according to Demanya (2006) primarily focuses on the collection and disposal of waste, and ignores other aspects such as waste generation, and the alternative practices of recycling and reuse. Thus, the approach struggles to cope with the nature, quality, and complexity of waste produced, as in most developing countries; the essential components of this approach are storage, collection and disposal. It is clear that the disposal practice carries the greatest threat to human health. The prevalent disposal type in African cities under this approach is the open pit dumping with no leachate control, no application of cover material to limit odor, exposure to particulate, flies and refuse being blown, and no control of methane emissions.

The approach has been noted to be both expensive and unsustainable (Sicular, 1992). Many cities that adopt this approach spend between 30 to 50 percent of their operating budgets on managing their waste (Arlosoroff and Barton, 1987). Also, the approach suffers from a lack of public participation (Soerjani, 1984; Sinha, 1993).

4.3.3 Solid Waste Disposal Options available to Zoomlion in the Wa Municipality

The third objective of this study was to examine solid waste disposal options available to Zoomlion in the Wa municipality. To achieve this objective fieldwork was also undertaken in the municipality to collect primary data on the solid waste disposal options available to Zoomlion in the Wa municipality. Analysis of the data showed that Zoomlion currently disposes solid waste at an open dumping site owned by the municipal Assembly and located at Siiriyir on the Wa - Dorimo road. According to the United States Environmental Protection Agency, many cities have no controlled system for waste disposal. Waste is burned in pits, dumped in random locations, or disposed of in uncontrolled dumps without any further management. All these actions harm public health and the environment. Controlled waste disposal can help improve and protect the health of local populations and preserve valuable environmental resources, such as groundwater and drinking water. However, the data analysed showed that there are three options for solid waste disposal available to Zoomlion in the Wa municipality: to operate a properly designed, constructed, and managed landfill; burn the waste in a controlled facility that converts waste to energy; and compost the waste into manure for agricultural purposes; the main occupation of the indigents of the municipality is agriculture. Therefore, Zoomlion composting waste will go a long to improve agricultural production in the municipality; manure will readily be available to farmers to fertilize their farms and not over depend on foreign fertilizers which sometimes have advent effects on the environment.

Plate 4 - 1: Zoonilion's illegal dumping site on me Wa — Busa roan

Source: field survey, September 2010

4.3.4 Capacity of Zoomlion to Manage Urban Solid Waste in the Wa Municipality

The fourth objective of the study was to assess the capacity of Zoomlion to manage urban solid waste in the study area. This objective was achieved based on the analysis of data on the fleet of equipment and the staff strength of Zoomlion in the Wa municipality. The following tables (table 4-1 and 4-2) show the fleet of equipment and the staff strength of Zoomlion in the Wa municipality.

Table 4 -1: Fleet of Equipment disposition of Zoomlion

S/N	TYPE OF EQUIPMENT	NUMBER OPERATIONAL	NUMBER BROKEN DOWN	NUMBER IDLE
1	Compactor tracks	1		1
2	Skip and Roll-on/off tracks	2		3
3	Bull Dozer	1		1
4	Tricycles	51	4	
5	Communal Containers	50		
6	Brooms	250		
7	Pickers	320		
8	Foot/Hand forks	20		
9	Shovels	110		
10	Wheel barrows	52		
11	Rakes	258		
12	Cutlasses	21		

Source: Field survey, September 2010

The main problems associated with waste management in Ghana include; poor waste management systems, inadequate sites and facilities for waste management operations, inadequate equipment, and operational funds to support waste management. These problems have become more complex in recent years as the volume and type of wastes being generated are increasing at alarming rates. From table 4-1, it is clear that Zoomlion is far ahead of the Municipal assembly in terms of waste management equipment (the municipal assembly has only one roll on/off track and one collection track); however, Zoomlion still lack some key equipment that are necessary for effective waste management. Equipment such as tipper trucks, tractors,

Table 4 -2: Staff strength of Zoomlion

TITLE/RANK	NUMBER	SKILLS	QUALIFICATION
Municipal Operation Supervisor	1	Skilled	Graduate
Municipal Operation Monitor	1	Partially skilled	Post-secondary
Municipal Tricycle Supervisor	1	Partially skilled	Post-secondary
Spraying Gang Leader	1	Partially skilled	None
Team Leaders	35	Unskilled	None
Riders and container side attendants	348	Unskilled	None

Source: field survey, September 2010

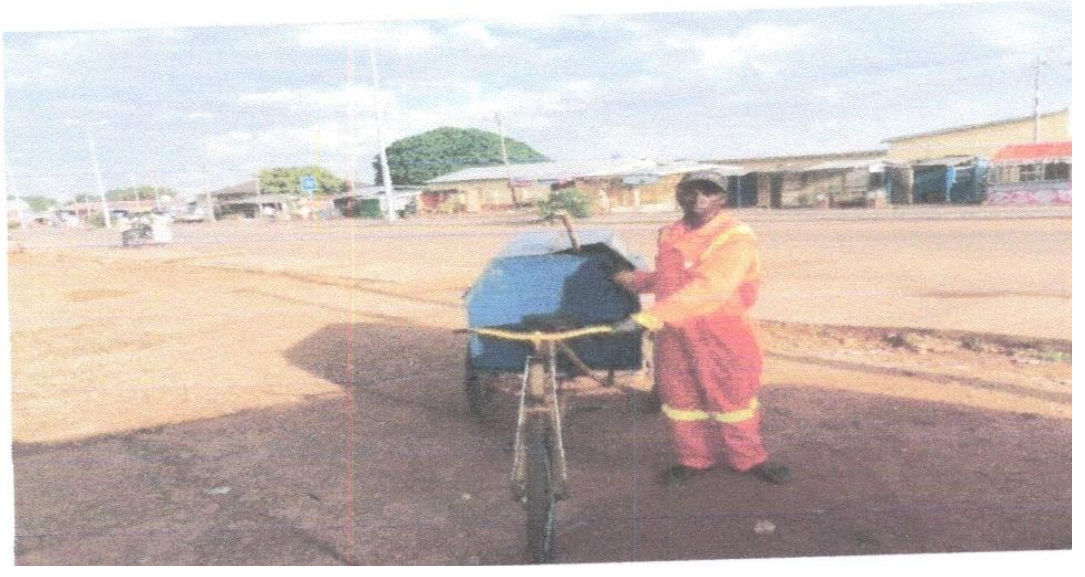
Also, from table 4-2, it is clear that Zoomlion lacks the personnel with the requisite skill to manage urban solid waste management; the Assistant Chief Municipal Environmental Health Officer of the municipal assembly bemoaned the lack of skilled personnel of Zoomlion in the municipality. Waste engineers and planners are needed to ensure proper planning of any waste management system.

4.3.5 How Land Use Planning affects Zoomlion's Operations in the Wa Municipality

The fifth objective of the study was to examine how land use planning affects Zoomlion's operations in the Wa municipality. In the pursuance of this objective, government agencies that regulate the use of the urban environment together with Zoomlion were conducted for information on land use planning in the municipality. It was revealed that land use planning is seriously affecting waste management in the municipality. Most locations of the municipality are not unplanned and structures are built in a congested manner which makes it difficult for refuse trucks to get access to those locations to pick communal containers; sitting of the communal containers in the various communities is also affected by land use planning. This explains why

most residents and business/shop owners are not covered by the door to door collection service of Zoomlion (see graph 4-4 and graph 4-12 for the percentages of waste disposal methods by the household respondents and business/shop owners respectively in the Wa municipality).

Plate 4 3: A tricycle rider about to begin his duties



Source: field survey, September 2010

However, the introduction of tricycle in solid waste collection enables Zoomlion to gain access to inaccessible areas in the municipality.

4.4 Performance of Zoomlion in Urban Solid Waste Management in the Wa Municipality

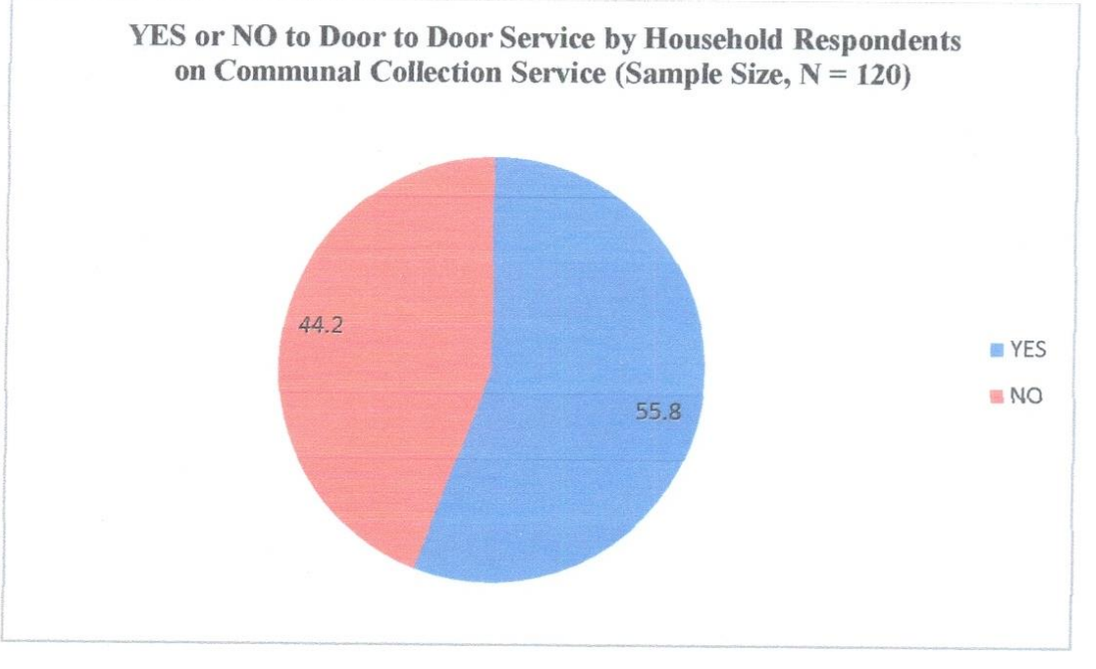
The services delivered by Zoomlionin the Wa municipality are quite satisfactory according to respondents of this study. However, the communal system of collection of waste and the door to door service are faced with some challenges.

4.4.1 Households Respondents Assessment of the Performance of Zoomlion in Urban Solid Waste Management

120 household respondents were sampled for this study. 45% and 23.3% of the household respondents' patronise the communal containers and door to door service respectively as modes of solid waste disposal, while the remaining 31.7% resort to bad practices of waste disposal such as dumping into the bush and burning. These practices cause problems associated with health and in sanitary conditions Human and animal welfare is reduced by ill-health and pre-mature mortality. Below are some specific responses from the household respondents.

The pie chart (figure 4 - 13) below shows the percentages of household respondents who utilise the communal containers that are willing to patronise or not patronise the door to door collection service.

Figure 4 - 13: Household respondents who answered yes or no the door to door service

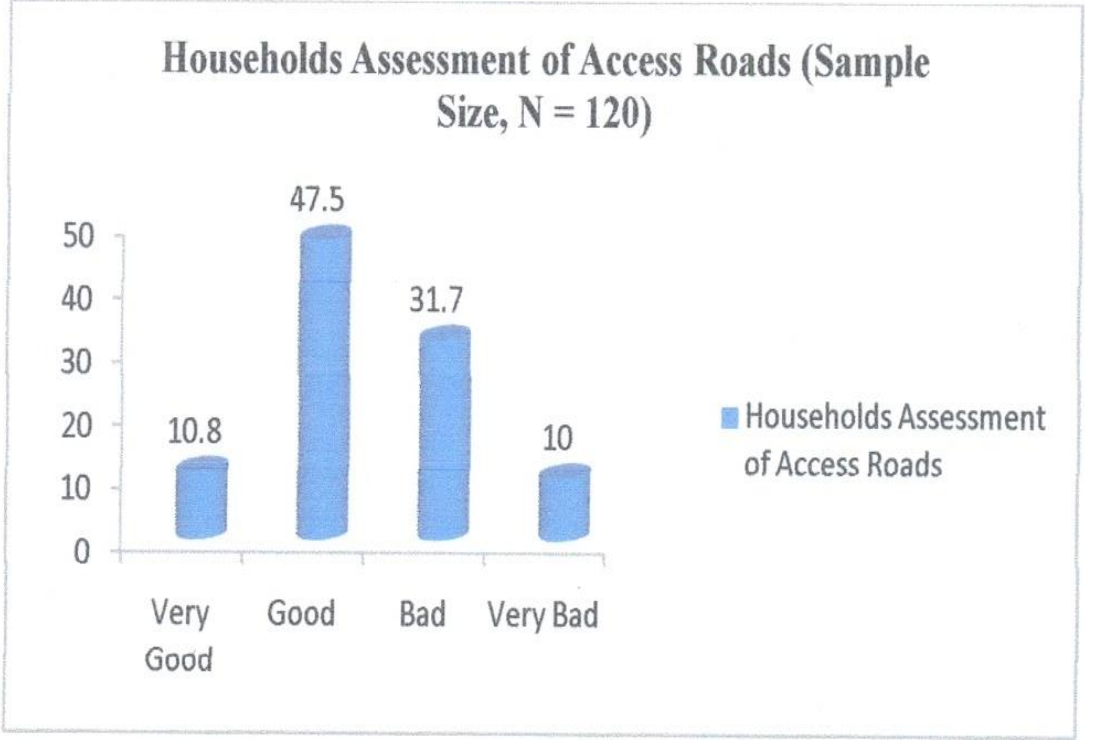


From fig. 4 - 13, 55.8 percent of household respondents on the communal collection service are willing to switch to the door to door service and from fieldwork, 74.2 percent of the household

respondents rated the cost of the door to door service moderate. This implies that with proper public education and good marketing strategy, Zoomlion can increase the number of households who patronise the door to door collection service.

Furthermore, good access roads are essential for effective waste collection. The bar graph below (figure 4-14) shows the percentages of how the household respondents rated the access roads to their homes.

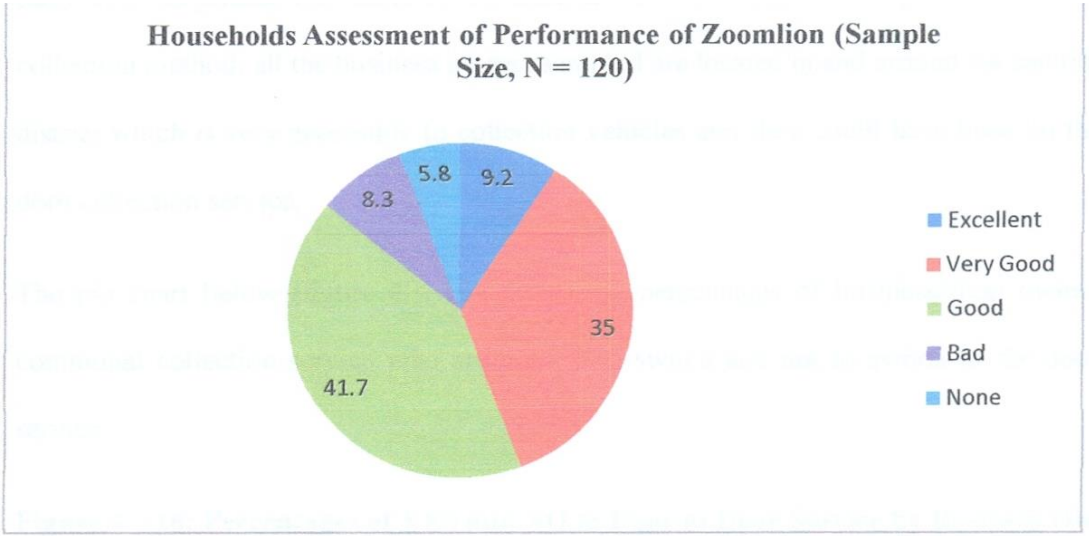
Figure 4-14: Percentages of how the household respondents rated the access roads to their homes



Majority of the household respondents assessed the access roads to their homes as good and accessible to collection vehicles. It would be possible for Zoomlion to operate the door-to-door collection in entire municipality.

On the scale of excellent, very good, good, bad and none, the pie chart below (figure 4 - 15) indicates the percentages of rating of the performance of Zoomlion in urban solid waste management in the municipality by household respondents.

Figure 4 —15: Households assessment of the performance of Zoomlion



Though from the above preceding the household respondents rated the performance of Zoomlion as good, they gave the following recommendation as to how Zoomlion could improve upon its service delivery; Zoomlion should:

- provide more communal containers
- empty the communal containers regularly (when the containers are full)
- provide bins at vantage points in town
- increase its workforce
- door to door collection should be at least twice a week and not once a week
- ensure supervision of their worker
- extent the door to door collection service to cover the whole municipality

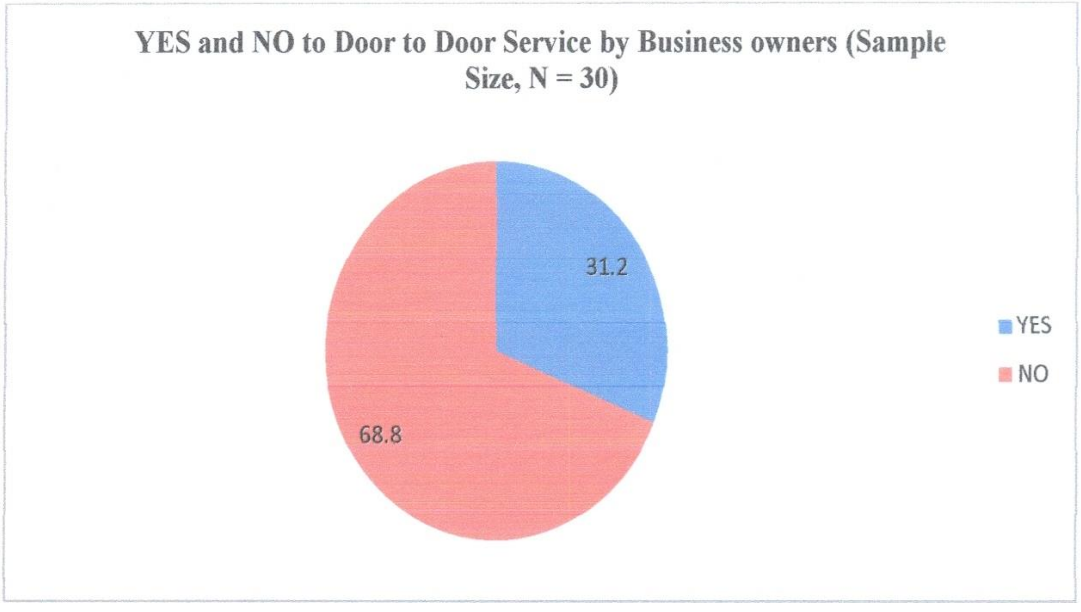
4.4.2 Business/shop owners Assessment of the Performance Zoomlion in Urban Solid Waste Management in the Wa municipality

30 business/shop owners' respondents were sampled for this study. 76.7 percent and 10 percent of the business owners' respondents are on the communal collection and door to door collection

services respectively; the remaining 13.3 percent either dump their solid waste into the bush or burn. It is surprising that most of the business owners' respondents patronise the communal collection method; all the business owners sampled are located in and around the central business district which is very accessible to collection vehicles and they could have been on the door to door collection service.

The pie chart below (figure 4 - 16) shows the percentages of business/shop owners on the communal collection service who are willing to switch and not to switch to the door to door service

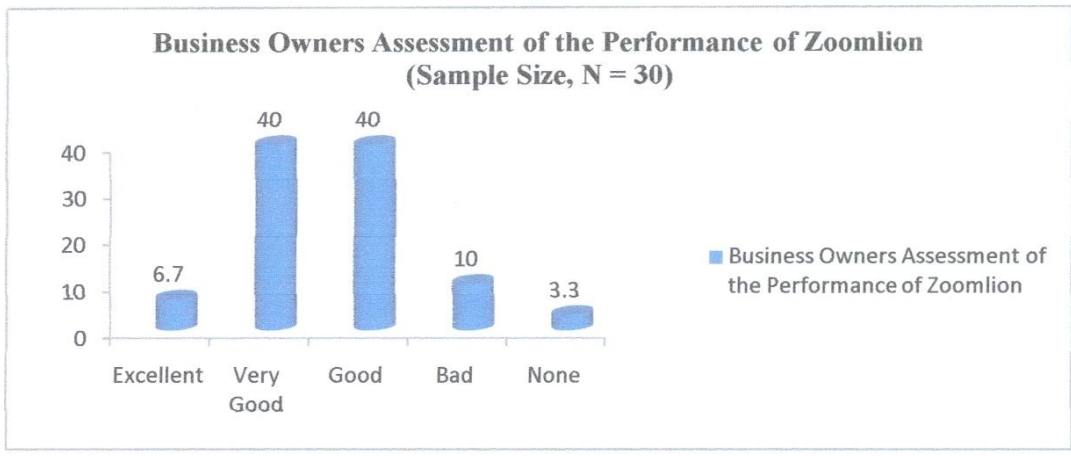
Figure 4 - 16: Percentages of YES and NO to Door to Door Service by Business Owners



The percentage of 68.8 of business owners' respondents saying no the door to door service explains the low patronage of the service by business/shop owners in the Wa municipality.

The histogram below (figure 4 - 17) shows the percentage of rating of the performance of Zoomlion in urban solid waste management by business/shop owners in the municipality.

Figure 4 -17: Business Owners Assessment of the Performance of Zoomlion

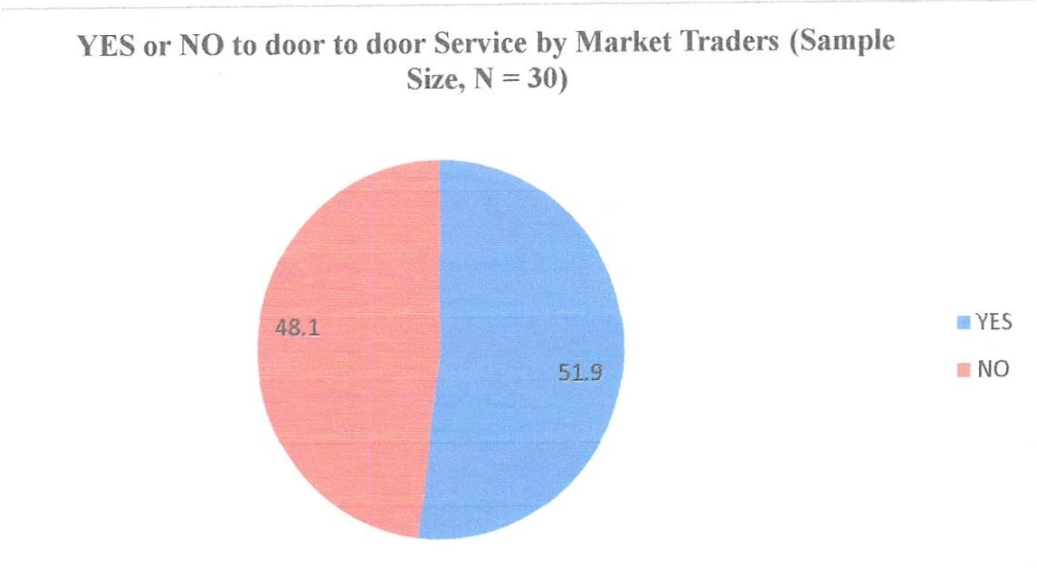


From fig. 4 - 17, majority of the business owners have assessed Zoomlion to be very good or good in solid waste management; Zoomlion is currently enjoying the good will of residents in the Wa municipality.

4.4.3 Market Traders Assessment of the Performance of Zoomlion in Urban Solid Waste Management

30 market traders from the Fadama and Kejetia markets were sampled for the study. 83.3 percent and 3.3 percent of the market trades depend on the communal collection and door to door service respectively. The large percentage of traders depending on communal collection of solid waste is normal because more often than not, the door to door service operates in residential areas. The pie chart below (figure 4 - 18) indicates the response of YES and NO to the door to door service by market traders.

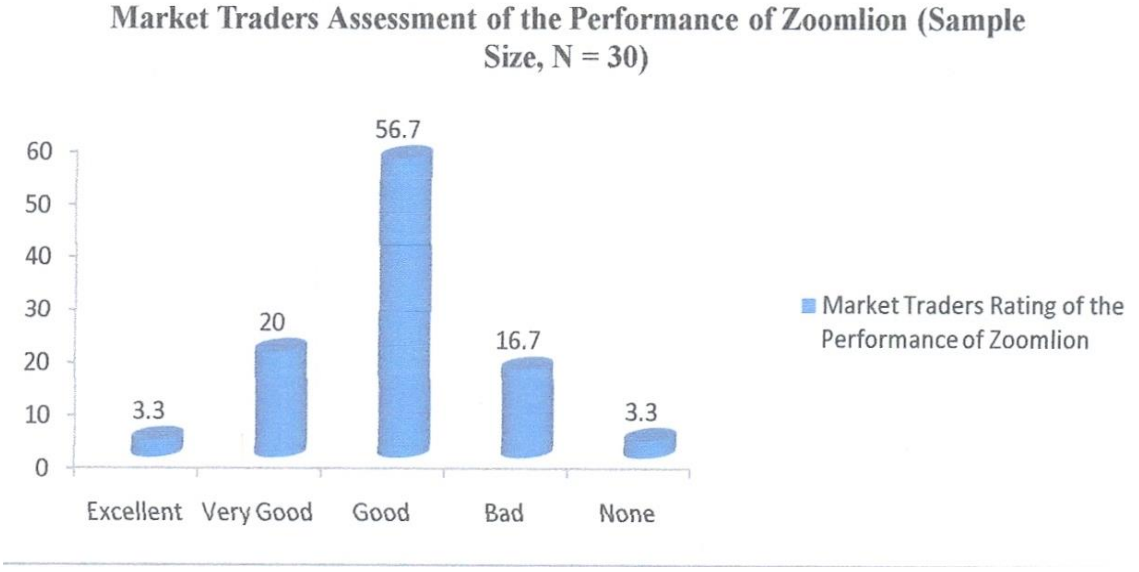
Figure 4 -18: YES or NO to the door to door service by market traders



From figure 4-18, a good number of the market traders wanted to switch from the communal collection to door to door service (51%).

The histogram below indicates (figure 4 - 19) the rating of the performance of Zoomlion in urban solid waste management by market traders.

Figure 4 -19: Market Traders Assessment of the Performance of Zoomlion by Market Traders Assessment of the Performance of Zoomlion (Sample Size, N = 30)



Majority of the market traders (56.75%) rated the performance of Zoomlion as good but have the following recommendation; Zoomlion should:

- empty communal containers regularly
- provide bins at vantage points in the market for consumers to dispose waste
- clean the market on Sundays and Saturdays

4.4.4 Government Agencies Assessment of the Performance of Zoomlion in Urban Waste Management in the Wa Municipality

The data analyse from data received from government agencies such the Environmental Protection Agency and municipal assembly indicated a satisfaction with the performance of Zoomlion in urban solid waste management in the municipality; they all averagely rated the performance of Zoomlion as good. However, the inability of the municipal assembly or any government agency to supervise the operations of Zoomlion is affecting solid waste management in the municipality. Payment for the services of Zoomlion to municipality apart the door to door service and other private organisiations or individual contracting Zoomlion, is made at source; the money is deducted from the Wa municipal's share of the Common Fund. The municipal assemble does not determine or evaluate the operations of Zoomlion before payment is made. According to the municipal Environmental Unit, if the amount that is paid to Zoomlion were given to the unit, there would have improved the solid waste management situation in the municipality better than what Zoomlion is currently doing because 'the Environment unit has the technical personnel but lack the financial resources and equipment to manage solid waste whiles Zoomlion has the financial resources and equipment but lack the technical personnel'. However, the Environmental Unit of the Municipal Assemble acknowledges that there has been an improvement in solid waste management since the presence of Zoomlion in the municipality.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary and Conclusion

The research has shown that the presence and operations of Zoomlion in the Wa municipality has improved solid waste management in Wa Municipality. Hitherto, solid waste management was a monster in the municipality like all Ghanaian cities staring the authorities in the face while they look on rather helplessly. However, lack of the required legal strength to enforce existing bylaws on waste disposal, and to check the rather poor waste-handling attitude of the populace as well as the inability to enforce standards on land use and shelter development within the municipality continue to frustrate the efforts of Zoomlion in her attempt to keep the municipality clean and safe. The frustrating waste problem, however, has also been caused by poor governance practices in the organisation of waste management; Zoomlion has failed to promote partnership with the waste-producing public and to involve them in the various aspects of waste management including needs assessment, financing, waste collection and final disposal; this can be attributed to the fact that Zoomlion is always sure of payment for her services from the WMA share of the Common Fund. Though there is a cordial relationship between Zoomlion and WMA, the municipal authorities seems to be dissatisfied at times with the operations Zoomlion but look helpless because they do not play any supervisory role over Zoomlion's operations in the municipality; according to municipal authorities, Zoomlion was contracted by the Ministry of Rural and Local Government without consulting them.

Solid waste management embraces the storage, collection, transportation, treatment and final disposal of the solid waste. Zoomlion is doing quite well in the storage, collection and transportation of solid waste but faces challenges with the treatment and fmal disposal. Zoomlion uses the dumping site of the WMA located at Siiriyir, however, most often, the roll on/off trucks drivers resort to disposing the waste at every available space. Zoomlion's approach to managing

waste has mainly focused on getting rid of the trash, with very little or no attention paid to waste minimization or recovery efforts. From the researcher's fieldwork however, most of solid the waste generated in the households and the markets are putrescible, which could easily be composted into manure for agricultural use; composting the putrescible waste in the municipality would be a method of solid waste treatment before final disposal.

5.2 Recommendations

Though Zoomlion is chocking success in urban solid waste management in the Wa municipality, there are still some challenges that confronts her solid waste management stream. In this regard, the researcher makes the following recommendations:

Zoomlion should:

- Formulate a policy to guide its operations in urban solid waste management in addition to their objective of providing services which seek to prevent environmental pollution and safeguarding public health
- Use the integrated approach to urban solid waste management and not the conventional approach; the conventional approach, primarily focuses on the collection and disposal of waste, and ignores other aspects such as waste generation, and the alternative practices of recycling and reuse whiles the integrated approach is based on the premise that to solve the complex problems of managing solid waste, the formal and informal sectors of managing urban solid waste would have to operate in a complementary manner so as not to conflict with each other. Thus, composting of waste to produce manure for agricultural production in the municipality could be part of this approach
- Construct an engineered landfill and stop the current practices of relocation of waste to any unused land that they find

- Employ planners and engineers to boost their staff technical capacity to manage urban waste.
- Procure waste management equipment such as tipper trucks, tractors, front end loaders and landfill compactors to support her plant pool.
- Increase the number of communal containers in the municipality, especially the densely populated areas; monitor the communal containers and empty them regularly.
- Provide bins at vantage points such as along the streets, lorry stations and markets for consumers to easily dispose their waste; this will reduce the work load of street sweepers.
- Extent the door to door service to all accessible residential areas; and businesses in and around the central business district.
- Increase the door to door collection to at least twice a week as suggested by the residential respondents who patronise the service.
- Increase the number of street sweepers and container side attendants to ensure effective cleaning and collection of waste.
- Ensure proper supervision of their sweepers and container attendants.
- Liaise with the WMA and other government agencies to enforce by-laws and not take the law into their own hands.

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QUESTIONNAIRE TO ZOOMLION

APPENDIX I

The researcher is a Masters student whose dissertation is on the Performance of Zoomlion in Urban Solid Waste Management in Wa Municipality. Answers to this questionnaire will be used for academic purposes only. Your cooperation will be highly appreciated.

INSTRUCTION: please, tick in the box ☐ to respond to the questions. For open ended questions you are free to use extra sheets of paper to express yourself.

A. PERSONAL DATA

1. Name:……

2. Title:……...

3. Level of Education: 01 Basic ☐ 02 Secondary ☐ 03 Tertiary ☐ 04 None ☐

4. If Tertiary education, state the highest qualification:……

B. ZOOMLION'S URBAN SOLID WASTE MANAGEMENT IN THE WA MUNICIPALITY

5. Are existing laws and policies adequate to support Zoomlion's operations?

01 Yes ☐ 02 No ☐

6. If yes, state these laws and policies.

.....

.....

7. If no, suggest laws and policies that can support Zoomlion's operations

.....

8. What is Zoomlion's waste management policy?

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9. What is Zoomlion's approach to solid waste management?

.....

10. What types of solid waste does the Wa municipality generate and how does Zoomlion manage or intent to manage the generated solid waste?

.....

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.....

11. How many households are covered by Zoomlion's house - to - house solid waste collection service? **.....**

.....

12. What is the residents respond to Zoomlion's door to door collection service? 01 High ☐ 02 Moderate ☐ 03 Low ☐

13. How much in monetary terms is gained from the door to door services in the Wa municipality in a month?**..... …..**

14. Is this amount able to support Zoomlion's door to door service in the Wa municipality? 01 Yes☐ 02 No☐

15. How many communal storage containers does Zoomlion own in the Wa municipality?.....

16. How do you dispose the collected solid waste in the Wa municipality? Into:

01 Open Dumping site ☐ 02 Landfill ☐

17. Who owns the dumping site/landfill? 01 Zoomlion☐ 02 municipal assembly☐

03 Others☐

18. If others, specify…….

19. Does Zoomlion treat the solid waste before disposal? 01 Yes☐ 02 No☐

20. If yes, state how the solid waste is treated before disposal……

21. Does land use planning affect Zoomlion's operations in the Wa municipality?

01 Yes ☐ 02 No ☐

22. If yes, state how land use planning affect Zoomlion's operations in the Wa municipality……..

.....

.....

23. How do you assess the access roads in the Wa municipality for your door-to-door collection? 01 Very good☐ 02 Good☐ 03Very bad☐ 04 Bad☐

24. What is the staff strength of Zoomlion in the Wa municipality? Please categorize them in terms of skills in relation to waste management.

Title/Rank	Number	Skills	Qualification

25. Current Fleet of equipment Disposition of Zoomlion:

S/N	Type of Equipment	No. Operational	No. Broken Down	No. Idle
1	Compactor tracks			
2	Skip trucks			

3	Tipper trucks			
4	Tractors			
5	Front End Loaders			
6	Bull Dozer			
7	Landfill Compactors			
8	Tricycles			
9	Others			
10				
11				
12				
13				
14				

26. State the challenges of Zoomlion in urban solid waste management in the Wa municipality .....

.....

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27. Comments on Zoomlion's operations in the Wa municipality:

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QUESTIONNAIRE TO THE ENVIRONMENTAL UNIT OF THE WA MUNICIPAL ASSEMBLY

APPENDIX II

The researcher is a Masters student whose dissertation is on the Performance of Zoomlion in Urban Solid Waste Management in Wa Municipality. Answers to this questionnaire will be used for academic purposes only. Your cooperation will be highly appreciated.

INSTRUCTION: please, tick in the box ☐ to respond to the questions. For open ended questions you are free to use extra sheets of paper to express yourself.

A. PERSONAL DATA

1. Name:……
2. Title:……
3. Level of Education: 01 Basic ☐ 02 Secondary ☐ 03 Tertiary ☐ 04 None ☐
4. If Tertiary education, state the highest qualification:……

B. ZOOMLION'S URBAN SOLID WASTE MANAGEMENT IN THE WA MUNICIPALITY

5. Are there existing laws and policies to support solid waste management in the Wa municipal? 01 Yes ☐ 02 No ☐

6. If yes, state these laws and policies……...

.....

.....

.....

7. If no, what laws do you think should be formulated?.....

.....

.....

8. What is the Wa municipal assembly's policy on solid waste management?

.....

.....

.....

.....

9. Do you know the policy Zoomlion employs in solid waste management in the Wa municipality? 01 Yes ☐ 02 No ☐

10. If yes, state Zoomlion's solid waste management policy……

……

11. What is the Wa municipal assembly's approach to solid waste management?

……

……

12. Do you know the approach Zoomlion employs in solid waste management in the Wa municipality? 01 Yes 02 No

……

13. If yes, state Zoomlion's approach to solid waste management……..

……

……

9. Do you know the policy Zoomlion employs in solid waste management in the Wa municipality? 01 Yes ☐ 02 No ☐

10. If yes, state Zoomlion's solid waste management policy

.....

11. What is the Wa municipal assembly's approach to solid waste management?

.....

.....

12. Do you know the approach Zoomlion employs in solid waste management in the Wa municipality? 01 Yes pi 02 No ri

.....

13. ..... If yes, state Zoomlion's approach to solid waste management .....

.....

.....

14. Is Zoomlion the only private solid waste company that operates in the Wa municipality? 01 Yes ☐ 02 No ☐

15. If no, state the other private solid waste management that operate in the Wa municipality .....

.....

.....

16. Does the Wa municipality play any role in solid waste management since the existing of Zoomlion in the municipality? 01 Yes 02 No

17. If yes, what role does the municipal assembly play in solid waste management in the municipality? .....

18. Does the Wa municipal supervise the operations of Zoomlion in the municipality?

.....

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.....

.....

01 Yes ☐ 02 No ☐

19. If Yes, what supervisory role does the Wa municipal assembly play over Zoomlion in the Wa municipality?.....

.....

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.....

20. If No, who supervises Zoomlion's operations in the Wa municipality?

.....

21. How is Zoomlion paid for its services in the Wa municipality?

.....

22. How many communal storage containers does the Zoomlion own in the Wa municipality?.....

.....

23. How many communal storage containers does the Wa municipal assembly own?

24. Where does Zoomlion dispose the solid waste collected in the Wa municipality?

01 Dumping Site ☐ 02 Landfill ☐

25. Who owns the dumping site/landfill? 01 Wa municipal assembly ☐

02 Zoomlion ☐ 03 others, specify .....

☐

26. Where is the dumping site/landfill located in the Wa municipality? .....

27. Does land use planning affect solid waste management in the Wa municipality?

01 Yes ☐ 02 No ☐

28. If yes, how does land use planning affect solid waste management in the Wa municipality?.....

.....

.....

29. How do you assess the access roads in the Wa municipality in relation to solid waste management in the municipality ? 01 Excellent ☐ 02 Very Good ☐ 03 Good ☐ 04 Bad ☐

30. How do you assess the Zoomlion's solid waste management in the Wa municipality:

01 Excellent ☐ 02 Very Good ☐ 03 Good ☐ 04 Bad ☐ 05 Very Bad ☐

31. How will you describe the relationship between the Wa municipal assembly and Zoomlion: 01 very cordial ☐ 02 cordial ☐ not cordial ☐

32. Suggest ways Zoomlion can improve upon solid waste management in the Wa municipality

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33. Comment on solid waste management in general in the Wa municipality:

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HOUSEHOLDS QUESTIONNAIRE

APPENDIX III

The researcher is a Masters student whose dissertation is on the Performance of Zoomlion in Urban Solid Waste Management in Wa Municipality. Answers to this questionnaire will be used for academic purposes only. Your cooperation will be highly appreciated.

INSTRUCTION: please, tick in box ☐ to respond to the questions. For open ended questions you are free to use extra sheet of paper to express yourself.

A BACKGROUND CHARACTERISTICS OF RESPONDENTS

1. Age group: 01, 10 – 20☐ 02, 21- 30☐ 03, 31- 40☐ 04, 41- 50☐ 05, 51 and above ☐
2. Sex: 01 Male☐ 02 Female☐
3. Level of education: 01Basic☐ 02 Secondary☐ 03Tertiary☐ 04 None☐
4. Occupation:…….
5. Name of residence Area:……
6. House number:……

B RESIDENTS ASSESSMENT OF ZOOMLION'S URBAN SOLID WASTE MANAGEMENT IN THE WA MUNICIPALITY

7. How do you dispose your solid waste? In to: 01 the Bush ☐ 02 Burns ☐
   03 Communal container ☐ 04 Door to door service ☐ 05 Others ☐

8. If you dispose your solid waste into a Communal container, how often is it emptied?
   01 Once a week ☐ 02 Once every two weeks ☐ 03 Once a month ☐
   04 others ☐

9. If others, specify.....

10. Do you pay for disposing your waste? 01 Yes ☐ 02 No ☐

11. If yes, how much?.....

12. If No, will you be willing to switch to the door to door service for effective collection? 01 Yes ☐ 02 No ☐

13. If you are covered by door to door collection service, how often does Zoomlion collect your waste? 01 Once a week ☐ 02 Once every two weeks ☐
    03 once a month ☐ 04 others ☐, specify……..

14. How do you assess the cost of the door to door collection service?
    01 High ☐ 02 Moderate ☐ 03 Low ☐

15. How do you assess the access roads to your house?
    01 Very good ☐ 02 Good ☐ 03 Bad ☐ 04 Very bad ☐

16. How do you rate Zoomlion's Solid Waste Management in the Wa Municipality?

01Excellent☐ 02Very Good☐ 03Good☐ 04Bad☐ 05None☐

17. Suggest ways that Zoomlion can improve upon its service delivery

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18. What are your general comments on Solid Waste Management in the Wa municipality

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BUSINESS/SHOP OWNERS IN AND AROUND THE CENTRAL BUSINESS DISTRICT QUESTIONNAIRE

APPENDIX IV

The researcher is a Masters student whose dissertation is on the Performance of Zoomlion in Urban Solid Waste Management in Wa Municipality. Answers to this questionnaire will be used for academic purposes only. Your cooperation will be highly appreciated.

INSTRUCTION: please, tick in box☐ to respond to the questions. For open ended questions you are free to use extra sheet of paper to express yourself.

A BACKGROUND CHARACTERISTICS OF RESPONDENTS

1. Age group: 01, 10-20☐ 02, 21-30☐ 03, 31-40☐ 04, 41-50☐ 05, 51 and above☐
2. Sex: 01 Male☐ 02 Female☐
3. Level of education:01 Basic☐ 02Secondary☐ 03Tertiary☐ 04None☐
4. Business Name:…….
5. Business location:……..…

B BUSINESS OWNERS ASSESSMENT OF ZOOMLION'S URBAN SOLID WASTE MANAGEMENT IN THE WA MUNICIPALITY

6. How do you dispose your solid waste? In to: 01 the Bush ☐ 02 Burns ☐
03 Communal container ☐ 04 Door to door service ☐

7. If you dispose your solid waste into a Communal container, how often is it emptied?
01 Once a week ☐ 02 Once every two week ☐ 03 Once a month ☐

04 others ☐ specify. .....

8. Do you pay for disposing your waste into the communal container?

01 Yes ☐ 02 No ☐

9. If yes, how much?.....

10. If No, will you be willing to switch to the door to door service for effective collection?
01 Yes ☐ 02 No ☐

11. If you are covered by door to door collection service, how often does Zoomlion collect your waste? 01Once a week ☐ 02Once every two weeks ☐

03 once a month ☐ 04 other ☐, specify. .....

12. How do you assess the cost of the door to door collection service?

01 High ☐ 02 Moderate ☐ 03 Low ☐

13. How do you assess the access roads to your business location?

01Very good ☐ 02Good ☐ 03Bad ☐ 04Very bad ☐

14. How do you rate Zoomlion's Solid waste management in the Wa Municipality?

01 Excellent ☐ 02Very Good ☐ 03Good ☐ 04Bad ☐

15. Suggest ways that Zoomlion can improve upon its service delivery

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16. What are your general comments on Solid Waste Management in the Wa municipality?

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MARKET TRADERS QUESTIONNAIRE

APPENDIX V

The researcher is a Masters student whose dissertation is on the Performance of Zoomlion in Urban Solid Waste Management in Wa Municipality. Answers to this questionnaire will be used for academic purposes only. Your cooperation will be highly appreciated.

INSTRUCTION: please, tick in box ☐ to respond to the questions. For open ended questions you are free to use extra sheet of paper to express yourself.

A BACKGROUND CHARACTERISTICS OF RESPONDENTS

1. Age group: 01, 10-20☐ 02, 21-30☐ 03, 31-40☐ 04, 41-50☐ 05, 51 and above ☐
2. Sex: 01Male☐ 02Female☐
3. Level of education:01Basic☐ 02Secondary☐ 03Tertiary☐ 04None☐
4. What items do you sell? 01Ingredients☐ 02food staff☐ 03vegetables ☐ 04 clothing☐ 05 others☐ specify:…….
5. Your location in the market:……..

B MARKET TRADERS ASSESSMENT OF ZOOMLION'S URBAN SOLID WASTE MANAGEMENT IN THE WA MUNICIPALITY

6. How do you dispose your solid waste? In to: 01 the Bush ☐ 02 Burns ☐

03 Communal container ☐ 04 Door-to-door service ☐

7. If you dispose your solid waste into a Communal container, how often is it emptied?

01 Once a week ☐ 02 Once every two week ☐ 03 Once a month ☐

04 others ☐, specify:…….

8. Do you pay for disposing your waste into the communal container?

Yes ☐ 02 No ☐

9. If yes how much?.....

10. If No will you be willing to pay for effective collection? 01 Yes ☐ 02 No ☐

11. If you are covered by door-to-door service, how often does Zoomlion collect your waste? 01 Once a week ☐ 02 Once every two weeks ☐ 03 once a month ☐
04 others ☐, specify:……..

12. How do you assess the cost of the door to door collection service?

01 High ☐ 02 Moderate ☐ 03 Low ☐

13. How do you assess the access roads to your location in the market? 01 Very good ☐

02 Good ☐ 03 Bad ☐ 04 Very bad ☐

14. How do you rate Zoomlion's Solid waste management in the Wa Municipality?

01 Excellent ☐ 02 Very Good ☐ 03 Good ☐ 04 Bad ☐

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15. Suggest ways that Zoomlion can improve upon its service delivery

.....

16. What are your general comments on Solid Waste Management in the Wa municipality?

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