UNIVERSITY FOR DEVELOPMENT STUDIES

PUBLIC PERCEPTION OF ZOOMLION'S SOLID WASTE MANAGEMENT SERVICES IN THE TAMALE METROPOLIS

BY

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(UDS/MDM/0112/10)

A DISSERTATION SUBMITTED TO THE DEPARTMENT OF PLANNING AND MANAGEMENT, FACULTY OF PLANNING AND LAND MANAGEMENT, UNIVERSITY FOR DEVELOPMENT STUDIES, IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF A MASTER OF SCIENCE DEGREEE IN DEVELOPMENT MANAGEMENT

APRIL, 2015

DECLARATION

Student

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

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Supervisor

I hereby declare that the preparation and presentation of the thesis was supervised in accordance with the guidelines on the supervision of thesis laid down by the University for Development Studies.

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ABSTRACT

The study sought to establish public perception of Zoomlion's solid waste management services in the Tamale Metropolis. The study employed the case study research design in collecting and analyzing data from 150 respondents through the use of structured questionnaires and interview guides. The study established that there is marked improvement in waste management in the Tamale Metropolis by Zoomlion Ghana Limited. Significant proportions of respondents now dump their household waste in communal containers and waste-bins instead of using unapproved places like gutters and open spaces. In this regard, respondents had good impression about the activities of the company and were quite satisfied with their services in terms of provision of waste dumping containers, waste collection, clearing of heaps of waste and cleaning of all gutters of filth. Despite these achievements of the company, the study revealed that it had not been able to frequently collect waste as expected. Additionally, the study showed that the company lacked the needed equipment and logistics to effectively manage waste in the Metropolis. Key among them were: waste-bins, skip-trucks, compaction trucks, bulldozers and Roll on/Roll off trucks. The study therefore concluded that despite the inability of the company to regularly manage the city's waste coupled with some other challenges, Zoomlion Ghana Limited, entrusted with the responsibility of providing waste management services in the Tamale Metropolis, had been able to deliver the services as expected to some extent and as such their services have been perceived by residents as good. The study therefore recommends the need for the company to procure the required equipment and logistics to help boost their

operations in the area of waste management in the metropolis. This will help rid the metropolis of filth and enhance the company's core mandate of green, clean and healthy communities.

ACKNOWLEDGEMENTS

My first thanks go to the Almighty God for His Grace and Guidance throughout this work. My special thanks go to my supervisor, Dr. Osumanu Kanton Issaka, for his guidance and valuable suggestions towards the output of this work.

I am also grateful to the staff of the Tamale Metropolitan Assembly for their assistance with vital information and collection of data for this work. I am equally grateful to the Management and staff of Zoomlion Ghana Limited-Northern Region for their assistance, especially Mr. Volsuuri, the Regional Manager, who spent their precious time responding to my interviews. My indebtedness also goes to Felix Puopiel for his priceless role in this work. I will never forget the goodwill of Mr. Bebelleh Frederick, Mr. Kosoe Akwasi Enoch and Mr. Abirigo Francis for the encouragement in my pursuit of this work.

My commendations go to Bernard Alando, Edward Bawa and Paul Asianab for always being there for me, both in my difficult and joyful times. To my classmates, Robert Tawia and Romanus Zeim, I extend my appreciation for your company and mentoring through the years of our study together. To my long time pals Alhassan, Duut Sebastian, Alexis Buunaaim, Atimolga Joseph, John Adore, Fred Yiryel, and Francis Dompae for keeping our friendship alive with your company and support all this while, thank you.

DEDICATION

I dedicate this work to my parents, Mr. and Mrs. Ontoaneyin, for inspiring me to persevere and pursue this degree.

Contents

ACRONYMS

DESSAPs	District Level Environmental Sanitation Strategies and Action Plans EHSDs Environmental Health and Sanitation Departments
ESICOME	Expanded Sanitary Inspection and Compliance Enforcement
EPA	Environmental Protection Agency
ESP	Environmental Sanitation Policy
GYEEDA	Ghana Youth Entrepreneurial Enterprise Development Authority
ISWM	Integrated Solid Waste Management
KNUST	Kwame Nkrumah University of Science and Technology
MEST	Ministry of Environment, Science and Technology
MMDAs	Metropolitan, Municipal and District Assemblies
MLGRD	Ministry of Local Government and Rural Development
MSW	Municipal Solid Waste
NESPoCC	National Environmental Sanitation Policy Coordination Council
NYEP	National Youth Employment Programme
SPSS	Statistical Package for Social Science
TAMA	Tamale Metropolis

USPS	Urban Sector Programme Support
USEPA	United States Environmental Protection Agency
UK	United Kingdom
UNEP	United Nations Environmental Programme
WHO	World Health Organization
WMDs	Waste Management Department

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

The situation of environmental sanitation in African countries over the years has not been a healthy one. Waste Management, a major component of environmental sanitation, has, over the years to date, been a major headache of successive central government and local authorities (Agyepong, 2011). Shan (1989) in Abdul-Yahaya and Owusu-Sekyere (2012), therefore recommended privatization and award of contracts to private waste management contractors in other to ensure proper waste management services, managerial competence and efficiency.

A United Nations Population Fund (UNFPA) report revealed that, more than half of the 3.3 billion human populations live in towns and cities. This number is projected to swell to about 5 billion by 2030 (UNFPA, 2008). The challenge that such potential population growth presents to decision makers and planners in meeting corresponding needs for food, shelter and waste management is complex. For instance, rapid urban growth in Africa comes with the need for provision of sufficient food on sustainable basis as well as adequate and safe waste management. Countries with fast growing urban populations face serious waste disposal problems mainly because the rate of waste generation is often not matched by improvement in management and disposal of the waste materials. Studies have shown that the large amounts of garbage generated in urban settlements mostly come from households, schools, medical facilities and industrial activities (Boadi and Kuitunen, 2004).

According to the United Nation (UN) Report (2013), in 2011, almost two thirds (64%) of the world, relied on improved sanitation facilities. Since 1990, almost 1.9 billion people have gained access to an improved sanitation facility. The greatest progress has been made in Eastern Asia, where sanitation coverage increased from 27% in 1990 to 67% in 2011. However, the same cannot be said about Sub-Saharan Africa and Southern Asia, where current trends show they still struggle with low sanitation coverage. In sub-Saharan Africa, 44 per cent of the population uses either shared or unimproved facilities, and an estimated 26 per cent practices open defecation. Environmental sanitation is an important factor that contributes to the health, productivity and welfare of the people of Ghana (GOG, 2001). Indeed, it was highlighted in the "Vision 2020" document as a key element underlying health and human development. Solid waste collection was therefore targeted as means of achieving targets in environmental sanitation.

In Ghana, the waste management problems are national in character and complicated by population pressures in the heavily populated cities including Tamale. A combination of poor governance and human factors have been cited as reasons for the resultant refuse piles and chocked drains in the major cities in the country (Hardoy and Satterthwaite, 1993).

Several approaches have been suggested in order to improve solid waste management in developing countries ranging from environmental awareness campaign through mass media and advertisement by Chan (1998). In another study by Anjum and Deshazo (1996), they proposed an integrated demand-side information into the planning process and recommended the need for involvement

of urban households in Solid Waste Management (SWM) planning. To ensure proper waste management and sanitation in Ghana, the Ghana government in 2006 contracted the services of Zoomlion Ghana Limited to augment the efforts of the Metropolitan, Municipal and District Assemblies (MMDAs) across the country. The need to invite a private company was prompted by the fact that MMDAs had not been able to manage the waste generated efficiently over the years due to the fact that they lacked the needed resources (Mensah, 2010 in Abdul-Yahaya and Owusu-Sekyere, 2012). The company was therefore contracted to operate throughout the country with assistance from the assemblies in the form of providing them with project staff (beneficiaries) through the recruits of National Youth Employment Programme (NYEP).The aim of government was to include efforts from all sectors such as the public-private partnership agreement to enhance proper disposal of waste generated across the regions in the country (Government of Ghana, 1999 in Abdul-Yahaya and Owusu-Sekyere, 2012).

Zoomlion Ghana Limited, a leading waste management company in Ghana today began its operations in 2006. It currently handles 70% of the solid waste generated in the towns and cities of Ghana. The company currently operates in all Metropolitan/Municipal/District Assemblies in the country. The range of services include among others: solid waste collection, landfill management, landscaping and beautification services, janitorial and indoor cleaning services, vector control services, cesspit empting services, fabrication and sale of refuse containers. The company has also ventured into other sectors, such as agriculture, heavy duty equipment hiring, sale and rental of construction and waste management equipment

as well as oil waste management services (Agyepong, 2011). In addition, the company is in collaboration with local and internationally renowned institutions, like the Kwame Nkrumah University of Science and Technology (KNUST) and the University of Western Ontario in Canada is establishing a Waste Management University to train sector workers in waste management practices at degree, diploma and certificate levels.

1.2 State of the Research Problem

In recent times solid waste management has become a major problem in Ghana and Tamale Metropolis in particular. Indiscriminate dumping, irregular collection, poor storage and inadequate resources are the main problems facing the management of solid waste in the Metropolis. Anecdotal evidence suggests that less than 50% of urban residents are served by a solid waste collection service. According to Puopiel (2010), out of 810 tonnes of waste generated daily in the Tamale Metropolis, 216 tonnes is hauled leaving a backlog of 594 tonnes uncollected, possing a major challenge to the health of residence, environmental degradation and negative impact on the socio-economic activities of residence within the Metropolis.

In Ghana, a study made by Attipoe, 1996, estimated environmental related diseases reported in the capital Accra to be between 60-80%. This finding is in fact a reflection of sanitation and in particular solid waste management situation in Accra and the country as a whole.

Wastes uncollected are a major problem to the environment, especially on the air that the people inhale. These equally emit obnoxious odours and smoke that cause illness to people living in, around, or closer to them. Marshal (1995)

In a number of community health surveys, a wide range of health problems, including respiratory symptoms, irritation of the skin, nose, and eyes, gastrointestinal problems, psychological disorders, and allergies, have been discovered. A number of researches have been carried out in response to concerns from the public, often triggered by nuisances caused by emissions of volatile organic compounds.

Meanwhile, the government of Ghana in the year 2006 went into partnership with Zoomlion Ghana Limited- the leading waste management company in Ghana to help rid the city of filth and other related diseases which will culminate into clean and healthy environment. This was because Metropolitan, Municipal and District Assemblies (MMDAs) could not effectively tackle the sanitation problem in the country as expected.

In the light of this, has Zoomlion Ghana Limited been able to live up to its mandate? The study therefore seeks to assess public perceptions about the operations of Zoomlion as a domestic waste management company in the Tamale Metropolis.

1.3 Research Questions

The main research question of the study is: what are people's perceptions about Zoomlion's solid waste management services in the Tamale Metropolis? The specific questions are:

i. What are households' perception about the current waste management practices and coverage of Zoomlion in Tamale?

ii. What are the perceived impacts of Zoomlion's waste management services?

iii. What are the challenges with the current waste management services provided by Zoomlion?

1.4 Objectives of the Study

The main objective of the study is to examine public perceptions about Zoomlion's solid waste management services in the Tamale Metropolis. The specific objectives are:

i. To examine households' perception about the current waste management practices and coverage of Zoomlion in the Tamale Metropolis.

ii. To assess the perceived impacts of Zoomlion's waste management services.

iii. To examine the challenges associated with the current waste management services provided by Zoomlion.

1.5 Significance of the Study

The significance of any academic work that is research-oriented had been established by Marshall and Rossman (1995) in three key areas: the linkage of the study to large practical and theoretical problem; concern of practice; and social policy issues. This study will be relevant in all three respects.

The essence of this research will be to assess the impact of the waste and sanitation module of the National Youth Employment Programme (NYEP) now Ghana Youth Entrepreneurial Enterprise Development Authority (GYEEDA) under Zoomlion to answer a series of questions arising from urbanization and its intended effects on solid waste management since it has become a major aspect of urbanization, modern lifestyle and public perceptions about services rendered by Zoomlion, production and transportation of waste generated in the Metropolis.

Furthermore, a number of researches have been conducted on the contribution of measures towards household solid waste management and this study will complement other researches already carried out. One other ultimate objective of any scientific study is to identify information relevant to improve upon the existing situations, the study will help Zoomlion Ghana Limited improve upon their services rendered in the entire country. The study will also aim at contributing to knowledge on an efficient and effective waste management option in Ghana and in the Tamale Metropolis in particular and in this direction, the outcome of this study will provide a frame of reference on social policy issues concerning effective household solid waste management.

1.6 Delimitations of the Study

Geographically, the study area covered Central Sub-Metro of Tamale Metropolis in the Northern Region of Ghana. The Sub-Metro was chosen because it is a densely populated area in the Tamale Metropolis and as such contributed about 60% of waste generated. Contextually, the study focused on perception about domestic solid waste management services by Zoomlion Ghana Limited. This is because about 80% of solid waste generated in the Metropolis comes from domestic sources.

1.7 Limitations of the Study

Limitations are inevitable in every research. One major problem faced by the researcher was the difficultiy in getting respondents to respond to the questionnaires. This was due to the fact that most of them were business people and hardly sat at home particularly week days. Other respondents were not just willing for reasons best known to them.

Another limitation that cannot be ignored was time constraint. The time limit given for the submission of the final draft of this work coupled with tight work schedule was a major constraint in carrying out this work. Financial constrains was also a serious constraint on the researcher since the research required the use of some financial resources to be able to secure the necessary information. This included the use of the internet, travelling from one location to the other, printing of materials and some other cost that have not been mentioned. This led to serious financial burdens on the researcher. These and many other constrains limited the research in

one way or the other. In spite of the limitations above, the researcher's work was carried out successfully and there is no doubt about the credibility of the research.

1.8 Organisation of the Study

The study is presented in five chapters. Chapter one provides a general introduction to the study. It highlights the problem statement, research questions, objectives of the study and significance of the study. Chapter two examines existing literature on solid waste management providing conceptual and empirical issues. Chapter three describes the study area and methodology employed in gathering data from the field for analysis. It captures the profile of the study area, demographic characteristics, profile of Zoomlion Ghana Limited, research design, sampling design, data collection instruments as well as methods of data analysis. Chapter four is devoted to findings gathered from the field. Here the results gathered from the field is discussed extensively. Chapter five summarizes the key findings of the study, conclusion and recommendations. The next chapter reviews literature on solid waste management.

CHAPTER TWO

LITERATURE REVIEW AND CONCEPTUAL ISSUES

2.1 Introduction

This chapter of the study reviews critical literature on solid waste management. It is segmented into three (3) thematic areas namely conceptual issues, empirical framework and Waste Management Regulation and Policy in Ghana. The conceptual issues encapsulate the concept of solid waste and solid waste management. The second part of the review assesses empirical literature on solid waste management with focus on Zoomlion's activities in managing solid waste and the third section highlights waste management regulation and policy in Ghana. The chapter concludes with summary, drawing lessons from the literature on solid waste management.

2.2 Conceptual Issues

This section discusses conceptual issues on solid waste management. These are solid waste, solid waste management, methods of solid waste management and challenges of managing solid waste. Therefore, the next sub-section operationalizes the concept of solid waste.

2.2.1 Solid Waste

The term solid waste has been defined differently by various authors. According to in Puopiel (2010), in Tchnobanoglous *et al* (1993), solid waste is any material that

arises from human and animal activities that are normally discarded as useless or unwanted. Zerbock (2003), on the other hand indicates that solid waste includes non-hazardous industrial, commercial and domestic waste including: household organic trash, street sweepings, institutional garbage and construction wastes. Operationally, it can therefore be said that, solid waste is any material which comes from domestic, commercial, and industrial sources arising from human activities which has no value to people who possess it and is discarded as useless.

2.2.2 Sources and Types of Solid Waste

There are various classifications of solid waste but Tchobanoglous *et al* (1993) give a more apt classification. They classified solid wastes in relation to the sources and generation facilities, activities, or locations associated with each type which is presented in Table 2.1

Table 2.1: Sources, Typical Location and Types of Solid Waste

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

Source: Tchobanoglous et al 1993 p.52-53.

Tchobanoglous _ *et al*_ (1993), in Puopiel (2010), have further explained the types of solid waste which include food waste, rubbish, ashes and residues and special waste.

- *Food waste:* Food wastes are all the animal, plant or vegetable residues resulting from the handling, preparation, cooking, and eating of foods (also called garbage). The most important characteristics of these waste is that they are highly putrescible and will decompose rapidly, especially in warm weather. Often, decomposition will lead to the development of offensive odors. In many locations, the putrescible nature of these wastes will significantly influence the design and operations of solid waste collection.
- *Rubbish:* Rubbish consists of combustible and non- combustible solid wastes of households, institutions and commercial activities. This excludes food wastes or other highly putrescible materials. Typically, combustible rubbish consists of materials such as paper, cardboard, plastics, textiles, rubber, leather, wood, furniture, and garden trimmings. Non-combustible rubbish consists of glass, tin cans, aluminium cans, ferrous and other non-ferrous metals, and dirt.
- *Ashes and Residues:* These are materials remaining from the burning of wood, coal, coke and other combustible wastes in homes, stores, institutions, and industrial and municipal facilities for purposes of heating, cooking and disposing of combustible wastes. These are referred to as ashes and residues.
- *Special waste:* Special waste includes street sweepings, roadside litter and litter from municipal containers, catch-basin debris, dead animals and abandoned vehicles.

The Centre for Environment and Development (2003), has also classified types of solid waste based on origin (food waste, rubbish, ashes and residues, demolition, construction and agriculture waste), based on characteristics (biodegradable and non-biodegradable), based on the risk potential (hazardous waste). The Centre also enumerated sources of solid waste as residential, waste from shops, commercials establishment, hotels/restaurants/eating stalls, slaughter houses and others. This has confirmed the sources and types of solid waste outlined by Tchobanoglous _*et al*_ (1993). Based on the types of solid waste enumerated by Tchobanoglous _*et al*_ (1993) and the Centre for Environment and Development (2003), it can be said that types of solid waste include the following: food waste, rubbish, ashes and residues, demolition and construction, and agriculture waste. The sources of solid waste also include domestic, commercial and industrial.

2.2.3 Components of Solid Waste

Solid waste consists of many different materials: combustibles and non-combustible materials. Some can burn, some cannot. Some can be recycled, some cannot. Therefore, a detailed understanding of the composition of solid waste will indicate the management methods that will be used. The combustible materials include paper, plastics, yard debris, food waste, wood, textiles, disposable diapers, and other organics. Non-combustibles also include glass, metal, bones, leather and aluminium (Denison and Ruston 1990; Kreith 1994 and Zerbock 2003).

2.2.4 Solid Waste Management

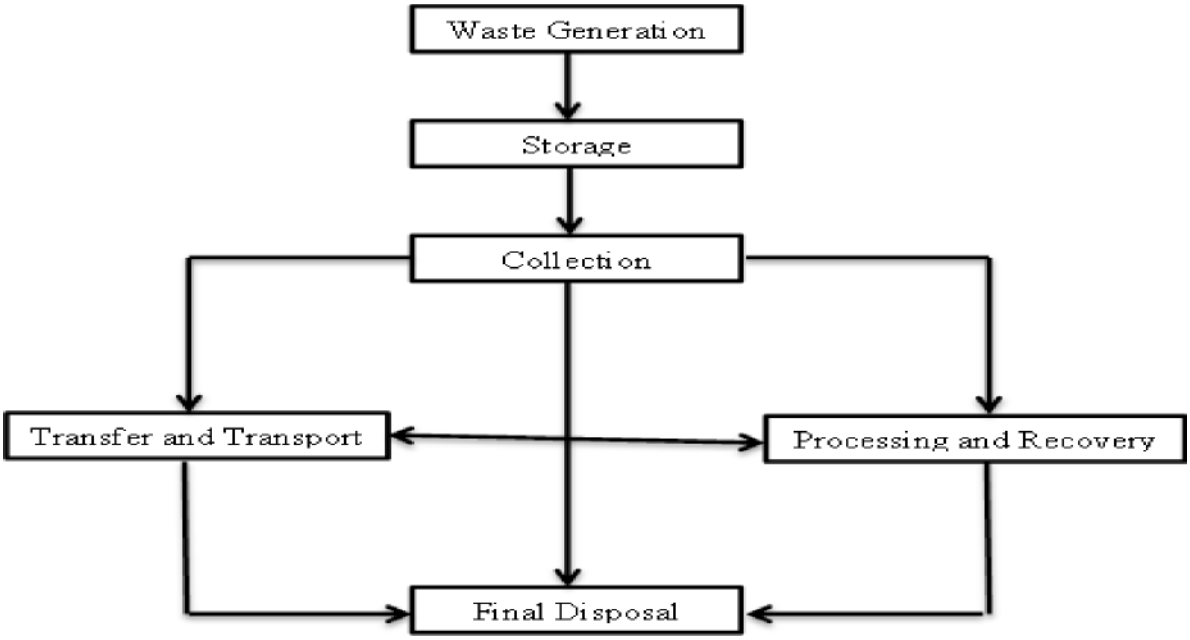
The term solid waste management has been viewed differently by various authors. Kumah (2007: 2) defines solid waste management as "the administration of activities that provide for the collection, source separation, storage, transportation, transfer, processing, treatment, and disposal of waste". However, Tchobanoglous _et al_ (1993: 7), provide a more comprehensive definition of solid waste management. According to them, solid waste management is:

".....that discipline associated with the control of generation, storage, collection, transfer and transport, processing and disposal of solid wastes in a manner that are in accord with the best principles of public health, economics, engineering, conservation, aesthetics and other environmental considerations and that is also responsive to public attitudes".

Therefore, if solid waste management is to be accomplished in an efficient and orderly manner, the fundamental aspects and relationships involved must be identified and understood clearly (Tchobanoglous *et al*, 1993). On the basis of this, solid waste management incorporates the following: source separation, storage, collection, transfer and transport, processing and recovery and final disposal of solid waste in an environmentally sustainable manner as illustrated figure 2.1.

As shown in Figure 2.1, the key elements in solid waste management include: waste generation, storage, collection, transfer and transport, processing and recovery and final disposal. This means that when waste is generated it is first stored in either dustbin or skip (container). It is then collected and finally disposed of in landfill.

Figure 2.1: Key Elements of Solid Waste Management



Source: Tchobanoglous *et al.*, 1993.

Also, when waste is collected it can be transferred from small collection equipment like the tricycle to a bigger skip for final disposal. On the other hand, waste collected can be processed and recovered for materials to be reused. These elements are further elaborated below.

2.2.4.1 Waste Generation

Released on June 6, 2012, the report titled "What a Waste: A Global Review of Solid Waste Management", said a sharp rise in the amount of garbage generated will come from urban residents between now and 2025. The report estimates that the amount of municipal solid waste (MSW) will rise from the current 1.3 billion

tonnes per year to 2.2 billion tonnes per year by 2025, with much of the increase coming in rapidly growing cities in developing countries.

Waste generation encompasses those activities in which materials are identified as no longer being of value and are either thrown away or gathered together for disposal (Momoh and Oladebeye, 2010). According to the United Nations Environmental Programme (UNEP) (2009), in 2006 the total amount of municipal solid waste (MSW) generated globally reached 2.02 billion tones, representing a 7 per cent annual increase since 2003. It further estimated that between 2007 and 2011, global generation of municipal waste will rise by 37.3 per cent, equivalent to roughly 8 per cent increase per year (UNEP, 2009). UNEP also says that, as per World Health Organization (WHO) estimations, the total health-care waste per person per year in most low income countries, is anywhere from 0.5 kg to 3 kg. That not withstanding, the causes of this increase should have been enumerated by the organization and therefore, has not exhausted the issue on discussion. It is accepted that solid waste generation is increasing at a faster rate globally as indicated by UNEP and this is confirmed by Mensah and Larbi (2005), concerning solid waste generation in Ghana.

2.2.4.2 Storage

Tchobanoglous_*et al.*_ (1977), explain storage to mean where solid waste is stored before it is collected. It could be stored in a skip or dustbin and not thrown away indiscriminately. According to them, storage is of primary importance because of the aesthetic consideration.

2.2.4.3 Collection

The element of collection includes not only the gathering of solid waste, but also the hauling of waste after collection to the location where the collection vehicle is emptied (Kreith, 1994). According to Kreith (1994), the most common type of residential collection services in the United States include "curb", "setout-setback" and "backyard carry". According to the Urban Sector Programme Support (USPS) (2000), in the city of Thimphu in Bhutan the collection of solid waste from households, commercial set-ups was done in concrete receptacles placed at strategic points and conveyed by trucks/tractors. Accordingly, there were concrete bins and containers provided at various locations from where the waste was lifted for disposal. Individual bins/containers were also placed alongside the shops in certain areas, which were emptied directly into the trucks/tippers. This prevents people from dumping waste indiscriminately. On the other hand, the building of these concrete bins and containers may be expensive to do in Ghana and for that matter Tamale metropolis.

2.2.4.4 Transfer and Transport

According to Kreith (1994), transfer and transport involves two steps: (i) the transfer of wastes from the smaller collection vehicle to the larger transport equipment and (ii) the subsequent transport of the wastes, usually over long distances to the final disposal site.

2.2.4.5 Processing and Recovery

The element of processing and recovery includes all the technology, equipment, and facilities used both to improve the efficiency of other functional elements and to recover usable materials, conversion products or energy from solid wastes (Tchobanoglous *et al,* 1977). In the recovery, separation operations have been devised to recover valuable resources from the mixed solid wastes delivered to transfer stations or solid waste processing plants (Tchobanoglous *et al,* 1977).

2.2.4.6 Disposal

Disposal is the ultimate fate of all solid wastes, whether they are residential wastes uncollected and transported directly to landfill site. Having explained the various elements in the diagram by some authorities, the next section analysis in further details the final disposal methods of solid waste. Several methods of solid waste management have evolved over the years. These methods according to the Centre for Environment and Development (2003) vary greatly with types of wastes and local conditions. The next section highlights on the methods of waste management.

2.2.5 Methods of Managing Solid Waste

In the contemporary era, the methods of managing solid waste include source reduction, sanitary landfills, composting, recycling, and incineration (Denison and Ruston, 1990 in Puopiel, 2010).

2.2.5.1 Source Reduction

Denison and Ruston (1990) viewed source reduction as any action that reduces the volume or toxicity of solid waste prior to its processing and disposal in incinerators or landfills. This view is similar to the one given by Kreith (1994). According to him, source reduction focuses on reducing the volume and /or toxicity of waste generated. Source reduction includes the switch to reusable products and packaging, the most familiar example being returnable bottles. According to Urban Sector Programme Support (USPS) (2000) in the city of Thimphu in Bhutan to reduce waste problems in future, reduction in waste generation would be the most important factor. Examples of possible reduction at the consumption level include reuse of containers (including bags), better buying habits, and cutting down on the use of disposable products and packaging (USPS, 2000).

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

2.2.5.2 Sanitary Landfill

Sanitary land filling includes confining the waste, compacting it and covering with soil. It not only prevents burning of garbage but also helps in reclamation of land for valuable use (Centre for Environment and Development, 2003). The placement of solid waste in landfills is the oldest and definitely the most prevalent form of ultimate waste disposal (Zerbock, 2003). He further argued that "landfills" are nothing more than open, sometimes controlled dumps. According to him the difference between landfills and dumps is the level of engineering, planning, and administration involved. Open dumps are characterized by the lack of engineering measures, no leachate management, no consideration of landfill gas management, and few, if any, operational measures such as registration of users, control of the number of "tipping fronts" or compaction of waste (Zerbock, 2003).

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

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

2.2.5.3 Recycling

According to Momoh and Oladebeye (2010), recycling has been viewed as a veritable tool in minimizing the amount of household solid wastes that enter the dump sites. It also provides the needed raw materials for industries. According to them, it has been established that, it is the best, efficient and effective method of solid waste management system. However, this may not be cost effective in developing countries like Ghana. The United States Environmental Protection Agency (USEPA) (1999), has recommended recovery for recycling as one of the most effective waste management techniques. According to USEPA, recycling turns materials that would otherwise become waste into valuable resources and, it yields environmental, financial, and social returns in natural resource conservation, energy conservation, pollution prevention, and economic expansion and competitiveness. More importantly, a sizeable portion of what is thrown away contains valuable

resources such as metals, glass, paper, wood, and plastic that can be reprocessed and used again as raw materials (USEPA, 1999).

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

2.2.5.4 Composting

Composting process uses microorganisms to degrade the organic content of the waste. Aerobic composting proceeds at a higher rate and converts the heterogeneous organic waste materials into homogeneous and stable humus (Centre for Environment and Development, 2003). UNEP (2009), has also defined composting as a biological decomposition of biodegradable solid waste under controlled predominantly aerobic conditions to a state that is sufficiently stable for nuisance-

free storage and handling and is satisfactorily matured for safe use in agriculture. According to the UNEP (2009), composting is the option that, with few exceptions, best fits within the limited resources available in developing countries. A characteristic that renders composting especially suitable is its adaptability to a broad range of situations. According to Zerbock (2003), a low-technology approach to waste reduction is composting. He further says that in developing countries, the average city's municipal waste stream is over 50 % organic material.

2.2.5.5 Incineration

According to the Centre for Environment and Development (2003), incineration is a controlled combustion process for burning combustible waste to gases and reducing it to a residue of non-combustible ingredients. According to the Centre, during incineration, moisture in the solid waste gets vapourised and the combustible portion gets oxidised and vapourised. $C0_2$, water vapour, ash and non-combustible residue are the end products of incineration. Incinerators have the capacity to reduce the volume of waste drastically, up to nine fold than any other method (Kreith, 1994).

According to him incineration can also recover useful energy either in the form of steam or electricity. He however recognised that the main constraints of incineration are high cost of operation, relatively high degree of sophistication needed to operate them safely and economically as well as the tendency to pollute the environment through emissions of carbon dioxide. Having assessed the major methods that have been proposed by the various authors, literature has further revealed that there is an

alternative method of managing solid waste effectively which is synonymous to waste reduction and recycling as mentioned earlier on. This forms the next section of the review.

2.2.5.6 Integrated Solid Waste Management

As a residual component of the production and consumption processes, waste cannot be completely avoided. There are problems associated with all forms of waste disposal. This situation has been instrumental in redefining contemporary solid waste management practices. An integrated solid waste management is oriented towards emphasizing management options that have the least negative impact on the environment. This involves categorizing waste management options into different levels. The categorization can vary from one country to another.

According to UNEP (2009), the World Bank estimates that in developing countries, it is common for municipalities to spend 20 to 50 percent of their available budget on solid waste management, even though 30 to 60 percent of all the urban solid wastes remain uncollected and less than 50 percent of the population is served. The programme (UNEP) suggested that if most of the waste could be diverted for material and resource recovery, then a substantial reduction in final volumes of waste could be achieved and the recovered material and resources could be utilized to generate revenue to fund waste management.

This forms the premises for the Integrated Solid Waste Management (ISWM) system based on 3Rs (reduce, reuse and recycle) principle**.** ISWM system has been pilot tested in a few locations (Wuxi, PR China, Pune, India, Maseru, Lesotho) and

has been well received by local authorities. It has been shown that with appropriate segregation and recycling system significant quantities of waste can be diverted from landfills and converted into resource (UNEP, 2009). Similarly, the United States Environmental Protection Agency (1999) has said that if a state or local government wants to plan for and implement ISWM, they have to consider a hierarchy of methods which are reduce, recycle, and incinerate/landfill. For example in Europe, four waste management hierarchies are prescribed in European Council Framework Directive on waste management (75/442/EEC). The options from the most preferred to the least preferred level are: 1st source reduction, 2nd material recycling, 3rd energy recovery, and 4th final disposal (Geigrich, 2004).

2.3 Challenges of Solid Waste Management

According to Ogawa (2005) in Puopiel (2010), a typical solid waste management system in a developing country displays an array of problems, including low collection coverage and irregular collection services, crude open dumping and burning without air and water pollution control. He categorised these challenges into technical, financial, institutional and social constraints. He further discussed these constraints in relation to the sustainability of solid waste in developing countries.

2.3.1 Technical Constraints

According to him, in most developing countries, there are inadequate human resources at both the national and local levels with technical expertise necessary for

solid waste management planning and operation. Many officers in charge of solid waste management, particularly at the local level, have little or no technical background or training in engineering or management. Additionally, research and development activities in solid waste management are often given low priority in developing countries. The lack of research and development activities in developing countries leads to the selection of inappropriate technology in terms of the local climatic and physical conditions, financial and human resource capabilities, and social or cultural acceptability. As a result, the technology selected can never be used, wasting the resources spent and making the project unsustainable.

2.3.2 Financial Constraints

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

2.3.3 Institutional Constraints

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

".....The lack of coordination among the relevant agencies often results in different agencies becoming the national counterpart to different external support agencies for different solid waste management collaborative projects without being aware of what other national agencies are doing. This leads to duplication of efforts, wasting of resources, and unsustainability of overall solid waste management programmes. The lack of effective legislation for solid waste management, which is a norm in most developing countries, is partially responsible for the roles/functions of the relevant national agencies not being clearly defined and the lack of coordination among them" (Ogawa,2005: p.2 in Puopiel, 2010).

According to him, Legislation (Public Health Act, Local Government Act, Environmental Protection Act) related to solid waste management in developing countries is usually fragmented. The rules and regulations are enforced by the different agencies. However, there are often duplication of responsibilities of the agencies involved and gaps/missing elements in the regulatory provisions for the development of effective solid waste management systems. It should be also noted that legislation is only effective if it is enforced. Therefore, comprehensive legislation, which avoids the duplication of responsibilities, fills in the gaps of

important regulatory functions, and is enforceable, is required for sustainable development of solid waste management systems.

Because of a low priority given to the sector, the institutional capacity of local government agencies involved in solid waste management is generally weak, particularly in small cities and towns. Local ordinance/by-laws on solid waste management is not also well developed. These weak local government institutions are not provided with clear mandates and sufficient resources to fulfil their mandates. In large metropolitan areas where there are more than one local government, coordination among the local governments is critical to achieve the most cost-effective alternatives for solid waste management in the area. For instance, the siting of a solid waste transfer station or disposal facility for use by more than one local government is cost-effective due to its economy of scale. However, as these facilities are usually considered unwanted installations and create not-in-my-backyard (NIMBY) syndromes among the residents, no local government is willing to locate them within its boundary. The lack of a coordinating body among the local governments often leads to disintegrated and unsustainable programmes for solid waste management.

Zurbrugg (2009) further added that, solid waste collection schemes of cities in the developing world generally serve only a limited part of the urban population. The people remaining without waste collection services are usually the low-income population living in peri-urban areas. According to him, one of the main reasons is the lack of financial resources to cope with the increasing amount of generated waste produced by the rapid growing cities. Often inadequate fees charged and

insufficient funds from a central municipal budget cannot finance adequate levels of service. He indicated that, apart from financial constraints that affect the availability or sustainability of a waste collection service; operational inefficiencies of solid waste services such as deficient management capacity of the institutions and inappropriate technologies affect effective waste management. Zurbrugg (2009) therefore underscores the key challenges of waste management which include financial and institutional constraints.

In Ghana, Boadi and Kuitunen (2004), point out some of the problems affecting solid waste management. These include: weak institutional capacity and lack of resources; both human and capital. They also indicated that, 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. Furthermore, the Ministry of Local Government and Rural Development (MLGRD) (2004) summarises the challenges of solid waste management in Ghana as follows: poor planning for waste management programmes; inadequate equipment and operational funds to support waste management activities; inadequate sites and facilities for waste management operations; inadequate skills and capacity of waste management staff; and negative attitudes of the general public towards the environment in general. It can therefore be said that the main challenges facing solid waste management in developing countries and for that matter Ghana include: inadequate funds to support waste management, inadequate equipment to support waste storage, collection and

disposal, low collection coverage and irregular collection services, crude open dumping and burning without air and water pollution control.

2.4 Private Sector Participation in Solid Waste Management

The term Private Sector Participation" refers to processes that increase the involvement of formal private enterprises in sanitary service provision and management but does not necessarily amount to the transfer of assets to the private operator (Dinye, n.d). Hartman (1995) in Dinye (n.d) noted that the provision of solid waste management via the private sector promotes high efficiency, equity and accountability to users and financiers. Idelovitsch and Ringskog (1995) in Dinye (n.d) indicate that the efficiency gains result in cost savings that can generate investment funds through easy access to private capital. The situation is not such that there is no known means of dealing with the solid waste problems in Third World cities and therefore in Ghana. Available literature indicate that more effective environmental and specifically sanitation policies can emanate from the stand point of questions addressing issues of governance, political will, poor management, available resources, inter-agency rivalry, poor data collection and lack of information, equity and popular attitudes (Fransen,1999 in Dinye, n.d).

Private Sector participation in utility service provision and management is rooted in the broad conception of privatization which is an embodiment of the neo-liberal orthodoxy. The neo-liberal ideology holds that social as well as economic functions should be undertaken by businesses under a free market mechanism. Within that context, the state through the political process is to play a facilitating and regulatory

role without direct engagement (Gutierrez, 2001 in Dinye, n.d). According to Fransen (1999) in Dinye (n.d), the main driver for a successful private sector involvement in solid waste management is competition, accountability and transparency between customers and service providers. Cointreau (1994) in Dinye (n.d), identified contracting, concession, franchaise and open competition as the most common types of private sector participation in solid waste management.

According to Mibuika (2001), where direct comparison could he made between public and private solid waste service providers (in terms of efficiency, effectiveness, equity and utility), it was found out that small firms performed better than the public sector in Ghana. However, with the exception of ABC waste management company, the public sector delivered at lower cost per ton collected than the private sector. It was not however; possible to draw from this, the general conclusion that privatisation means greater efficiency and effectiveness over all. He further added that, the greater volumes of waste collected by KWML Company are partly due to the fact that they were better rewarded. The weak institutional capacity of the private firms directly reflected in low performance.

2.5. Empirical Framework

There are a number of studies that have been conducted on the solid waste management by Zoomlion Ghana Limited in various MMDAs in Ghana. One of such studies was conducted by Puopiel (2010), on Solid Waste Management in the Tamale Metropolis. According to him, there were three main modes of waste collection in the Metropolis by Zoomlion. These were: door-to-door, curb and

communal dumpsites. The analysis of the study further shows that, waste was collected directly from yards of respondents (door-to-door) while others were collected outside their yards (curb). The door-to-door and curb modes of waste collection were carried out mainly in the high class residential areas such as Kalpohin Estates, SSNIT Flats and Vitting Estates. However, in the low class residential areas in the Metropolis the main mode of waste collection in areas was through communal containers. The waste collected was finally disposed off in a landfill located at Gbalahi, a suburb of Tamale metropolis.

On regularity of solid waste collection, Puopiel (2010) indicated that waste was collected twice a week and in some instances once a week as indicated by Zoomlion. In some areas like Russian bungalows and Education Ridge where collection are to carried out daily, that did not take place at all. The frequency of hauling waste particularly on low class residential areas were even worse. This brought about heaping of waste in dumpsites and skips (communal containers) overflowing with waste particularly in the low class residential areas. Table 2.2 further summarises the mode and number of times waste was collected in a week in the selected areas of the study in the metropolis given by the Zoomlion Ghana Limited.

Table 2.2: Mode and Number of Times of Waste Collection Per Week

Residential Area/Section	Mode of Collection	No. of Times in a Week
Low Class Residential Areas		
Aboabo	Communal	5
Choggu	Communal	3
Lamashegu	Communal	4
Moshi Zongo	Communal	4
Nyohini	Communal	3
Sakasaka	Communal	3
Middle Class Residential Areas		
Education Ridge	Communal	1
Ghanasco	Communal	1
Russian Bungalows	Communal/Door-todoor	1
High Class Residential Areas		
Kalpohin Estates	Door-to-door	2
SSNIT Flats	Door-to-door	
Vitting Estates	Door-to-door	2

Source: Puopiel, 2010

From Table 2.2 above, the average number of times that waste was collected in low class residential areas was thrice a week as opposed to the minimum of four times a week. Therefore, a lot of waste was generated in these areas. In the middle class residential areas, waste was collected once a week. This is because these areas were supposed to demand door-to-door collection in the Metropolis which they did not do. As a result Zoomlion did not find it prudent to communally collect waste from these areas like the low class residential areas. This is because Zoomlion felt the

people in the middle class were capable of paying for the door-to-door collection. But respondents also gave a contrary view. According to them, door-to-door services were expensive. Additionally, though Zoomlion Ghana Limited indicated that waste was collected at least once a day in the middle class residential areas, the survey conducted by Puopiel revealed a different view. In some areas like Education Ridge and Russian bungalows, collection did not take place at all.

This resulted in people dumping their waste at unapproved sites and in some cases burning the waste. During the field investigation it was observed that a lot of skips (communal containers) were overflowing with waste uncollected for days in the low class residential areas (Puopiel, 2010).

More so, a study conducted by Abdul-Yahaya and Owusu-Sekyere (2012), with regard to public perception on solid waste management in the Wa Municipality revealed that the sanitation situation in the municipality still needed much to be done. According to them, 47.8% of the respondents indicated that Zoomlion offered poor sanitation services, 22.2% indicated fair, 13.3% for very good services and 16.7% were in support of good. It means that natives and residents in the Wa municipality were not satisfied with the services being rendered by Zoomlion Ghana Limited and secondly their study revealed the need for a more comprehensive sensitization programmes on waste management practices based on the logic that waste management activities are shared responsibility of all.

The study further assessed the capacity of Zoomlion to effectively manage solid waste in the Metropolis. According to Puopiel (2010), analyses of the capacity were in terms of equipment and staff. Accordingly, equipment base was grouped into

their respective uses namely storage, collection and transportation. In terms of waste storage 230 skips were required by Zoomlion Ghana Limited to be supplied to both the middle and low class residential areas. However, 186 were available and supplied for storing waste in the Metropolis. Also, about 4000 dust-bins were needed for storing waste in the high class residential areas for effective service in the Metropolis particularly those living in the high class residential areas. This is because dustbins are the main equipment for storing waste in order to prevent dumping of waste at unapproved sites. In terms of waste collection and transportation in the Metropolis, Oboafo tricycle(Manual and Motorised), skip loaders, roll on/off truck and compaction trucks were mainly used. The Oboafo tricycles were used for primary collection and transferring of waste collected into a compaction truck for final disposal at the landfill. However, these were not enough to ensure regular collection and transportation of waste to the landfill. For instance about 200 Oboafo tricycles were needed for the door-to-door collection. Also, the compaction trucks which were used for the door-to-door collection were only two for the entire Metropolis. In effect if the few existing core waste equipment for collection and transportation like skip loaders, compaction trucks and roll on/roll off trucks are broken down for just a day or two it will result in heaping of waste. In a similar vein, Abdul-Yahaya and Owusu-Sekyere (2012), indicated that Zoomlion company had inadequate logistics and personnel to effectively manage solid waste in the Wa Municipality. They also mentioned that, efforts were made to ensure environmental cleanliness in the municipality but these were still in vain. This was due to the fact that the company was confronted with series of challenges

and difficulties including logistics, unqualified personnel and financial constraints. They further posit that the main source of the company's revenue was government subsidy on sanitation. They therefore concluded that, the company was not resourceful enough to purchase sophisticated equipment.

2.6 Waste Management Regulation and Policy in Ghana

According to the Ministry of Local Government and Rural Development (MLGRD) (2004), general waste management in Ghana is the responsibility of the MLGRD, which supervises the decentralized Metropolitan, Municipal and District Assemblies (MMDAs). However, the ministry indicates that, regulatory authority is vested in the Environmental Protection Agency (EPA) under the auspices of the Ministry of Environment and Science. The Metropolitan, Municipal and District Assemblies are responsible for the collection and final disposal of solid waste through their Waste Management Departments (WMDs) and their Environmental Health and Sanitation Departments (EHSD). The policy framework guiding the management of hazardous, solid and radioactive waste includes the Local Government Act (1994), Act 462, the Environmental Protection Agency Act (1994), Act 490, the Pesticides Control and Management Act (1996), Act 528, the Environmental Assessment Regulations 1999, (LI 1652), the Environmental Sanitation Policy of Ghana (1999), the Guidelines for the Development and Management of Landfills in Ghana, and the Guidelines for Bio-medical Waste (2000). All these Acts and Regulations emanate from the National Environmental Action Plan (MLGRD, 2004).

Furthermore, the ministry has published the National Environmental Sanitation Policy (NESP) since May 1999. Accordingly, the policy looks at the basic principles of environmental sanitation, problems and constraints. The role and responsibilities assigned to communities, ministries, departments and agencies and the private sector impinge on environmental management and protection, legislation and law enforcement and the criteria for specifying services and programmes, funding, equipment and supplies. Out of the National Sanitation Policy, the MLGRD has also developed a technical guideline document titled 'The Expanded Sanitary Inspection and Compliance Enforcement (ESICOME) Programme guidelines. The programme guidelines which are implemented by the MMDA's, routinely looked at four broad areas namely; effective environmental health inspections (Sanitary Inspections), dissemination of sanitary information (Hygiene Education), pests/vector control and law enforcement. All MMDAs have developed waste management and environmental health plans to help solve the numerous sanitation problems. Generally, the National Environmental Sanitation Policy Co-ordination Council (NESPoCC) is responsible for coordinating the policy and ensuring effective communication and cooperation between the many different agencies involved in environmental management in their respective Districts (MLGRD**,** 2004).

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

relevant legislations for the control of waste have also been enacted. These include the following.

Local Government Act, 1990 (Act 462)

Environmental Assessment Regulations, 1999 (LI 1652).

Criminal Code, 1960 (Act 29).

Water Resources Commission Act, 1996 (Act 522).

Pesticides Control and Management Act, 1996 (Act 528).

National Building Regulations, 1996 (LI 1630).

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

National Environmental Quality Guidelines (1998)

Ghana Landfill Guidelines (2002)

Manual for the preparation of district waste management plans in Ghana (2002)

Guidelines for the management of healthcare and veterinary waste in Ghana (2002)

Handbook for the preparation of District level Environmental Sanitation Strategies and Action Plans (DESSAPs).

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

Management in Ghana, it can be said with certainty that MMDAs are the primary authorities to manage solid waste at the local level.

2.7 Conclusion

Solid waste management incorporates the following: source separation, storage, collection, transportation and disposal of solid waste in an environmentally sustainable manner and in accordance with the best principles of public health, economics, engineering, conservation, aesthetics, and other environmental considerations, and that is also responsive to public attitudes. In this regard, the main methods of managing solid waste are: source reduction, recycling, composting, incineration, Sanitary filling and Integrated Solid Waste Management model. In Ghana, Zoomlion Ghana Limited is the main waste management company that manages waste on behalf of the Government of Ghana for MMDAs. However, there is limited literature on public perception on what the company has done so far as regards solid waste management most especially in Metropolitan Assemblies and more particularly perception's about Zoomlion's solid waste management in the Tamale Metropolis . This has initiated the study so as to fill this academic gap particularly in the Tamale Metropolis.

CHAPTER THREE

STUDY AREA AND METHODOLOGY

3.1 Introduction

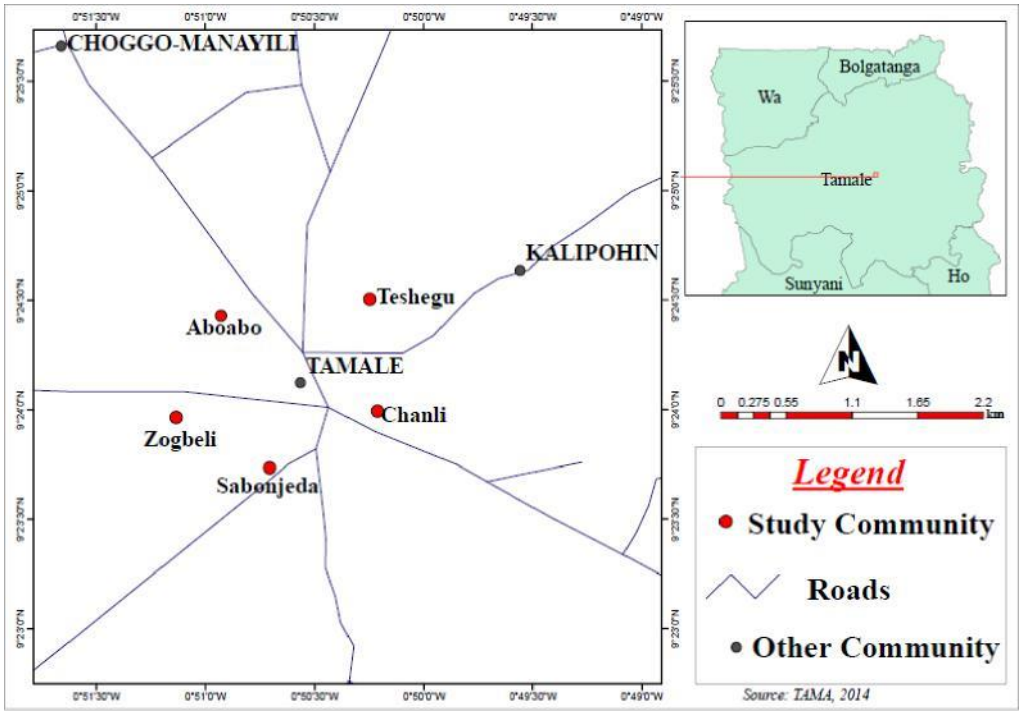
This chapter highlights on the profiles of the study area and the study organization (Zoomlion Ghana Limited) as well as the study research methodology. It gives a brief profile of the study area touching on the location and size, population and economic activities. It is acknowledged that several methodological options are available in social research. But the choice of a research design is dependent largely on the nature, objectives and components of the study. This leads the discussion on research design in the next sub- section.

3.2 Profile of the Study Area

3.2.1 Location and Size

The Tamale Metropolitan Area is located at the centre of the Northern Region. It shares common boundaries with Savelugu/Nanton District to the north, Tolon / Kumbungu District to the west, Central Gonja District to the south-west, East Gonja District to the south and Yendi Municipal to the east as in Figure 3.1. The Tamale Metropolis occupies approximately 750 square kilometres which is 13% of the total area of the Northern Region.

Map 3.2: Tamale Metropolis Showing Study Areas



3.2.2 Demographic Characteristics

According to the Ghana Statistical Service (2010), the Tamale Metropolis has a population of 371,351 in 2010. This figure shows an increase of 36.2% over the 2000 population of 293,881 and represents an inter-censal growth rate of 2.9%. This is higher than the national population growth rates of 2.5%. It is thus becoming one of the fastest growing city not only in Ghana but in West Africa. This is because with the development potential of an International Airport, a lot of people are moving in to do businesses. With an urban population of 73.8%; the Metropolis is the only district in the region which is predominantly urban. The population density of 318.6 persons per square kilometres for the Metropolis is about 12 times higher than the regional average density of 25.9 persons per square kilometres. Therefore, the growth rate and the density of population in the area have implications for waste

generation and management. This explains why waste generation has increased from 150 tonnes a day in 2006 to 810 tonnes in 2010.

3.2.3 Ethnicity and Cultural Values

The Dagombas who are the indigenous population constitute about 80 per cent of the total population in the Metropolis. Apart from Metropolitan centre where there is ethnic diversity almost all people in the surrounding villages are Dagombas. Before the advent of both Christianity and Islam religions, the Dagombas were mostly traditionalists. Their culture was deeply enshrined in their customs and beliefs. The result of this is still manifested in the numerous traditional festivals still practised. These practices are no longer pronounced in Metropolitan centre as a result of the ethnic diversity and the influence of both Islam and Christianity.

On the religious front, the people in the Metropolis are mostly Muslims since this was the first religion exposed to them by Arabs from the north. It is therefore not surprising that almost 90 per cent of ethnic Dagombas are Muslims. On the other hand, Christianity arrived later from the south and hence mostly practised by non-Dagomba ethnic groups. Until recently, festivals were largely enshrined in the customs of the Dagombas.

However, this is changing as a result of the practice of Islam. Festivals are not much celebrated especially in the Metropolis as compared to the villages. These festivals are Fire and Damba.

3.3 Profile of Zoomlion Ghana Limited in the Tamale Metropolis

Zoomlion Ghana Limited is a fully Ghanaian owned company that focuses on delivering quality Waste Management and Scientific Cleaning services by providing solutions that rely on ongoing technical innovations that respect the environment. In this light, Zoomlion Ghana Limited seeks to satisfy clients by continuously improving operations to make them efficient and cost effective. Zoomlion Ghana Limited is wholly committed to building long lasting and closer relationships with customers, government, local authorities, communities at large and even competitors who would prefer to be called partners. Zoomlion has a core staff strength of 3,000 and a field staff of 65,100 under a government initiative dubbed "The National Youth Employment Programme" (NYEP).

3.3.1 Objectives of the Company

Zoomlion intends to revolutionize waste management services in the industry. The mission of introducing simple but technologically innovative solutions to waste management services delivery in Ghana will take into consideration the following objectives:-

Using brand new waste management vehicles and equipment.

Implementing fully the new 'OBOAFO' tricycle concept throughout the country in waste management;

Poverty reduction through job creation for the unemployed youths in collaboration with Ministry of Manpower, Youth & Employment, and the Ministry of Local Government, Rural Development and Environment.

The development of skills in the local assembly of waste management equipment and tools by giving contracts to local artisans rather than relying on imported items. Contribution to skills development through training in the sector.

Removal of the conditions that support mosquito and fly breeding in drains and markets, thereby protecting public health.

100% collection of waste generated in collection zones to be assigned at doorstep.

Controlling indiscriminate dumping, environmental pollution and degradation.

3.3.2 Staffing of the Company

The staffing of the various departments and units are the following: -

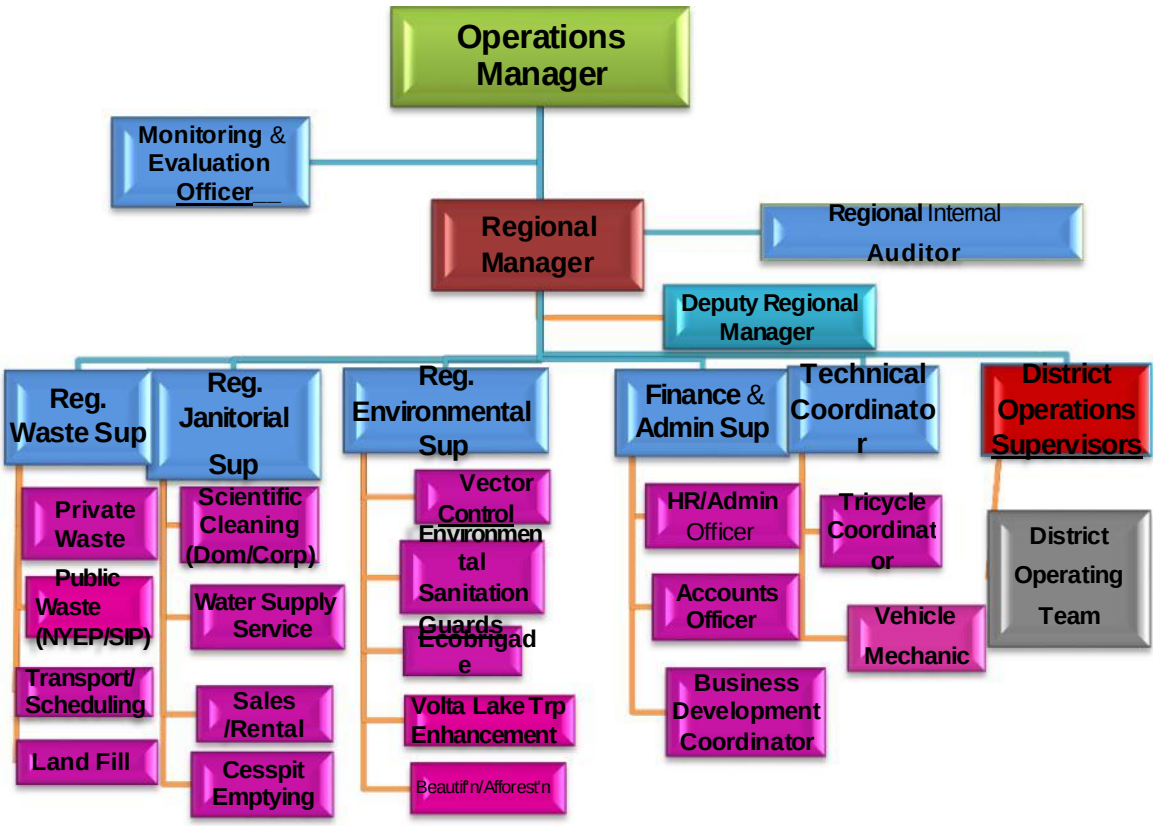
a. A Board of Directors, whose membership has varied experience and expertise in the environmental sanitation and waste management sectors.
b. An Administration which is headed by the Managing Director and has as her immediate aides Directors of Administration, Finance and Technical. This administrative headship is further supported by Operations Department, Research and Development Unit, Human Resource Unit and Communication and Public Relations and Marketing Departments.
c. A Technical Manager, with the relevant mechanical engineering experience, competence and expertise, in charge of the Technical Department and assisted by Mechanical Maintenance Workshop and Stores.
d. An Operations Manager, for the delivery of waste management services, heading the Operations and Transport Department, with supervisors overseeing the operations at suburbs and sector levels within the MMDAs.

e. A Finance Manager of the Finance, Stores and Procurement Department

f. A Human Resource Manager, responsible for the recruitment of the human resources of the company and their training and development.

g. The organogram of Zoomlion Ghana Limited is shown in figure 3.2.

Figure 3.2: Organogram of Zoomlion Ghana Ltd.



Source: Zoomlion, Northern Region, 2015

The management is supported by carefully selected supervisory and field operatives, namely Operational Supervisors, Drivers, Operators, and Janitors (collection labour force). These operatives receive and continue to undergo periodic intensive training under professional trainers in other to maintain and improve

service delivery. The company has well-furnished offices for its administrative and operational activities. It has a well-stocked office equipment and logistics such as computers, furniture, air conditioners, fridges, cabinets, printers, and telephones among others, which are deployed to the job in order to facilitate administrative and operational processes.

3.3.3 Products and Services

Services provided by the company include but not limited to the following :(Shown in plate 3.1)

- Tricycle waste collection concept in public cleansing, street sweeping and drain cleaning;
- Door-to-Door Solid waste collection with compaction trucks
- Solid Waste Collection with large capacity waste containers for communities;;
- Liquid waste collection (septic tank emptying)
- Pest Control Services, de-infestation and fumigation of facilities and localities;
- Landfill or final Dump site operation and management;
- Street and pavement sweeping and desilting and cleaning of drains;
- Hiring and leasing of waste management equipment;
- Tanker services;
- Maintaining a pool of vehicles for emergency services i.e.: water tankers, cesspit emptying and refuse collection.

Plate 3.1: Services Provided by Zoomlion

Tricycle Services

Bola Taxi Services

Fumigation Services

Skip Truck Services

Roll-On/off Truck Services

Cesspit Services

3.3.4 Subsidiaries

In the last few years of its existence, Zoomlion has expanded its line of business to encompass various aspects of sanitation and environmental management. This has led to the birth of several subsidiaries that take charge of different aspects of our operations. These subsidiaries include the following:

- ***Zoomlion Domestic Waste Services Limited*** which is in charge of Domestic as well as corporate Services.
- ***Zoomlion Janitorial Services Limited*** which is in charge of Janitorial services in offices, homes and stadia
- ***Zoomlion Cabin Limited*** which manages Mobile toilets
- ***Zoomlion Domestic and Beautification Services*** –which is into landscaping and beautification services
- ***Zoil Services Limited*** is into Coastal Reforestation, Coastal environmental sanitation and oil spill management. Zoil is also the major private sector partner

in the implementation of the National Forest Plantation Development Programme under the auspices of the Ministry of Lands and Natural Resources and the Forestry Commission of Ghana.

- ***The Institute of Sanitation and Waste Management*** which trains environmental sanitation workers.
- ***Accra Compost and Recycling Plant is into the sorting and composting of waste***
- ***Zoom Alliance*** is into forging alliance with other waste management companies with concessions for waste collection but with no equipment for mutual operations and benefit.

3.4 Research Methodology

3.4.1 Research Design

The need for research design stems from a skeptical approach to research and a view that scientific knowledge must always be provisional (de Vaus, 2001). The purpose of research design is to reduce the ambiguity of much research evidence. According to de Vaus (2001), the function of a research design is to ensure that the evidence obtained enables one to answer the initial question as unambiguously as possible. The design for this study is a case study. A case study is defined as an enquiry which uses multi-sources of data (Johnson, 1994 in Oteng-Abayie, 2011). That is, both qualitative and quantitative. Qualitative research is appropriate for this study because qualitative methods are useful to unveil knowledge and to facilitate understanding of phenomenon that little is known about. Quantitative data were also

generated through the use of questionnaire survey where a wide range of questions were asked.

Furthermore, a case study investigates a contemporary phenomenon within its real life context when the boundaries between the phenomenon and context are not clearly evident. It provides a rich understanding of a real life context. It uses and triangulates multiple sources of data. Therefore, the purpose of this design is to give the researcher an in-depth understanding of the activities of Zoomlion Ghana Limited in relation to solid waste management in the Tamale Metropolis. On this basis, generalisations and inferences can be made regarding how the Company operates in other metropolitan areas in Ghana.

3.4.2 Sources of Data

Data for the study were gathered from two main sources, namely secondary and primary sources. The data from the secondary sources were obtained from books, journals, thesis reports and records of Zoomlion's solid waste collection activities on the coverage, distribution of waste management facilities (waste-bins and skips), quantity of waste generated and quantity collected in a day, regularity of collection as well as the situation before and thereafter. Secondly, the primary data were obtained both qualitatively and quantitatively on perceptions of Zoomlion's waste management activities, perceived impacts, challenges and methods of handling solid waste in the Tamale metropolis. Therefore, the next subsection gives a detailed account on how the primary data were collected.

3.4.3 Primary Data Collection

The design for collecting primary data included the study population, sample size, sampling techniques, data collection instruments and procedure. The purpose of the design is to ensure fair representation of sample cases in the study.

3.4.4 Study Population

According to Zikimund (2003), one of the challenges of any type of research is the definition of the population from which the respondents are selected. The population of the study refers to the entire set of relevant units that fit into a certain specification (Oteng-Abayie, 2011). In this regard, the study targeted resident adult males and females population of the catchment area (Central Sub-Metro), Assembly persons, Metroplilitan Environmental Officer, Supervisors and the Regional Manager of Zoomlion Ghana Limited. These sample cases were targeted because they could provide needed and in-depth information on the study topic. Secondly, these sample cases are directly involved and concerned about solid waste management in the metropolis.

3.4.5 Sampling frame and Sample Size

Sampling frame is a representation of the elements of the target population (Oteng-Abayie, 2011). It is the complete list of all cases in the population from which a sample will be drawn. Therefore, the sample frame for the households in the various electoral areas in the central sub-metro was obtained from the Metropolitan Census Officer. In the light of this, the total number of households obtained was 1,851(PHC,

2010). This represented the sample frame for the households. Furthermore, a mathematical method was used to determine the sample size for the households in the sub-metro. This was to ensure that the sample mean was closer to the population mean and to minimise errors. Below is the procedure used:

Formula: n **,** Where **n**=sample size, **N**=sample frame **(1851)** and α represented the margin of error which is **0.08** with confidence level of **92%** (Oteng-Abeyie, 2011). By substituting 1851 and 0.05 into the formula: **, n=144.**

Therefore, the sample size for the households was 144. In addition to this, Assemblypersons for the five electoral areas and the Regional Manager of Zoomlion Ghana Limited was also captured in the sample size; giving the total sample size of 150. The proportion random method was further used in determining the sample size for each Electoral Area (EA) as indicated below.

Sample Size per EA = Total sample size x N° of Households per EA

Total N° of households

For instance the number of households in Aboabo was 540. Therefore, the sample size was

$$\frac{144 \times 540}{1851}$$

= 42 households

In the light of this, the sample size for Aboabo EA was 42 households and this applied to all the electoral areas. Table 3.1 further illustrates the electoral areas, number of households and sample size.

Table 3.1: Electoral Areas and Sample Sizes

Name of Electoral Area	No. of Households	Sample Size
Aboabo	540	42
Zogbeli	476	37
Sabonjeda	284	22
Chanli	308	24
Teshegu	243	19
Total	**1851**	**144**

Source: Author's Construct, 2015

Furthermore, systematic sampling technique was used to select houses and for that matter households in each electoral area. Table 3.2 illustrates the systematic sampling procedure.

Table 3.2: Systematic Sampling Procedure

Electoral Area	No. of Households/EA (Sample frame)	Sample Size/EA	Sample fraction(Kth house)=Sample size/Sample frame
Aboabo	540	42	$1/5^{th}$
Zogbeli	476	37	$1/5^{th}$
Sabonjeda	284	22	$1/5^{th}$
Chanli	308	24	$1/5^{th}$
Teshegu	243	19	$1/5^{th}$

Source: Author's Construct, 2015

From Table 3.2, the sample fraction for all the electoral areas was $1/5^{th}$ which means that every 5^{th} house in the various electoral areas was selected for the study. In this regard, every 5^{th} house represented a household. Because most of the houses in the selected areas were not well planned with serial numbers, a serpentine movement was used to select every 5th house starting from the direction of the first point of contact with any house in the selected area. With this approach a respondent was interviewed in each 5^{th} house until the required sample for each EA was obtained.

Furthermore, convenience sampling method was used to select the respondents for interview. That is, the first adult person to be contacted in each selected house was interviewed. If the first person contacted was not ready, the next available person was interviewed. Since some of respondents did not understand English language, people who understood both the English and the local dialect were trained and employed to administer the questionnaires.

Finally, purposive sampling technique was used to select key stakeholders of solid waste management in the sub-metro. These were: the Regional Manager of Zoomlion Ghana Limited, Department of Environmental Sanitation, Supervisors and Assemblypersons. As the name implies, in trying to adhere to the objectives of the study, respondents who can answer the research questions best are selected. In this case, these key stakeholders had the necessary information, adequate knowledge and experience on solid waste management in the study area.

3.4.6 Data Collection Instruments and Techniques

The research instruments used in the survey were questionnaires and interview guides. These instruments were developed to collect data on the public perceptions of Zoomlion's solid waste management services in the study area. The specific issues considered were length of time of operation of the company, place of disposal of domestic solid waste and collection. The others are challenges faced by the waste management company and approved methods of handling domestic solid waste. The questionnaire was designed in a closed-ended format to elicit information from households in relation to their perceptions and perceived impacts of Zoomlion's

waste management services. A four point likert scale was used to measure the perceived impacts of the company's activities in managing solid waste. The ratings were: SA=Strongly Agreed; A=Agreed; D=Disagreed and SD=Strongly Disagreed as in appendix I and II.

The individual administering procedure was used in administering the questionnaires to all respondents using the interview approach. In other words, the questionnaires were administered to the respondents independently or individually and directly or personally, after establishing rapport with them and assuring them of anonymity. The individual administering procedure was chosen so that difficult respondents could be talked to and hopefully convinced to participate in the process.

3.4.7 Pilot of Research Instrument

The research instruments specifically the questionnaire for the households was pre-tested before a full scale study was conducted. It is one of the basic principles of social research (Sarantakos, 1998). This was done to ascertain its validity and reliability. Therefore, the pilot survey was conducted in Choggu; a section of the Central Sub-Metro from 25th January, 2015. This was because the selected section had the same characteristics as those other communities in the selected sub-metro. In the light of this, 50 questionnaires were randomly administered to various households to answer. Respondents answered them with enthusiasm as they perceived the exercise was going to benefit them. The answered questionnaires were analysed using the SPSS and a reliability test was run using the Cronbach's Alpha reliability test. Therefore, the test value was r= 0.8345 indicating about 80 %

consistency in the scores that were produced by the instruments. In this regard, the questionnaire demonstrated good internal consistency and could produce the same or similar results when used in another setting. Very few errors were detected and corrected.

3.4.8 Methods of Data Analysis and Presentation

Data analysis is the application of reasoning, understanding and interpretation to data that had been collected (Zikimund, 2003). Firstly, field data were edited to ensure that questionnaire were properly answered and completed. For those that were not properly answered and completed, data collectors were returned to the field to complete them. Statistics are simple tools used by the researcher to help make sense out of the observations which had been collected. Some statistical techniques are quite complex and help the researcher make detailed inferences. For data to be statistically manipulated, it must be organized and quantified in some way (Riggio, 2000). Therefore, the Statistical Package for Social Sciences (SPSS) was used to analyze the data on close ended questionnaire collected from the field. This was presented in the form of frequencies, percentages, scores (tables). Because pictorial figures do not normally look presentable generated from the SPSS package, the excel application software was further used to draw pie charts and bar graphs. The analysis was mainly qualitative interspersed with some quantitative data. This was mainly drawn from the tables and charts generated from the SPSS and excel programmes. The focus of the next chapter is an analysis of the data gathered in the field.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Introduction

This chapter presents results and discussion of field data. The analysis is presented according to the thematic areas of the specific objectives of the study. These are: households' perception about current waste management practices by Zoomlion; the perceived impacts of Zoomlion's waste management services; and challenges associated with the waste management services provided by Zoomlion in the Tamale Metropolis. This section also analyses the background information of respondents as discussed in the next sub-section.

4.2 Background Information of Respondents

This section highlights the educational level and occupation of respondents as discussed in the following subsections.

4.2.1 Educational Level of Respondents

From Table 4.1, almost 90% of the respondents had some level of education with majority (24.8%) of them educated up to the Middle/J.S.S/J.H.S level. This is followed by 21.5% who had tertiary education with the least (6.1%) having Vocational education. This suggests that majority of the respondents are enlightened and as such will appreciate the importance of good sanitation in their various residential areas. Therefore, there are prospects of them ensuring good sanitation in

the area and possibility of also ensuring that Zoomlion Ghana Limited entrusted with the responsibility of waste management does its work as expected of them.

Table 4.1: Educational Level of Respondents

Level of Education	Frequency	Percent
None	15	10.1
Primary	15	10.1
Middle/J.S.S/J.H.S	37	24.8
Secondary/Technical	23	15.4
Vocational	9	6.1
Training College	18	12.1
Tertiary	32	21.5
Total	**149**	**100.0**

Source: Field Data, 2015

4.2.2 Occupation

Data gathered from the field shows that majority (32.2%) of the respondents were petty trading. This has the potential of generating various types of waste thereby adding up to the volumes of waste generated daily in the metropolis. This type of waste could include: rubbish, food waste and special waste. However, the least (6%) occupation of respondents was farming as indicated in figure 4.2. This could also generate agriculture waste and add up to the volume of waste generated in the area. This is because harvested crops would be trashed and by-product disposed of either in dump sites or into communal containers.

Table 4.2: Occupation of Respondents

Occupation	Frequency	Percent
Farming	9	6
Petty trading	48	32.2
Business	31	20.8
Public Servant	39	26.2
Other	22	14.8
Total	**149**	**100.0**

Source: Field Data, 2015

4.3 Households' Perception on Current Waste Management Practices

This section discusses perceptions of respondents on current waste management practices of Zoomlion Ghana Limited in the Tamale Metropolis. The issues are: where respondents dumped their waste prior to the coming of Zoomlion; where they currently dump their waste and frequency of waste collection by Zoomlion. The rest include: provision of waste dumping containers and sensitization of residents on management of solid waste. Each of these issues is discussed below.

4.3.1 Place of Dumping of waste prior to Zoomlion Ghana Limited

The place of waste disposal by residents in the Tamale Metropolis before the coming of Zoomlion ranges from gutter to roadside as shown in Table 4.3. Prior to the coming of Zoomlion Ghana Limited in the study area, the commonest place of waste disposal was open dump sites. This constituted 67.1%. This implies that

people did not have access to waste collection containers such as communal containers and waste-bins to deposit their wastes. Apart from open dumping waste sites, others also disposed of their wastes at various places. These were roadside (12.1%), pits (6.7%) and gutters (2.0%) as indicated in the table 4.3.

Table 4.3: Place of Dumping of Waste Prior to Zoomlion Ghana Limited.

Place of dump	Frequency	Percent
Gutters	3	2.0
Pits	10	6.7
Any place of choice	18	12.1
Dump site	100	67.1
Roadside	18	12.1
Total	**149**	**100.0**

Source: Field Data, 2015

From the above discussion, this therefore suggests that people were dumping their household waste any how thereby littering the environment and creating unsanitary scenes in the area as in plate 4.1

Plate 4.1: Waste Disposal by Residents prior to Zoomlion

Source: Zoomlion Ghana Ltd., Tamale Metropolis, 2014

4.3.2 Current Place of Waste Dump

According to Puopiel (2010), the commonest place of waste disposal in the Tamale metropolis was the skip (Communal Container). This method was used in the low class residential areas. These areas were Sakasaka, Choggu, Moshi Zongo, Lamashegu and Aboabo. This is followed by storing waste in dust-bins mostly in

the high class residential areas and some middle class residential areas in the metropolis. These areas were Vitting Estates, Russian Bungalows, SSNIT Flats and Kalpohin Estates. The rest of respondents resorted to dumping waste in either the roadside, dump, open spaces, nearby gutter or backyard. These methods of waste disposal also happened in the low class residential areas as mentioned above. This resulted in littering and heaping of waste thereby making the environment filthy. Therefore, the possibility of outbreak of cholera and other environmental related diseases was high if such practice continued.

In this regard, the current place of waste disposal by residents in the area is not different from what Puopiel (2010), established. The field data revealed that, more than half (55.7%) of the respondents now dumped their wastes in Skips (Communal Containers) as in Table 4.4. Also, 21.5% of them dumped their wastes in waste-bins. This implies that the sanitation situation will improve since majority of the people resorted to dumping their waste in skips and waste-bins as in Plate 4.2. This suggests that the activities of Zoomlion have contributed significantly to improving the sanitation situation in the area. This notwithstanding, about 22.8% of the respondents still deposited their wastes at unapproved places such as dumpsites, roadside and open spaces. This still raises some questions about the effectiveness of Zoomlion in managing solid waste in the area.

Table 4.4: Current Place of Dumping Waste

Current Place of Disposal	Frequency	Percent
Roadside	3	2.0
Skip(CommunalContainers)	83	55.7
Dump sites	24	16.1
Open spaces	2	1.3
Nearby gutter	2	1.3
Backyard	2	1.3
Waste-bin	32	21.5
Other	1	0.7
Total	**149**	**100.0**

Source: Field Data, 2015

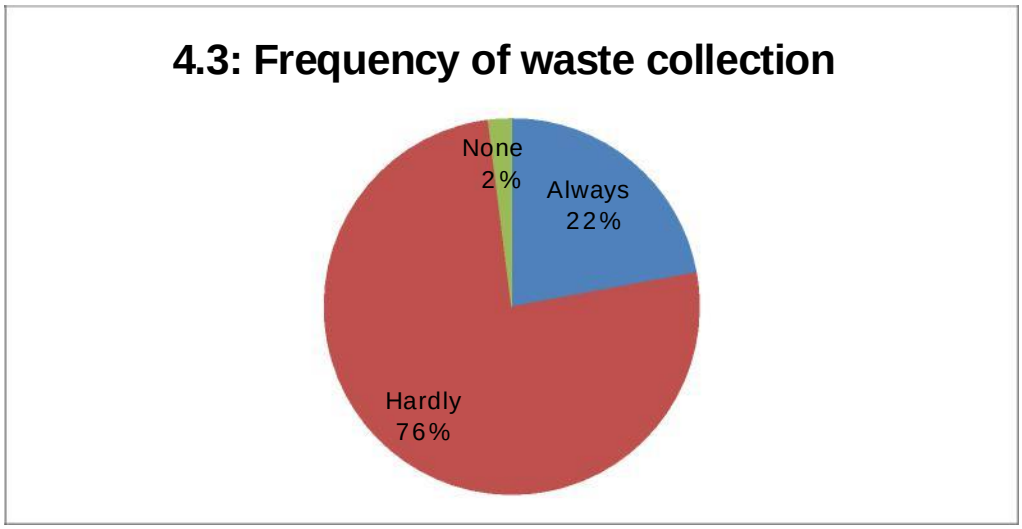
Plate 4.2 a: Waste dumping containers for Communities

Plate 4.2b: Waste Container for Households

Source: Field Survey, 2014

4.3.3 Frequency of Waste Collection

On regularity of solid waste collection in the Tamale Metropolis, Puopiel (2010), indicated that waste was collected twice a week and in some instances once a week. In some areas like Russian Bungalows and Education Ridge, collection did not take place at all. Five times a week which should have been the required number of times waste was to be collected was rather the least particularly in the low class residential areas as illustrated in table 2.2. This brought about heaping of waste in dumpsites and communal containers overflowing with waste particularly in the low class residential areas. This situation is not different from the current situation in the Metropolis. In this regard, the study showed that Zoomlion hardly collected waste (76%) as indicated in Figures 4.3.



Source: Field Data, 2015

The study further revealed that the average number of times Zoomlion collected waste from the study sites was twice a week. This finding concurs with the findings of Puopiel (2010). This therefore implies Zoomlion is not very effective and efficient with its collection of waste in the area. Plate 4.3 shows heaps of uncollected wastes in the study area.

Plate 4.3a: Uncollected Waste in Chanli

Plate 4.3b: Uncollected waste in Zogbeli

Source: Field Survey, 2015.

4.3.4 Provision of Waste Dumping Containers

On the provision of waste dumping containers, it was gathered that, 88.6% of the respondents indicated that they were supplied with skips (Communal containers) by Zoomlion for dumping of their wastes. Also, 8.7% indicated that they had been supplied with waste-bins for depositing their waste before final collection and disposal as shown in figure 4.5. This contravenes Puopiel's (2010) findings that about 66% of respondents had no access to communal containers for disposing their waste particularly those living in the low class residential areas. This therefore suggests that there is a significant improvement in access to communal containers by residents to conveniently dispose of their household wastes.

Table 4.5: Provision of Waste Dumping Containers

Type of Container	Frequency	Percent
Skip	132	88.6
Waste-bin	13	8.7
None	4	2.7
Total	**149**	**100.0**

Source: Field Data, 2015

The study, however, revealed that the waste collection containers supplied were inadequate. In this regard, 93.3% of the respondents indicated that the waste dumping containers supplied them were not enough. This goes to buttress Puopiel's (2010) findings that the skip ratio to population was very high. According to him, the ratio was 1: 9,378 compared to the acceptable standard of 1:700. This goes to reaffirm the inadequacy of supply of waste dumping containers such as communal containers and dust-bins in the metropolis.

As a result of the inadequacy of waste dumping containers, people resorted to dumping their wastes in various unapproved places as in Table 4.6. Thus, greater proportion (83.2%) of the respondents dumped their wastes in the nearest available spaces. This has the tendency of littering the environment since people have no specific place of dumping their wastes.

Table 4.6: Place of dumping of waste due to lack of waste storage containers

Place of dump	Frequency	Percent
Nearest available space	124	83.2
Nearest gutter	8	5.4
Burn them	7	4.7
Other	10	6.7
Total	**149**	**100.0**

Source: Field Data, 2015

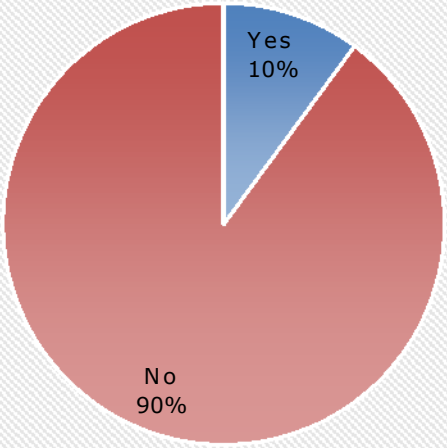
4.3.5 Opinions on Sensitization on Waste Management

According to Tchobanoglous *et al,* (1993), solid waste management is that discipline associated with the control of generation, storage, collection, transfer and transport, processing and disposal of solid wastes in a manner that is in accord with the best principles of public health, economics, engineering, conservation, aesthetics and other environmental considerations and that is also responsive to public attitudes. Therefore, there are various methods of managing solid waste namely: source reduction, sanitary landfills, composting, recycling, and incineration (Denison and Ruston, 1990). Apart from these methods, the Integrated Solid Waste Management (ISWM) system, which is based on 3Rs (reduces, reuse and recycle), is another viable method which could be used to manage solid waste.

In the light of this, greater percentage (90%) of the respondents indicated that Zoomlion did not sensitize them on any of the aforementioned methods of managing solid waste in the area as shown Figure 4.2. This could lead to lose of valuable

materials as waste which could otherwise been re-used for other purposes are discarded as useless. This supports the United Nations Environmental Programme (UNEP) (2009), argument that if most of the solid waste could be diverted for material and resource recovery, then a substantial reduction in final volumes of waste could be achieved and the recovered material and resources could be utilized

Figure 4.2: Opinions on sensitization on waste management



to generate revenue to fund waste management.

Source: Field Data, 2015

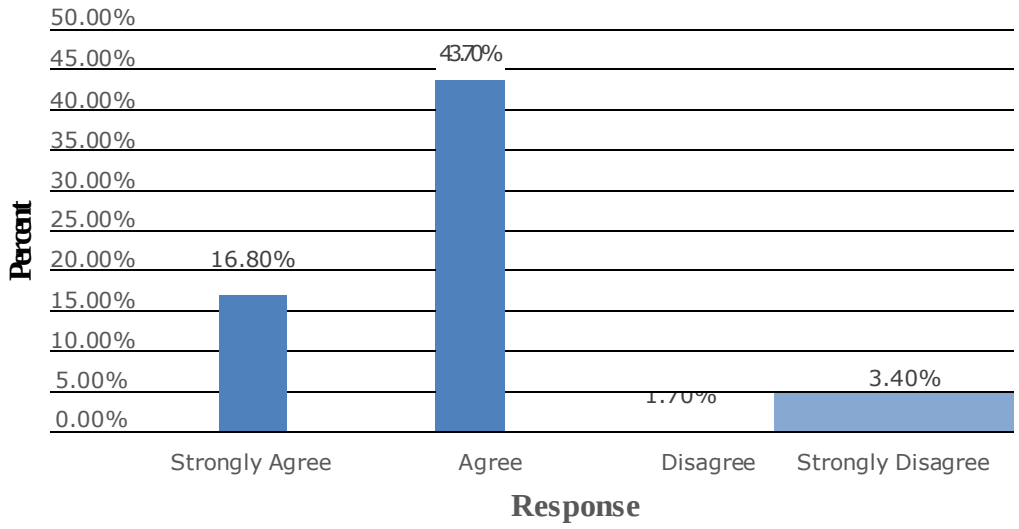
4.4 Perceived Impact of Zoomlion's Waste Management Services

This section discusses the perceived impact of Zoomlion's waste management services in the Tamale Metropolis. The issues covered are ability of the company to collect waste regularly, perceived improvement in waste collection, emptying of waste collection containers regularly and clearing of heaps of waste in waste deposit containers. The rest are perceived cleaned gutters of waste and provision of enough waste deposit containers.

The element of collection includes not only the gathering of solid waste, but also the hauling of waste after collection to the location where the collection vehicle is emptied (Kreith, 1994).

In this light, greater percentage of respondents perceived that Zoomlion had been able to collect waste regularly in the area. From Figure 4.4, majority (43.7%) of the respondents agreed that waste was collected regularly in the area. Also, 16.8% of the respondents strongly agreed that waste was collected regularly by Zoomlion in their residential area.

Figure 4.3: Ability to Collect Waste Regularly

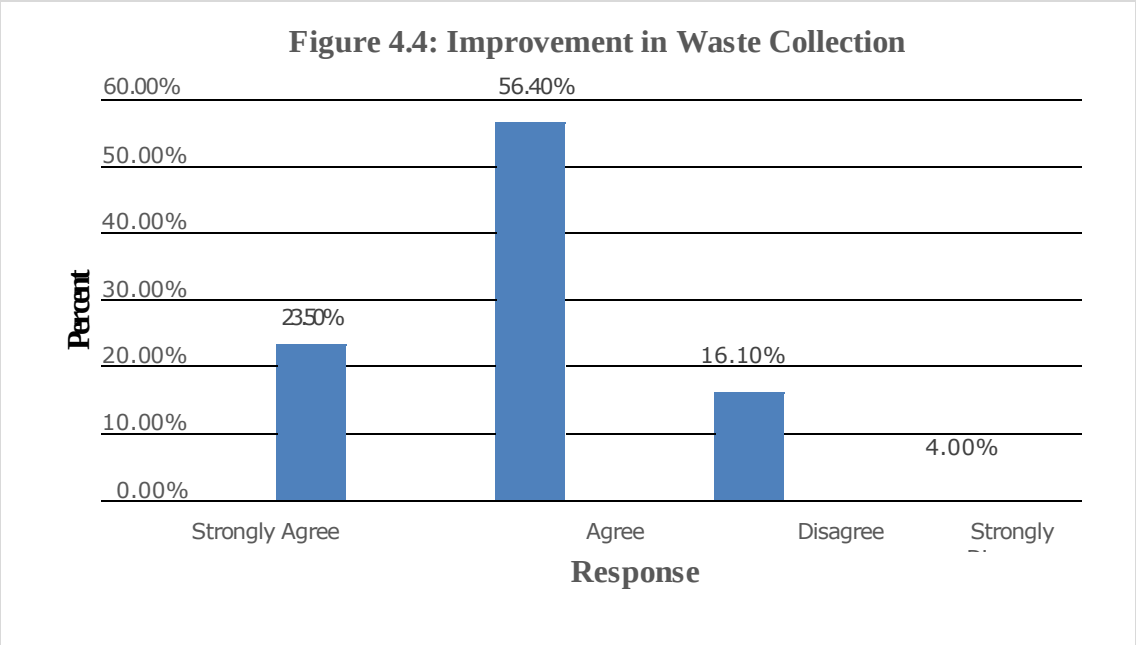


Source: Field Data, 2014.

This implies that waste that was stored in communal containers and waste-bins was constantly collected and transported to the landfill site for final disposal. This goes to suggest that Zoomlion as a waste management company has lived to its task of ensuring clean environment in the area.

Data gathered from the field equally indicated that more than (56.4%), half of the respondents, agreed that there had been significant improvement in waste collection

by Zoomlion since its establishment in 2006 to manage waste in Ghana as a whole and Tamale in particular. This is followed by 23.5% of them who strongly agreed



that waste collection in the metropolis had improved as shown in figure 4.4 below.

Source: Field Data, 2015.

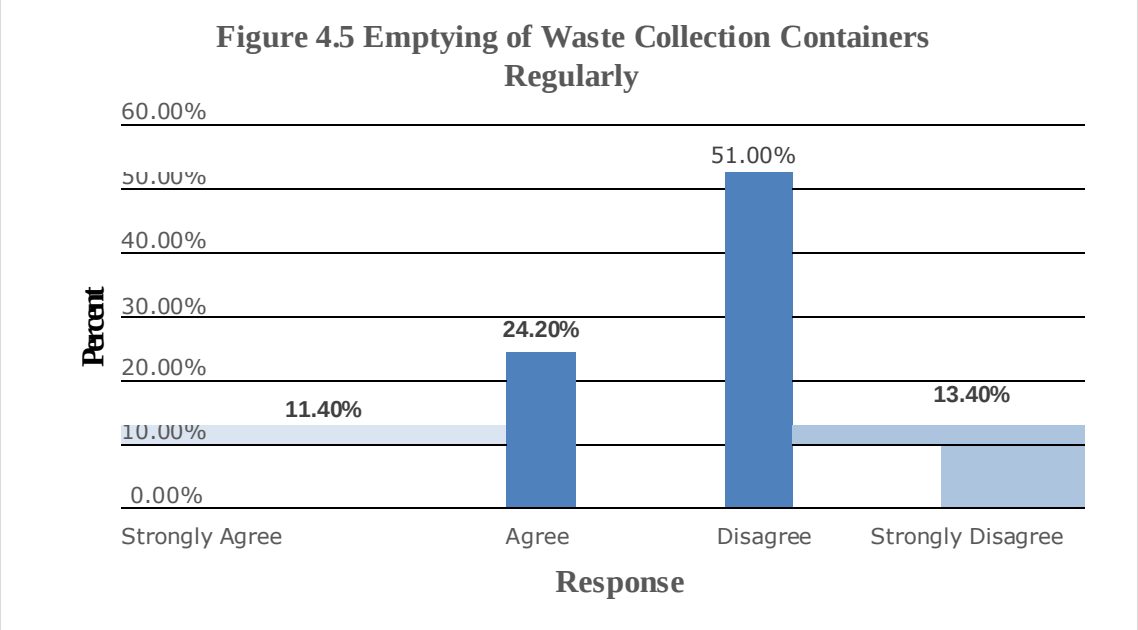
This suggests that Zoomlion Ghana Limited is living up to its mandate of improving sanitation in the area. Plate 4.4 further illustrates the situation of waste management in the Tamale metropolis before and after the intervention of Zoomlion Ghana Limited.

Plate 4.4: Waste Situation before and after Zoomlion Services

Source: Zoomlion Ghana Ltd., Tamale Metropolis, 2015.

Further data from the field found out that, in terms of emptying waste collection containers regularly, majority of the respondents were of the view that this had not been successfully done by Zoomlion Ghana Limited. From Figure 4.6, 51% of

respondents disagreed with the fact that Zoomlion Ghana Limited constantly empty communal containers and waste-bins as expected of them. Furthermore, 13.4% of the respondents strongly disagreed that Zoomlion Ghana Limited constantly emptied communal containers and waste-bins. During close collection, waste collection containers could be seen overflowing with waste in the area as in plate 4.4. This refutes the claim by Zoomlion in an indepth interview that they constantly collected waste in the area. As indicated by Management *"We constantly collect waste every now and then. We collect waste daily; emptying all containers in every*



corner in the Metropolis".

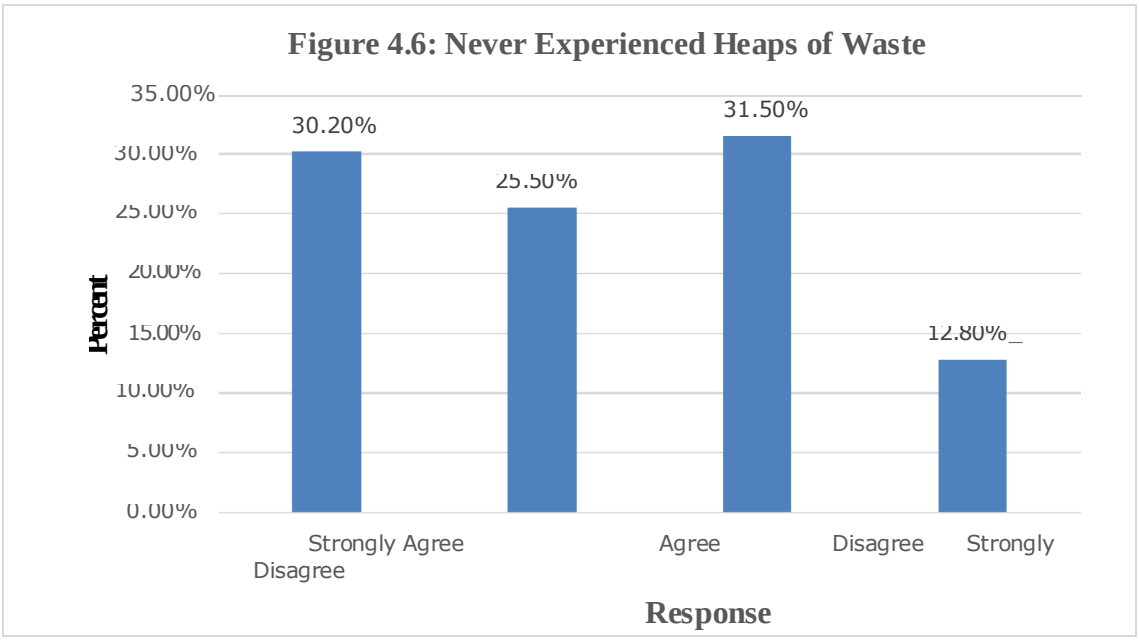
Source: Field Data, 2015

Plate 4.5:Plates Showing Communal Containers overflowing with solid waste

Source: Field Survey, 2014.

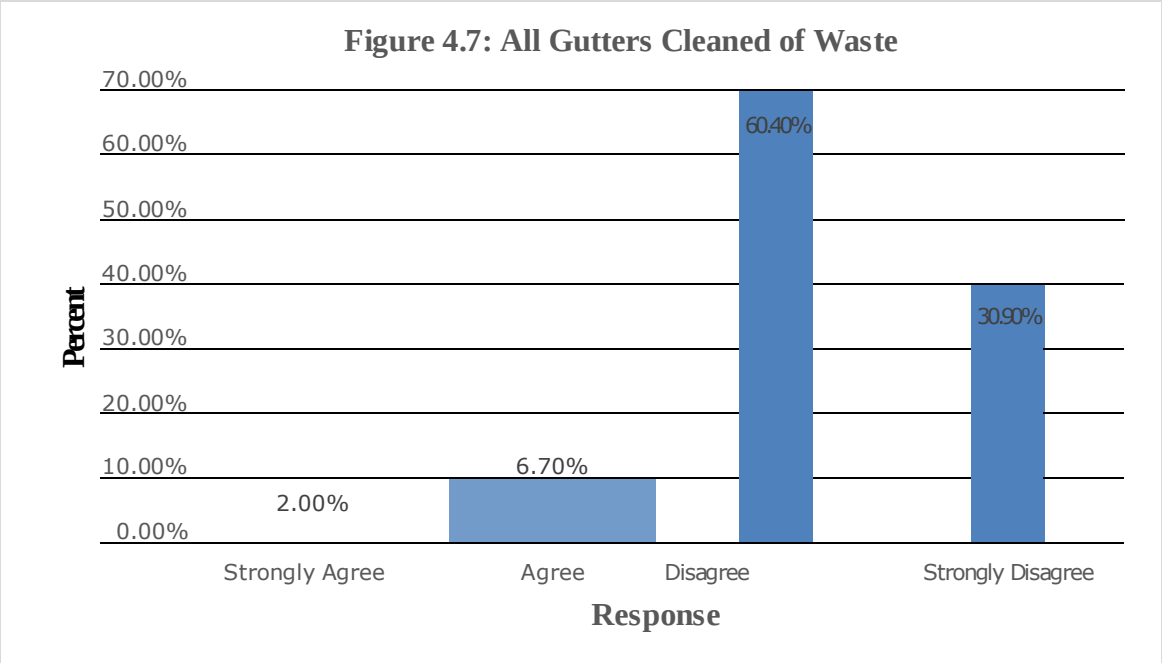
From Figure 4.6, greater proportion of respondents indicated that they had never experienced heaps of waste after the coming of Zoomlion Ghana Limited. This shows that heaps of waste which hitherto could be seen in residential areas has been

cleared, suggesting some level of efficiency and effectiveness in managing solid waste in the Tamale Metropolis. In spite of these successes by Zoomlion Ghana Limited, proportions of respondents indicated that they still experience pile of waste in communal containers and dust-bins as indicated in Plate 4.4. In this regard, 31.5% of respondents disagreed that they never experienced heaps of waste and 12.8% also strongly disagreed with the perception that they never experienced heaps of waste. This means that the Company still needs to double its efforts in waste collection.



Source: Field Data, 2015

From Figure 4.7, 60.4% of respondents disagreed that all gutters were cleaned of waste in the metropolis. This was followed by 30.9% of them who strongly disagreed with the fact that all gutters in their residential areas were free of filth.



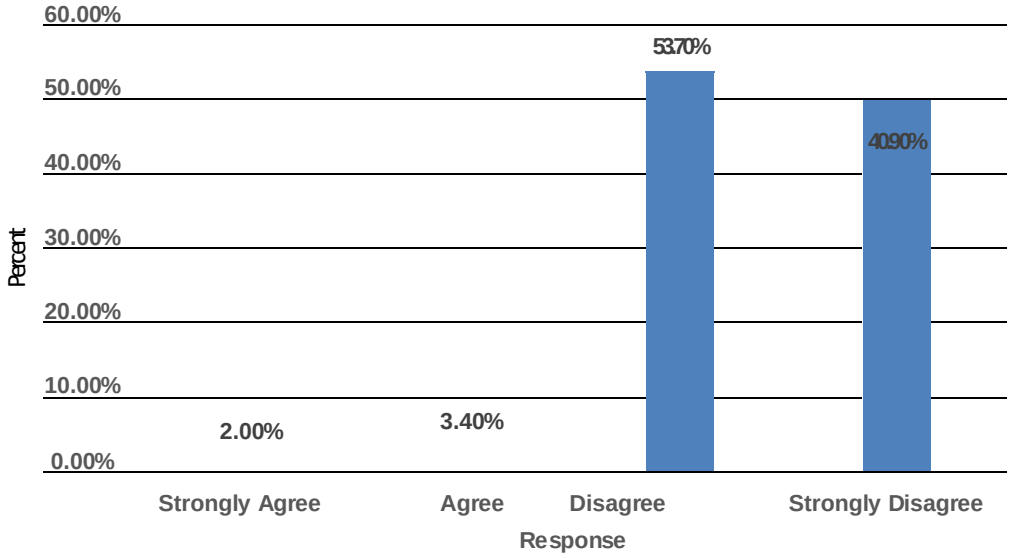
Source: Field Data, 2015

A personal observation also showed that some gutters in the area were choked with solid waste. This implies that despite the effort made by Zoomlion Ghana Limited in clearing filth within the metropolis, it has not been successfully done. This has the tendency of causing unsanitary conditions in the area and as such can course the outbreak of diseases such as cholera and typhoid. However, less than 10% of the respondents were of the view that all gutters in the area were cleaned of waste.

Provision of containers for depositing waste is one the functions of the Zoomlion Ghana Limited per the agreement it went into with the various MMDAs. The provision of adequate waste containers will prevent people from dumping waste at unapproved places such as gutters, open spaces, by the roadside among others. The field data, therefore, shows that Zoomlion did not provide enough containers for people to store their household waste. In this light, figure 4.8 shows that, 53.7% of

the respondents disagree that Zoomlion provided enough containers for them to deposit their waste. This is followed by 40.9% of them who strongly disagreed that enough containers were provided them to dump their waste.

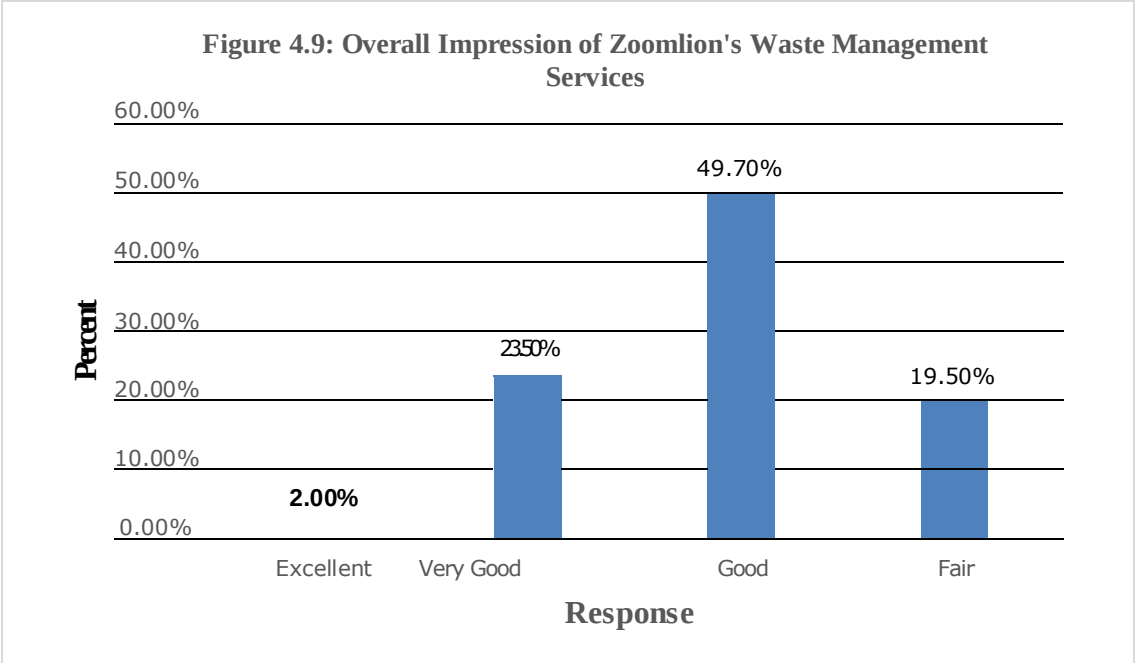
Figure 4.8: Provision of Enough Waste Dumping Containers



Source: Field Data, 2015

This can cause people to litter the environment since they have no convenient way of disposing their waste. This notwithstanding, less than 6% of the respondents were of the view that Zoomlion provided enough waste containers for them to store their waste.

Analysis of the field data shows that respondents were impressed with the activities of Zoomlion Ghana Limited in managing solid waste in the Tamale Metropolis. Thus, majority (49.7%) of respondents rated them "Good" in providing waste management services. This is followed by 23.5% of them who rated the company "Very Good" in managing waste in the area as shown in figure 4.9.



Source: Field Data, 2015

These findings, however deviates from that of Abdul-Yahaya and Owusu-Sekyere (2012). According to them, public perception on solid waste management in the Wa Municipality by Zoomlion revealed that the sanitation situation in the municipality still needed much to be done. According to them, 47.8% of the respondents indicated that Zoomlion offered poor sanitation services, 22.2% indicated fair, 13.3% for very good services and 16.7% were in support of good.

4.5 Challenges of Current Waste Management Services by Zoomlion

The MLGRD (2004), summarises the challenges of solid waste management in Ghana to include poor planning for waste management programmes, inadequate equipment and operational funds to support waste management activities, inadequate sites and facilities for waste management operations, inadequate skills

and capacity of waste management staff, and negative attitudes of the general public towards the environment in general. In this regard, this section of the study analyses the challenges of current waste management services by Zoomlion Ghana Limited in the Tamale Metropolis. These challenges capture the availability of equipment, technical staff, supporting staff and financial resources.

Statistics on availability of equipment shows that, the company did not have adequate equipment for managing waste. Key among them were waste-bins, skips trucks, skip loaders, compaction trucks and Rollon/Rolloff trucks as shown in Table 4.7. The company had a deficit of 2,000 waste-bins and 44 skips (Communal Container) to supply for residents to always deposit their household waste. This implies that the tendency of people to litter the environment through indiscriminate dumping of waste is high. Once people have no convenient place of dumping their waste, any available space will do. Furthermore, skip loaders and Rollon/Rollof trucks are also critical for ensuring efficient and effective waste collection and disposal. However, these were also inadequate. Table 4.7 shows that, instead of a total of 10 Rollon/Rolloff trucks, they had 4 which is woefully inadequate to serve an estimated population of 371,351. This confirms Puopiel's (2010) and Abdul-Yahaya and Owusu-Sekyere's (2012), findings on the availability of waste management equipment. According to them, lack of skips, dust-bins and other equipment was a major challenge of Zoomlion Ghana Limited in managing solid waste.

Table 4.7: Availability of Equipment

Equipment	Number Available	Number Required
Waste-bins	3000	5000
Skips(communal containers)	56	100
Oboafo tricycle	1002	600
Motorist tricycle	66	100
Graders	-	2
Skip Loaders	9	15
Compaction trucks	2	3
Rollon/Roll off trucks	4	6
Bulldozers	1	2
Road sweepers	-	5

Source: Office of Zoomlion, Northern Region, 2015

Puopiel (2010), further added that interms of waste storage in the Tamale Metropolis, 230 skips(communal container) were required by Zoomlion Ghana Limited to be supplied to both the middle and low class residential areas. However, 186 were available and supplied for storing waste in the Metropolis. Also, about 4,000 dust-bins were needed for storing waste in the high class residential areas for

effective service in the metropolis. This is because dust-bins are the main equipment for storing waste in order to prevent dumping of waste at unapproved sites.

The study revealed that the company had adequate technical staff to support in managing solid waste effectively. Table 4.8 shows that they had adequate operators, Janitors and drivers. This notwithstanding, the company had a slight constraint in terms of Electricians, Mechanics and Welders. They still needed 2 Electricians, 4 Mechanics and 1 Welder. Table 4.8 further shows that almost all the technical staff had some minimum academic qualification which gave them the opportunity to work in the company.

Table 4.8: Availability of Technical Staff

No.	Technical Staff	Number	Qualification	Number Needed
1	Operators	40	SSSCE/Diploma	Not needed
2	Electricians	2	Advance	2
3	Mechanics	8	HND Mechanical Engineering	4
4	Welders	4	Advance Welding	1
5	Janitors	4	-	Not needed
6	Drivers	4	License F, D,C	Not needed

Source: Office of Zoomlion, Northern Region, 2015.

These findings does not support Ogawa's (2005) argument that in most developing countries, there are inadequate human resources at both the national and local levels

with technical expertise necessary for solid waste management planning and operation. Many officers in charge of solid waste management, particularly at the local level, have little or no technical background or training in engineering or management.

The company- Zoomlion Ghana Limited had adequate supporting staff as shown in table 4.9. These included supervisors, District Operation Supervisors, Managers, Administrative Assistants, Finance and Human Resource Officers. The Table further indicates that the supporting staff had the required qualification. This debunks Ogawa's (2005), statement that in most developing countries, there are inadequate human resources at both the national and local levels with technical expertise necessary for solid waste management planning and operation.

Table 4.9: Availability of Supporting Staff

No.	Supporting Staff	Number	Qualification	Number Needed
1	Supervisors	10	Diploma/SSSCE	Not needed
2	District Operation Supervisors	2	Bachelor's Degree	Not needed
3	Managers	2	Master's Degree	Not needed
4	Admin-Assistants	2	HND in Sec and Mgt.	Not needed
5	Finance Officer	1	B.Sc. Accounting	1
6	Human Resource Officer	1	Bachelor's Degree	Not needed

Source: Office of Zoomlion, Northern Region, 2015

Ogawa (2005), posits that solid waste management is given a very low priority in developing countries, except perhaps in capital and large cities. As a result, very limited funds are provided to the solid waste management sector by governments, and the levels of services required for protection of public health and the environment are not attained. The problem is acute at the local government level where the local taxation system is inadequately developed and, therefore, the financial basis for public services, including solid waste management, is weak. This

weak financial basis of local governments can be supplemented by the collection of user service charges.

Table 4.10: Availability of Financial Resources

Cost Item	**Revenue (**GH¢)	**Expenditure (**GH¢)
1. Annual budget		
a. Government	48,791, 916.00	
b. IGF	1,320, 149.00	
2. **Operational cost**		
a. Equipment		6565036.52
b. Maintenance		3751449.44
c. Fuel		5627174.16
d. Labour		2813587.08
3. Miscellaneous		4,356.00
Total	**50,112,065**	**18,761, 603.20**

Source: Office of Zoomlion, Northern Region, 2015.

However, this is not the case of Zoomlion in the Tamale Metropolis as shown in Table 4.10. The company had adequate financial resources to execute waste management services as expected. Thus, the total revenue made by the company far outweighed the operational cost thereby leaving a surplus of GH¢ 31, 350,461.8. This seems to suggest that the company spent prudently on waste management. In spite of the surplus made, the company still lacked critical waste management equipment such as skips, waste-bins, compaction trucks, just to mention, as

indicated in Table 4.10, to effectively manage waste. This means that revenue generated was not put into full use by Zoomlion Ghana Limited.

4.6 Conclusion

From the discussion of the findings from the questionnaire, it can be concluded that as Tamale is one of the fastest growing cities in Ghana, waste management has been described as a daunting challenge (HDR, 2010). This situation compelled the government of Ghana to contract the services of Zoomlion Ghana limited to augment the efforts of the MMDAs. This has improved tremendously the sanitary situation in the metropolis though much is required.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This section presents a summary, conclusion and recommendations of the study. The summary captures the problem statement, methodology and key findings of the study. The conclusion is drawn based on the key findings and main objective of the study. The chapter ends with recommendations based on the key issues identified in the study.

5.2 Summary

Ghana like most developing countries is faced with serious solid waste management problems. All over the country solid waste is ultimately disposed of in both authorised and unauthorised waste dumps. In 1999, the Ministry of Local Government and Rural Development produced an Environmental Sanitation Policy document which sought to reform the solid waste management sector and allowed private sector participation in solid waste collection, transport and disposal in the major cities. This new policy reforms did not come with the anticipated efficiency. The Solid Waste Management sector is still characterized by problems typified by indiscriminate waste disposal, attitude of the general public and the creation of unauthorized waste dumps.

Meanwhile, the government of Ghana in the year 2006 went into partnership with Zoomlion Ghana Limited- the leading waste management company in Ghana to

help rid the cities of filth and other related services which will culminate into clean and healthy cities. This was because Metropolitan, Municipal and District Assemblies (MMDAs) could not effectively tackle the sanitation problem in the country as expected. In the light of this, the study sought to establish public perception of Zoomlion's solid waste management services in the Tamale Metropolis.

The study employed the case study approach in collecting and analyzing data from 150 respondents through the use of questionnaires and interview guides. The main sampling techniques used in selecting respondents for the study were stratified, systematic, convenience and purposive. Data collected from the field were analysed both qualitatively and quantitatively.

With the activities of Zoomlion Ghana Limited, significant proportion of the people now dump their household waste in skips (Communal Container) and waste-bins instead of previously unapproved places like gutters, open spaces, by the roadside, etc. The field data revealed that 88.6% of the respondents were supplied with skips by Zoomlion Ghana Limited for dumping of their wastes. Also, 8.7% indicated that they had been supplied with waste-bins for depositing their waste before final collection and disposal. This has greatly improved the sanitation situation in the metropolis. The field data further indicated that more than half (55.7%) of the respondents now dumped their waste in skips and 21.5% of them also dumped their waste in waste-bins. However, the waste collection containers supplied by Zoomlion Ghana Limited was woefully inadequate as 93.3% of the respondents

indicated this. This resulted in majority (83.2%) of the residents still resorting to dumping their wastes in nearest available spaces and nearby opened gutters.

The study established that the company had not been able to frequently collect waste as expected of them. In this regard, 76% of the respondents indicated that the company hardly collected waste in their residential areas. The study also established that residents had a good perception of waste management services offered by Zoomlion in the metropolis. The areas of services offered included provision of waste dumping container, waste collection, clearing of heaps of waste and cleaning gutters of filth. Analysis of the field data showed that respondents were impressed with the activities of Zoomlion in providing waste management services. Thus, majority (49.7%) of respondents rated them "Good" in providing waste management services. This was followed by 23.5% of them who rated the company "Very Good" in managing waste in the area.

Furthermore, the study showed that the company lacked the needed equipment and logistics to effectively manage waste. Key among them were waste-bins, skips, skip loaders, compaction trucks, bulldozers and Roll on/Roll off trucks. The company had a deficit of 2,000 waste-bins and 44 skips to supply for residents to always deposit their household wastes. This notwithstanding, the company had adequate and qualified human resources to manage its affairs. These were both technical and supporting staff. The technical staff composed of mechanics, operators, welders, electricians, janitors and drivers. The supporting staff also included Managers, Supervisors, Administrative Assistants, Finance Officer and Human Resource Officer. Additionally, the study revealed that the company had adequate financial

resources to execute waste management services as expected. Thus, the total revenue made by the company far outweighed the operational cost thereby giving a surplus of GH¢ 31, 350,461.8.

5.3 Conclusion

From the findings, it can be concluded that Zoomlion Ghana Limited charged with the responsibility of providing waste management services in the Tamale Metropolis, had been able to deliver the services as expected to some extent and as such their services have been perceived by residents as good. This has seen a significant improvement in the sanitation situation in the area. However, the company has failed in its bid to regularly collect waste and adequately supply waste dumping containers to residents to store their household waste. Additionally, the company also lacked the required waste management equipment to effectively manage waste in the area.

5.4 Recommendations

The following measures are recommended to address the sanitation situation in the tamale metropolis:

- Firstly, adequate dustbins and skips should be provided by Zoomlion Ghana Limited in collaboration with the Waste Management Department and the Metropolitan Assembly for residents to store their solid waste. The deficit of 44 skips and 2,000 waste-bins should be supplied particularly for low class and

middle class residential areas. The skips should be placed in vantage places so that people can have easy access.

- Secondly, wastes should collected regularly by Zoomlion Ghana Limited. This should be done particularly in the highly populated areas like Aboabo, Chanli, Teshegu and Zogbeli, to avoid heaping of waste and over flowing of skips with solid waste. At least, waste should be collected thrice a week in these areas. There should also be regular monitoring of waste collection by the Metropolitan Assembly. This will keep the place constantly clean and prevent any possible outbreak of communicable diseases such as cholera and typhoid.
- Finally, the company has to procure the required equipment and logistics such as compaction trucks, roll on/roll off trucks, bulldozers, skips and waste-bins. This will enable the company effectively manage solid waste as expected. The surplus revenue of GH¢ 31, 350,461.8 should be used to procure these equipment.

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APPENDICES

Appendix I

UNIVERSITY FOR DEVELOPMENT STUDIES

FACULTY OF PLANNING AND LAND MANAGEMENT

DEPARTMENT OF PLANNING

M.Sc. Development Management

Public Perception of Zoomlion's Solid Waste Management Services in the ***Tamale Metropolis***

Household Questionnaire

The research is mainly for academic purpose. Therefore, answers given will be treated as confidential.

Thank you.

Name of Electoral Area:.....

House Number (if available): .....

Date of Interview: .....

Questionnaire Number:.....

SECTION A

Please tick *ONLY THE BOX* of the response given/state briefly for an unprovided answer.

Households' perception on current waste management practices of Zoomlion.

Q1. For how long has Zoomlion been operating in your area?

> 5 yrs. *5 yrs.*

4 yrs. 3 yrs.

2 yrs. *< 1 yr.* Q2. Before they came, where were you dumping your waste?

Gutter Dump site

Pits. Roadside.

_____ Any place of choice

Q3 Where do you dump your waste currently?

_____ Roadside Nearby gutter

Skip Backyard

Dump sites Waste-bin

Open spaces other, specify: _____

Q4 How often does Zoomlion come around to collect waste?

Alway ___ Hardly None

Q5 How many times a week do they come to collect the waste?

5 4

3 0

2 1

Q6 Which of the following waste collection containers have been supplied to you/in your area for dumping waste?

Skip Waste-bin None

Q7 If supplied, are they enough?

Yes No

Q8 If they are not enough, what do you do with the waste? I/ dump them in

____ Nearest available space

____ Nearest gutter

Burn them

Barry them

Other, specify .....

Q9 Do the company sensitise you on how to manage waste in your households?

Yes No

Q10. If yes, what commonest waste management method have you been educated on?

Waste segregation and re-use

Composting

Burning Burying

Other, specify.....

SECTION B

Perceived impact of Zoomlion's waste management service

Indicate your candid opinion on the following activities of Zoomlion in the area.

No.	Question item	SA	A	D	SD
11	They have been able to collect waste regularly				
12	I have seen so much improvement on waste collection				
13	Waste collection containers are emptied every now and then				
14	I have never experienced or seen heaps of waste in skips/waste-bins/dumpsites since they came				
15	All gutters are clean of waste in my area				
16	We have enough skips/waste-bins to dump our waste				

KEY: SA= Strongly Agreed, A=Agreed, D=Disagreed, SD=Strong Disagreed

Q17. What is your overall impression on Zoomlion's waste management activities in the area.

Excellent Very Good Good Fair Poor

SECTION C

Background Information

Q18.What is your highest level of education?

None

Primary

____ Middle/J.S.S/J.H.S

Secondary/Technical

Training College

Tertiary

Vocational

Q19. What is your major Occupation?

Farming

Petty Trading

Business

Public servant

Other, specify .....

Appendix II

UNIVERSITY FOR DEVELOPMENT STUDIES

FACULTY OF PLANNING AND LAND MANAGEMENT

DEPARTMENT OF PLANNING

M.Sc. Development Management

Public Perception of Zoomlion's Solid Waste Management Services in the ***Tamale Metropolis***

Questionnaire for Assemblypersons

The research is mainly for academic purpose. Therefore, answers given will be treated as confidential.

Thank you.

Name of Electoral Area:

Date of Interview: .....

Questionnaire Number:.....

SECTION A

Please tick *ONLY THE BOX* of the response given/state briefly for an unprovided answer.

Households' perception on current waste management practices of Zoomlion

Q1 For how long has Zoomlion been operating in your area?

> 5 yrs.	5 yrs.
4 yrs.	yrs.
2 yrs.	< 1 yr.

Q2 Before they came, where were people dumping their waste?

Gutter	Dump site
Pits.	Roadside.

Any place of choice

Q3 Where do people dumping their waste currently?

Roadside	Nearby gutter
Skip	ackyard
Dump sites	Waste-bin
Open spaces	Other, specify: .....

Q4. How often does Zoomlion come around to collect waste?

Always Hardly None

Q5. How many times a week do they come to collect the waste?

5	4
3	0
2	1

Q6. Which of the following waste collection containers have been supplied to people in your electoral area for dumping waste?

Skip Waste-bin None

Q7 If supplied, are they enough?

Yes No

Q8 If they are not enough, what do people do with the waste? They dump them in

Nearest available space

Nearest gutter

Burn them

Barry them

Other, specify .....

Q9 Do the company sensitise people on how to manage waste in your households?

Yes No

Q10 If yes, what commonest waste management method have you been educated on?

Waste segregation and re-use

Composting

Burning Burying

Other, specify .....

SECTION B

Perceived impact of Zoomlion's waste management service

Indicate your candid opinion on the following activities of Zoomlion in the area

No.	Question item	SA	A	D	SD
11	They have been able to collect waste regularly				
12	I have seen so much improvement on waste collection				
13	Waste collection containers are emptied every now and then				

KEY: SA= Strongly Agreed, A=Agreed, D=Disagreed, SD=Strong Disagreed

14	I have never experienced or seen heaps of waste in skips/waste-bins/dumpsites since they came				
15	All gutters are clean of waste in my area				
16	We have enough skips/waste-bins to dump our waste				

17. What is your general impression about Zoomlions waste management services since they started operations in your area?

Excellent Very Good Good Fair Poor

SECTION C

Background Information

Q18.What is your highest level of education?

None Training College

Primary Tertiary

_____ Middle/J.S.S/J.H.S

_____ Secondary/Technical

_____ Vocational

Q19. What is your major Occupation?

_____ Faming

Petty Trading

Business

Public servant

Other, specify.....

Appendix III

UNIVERSITY FOR DEVELOPMENT STUDIES

FACULTY OF PLANNING AND LAND MANAGEMENT

DEPARTMENT OF PLANNING

M.Sc. Development Management

Public Per*ception of Zoomlion's Solid Waste Management Services in the* ***Tamale Metropolis***

Interview Schedule for Management of Zoomlion

The research is mainly for academic purpose. Therefore, answers given will be treated as confidential.

Thank you.

Date of Interview: .....

SECTION A

Current waste management practices of Zoomlion

Q1. For how long have you operating in the Metropolis?

.....

…

Q2. Mention the areas of operation in the Central Sub-Metro

.....

…

.....

…

Q3 Have you been able to cover all areas in the Sub-Metro?

Yes No

Q4 Before you came, where were people dumping their waste? (Indicate the commonest place)

.....

Q5 Where do people dump their waste currently? (Indicate the commonest place)

.....

Q6 How often do you collect waste in the area?

.....

Q7 What is the ideal number of times waste is supposed to be collected?

.....

…

Q8 How many times a week do you normally collect waste in the area?

.....

Q9 Does the company sensitise people on how to manage waste in households?

Yes No

Q10 If yes, what commonest waste management method have they been educated on?

Waste segregation and re-use

Composting

Burning

Burying

Other, specify .....

SECTION B

Impact of Zoomlion's waste management service

Candidly rate yourself in terms of performance of the following activities **(E=Excellent, VG=Very Good, G=Good, F=Fair, P=Poor)**

No.	Activity	E	VG	G	F	P
11	Regular Collection of waste					
12	Emptying skips/waste-bins every now and then					

13	All gutters are clean of waste					
14	Clearing of all choked-gutters					
15	Enough skips/waste-bins distributed across all sections for storing waste					
16	Heaps of waste cleared					

SECTION C

Challenges of current waste management services by Zoomlion

Availability of Resources for Managing waste

Q16. Waste collection and disposal equipment (Indicate the number available and the number needed

Equipment	**Number Available**	**Number Required**
Waste-bin		
Skip		
Oboafo tricycle		
Motorist tricycle		
Grader		
Skip Loader		
Compaction truck		
Roll on/Roll off truck		

Bulldozer		
Road sweeper		
Others		

Q17. Availability of technical staff for managing waste

No.	Technical Staff	Number	Qualification	Number Needed
1				
2				
3				
4				
5				
6				

Q18. Availability of supporting staff for managing waste

Q19. Financial Resources for solid waste management

No.	Supporting Staff	Number	Qualification	Number Needed
1				
2				
3				

4				
5				
6				
7				

Cost Item	Revenue (GH¢)	Expenditure (GH¢)
4. Annual budget		
c. Government		
d. IGF		
Waste collection and Disposal/month		
e. Equipment		
f. Maintenance		
g. Fuel		
h. Labour		
5. Miscellaneous		
Total		

Q20. In your opinion, what are the major challenges facing the company in managing solid waste in the area? Please further give a brief reason attached to each challenge.

I . .....

.....

.....

I I . .....

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I I I . .....

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I V . .....

.....

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V . .....

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V I . .....

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V I I .....

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