

**AN APPRAISAL OF HOUSEHOLD WASTE MANAGEMENT IN THE CITY OF
CHIPATA**

BY

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A dissertation submitted to the University of Zambia in partial fulfilment of the requirements for
the award of the Masters of Science Degree in Environmental and Natural Resources
Management.

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APPROVAL

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DEDICATION

To my Parents, Amos and Silika, and my children, Mwaba, Elidah, Olipah, Ivwananji and Mussah.

ABSTRACT

The purpose of the study was to carry out an appraisal of the management of household waste in the city of Chipata. The study was based on the following objectives, to: (i) characterise household waste in Chipata city, in terms of composition, volume, recyclability and reusability, and (ii) examine the management strategies of household waste carried out in Chipata city.

A survey design supported by both qualitative and quantitative approaches was used and by using a checklist, questionnaire and interview guide relevant information on household waste composition, storage, handling and disposal were obtained from selected households of Kapata, Hollywood and Kalongwezi Townships of Chipata city. A sample of 120 households was involved. Stratified sampling was used to obtain the three townships so that high, medium and low density populated residential areas were represented while purposive sampling was applied to select 40 households per township. Quantitative data was analysed using descriptive statistics with the aid of the Statistical Software Package for Social Sciences 20.0 (SPSS) while qualitative data was coded and emerging themes were grouped into categories and then interpreted.

The results showed a marked variation in domestic waste types and quantity generated across the three residential areas reflecting the income levels of the inhabitants. The highest total weights (26.2 kilograms) were generated in Kalongwezi Township, area with low population while the lowest values (18.0 Kilograms) were reported in the highly populated Kapata area showing that despite some wealthier areas having much lower populations than poorer areas, they still generate more waste. In Kapata Township, plastic bags were the common receptacles used and more than 50 percent of the households had no receptacles meaning that open dumping was prevalent. Burning and burying of waste was observed in Kapata and Hollywood where waste dumping in drains and waste littering characterized by overfilled receptacles was also common. The waste generated in these townships contained less reusable materials compared to Kalongwezi where more reusable waste was generated.

The results of this study, therefore, provide evidence that many households in Chipata do not efficiently manage their household waste. The study recommended the following; re-enforcement of the existing legal framework in the country, improving public awareness through sensitization programmes, encouraging the minimisation of waste generation, introducing incentives to those who separate waste and encouraging private agencies to participate in both waste recovery and in general waste management efforts. Building on this study, research could be undertaken to assess the generation of household waste in all districts in the country as well as the household waste composition and storage facilities.

Key Words: Household Waste, Waste Management, Indiscriminate Waste Disposal, Receptacle

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LIST OF ACRONYMS

CBD	Central Business District
CBO	Community-Based Organisations
CCC	Chipata City Council
CSO	Central Statistical Office
DCBF	Danish-Chinese Business Forum
DEFRA	Department of Environment Food and Rural Affairs
DEPA	Danish Environmental Protection Agency
ECZ	Environmental Council of Zambia
EEA	European Environment Agency
EMA	Environmental Management Act
EPA	Environment Protection Authority
GAIA	Global Alliance for Incinerator Alternatives
GHGs	Green House Gases
GP	Green Productivity
GRZ	Government of the Republic of Zambia
HHW	Household Waste
LCC	Lusaka City Council
MSW	Municipal Solid Waste
MSWM	Municipal Solid Waste Management
NEAP	National Environmental Action Plan
NGO	Non-Governmental Organisation
NWMS	National Waste Management Strategy
PPP	Polluter Payers Principal
RUAF	Resource Centers on Urban Agriculture and Food Security Foundation

UK	United Kingdom
UN	United Nations
UNEP	United Nations Environmental Program
USA	United States of America
USEPA	United States Environmental Protection Agency
WRI	World Resources Institute
WHO	World Health Organisation
WTE	Waste to Energy
ZEMA	Zambia Environmental Management Agency
ZESCO	Zambia Electricity Supply Cooperation

DEFINITION OF TERMS

In this study the following meanings were adopted.

Waste: is garbage, refuse, sludge and other discarded substances generated from industrial commercial, domestic, social gatherings and community activities (ECZ, 2008). Waste is further defined as material which has been used and is no longer wanted because the valuable or usefulness part of it has been taken out (Soanes, *et al.*, 2006).

Solid waste: is often defined as all materials which are produced by human and animal activities that are in most cases solid and considered to be useless or unwanted (Hakami and El-Sayed, 2015). This type of waste is normally produced by households, industries, medical institutions, agricultural and construction activities. The waste may be organic or non- organic in nature.

Municipal Solid Waste (MSW): refers to all urban waste that is produced within the domain of local authorities. MSW consists of household waste, construction and demolition debris, sanitation residue, and waste from streets. Municipal solid wastes are defined by EPA as waste consisting of everyday items ,used and then thrown away, such as product packaging, grass clippings, furniture, clothing, bottles, food scraps, newspapers, appliances, paint, and batteries, which comes from homes, schools, hospitals, and businesses (United States Environmental Protection Agency (USEPA), 2013).

Household waste: refers to waste generated by normal household activities. Dahlen (2008). Household waste tend to be a combination of leftover food, sanitary towels and diapers, plastics, empty tins, fabric, rugs, oils, used batteries, broken furniture just to mention but a few. Household waste is generally defined as waste generated by normal household activities.

Solid Waste Management (SWM): refers to all those activities and action required to manage waste from its inception to its final disposal (UN, 1997). This includes amongst other things, collection, transport, treatment and disposal of waste together with monitoring and regulation.

Disposable diapers: in this study refer to single use diapers which are made of synthetic disposable materials which allows for defecation or urination in a discreet manner. Single-use

(disposable) diapers are not eco-friendly because they contain absorbent chemicals and are thrown away after use, remaining nondegradable in the disposal sites.

Biodegradable: refers to the change that a substance or chemical undergoes to change to a harmless natural state by the action of bacteria.

Indiscriminate: refers to the careless disposal of waste. Waste is disposed of in undesignated areas.

Incineration: refers to the burning of solid waste as a disposal method. It helps to reduce the amount of waste.

Landfilling: is a land disposal method for solid waste in which garbage is covered every day with several inches of soil.

Leachate: refers to the liquid that filters through a dump or landfill.

Recycling: is the use of waste materials, also known as secondary materials or recyclables, to produce new products.

Source reduction: refers to reduction in the quantity or the toxicity of material used for a product or packaging; a form of waste prevention.

Receptacle: is a container which is used for storing waste before disposing of it.

CHAPTER ONE

INTRODUCTION

1.1 Background

The problem of waste is a universal one as waste exists in every community and it is difficult to manage efficiently. In developing countries like Zambia waste has become an increasingly complex problem to handle and manage. Waste generation has often been directly linked to the size of population and the various activities undertaken by different categories of the population (Sherman, 1996; Environmental Council of Zambia (ECZ), 2004). As population grows and more waste is generated the more difficult and complex waste handling and management becomes. The consequences of burgeoning populations in urban centres are more noticeable in developing countries as compared to the developed countries (Rajkumar and Ahmed, 2016). Developing countries are facing serious challenges with increased waste (Ahmed and Ali, 2004; Ukpong and Udofia, 2011) while developed countries have over time developed rigorous waste management frameworks which ensure efficiency in waste collection, transportation and disposal (Ukpong and Udofia, 2011).

In addition to population increase, waste management challenges in developing countries have also been exacerbated by the increase in world urbanization. Urbanization has brought about a rapid change in many people's consumption patterns to match those in developed countries (Nchito, 2015). Many people are now using more disposable items emulating the general consumption pattern of the west. For instance, people are now consuming a lot of fast foods which normally require the use of disposable containers made from materials such as styro-foam and plastic. Changes in lifestyles have also seen an increase in the use of disposables by households. Things like disposable diapers, paper towels, tetra pack containers for milk and juice are used daily by households in the Global South. These have contributed to an increase in waste being generated. This increase has also resulted in inefficiency in the handling and management of the same waste which is generated and local authorities are often underfunded and unable to cope (Ukpong and Udofia, 2011).

The inefficiency in handling waste starts from the household level then it stretches upwards to township level. The inefficiency in handling, disposal and management of household waste has caused environmental hazards and the calamity associated with this phenomenon cannot be under-estimated as it affects the environment as well as human health (Pham and Brown, 2009). The environmental impacts regarding the inefficient handling, disposal and management of household waste is related to the impact on the environmental quality taking the form of foul odours and unsightly as well as contamination of groundwater, source of water and pollution of air (Cointreau, 2006). These in turn impact negatively on human health.

In Zambia like in many other developing countries, typically one to two thirds of the household waste generated is poorly handled, disposed and managed (Khonje *et al.* 1992). Such waste poses a lot of management challenges. Due to the many challenges that the country is facing in terms of managing waste, the Government of the Republic of Zambia (GRZ) has enacted several environmental laws to help curb the situation. The legal and institutional frameworks like the Zambia Environment Management Act (2011), Local Government and Housing Act (1991) and many more provide measures intended to protect and preserve the environment from abuse, pollution and degradation.

Despite these laws being in place, there has been a noticeable increase in indiscriminate disposal of waste even at household levels. Zambia's National Environmental Action Plan (NEAP) (1994) cites issues around poor waste management as, lack of garbage collection by the local authorities, lack of garbage sites, inadequate measures and methods of waste disposal and weak legislation with regards to solid waste disposal. Despite the fact that safe and sustainable management of waste contributes to improving public health and enhancing environmental quality, home based solid waste management has so far been the most ignored and least studied area in environmental sanitations in many developing countries (Coad, 2011).

It is imperative that waste generated at household level is efficiently handled and disposed of to make it easier for local institutions to do the same at township and municipal levels. It is against this background that this study seeks to investigate the management of household waste in the city of Chipata and then suggest options for efficient management of household waste

1.2. Statement of the Problem

Despite the legal and institutional frameworks that are in place to enhance the efficient handling and management of waste, there is still inefficient waste management in city of Chipata. The inefficiency in the management of waste in many townships of Chipata is evidenced by the visible waste found along the streets and in the drainages. Different types of household waste is disposed of carelessly within the urban environment. The types of waste that predominate include plastic bags, plastic bottles, disposable food packages, and disposable diapers. This has compromised the quality of the environment and human health. In order to maintain quality urban life, waste generated needs to be disposed of efficiently (Doan, 1998).

In addition, there is limited understanding of the composition of household waste and management in intermediate towns and cities like Chipata that have recently experienced rampant economic and infrastructure growth. Despite the fact that waste generation has become an inevitable consequence of lifestyles and daily living (United Nations, 2009; Liu, 2010), developing countries are largely unable to deal with the increasing amounts of waste generated in cities (Coffey and Coad, 2010). Furthermore, the investigation and understanding of options is often done for the large cities and solutions are adopted from the West. This poses a problem for small and intermediate towns which do not have the same resources base as the larger cities but produce waste which needs handling. Many people do not seem to mind the way they handle the waste they generate, all they think about is how to get rid of the trash using any method, yet according to Zake et al.(2007) a properly managed waste is wealth. It is for this reason that, this study was carried out to appraise the household waste management strategies in the city of Chipata and to mitigate the trend of poor waste management by suggesting viable options.

1.3. Aim of the study

To appraise the household waste management strategies in Chipata city.

1.4. Research Objectives

- i. To characterise household waste in Chipata city in terms of composition, volume, reusability, recyclability.
- ii. To examine the household waste management strategies carried out in Chipata city.

1.5. Research Questions

- i. What are the characteristics of household waste found in Chipata city?
- ii. Which one of the characteristics of household waste predominate in Chipata city?
- iii. What management strategies are carried out on household waste in Chipata city?
- iv. Is household waste stored in appropriate receptacles before disposing it of?

1.6. Significance of the Study

The findings will provide stakeholders and local authorities with information relating to how they can mitigate factors responsible for inefficient handling, disposal and management of household waste in intermediate towns and cities. The findings will also provide information in the nature of waste produced in residential areas. This information is important for the formulation of waste management strategies and can help improve and sustain household waste management in Chipata city. The findings will further contribute to the body of knowledge on the management of waste in the country. Additionally, the study is important because it relates to both public and personal hygiene.

1.7. Scope of the Study

The study on an appraisal of household waste management was conducted in Kapata, Hollywood and Kalongwezi townships of Chipata city of Eastern Province. The three townships were targeted so that, all the three types of formal townships in Chipata; low, medium and high density of population were represented. The scope is also limited to household Waste.

1.8. Organisation of the report

The report has six chapters. Chapter one provides the introduction and background of the study. It discusses the characteristics of household waste and the likely effects on the environment if they are indiscriminately disposed of. It is here that the problem, rationale and objectives of the study have been stated.

Chapter two discusses the literature review on two levels, namely, the global North and global South. The chapter discusses the management of waste in some countries in the global north and south while chapter three looks at the description of the study area.

Chapter four outlines the methodology that was used to come up with this report. It includes the survey design which was supported by quantitative and qualitative methods that were used. It also includes sampling procedures and methods of analysis.

Chapter five contains the data presentation and discussions of the findings of the research while chapter six is a combination of the conclusion and recommendations.

CHAPTER TWO

LITERATURE REVIEW

2.1. Introduction

This chapter reviews the relevant literature from different books, journals, magazines and other written materials on the management of waste. Literature was reviewed on two levels, namely, the Global North (Canada, Denmark and United Kingdom) and Global South (Bangladesh, Mexico, Manila, Kenya, Sierra Leone, South Africa and Zambia). The main themes that were reviewed include; waste management, household waste, and municipal solid waste management.

Some studies have already investigated various waste management and disposal strategies in the context of developing countries. For example, Ali *et al.* (1999) investigated solid waste disposal for Low-Income Countries and Simelane and Mohee (2012) considered future directions of municipal solid waste management in Africa.

Ali *et al.* (1999) identifies some types of waste composition, those with relatively low organic contents and calorific value and those with high proportion of fines. The study arrived at the conclusion that waste composition and quantity in Karachi (Pakistan) varies by income group and with season. Further, the study highlights the fact that there is lack of staff trained in solid waste management at Karachi Metropolitan Corporation and concluded that the lack of staff skilled in any method of safe waste disposal is a major constraint and therefore suggested that municipal capacity building should precede any new disposal operation. The case study of Karachi reveal that landfilling are preferable disposal option for Karachi because of the existing technical, institutional, financial, social and environmental conditions.

Simelane and Mohee (2012) state the waste management challenges that are faced by many cities in Africa as inefficient collection, management, disposal and reuse of municipal solid waste (MSW). The study looked at many African cities Lusaka inclusive. Their study revealed that in urban centres throughout Africa, less than half of the solid waste generated is collected, and 95 percent of that is neither contained nor recycled. The waste is indiscriminately thrown at

dumping sites on the periphery of urban centres, or at temporary sites. These inefficient forms of solid-waste disposal tend to have serious health and environmental impacts, which extend beyond their boundaries. The study further concluded that, these dynamics of waste production and management demonstrate that there are disparities between higher-income and lower income countries in the volume of waste generation and management strategies. Higher income countries generate more waste than the lower-income countries.

The two studies just examined provide a foundation for further investigation into the feasibility of waste management strategies in developing countries. Significant to the present research, Simelane and Mohee's (2012) suggestion that significant waste reduction could be accomplished through source reduction with increased backyard composting, since about 50 percent of household waste is organic material. This was examined under this study as well to find out if backyard composting can be a workable source reduction of waste even in Chipata, Zambia and what measures could be put in place to encourage many households to use it if at all it can partly help solve the waste management challenges in Chipata town.

The investigations conducted by Simelane and Mohee (2012) and Ali *et al.* (1999) suggest that of the options available, landfilling stands the best chance of being operated effectively. This was equally examined in this study to find out if landfilling could be the best waste management option even in Chipata, Zambia. In addition, the study also examined the composition of household waste in Chipata to find out if it contained more of organic material as the case was for some African cities and Karachi in Simelane and Mohee (2012) and Ali *et al.* (1999) respectively.

2.2. Global perspective on Waste Management

Effective management of solid waste is a pervasive urban problem globally. Many waste management and reduction strategies have been put in place to try to curb the situation but these strategies have received much more attention in developed countries than in developing countries. While several strategies have been applied for efficient Municipal Solid Waste Management (MSWM) in developing countries, their performance level has not been critically investigated (Aliu *et al.* 2014). This entails that, in developing countries, strategies with regard waste reduction and management of waste once it is generated are not well understood but have

the potential to resolve the current solid waste issues. Some studies suggest that the reutilization of solid waste is not only a viable option to MSWM (Sudhir *et al.* 1996; Kasseva and Mbuligwe, 2000) but also desirable socially, economically, and environmentally (Kasseva and Gupta, 1996; Uiterkamp *et al.*, 2011).

The generation of waste has continued to increase as human population in the world increases and many cities worldwide become more urbanized. Urbanisation has become a worldwide trend, and is particularly rapid in the developing world. The urban population of the world is expected to double to more than five billion people in the next 35 years, with 90 percent of this growth taking place in developing countries (World Resources Institute (WRI), 1997). Notably, the United Nations has also recently projected that nearly all global population growth from 2016 to 2030 will be absorbed by cities, about 1.1 billion new urbanites over the next 14 years (Barney, 2015).

Urbanization in Africa is increasing rapidly (Freire *et al.* 2014). The UN projects that by the year 2025 54.1 percent of Africans will live in urban areas. Its rate of urbanization soared from 15 percent in 1960 to 40 percent in 2010, and is projected to reach 60 percent in 2050 (UN Habitat, 2010). Urban populations in Africa are expected to triple in the next 50 years (Freire *et al.*, 2014). This entails that African countries are becoming more urbanized.

Reports have indicated that, globally, humans are extracting more resources to produce consumer goods than the planet can replenish (World Bank, 2005; United Nations Environmental Programme (UNEP), 2013). This increase in the use of the Earth's resources means that even the waste that is generated has increased and this waste is normally mismanaged leading to the environment and human health being at risk.

Further, urbanisation has also contributed to enhanced municipal solid waste generation and unscientific handling of waste which in turn degrades the urban environment and causes health hazards (Rajkumar and Ahmed, 2016). High population growth rates, rapidly varying waste compositions and generation patterns, growing urbanization and industrialization in developing

countries (Troschinetz and Mihelcic, 2009) are the important reasons for paying attention to MSWM as more area is required to accommodate waste (Idris *et al.*, 2004).

Proper management of waste is of prime importance because inefficient management can lead to indiscriminate disposal of waste on land, water and in the air which in turn can be hazardous to both human and environmental health (Pham and Brown, 2009). The way waste is handled at household level is the starting point to the abysmal state of the many urban areas today in terms of challenges faced when managing waste. It is thus imperative that household waste is efficiently handled and disposed to avoid piling the responsibility of managing household waste on municipalities which at the moment are grappling to correct the situation because of 'inadequate and erratic funding as well as human resource challenges. There are waste management phases which are common to many countries in both the global north and south and these are as discussed in the subsequent section.

2.3. Waste Management phases

The several phases in waste management are unavoidable and they include all activities that take place from the time waste is generated to the final stage when it is discarded. These phases follow the following chronological order; waste generation, waste handling and storage, collection by the relevant authorities, transportation, processing and recovery and then disposal (Post, 2007). Planning for proper management must consider all these phases and number of stakeholders around each of the phases could differ (Ali, 2000). For example, at the phase of household waste generation and storage, the households and community groups are more important as compared to final disposal where municipal and local authorities are the key players.

2.3.1. Waste generation

The sources of waste include; households, industries, hotels and institutions. This study focuses on household waste. The quantities and qualities of waste generated by households vary from household to household. The generation of waste also differs in volume and type according to region. The amount of waste generated from households per person is less in developing countries than in high income countries (Bobeck, 2010). For example, the generation rate for household waste in Haiti is 0.21kg per capita per day compared to the USA where it has been

calculated to 2.10kg per capita per day (Phillippe and Culot, 2009). Further, in 2012 Americans generated about 251 million tons of trash (United States Environmental Protection Agency (USEPA), 2012) while approximately 2,900 tons of solid waste is generated in Jamaica everyday (Post, 2007). Bobeck (2010) states that the volume and type of Municipal Solid Waste generated in developing countries depend on the standard of living and consumption patterns.

The global trend of increased generation of waste with improved economic situation has resulted in a rapid increase of waste in newly industrialised, middle- income countries like China (Eawag, 2008). The challenge of municipal waste generation and collection varies within the residential areas of urban areas (Ukpong and Udofia, 2011). According to the ECZ (2008) the waste that is generated does not pose an immediate threat to man or environment but later when it decomposes it infiltrates and percolates whereby producing leachate with an unacceptable high pollution potential. It is however important to state that this statement by ECZ (2008) somehow overlooked the immediate negative effects from some wastes immediately it is disposed or after a short while.

It is therefore true to acknowledge that garbage is capable of bringing destruction to the environment and so it is very important to put measures to help reduce and minimise the high flow of solid waste into the waste stream. In view of this, Kawai and Tasaki (2014) suggested some technical solutions for estimating MSW generation per capita at the local and national levels to improve reliability and comparability of data. Throughout history, human advancement has been intrinsically linked to the management of solid waste due to its effect on both public and environmental health (Mc-Allister, 2015). Abel (2007) also links the high volumes of domestic waste generation to the increased domestic and household activities in many urban environments.

2.3.2. Waste handling and storage

After solid waste has been generated it should be stored temporarily awaiting collection and transportation by the relevant authorities. The households normally are supposed to do this in order to prevent the waste from scattering all over their surroundings. The waste is stored in some receptacles before being put in communal storage containers en route to the final deposit site. However, Tadesse *et al.* (2007) conclude that the inadequate supply of communal waste

containers and the longer distance to these containers in developing countries increase the probability of waste dumping in open areas and roadsides.

Waste is handled and stored differently in developed and developing countries. According to Diaz (2011) many developing countries tend to inappropriately store their household waste and Gage (1998) found that in the low-income areas any convenient container was typically used. Cowing *et al.* (2014) describes the type of waste containers used in many developed countries for individual households as those with lids and that each household had multiple bins separated into categories usually represented by colour. Moreover, in developing countries, waste storage in many homes is based on poor storage practices, adding to the collection difficulties (Sood, 2004). Post (2007) adds that solid waste problems are exacerbated when the collection cycle does not match the disposal cycle dictated by the storage container, leading to the use of unsustainable disposal methods such as illegal dumping and burning. Different waste containers are used by different households, both from developing and developed countries, in cases where the waste is stored before being disposed. Figure 2.1 shows some common receptacles used by some households.





Figure 2.1: Receptacles used by some households

Source: Diaz (2011); Cowing *et al.* (2014)

The use of proper waste containers ensures that the waste does not mix or contaminate the surrounding and the waste that easily decomposes should be collected and transported immediately. There are two levels of waste storage and these are primary and secondary where the former involves temporal storage done at the source of generation while waiting for collection and transportation of such waste and the latter deals with storage done at institutions awaiting recycling and re-use (Tadesse *et al.*, 2007).

2.3.3. Collection and transportation

Waste collection is a service deemed so important that the law requires that it is provided for the benefit of the entire society and so there is need to pay for it (Wilson *et al.*, 2013). The collection and transportation of waste can be done by the relevant local authorities (Kawai and Tasaki, 2016). Normally three groups of stakeholders are involved. These may include the households generating the waste, the industry which needs the waste for recycling or re-use and private licenced transporters who may collect the waste from the primary storage to the recommended dumping sites. According to Post (2007), the vehicles used should be ideal and there must be no leakages so as to avoid contaminating areas along the way to the dumping site. Ukpong and Udofia (2011) however, observe that there was lack of specialised waste collection and disposal vehicles such as sand tippers and trailer trucks for conveying waste to disposal site in the city of

Uyo in Nigeria. This is a typical scenario that is prevalent in many cities in developing countries and Eawang (2008) adds that appropriate transport services are often lacking as well as are suitable treatment and disposal facilities in developing countries.

Palmer (1998) stresses that every country should uphold the appropriate design of safe and environmentally ways of waste management through providing safe storage and ideal transportation for disposal of such waste. Currently, this is the stage that is failing to meet the demand in developing countries. There is therefore need to allow other partners to come on board to supplement in the process and efforts the local councils are putting in.

The system that is followed when collecting waste varies from one area to another. For example, Agboge *et al.* (2014) say that for Lagos, the system of waste collection was mainly door-to-door collection and that in some areas it was reported that the collection was done once per week, while Nyakana (1997) reveals that in Kampala waste is collected from the communal dump site, households take their waste to this dump site (bin) and the local authorities collect it from there monthly. According to Post (2007), waste collection service in Jamaica, another developing country, varies for each community, where some communities only receive collection once per month due to the difficulty in accessing the community, while in the urban areas of Ocho Rios and St. Ann's Bay a weekly collection is followed. The process for waste collection services in developed countries follows the block, kerbside and door-to-door collection systems among others. According to Flintoff (1984) block collection system is operated in Mexico City where the collection vehicle travels a regular route at prescribed intervals. For kerbside collection, residents place their bins on the footway in advance of the collection time and remove them after they have been emptied while door-to-door collection involves the emptying of the bin by the collector to the vehicle (Flintoff, 1984).

2.3.4. Processing and recovery

The waste is collected and transported to areas where some vital resources are recovered from them as Jensen (2014) asserts that waste can contain materials and resources that can be recycled. The waste that has been directed for recycling is processed into other products. Market for waste to be recycled should be readily available and easily accessible so as to encourage the generators to sell more (Zurbrugg, 2002). In some cases, some small scale industries purchase

items like glass, metal cans, plastics and bottles from the scavengers (Ahmed and Ali, 2004). These are cleaned and refilled by industries with other products while used paper, pieces of metal and plastic are recycled by different recycling industries.

It is however important to note that it is difficult for developing countries to recycle because most of the waste is not sorted at source, collection, transportation and disposal (Ikiara *et al.* 2004). According to Hoornweg *et al.* (1999), Germany, South Korea, Slovenia and Austria are the world leaders in recycling and Eurostat (2013) states that these countries send less than half of the total waste output to the landfill.

2.3.5. Disposal

Final disposal is the last phase in the waste management stream. This is a critical stage which ensures that the waste is taken to the right destination. This is the phase when all the collected waste requires a safe disposal (Cofie, *et al.*, 2009). Despite all the efforts to reduce, recycle and reuse the waste, there are always certain quantities of waste requiring final disposal and this waste is collected and disposed at the dump site (Agboje *et al.*, 2014). There are several options used to discard of the waste. It can either be incinerated, composited or dumped on a landfill. Sometimes waste is indiscriminately disposed in pits and open areas. Once waste has been generated, it is supposed to be disposed of. At the final disposal stage there is need to deal with the larger and accumulated quantities of waste. Some common methods of final disposal of waste without energy recovery should usually be the last resort for waste (DEFRA, 2013). The options for disposing the waste in many countries from both the global north and south include the following;

2.3.5.1. Incineration

This involves the burning of waste. In most cases, this is done in unauthorized areas. Garbage incineration is however becoming increasingly unpopular because waste is now considered as a resource (Zake *et al.*, 2007). One of the benefits of incineration is the reduction of the amount of waste for disposal (Shin, 2014). Waste is incinerated when it cannot be recycled and when residues from incineration do not cause environmental problems (Danish Environmental Protection Agency (DEPA), 1999). Unfortunately in many cities of developing countries, uncontrolled burning is prevalent and in unauthorised areas (Post, 2007) and little attention is

paid to the environmental and health impact that it causes like the production of dioxins, a cancer forming chemical and air pollution (USEPA, 2005).

According to Cofie *et al.* (2009), the waste stream in developing countries is over 50 percent organic material which is wetter and more corrosive than in developed cities (Ogwueleka, 2009). Incineration of biodegradable waste is therefore ineffective in developing countries because of moisture and Cointreau (2006) adds that, a large part of municipal solid waste flow in developing countries is organic and biodegradable waste which originates from households. This explains why incineration in developing countries is ineffective and inefficient. The types of waste which can be incinerated include paper, plastic and other wastes that have no moisture content (mainly, organic matter). However, incineration creates gaseous waste and ash and can contribute to air pollution.

2.3.5.2. Landfilling

Landfilling is the oldest form of waste treatment for disposing waste materials by burying it. The majority of collected Municipal Solid Waste that is not recycled is typically sent to landfills (USEPA, 2014). Despite the fact that, landfills have been the most common method of organized waste disposal and remain so in many places around the world, Shin (2014) however states that some European and Asian countries were able to phase out most of landfilling by means of large investments in recycling, composting, and waste-to-energy (WTE). Although land is already becoming increasingly scarce and the cost of landfilling is rising, the United States of America still relies heavily on landfilling, with about 63 percent of MSW disposal (Shin, 2014).

The main environmental concerns related to landfills are leachate and landfill gas. As liquid moves through the landfill, it picks up a variety of toxic and polluting components in large or trace amounts forming leachate, which can potentially contaminate ground and surface water (Rathje and Murphy, 1992). Landfill gas is formed as organic material decomposes in landfills through the methanogenic process, leading to the production of carbon dioxide and methane (Bowen *et al.* 2014). Methanogenic processes refer to the formation of methane by anaerobic bacteria (Leverenz *et al.* 2002). This gas is composed mainly of methane, a greenhouse gas (GHG) 21 times more potent than carbon dioxide (CO₂) in terms of its global warming potential

(Light *et al.*, 1994). It also includes CO₂, small amounts of nitrogen and oxygen, and trace amounts of a wide range of other gases. The several types of landfills are as shown in Figure 2.2.

Figure 2.2: Types of Landfills

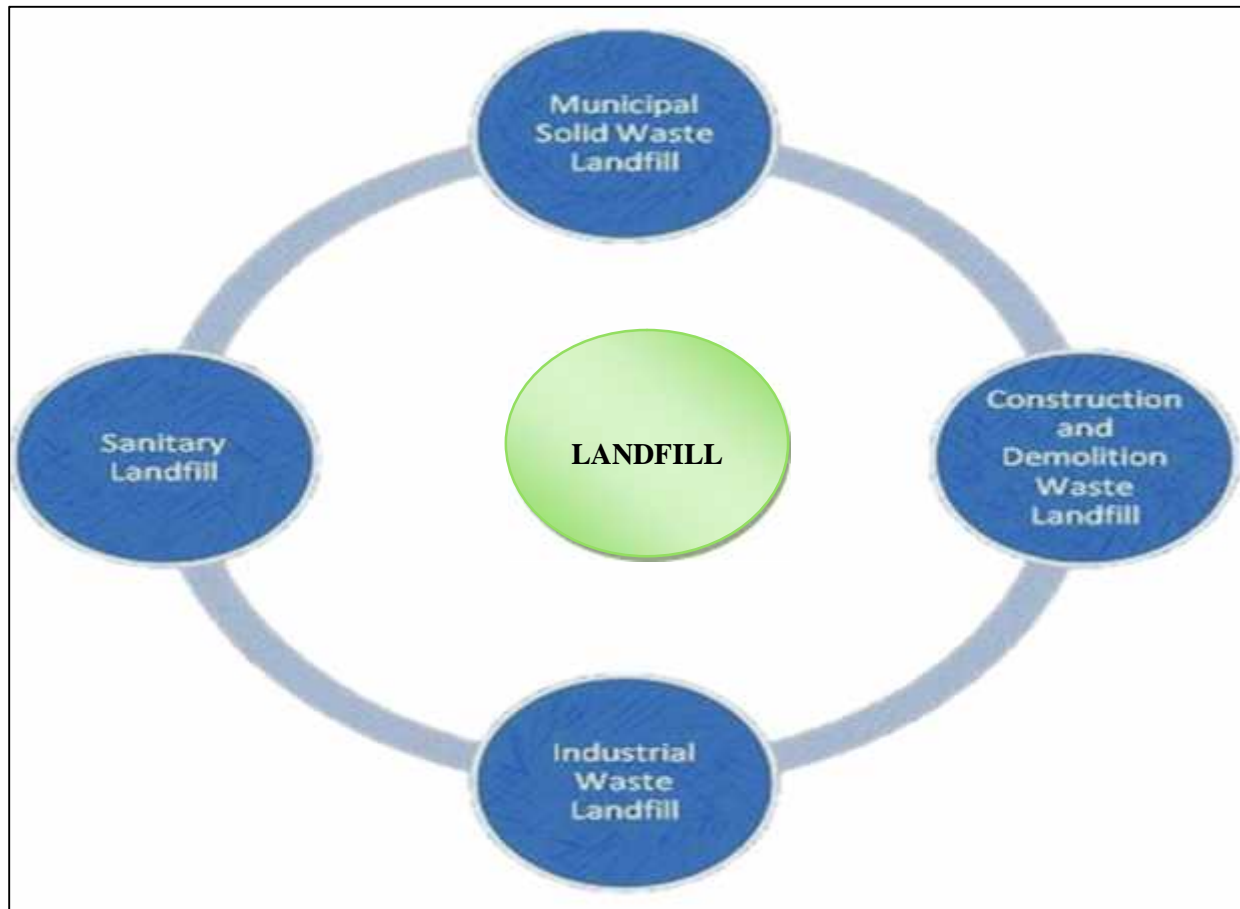


Figure 2.2: Types of Landfills

Source: EPA (2013)

2.3.5.2.1. Sanitary landfills

Sanitary landfills use technology to contain the waste and prevent the leaching out of potentially hazardous substances. The sanitary landfill does not address the pollution of ground waters by landfill leachate (garbage juice) (Lee and Jones, 2011). A clay liner is used to isolate the trash from the environment this is an attempt, through the use of inexpensive bottom liners and landfill covers, to initially isolate the waste from moisture in a “dry tomb” approach (Lee and Jones, 2011).

2.3.5.2.2. Municipal Solid Waste (MSW) landfills

These landfills are specifically designed to receive household garbage and are regulated by state and local governments (USEPA, 2014). The Environmental Protection Agency (EPA) has established minimum criteria that these landfills must meet. Some materials banned from disposal in MSW landfills include paints, cleaners, chemicals, motor oil, batteries, and pesticides (EPA, 2013). However, some household appliances and stream garbage collected by Sanitation Services from homes, businesses and institutions can be turned into MSW for disposal (USEPA, 2014). These landfills use a synthetic (plastic) liner to isolate the trash from the environment.

2.3.5.2.3. Construction and demolition waste landfills

These types of landfills used for debris generated during construction, renovations, demolitions of buildings and bridges (USEPA, 2014). The types of debris include: concrete, wood, asphalt, gypsum (the main component of drywall), metals, bricks, glass, plastics, trees, stumps, earth, rock, and building components (doors, windows, plumbing fixtures).

2.3.5.2.4. Industrial Waste Landfills

All industrial waste consisting of highly hazardous chemicals to non-hazardous waste associated with manufacturing and other industrial activities are deposited in this landfill (Chandrappa and Das, 2012).

2.3.5.3. Composting

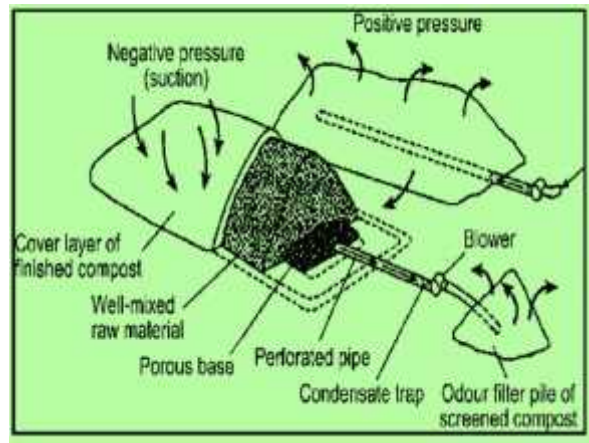
Waste is composted in order to make use of organic materials like vegetable matter, eggshells, coffee grinds, tea bags (anything that is not animal-based) and also reduce the volume of organic waste (Hoornweg *et al.*, 1999; Wilson and Feuche, 2014). These are placed in a suitable container or pile to decompose. Over time, these materials turn into a rich form of soil that is absolutely chock-full of vitamins and can assist in the growth of plants in any place (Holmgren, 2002). Composting is therefore, the process of turning organic matter that is ready for disposal into something beneficial. Inorganic matter such as sand, metal and glass does not decay and therefore, unaffected by compositing.

Despite being a potential sustainable method of organic waste recovery, composting has not been overwhelmingly successful and widespread in practice throughout the developing countries (Cointreau, 1982; Zurbrugg *et al.*, 2004). Hoornweg *et al.* (1999) list reasons such as insufficient

knowledge in carrying out composting operations and lack of markets as some of the contributing factors to the unsuccessful composting practises in cities of developing countries. The use of appropriate technology for the composting operation is often overlooked in many developing countries Pendley (2005). However, in some developing countries composting is advancing, mainly in Asian countries (Bobeck, 2010). Composting is normally done on both small and commercial scales using simple or advanced techniques respectively. Figure 2.3 shows some various composting facilities.



a) Windrow Composting



b) Static-pile Composting



b) Anaerobic digestion Composting



d) In-vessel Composting

Figure 2.3: Various Composting Facilities

Source: EPA (2013)

2.3.5.3.1. Windrow Composting

Aerated or turned windrow composting is suited for large volumes of waste such as that generated by entire communities and collected by local governments, and high volume food-processing businesses (e.g., restaurants, cafeterias, packing plants). It normally yields significant amounts of compost, which require marketing the end-product. When it is made by local authorities, compost is made available to residents for a low or no cost. This type of involves forming organic waste into rows of long piles called windrows and aerating them periodically by either manually or mechanically turning the piles (Cofie et al., 2009). The pile is large enough to generate enough heat and maintain temperatures. Large volumes of diverse wastes such as yard trimmings (Wilson and Feuche, 2014), grease, liquids, and animal by-products (such as fish and poultry wastes) can be composted through this method (Cofie et al., 2009)

Windrow composting often requires large tracts of land, sturdy equipment, a continual supply of labour to maintain and operate the facility, patience to experiment with various materials mixtures and turning frequencies. Windrow composting is a large-scale operation and might be subject to regulatory enforcement, zoning, and siting requirements. Compost should be tested in a laboratory for bacterial and heavy metal content. According to Pendley (2005), windrow composting operation is economically feasible resulting in a significant cost savings.

2.3.5.3.2. Static-pile Composting

Static pile composting produces compost relatively quickly (within three to six months). It is suitable for a relatively homogenous mix of organic waste and work well for larger quantity generators of yard trimmings and compostable municipal solid waste (e.g., food scraps, paper products), such as local governments, landscapers, or farms (Bobeck, 2010).

To aerate the pile, layers of loosely piled bulking agents (e.g., wood chips, shredded newspaper) are added so that air can pass from the bottom to the top of the pile. The piles also can be placed over a network of pipes that deliver air into or draw air out of the pile. Air blowers might be activated by a timer or a temperature sensor. Since there is no physical turning (Rynk, 1992) this method requires careful monitoring to ensure that the outside of the pile heats up as much as the core.

This method may require significant cost and technical assistance to purchase, install, and maintain equipment such as blowers, pipes, sensors, and fans (Hoornweg *et al.*, 2000). Having a controlled supply of air allows construction of large piles, which require less land than the windrow method.

2.3.5.3.3. Anaerobic Digestion Composting

This is composting without air, that is, the organic matter is decomposed in the absence of air (Cofie *et al.*, 2009). Organic matter may be collected in pits and covered with a thick layer of soil and left undisturbed six to eight months. Maintenance is therefore very low. If the debris is just stacked in a pile, it will generally compact to the point where there will be no available air for beneficial organisms to live. Instead there will be very slow working bacteria growing that does not require air. This can make the compost take years to break. The compost so formed may not be completely converted and may include aggregated masses. The bacteria break down the organic materials into harmful compounds like ammonia and methane. As a result, anaerobic composts create a foul smell and have a possibility of the inability to destroy harmful pathogens; it is therefore not recommended for urban agriculture (Cofie *et al.*, 2009).

2.3.5.3.4. In-Vessel Composting

In-vessel composting can process large amounts of waste without taking up as much space as the windrow method and it can accommodate virtually any type of organic waste (e.g., meat, animal manure, biosolids, food scraps). This method involves feeding organic materials into a drum, silo, concrete-lined trench, or similar equipment. This allows good control of the environmental conditions such as temperature, moisture, and airflow. The material is mechanically turned or mixed to make sure the material is aerated (Cofie *et al.*, 2009).

This method produces compost in just a few weeks. It takes a few more weeks or months until it is ready to use because the microbial activity needs to balance and the pile needs to cool. Very little odour or leachate is produced. This method is expensive and may require technical expertise to operate it properly. It uses much less land and manual labour than windrow composting.

2.4. Waste Composition

It is important to note that the composition of the waste in the cities in the global south is somehow different from those in the global north, the former contains a lot of waste comingling (where different types of waste is mixed) than the latter (Hoornweg and Bhada-Tata, 2012). It is therefore easy to manage waste in the global north because their waste is separated at the site where it is generated. In addition, many people in the global north are more aware of the implications of the health and environmental challenges and therefore they equally contribute to eradicate what can lead to the outcome of indiscriminate waste disposal by sorting out the waste once it is generated. This is the challenge that most cities in the developing countries face, especially when it comes to composting, lack of separation at source (Dhokhikah and Trihadiningrum, 2012). The lack of separation at source and the composition of waste have affected the collection and storing of waste in many developing countries leading to inefficiency waste management (Needhidasan *et al.*, 2014).

In developing countries a large part of household waste includes peelings from fruit and vegetables, food remnants and leaves (Cointreau, 2006). Organic materials make up the largest component of household solid waste in many developing countries (Bobeck, 2010) while paper and plastic wastes predominate in high income countries (Hakami and El-Sayed, 2015). The scenario on waste management in some of the selected countries in the global north and south is discussed below;

2.5. Waste Management in the Global North

World over the disposal and management of waste is an environmental and health concern. Developed countries are striving to achieve their obligations of managing the household waste efficiently by aiming at going further up the ladder of the waste hierarchy where they prefer prevention to taking the waste to a landfill. Studies conducted in the United Kingdom (UK) show that, the country is aiming at reducing the amount of waste that is to be taken to a landfill despite the fact that countries in the global north produce a lot of waste (Watson, 2013).

According to United States Environmental Protection Agency (USEPA), 2008), from 2002 to 2008, Municipal Solid Waste (MSW) in Canada increased slightly from 769 kilograms to 777

kilograms per capita. Household waste made up a third of the total and other reports state that used diapers are the largest contributors to landfills (USEPA, 2008). In addition, figures published by the UK Government's DEFRA (2013), show that in 2012 the UK produced about 31 tonnes of MSW. Bonam (2009) said, a lot of environmental pressures were currently resulting from the rising waste generation levels and improper disposal of waste. In recent years, a combination of recycling and composting has become the largest means of managing waste, accounting for 26.7 percent and 15.5 percent respectively, of the total waste generated (Eurostat, 2013). While recycling and incineration has simultaneously increased, waste is now seen as a resource to be recovered (Fischer *et al.*, 2012).

Denmark is perceived to be one of the world's greenest countries despite the country being one of the countries in Europe producing the most waste per inhabitant (Eurostat, 2012). In 2011 Danish households produced 447 kilograms (kg) of waste per person (Fischer *et al.*, 2012). This corresponds to every Dane throwing away more than 8kg of waste every week. (Eurostat, 2012). The Danish waste management system has a long tradition for recovering energy from waste, which goes back to the beginning of 1900 (Eurostat, 2012). It was however not until the 1990's that the major shift from landfilling of waste to incineration of waste took off. That was the result of a landfill ban on biodegradable MSW, which was introduced in 1997 (Kjaer, 2013). Today, insignificant amounts of waste are going to landfills and Denmark is characterized by a high degree of incineration, amounting to 54 percent in 2010 (Eurostat, 2012). As a consequence, many landfills receive so little waste that it is no longer economically viable to keep them fully operational (Eurostat, 2012; Fischer *et al.*, 2012).

Denmark uses the waste hierarchy framework developed by the United Nations (UN) for its waste management. The waste hierarchy presented in Figure 2.4 shows that waste disposal is the last resort method for waste management and the least favoured (in waste reduction terms), although still the most common. Figure 2.4 shows the waste hierarchy developed by the UN.

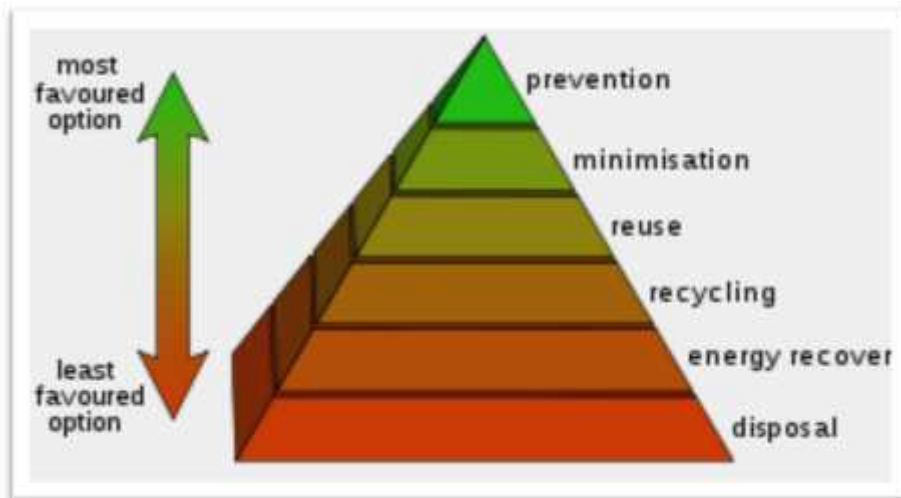


Figure 2.4: The Waste Hierarchy

Source: UNEP (2013)

The waste hierarchy is the basis for prioritisation of waste management options in Denmark. According to this hierarchy, recycling ranks higher than incineration with energy recovery, and landfilling ranks lowest (UNEP, 2013). Danish waste management has progressed in leaps and bounds from its initial focus on the protection of human health, through the integration of environmental protection, to the extraction and recovery of resources in waste (DEPA, 1999).

In addition, many countries in the global north are making use of the wastes by exploiting them for energy through incineration (Seltenrich, 2013). Landfills are used as the primary means for the disposal of waste materials and less than 5 percent of MSW disposal goes to incineration in Canada (USEPA, 2008). There is a major shift from landfilling of waste to incineration of waste in order to recover energy from it, because there is a great understanding that waste contains materials and resources that it makes sense to recycle it.

Other studies conducted in the United Kingdom (UK) show that, the country is striving to achieve its obligations of efficient household waste management by under turning increasingly to a wide range of alternative options for disposal which include increased recycling, composting, anaerobic digestion and the use of thermal treatment facilities to recover energy from waste (Watson, 2013). In 2013, 43.5 percent of the United Kingdom's municipal waste was recycled, composted or broken down by anaerobic digestion (Eurostat, 2013).

The other studies conducted in Canada and Denmark on residential waste have revealed that household waste is picked up by the municipality, private waste management companies or transported by households to collection, recycling and disposal facilities (Environment Canada, 2003; Eurostat, 2012). According to European Environment Agency (EEA), (2013), municipalities were obliged to introduce separate containers at each household for the waste generated. In addition, the waste management industry provides services under contract to industrial, commercial or institutional waste generators (Giroux, 2014). Each municipality in Canada develops its own waste management program which could include; curb side collection, depot drop-off, pay as you throw or any combination of these elements as long as the program is in compliance with the requirements of the Environmental Protection Act (2008).

2.6. Waste Management in the Global South

Many developing countries in the global south are facing a lot of challenges as they try to cope with the ever increasing solid waste in their respective countries. Some studies conducted in Bangladesh on waste management so far indicate that, there is a concern about the ever increasing amount of solid waste, not only in Bangladesh but in all Asian countries (Hwa, 2007). In South Africa, the gradual increase of waste generation has contributed to the historical backlog of inadequate waste services, leading to unpleasant living conditions and an unhealthy environment (Tancott, 2013). It is estimated that, over 42 million cubic metres of general waste is generated every year across the country, with the largest proportion coming from Gauteng province (42 percent) (Maithili and Malkani, 2003). The average amount of waste generated per person per day in South Africa is 0.7 kg which is closer to the average waste produced in developed countries (0.73 kg in the UK and 0.87 kg in Singapore), than to the average in developing countries such as 0.3 kg in Nepal (Maithili and Malkani, 2003).

In addition, WHO (2003) reports that, an estimate of over 742 tons per day of garbage is generated in the metro Freetown area of Sierra Leone and of this, over 84 percent is biodegradable organic waste, mostly from residential, markets and Industrial wastes consisting of mostly broken bottles, waste cans, rags and plastics and small quantities of hazardous wastes. It is a known fact that the generation of plastics has increased yet (Dhokhikah and Trihadingrum, 2012), plastics degrade very slowly because the intermolecular bonds in some plastics may persist in the environment for thousands of years (Lindahl *et al.*, 2014). The increase has been

attributed to the emulation by many developing countries of the lifestyles and attitudes of industrialised countries (Afon and Okewole, 2007; Bobeck, 2010). Many Asian countries are equally facing the problem of an increased generation of plastic waste (Zurbrugg, 2002) which tend to float in water due to their low density and when plastics are discarded in watershed areas they collect in the rain water sewers. Sometimes due to prolonged intervals of retrieval, they choke these rainwater outlets and increase the risk of sewer blockages. In China and Bangladesh, it has been the reason for exacerbated flooding during the rainy season (Alamgir and Ahsan, 2007).

Most Third World cities are grappling with the provision of adequate and equitable solid waste management services to their constantly growing populations (Coad, 2011; Chikwemeka *et al.*, 2012). The Philippines was one of the first developing countries to face up to the huge increase in waste due to urbanisation and population growth (Atienza, 2011). The best proof is that the very first law that President Gloria Macapagal Arroyo signed as president was the Solid Waste Management Act that was enacted to address the alarming garbage problem in the metropolis (World Bank, 2012). Since its enactment, nothing has improved. The problem has persisted leading to poor quality of the environment in Manila. Meanwhile, local councils struggle with limited resources to manage the increasing amounts of waste and waterlogged open landfill sites (Global Alliance for Incinerator Alternatives (GAIA), 2009).

In Sierra Leone, the Ministry of Youth and Sports has failed to manage the waste because it is struggling with tight budgets, lack of qualified manpower, and no institutional authority and experience in waste management (Sood, 2004). This is a misplacement of the waste management department showing that not much care is attached to how waste is managed even at the highest level and this makes it difficult for waste to be efficiently managed. In addition, the adequate management of MSW in developing countries is difficult because of the scarcity of studies about their composition (Momoh and Oladebeye, 2010; Achi, *et al.*, 2012)

Waste is mainly comingled, kitchen waste mixed with paper, dust, and rubbish from sweeping ground (Simon, 2008). This makes it a big challenge to manage the household waste in many developing countries. The household waste is usually poorly handled and not packed or stored in

receptacles before being disposed (Sood, 2004; Gogra, *et al.*, 2010). According to Sood (2004), lack of house-to-house collection of wastes and storing of waste without sorting it in old leaky buckets and used paper bags has contributed to inefficient management of waste in Freetown.

Household waste which includes used food scraps, sanitary towels and diapers is usually collected and disposed of in the landfill or incineration. In Bangladesh and Mexico City, open dumping or uncontrolled dumps are very common and presently, it is estimated that almost 20 tonnes of waste is not collected daily in Mexico City. (Rahat *et al.*, 2014; Ojeda-Benitez and Beraud-Lazono, 2002). In the recent past, most of the trash was being sent to one landfill, a massive dump called Bordo Poniente but was closed down because the site had amassed some 76 million tons of waste (Maciag, 2013). As a result, mountains of trash piled up at illegal dumping sites throughout the city and garbage bags lined the streets. Due to improper management of household waste, the overall environmental condition of the uncontrolled dumpsites is extremely vulnerable with severe environmental pollution (Hwa, 2007).

According to Hwa (2007), many governments in Asian countries, have realised that Green Productivity (GP) measures such as reduction, recycling, reuse and recovery are essential elements in SWM as a form of checking the rapid growth rate of waste in the cities. As a result, national awareness campaigns on GP measures are held regularly to promote recycling activities. Atienza (2011) has noted some successful cases on how the condition of the informal waste sector in Manila has improved by forming them into organizations and cooperatives and upgrading their material recovery processes. Aguinaldo (2009) also adds that, there is an increasing recycling rate that was noticed between 2000 and 2009.

The Mexican officials came up with an innovative idea of trading trash in order to cut on the amount of waste and encourage recycling (Ojeda-Benitez and Beraud-Lazono, (2002). The city set up a massive farmer's barter market where families haul their paper, metals and other recyclable waste to exchange for green point vouchers based on weight. Government employees and volunteers would then sort items and distribute vouchers. Despite the program's success, it is a small dent in Mexico City's massive trash problem.

Further, it has been observed that household waste management remains a big challenge and limited literature exists in Zambia on management of household waste especially in intermediate cities like Chipata. This might be attributed to the fact that little interest has been taken because the waste so produced by household activities initially was considered to be manageable at household level, but recently this assumption seems not to be true because of the many deposit sites that have emerged near many households, along the roads, near markets leading to a very offensive odour and unsightly heaps of garbage.

According to Zambia's NEAP (1994), the main issues around waste include, lack of garbage collection by the council, lack of garbage sites, inadequate measures and methods of waste disposal and weak legislation with regard to solid waste disposal. The following legal frameworks are in place in the country to help curb the waste management problem; these include; the Environmental Management Act (EMA), Zambia Environmental Management Agency (ZEMA), Local Government Act.

2.6.1. The Environmental Management Act (EMA) No. 12 of 2011

According to the Government of Zambia (GRZ) (2011), the generation of waste should be minimised, wherever practicable, and waste should, in order of priority, be re-used, re-cycled, recovered and disposed of safely in a manner that avoids creating adverse effects. The Act further outlines some responsibilities of people concerning the waste that they generate. It states that, a person shall not collect, transport, sort, recover, treat, store, dispose of, or otherwise manage waste in a manner that results in an adverse effect or dispose of waste in such a manner that it becomes litter (GRZ, 2011).

2.6.2. Zambia Environmental Management Agency (ZEMA)

The Environmental Council of Zambia (ECZ) now Zambia Environmental Management Agency (ZEMA) developed a waste management strategy on the premise that if systematic improvements were introduced at the various stages in the waste cycle (from generation to disposal), the quantity of waste generated at each of the subsequent stages would be considerably reduced (ECZ, 2004). It is important to note that the development of this strategy was through a consultative process involving all the major stakeholders. Some objectives of the strategy

included the minimisation of the generation of waste and maximisation of waste collection efficiency.

In addition, it was suggested that in order to accomplish the goal of efficient and effective management of waste, the strategy was to utilise the waste management hierarchy and the following principles; polluter pays principle, integrated life cycle principle, source reduction principle, precautionary principle and the principle of cooperation (ECZ, 2004). The Agency was given the mandate to issue a waste management licence to a person to allow the person to reclaim, re-use, recover or recycle waste; collect and dispose of waste from industrial, commercial, domestic or community activities and transport waste to a disposal site (GRZ, 2011).

2.6.3. Other Supporting pieces of legislation

Table 2.1 gives a summary of other supporting pieces of legislation in the field of waste management in Zambia.

Table 2.1: Other pieces of Legislation Associated with Waste Management in Zambia

Name of legislation	Area of coverage
Public Health Act of 1978	Prevention and suppression of diseases
Local Government Act of 1991	Establishment of local authorities and local government administrative system
Ionizing Radiation Act of 1975	Protection of public from dangers of ionizing radiation
Mines and Minerals Act of 1995	Granting of, renewal and termination of mining rights

Source: Environmental Council of Zambia (2004:3)

The waste generated in Zambia has undergone change in the recent past, for example, from the use of paper bags for wrapping food stuffs to plastic wrappers and disposable packages, shift by mothers from cloth nappies to disposable diapers, and so on. Beyond the mid-1990s, countries like Zambia saw an increase in the presence of the ubiquitous plastic bags as well as an increase in the number of household items with increased packaging with plastic based material such as

styro-foam and unrecyclable plastic receptacles (Nchito, 2015). The increase in the use of plastic bags has resulted in the increase in a lot of plastic waste thrown all over many towns in the country. The evolution of the composition of waste is an important factor which should not be ignored when it comes to waste disposal (Nchito, 2015).

Although a number of studies have been carried out on the management of household waste in the country, it should be noted with concern that most, if not all, of these studies have been carried out in big towns like Lusaka, Livingstone, Kitwe and Ndola and not in intermediate towns like Chipata. In addition, most literature is centred on SWM ignoring the composition of household wastes. The composition of household waste normally provides a basis for waste management, but if little is known about their composition, the management of the same waste becomes a challenge.

Limited literature, therefore, exists in Zambia on issues concerning handling, disposal and management of household waste. One of the viable literatures on waste management was carried out by Munthali (2000) on an analysis on the types of waste generated by households in Kamanga Compound (Lusaka), how it is collected and disposed as well as the actors involved in Municipal Solid Waste Management (MSWM). The gap in relation to this study is that, the study was only done in one compound, an informal highly densely populated area. This cannot be generalized to all townships in the country because their social- economic activities differ as well as the consumption patterns and waste generation rate.

Khonje *et al.* (1992) carried out a study on waste management in the cities of Lusaka, Ndola and Kitwe and concluded that the waste in the country was inefficiently managed. Nchito (2015) carried out an analysis of vehicle choices of private solid waste management companies in Lusaka and found that there were several factors like the haul distance between the collection area and the unloading point that influenced vehicle choices of private firms and that some of these choices were unsustainable. Both studies also looked at the big cities of the country and not the intermediate towns of Zambia.

Zambia like any other African country has been facing challenges in managing the MSW. The country has been experiencing the problem of lack of proper solid waste management, a situation that has resulted in drainages being clogged leading to flash floods during the rainy

season and waterborne diseases such as cholera and typhoid. According to Flintoff (1984), most solid wastes are very offensive materials which provide an attractive habitat for such disease vectors as flies and rodents and which pass through a lengthy process of decomposition the products of which can cause serious water pollution.

Zambia has high rate of waste generation (Nawa, 2008). This may be attributed to the increase in population which has recently been recorded. According to Central Statistical Office (CSO) (2010), Zambia's population increased from 9,885, 591 in 2000 to 13,092,666 in 2010. The population grew at an average annual rate of 2.8 percent during the 2000-2010 inter-censal periods. This has definitely led to high rate of waste generation, particularly in Chipata due to high population growth caused by rural-urban, urban-urban migration and natural growth. Poor waste management in many towns of Zambia has resulted in loss of people's lives due to the outbreak of diarrheal diseases like cholera and dysentery. Proper management of waste has positive impacts while poorly managed waste can have negative impacts on sustainable waste management. Poorly managed waste impacts negatively on both the environment and human health while efficiently managed waste does not only preserve the environmental and human health but also bring about some economic benefits like; energy recovery, recycle and reuse.

In Zambia, the generation of household waste has increased. Lusaka city like many other cities in Zambia is currently experiencing serious problems at all stages of SWM that is, the collection, sorting, transportation, and disposal of garbage (Kyambalesa, 2007). But regardless of the reasons for the unprecedented accumulation of solid wastes in Zambia's cities, it is perhaps important to underscore the fact that such wastes are a serious health hazard. For instance, piles of uncollected solid wastes facilitate the formation of pools of stagnant water and create breeding grounds for mosquitoes and as such, expose residents to the deadly malaria parasite.

According to Nawa (2013), in Lusaka's Kaunda Square, Kamwala South, Kalingalinga, Misisi and other townships, some abandoned or semi-finished structures have been turned into dumping sites. Without doubt waste management remains a challenge all over the country, particularly in the townships. Even the issue of garbage collection has continued to be a challenge which calls

for drastic measures to be put in place to address this challenge otherwise it will create larger environmental and health problems in the future.

The abysmal state of many towns in Zambia has led the country seek other ways of curbing the situation of uncollected garbage by partnering with the private sector and community based organizations in waste management. For example, a franchise system has been implemented in Lusaka and towns in the Copperbelt province that encourages the participation of the private sector in waste collection (Nchito, 2015). This has resulted in increased waste collected and disposed and consequently to cleaner cities. Initially, the Lusaka City Council (LCC) had been doing the collection of waste in Lusaka for years but now, the collection has been handed over to many various private companies.

In Lusaka before private companies took over the collection of waste all the garbage was being collected by the LCC's Health Department. They collected fortnightly from only a few selected places in Lusaka that would pay for waste collection such as some hotels, businesses and very few houses. As a result, there was a lot of accumulating waste in households as there was no one to collect waste from them and so people began littering around the surrounding of their homes. Since the council did not have enough resources to collect the garbage from all over Lusaka on its own, it joined forces with the private sector from the year 2003. In addition, the implementation of the Keep Zambia Clean and Healthy campaigns has been introduced as a way of strengthening information dissemination and awareness creation among members of the public.

In the city of Chipata, Eastern Province, open dumping as a form of waste disposal is an on-going issue and is now widely regarded by many environmental bodies as more of a problematic solution than a viable one. The generation of waste has increased in many townships of Chipata city and garbage like, bottles, plastics, used diapers are being thrown in drainages, along the main roads and streets. This clearly shows that waste generation has increased in all the townships of Chipata over the years. Many formal residential areas generate and indiscriminately dispose the waste.

With consumer products evolving and becoming more sophisticated so is the waste stream which can contain toxic substances. The end result, as in many towns in developing countries is the dilemma on how to dispose of the increasing waste. It is therefore important to find out how the waste produced in these three townships is managed and if it differs in generational quantities and composition because of the differences in their social and economic activities.

2.7. The Gap

Although a number of studies have been carried out on the management of household waste in the country, it should be noted with concern that most of these studies were often done in large cities ignoring the situations prevailing in intermediate towns and cities like Chipata that have recently been experiencing rampant economic and infrastructure growth. In addition, it should be noted that the efficient management of waste at household level was in fact the starting point of efficient and effective waste management at municipalities and national levels. This is the reason that prompted the researcher to seek to investigate how waste was handled and managed at household level and provide a basis for any changes or improvements in the way household waste can well be managed to suit the situations in cities like Chipata.

CHAPTER THREE

DESCRIPTION OF THE STUDY AREA

3.1. Introduction

This chapter presents a justification for the selection of the study area. It also gives a description of the study area, focusing on the physical as well as social and economic characteristics.

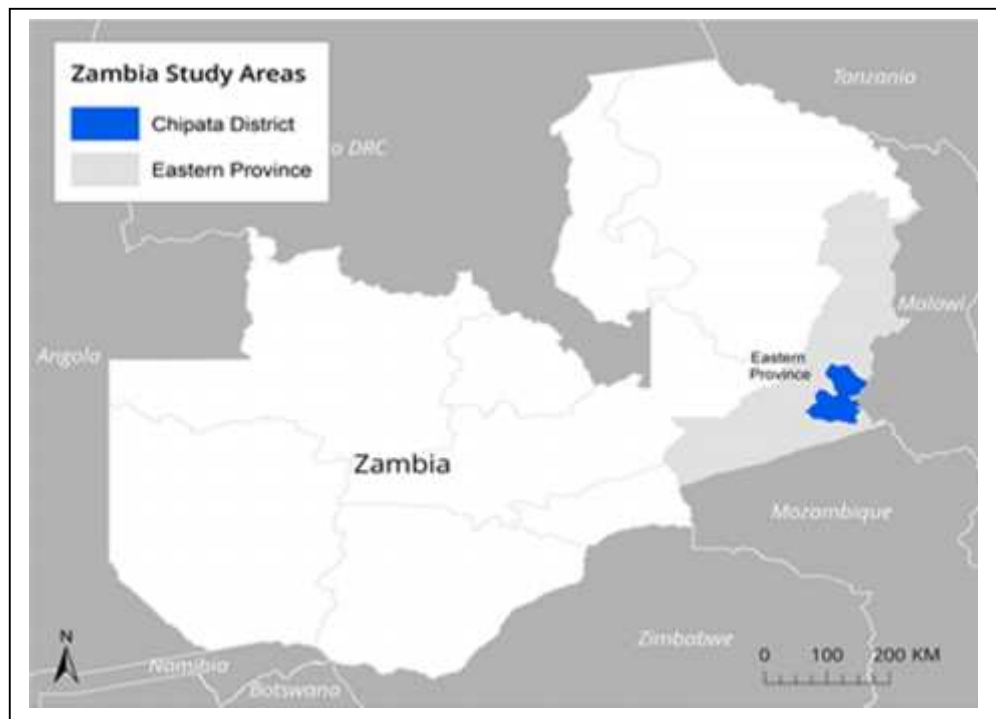
3.2. Location

The study was conducted in Kapata, Hollywood and Kalongwezi townships of Chipata City, Eastern Province of Zambia. Kapata is a high density settlement situated to the North-East of Chipata town, about 2.5 km from the Central Business District (CBD). Hollywood which is a medium density residential area is found in the Northern part of the town, about 1.5km from the CBD, while Kalongwezi, a low density area is found in the South-West of the town about 2.0km from the CBD, (see Figure 3.2).

The Eastern Province covers an area of 69,106 square kilometre and is located in the eastern part of the country between longitudes 30 and 33 degrees east of Greenwich meridian and latitudes 10 and 15 degrees south of the equator (Kunda, 2008). The major part of the province is located on the Central African Plateau which rises to an altitude of 900 to 1200 meters (Simon *et al.* 2008) while a smaller part of it lies in the Luangwa Valley at 300 to 600 meters above sea level (Kunda,2008).

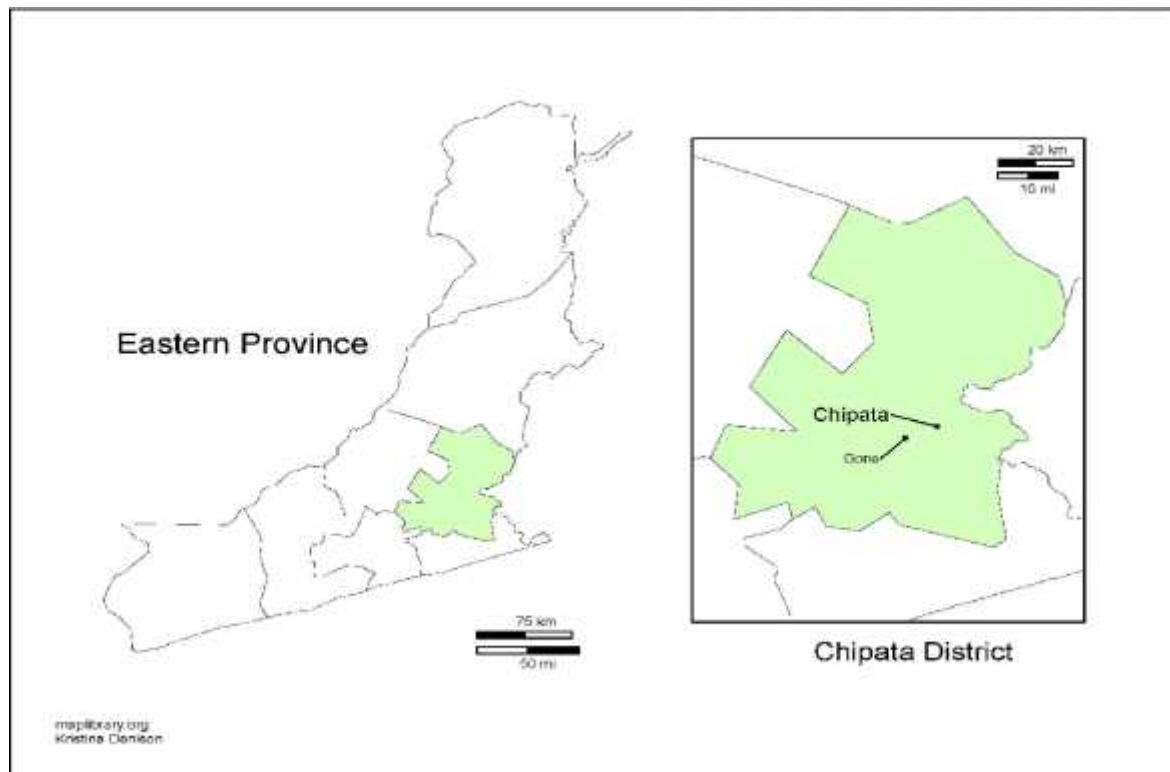
Chipata, which is the headquarters of Eastern Province, covers an area of 6,693 Km² (Hollingsworth *et al.* 2015) and is geographically positioned on latitude 13 degrees south and longitude 32 degrees east. It is situated about 576 km East of Lusaka and about 130 km South-East of the South Luangwa National Park in Mambwe District. To the East, the town borders Malawi with Lilongwe, the capital city of the neighbouring country, being only 110 km away. To the North, Chipata borders with Lundazi, and Katete lying in the South-West while Chadiza District is in the South as shown in Figures a and b. The accessibility and variations in social and economic activities in the three townships prompted the researcher to choose them for the study.

a)



Google Map of Chipata Town, Eastern Province.

b)



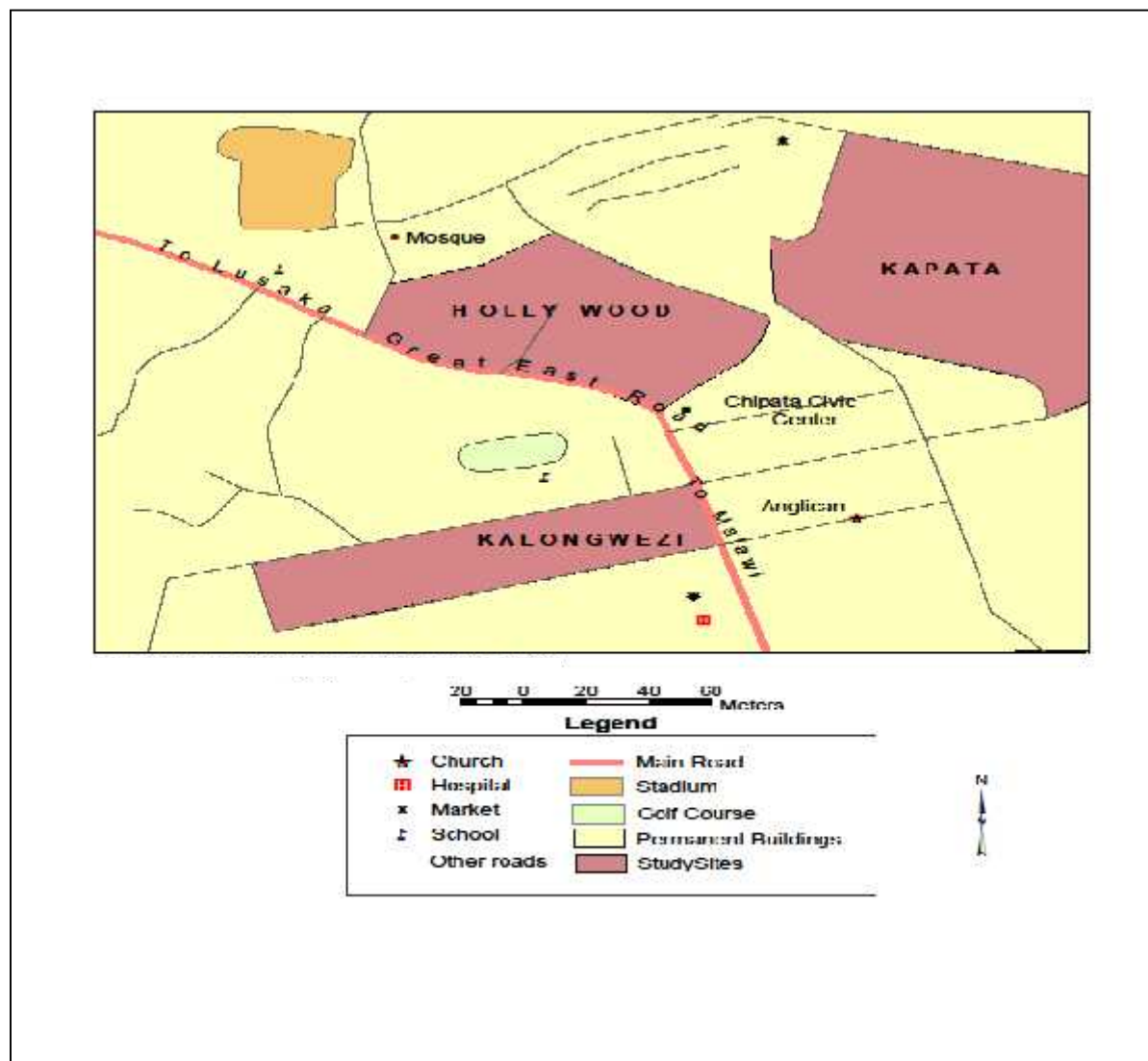


Figure 3.2: Location of three study Sites in Chipata

Source: Extracted from google earth (2017). GES UNZA

3.3. Socio-Economic Activities

The city of Chipata is a well-known agricultural area for crops are like maize, groundnuts, cotton, soya beans and also the keeping of domesticated animals like cattle, goats, pigs and sheep. According to Hollingsworth *et al.* (2015), approximately 74 percent of the people in the district live in rural areas and are dependent on agriculture activities. The socio- economic activities in the study area varies from small-scale businesses and small scale farming (Kapata), middle formal employment (Hollywood) to higher formal employment in Kalongwezi. Some

residents in the study area are civil servants while others are employed in the informal sector. All these three townships are formal settlement areas but they just differ in income and population levels. Kapata is a low income settlement, Hollywood a middle income area while Kalongwezi is a high income settlement area.

3.4. Demographic Characteristics

Chipata town has been witnessing an unprecedented population growth in recent years. Table 3.1 summarises the population changes that have occurred in three decades.

Table 3.1: Population changes in the city of Chipata in the three decades

Year	1990	2000	2010
Population	261,100	367, 539	455,783
Growth Rate (%)	-	28.96	19.36

Source: CSO (2010)

The population of Chipata increased from 261,100 in 1990 to 367,539 in 2000 and 455,783 in 2010 (CSO, 2010). Kapata and Hollywood are in Kapata ward which has 6,607 households while Kanjala ward has 6,990 households where Kalongwezi is found (CSO, 2010). Kapata is thus a highly populated formal settlement area. Hollywood has medium population while Kalongwezi is an area of low population. Although waste dumps are a regular experience in third world cities (Aliu *et al.* 2014), it has however wider spatial dimensions in areas with a higher population. Since the population of Chipata has been increasing, it follows that even the quantity of waste generated has increased. According to CSO (2010), Chipata was the most densely populated district in Eastern Province with a population density of 68.1 persons per square kilometre. It is therefore important that this waste is efficiently managed before the situation gets out of hand.

3.5. Topography and Soils

Chipata town is located on a fairly high altitude of about 1,500 metres above sea level and is near the Lake Malawi/Luangwa River Watershed (Simon *et al.*, 2008). The predominating topography of the district is a mixture of high plateau and rugged hills with an altitude of approximately

1,000m to 1,500m above sea level, particularly towards the south and south-west of Chipata. The northern zone of Chipata is undulating and mostly low lying with altitudes of between 1,000m and 1,500m above sea level. The town (1 198 644 ha) can roughly be divided into three major landscapes; the Degraded Plateau, Escarpment Complex and Rift Trough (Simon, et al. 2008).

The Degraded Plateau covers the area around Chipata town and consists of hills, ridges and minor escarpments. The soils in this area consist of associations of slightly leached, strongly acidic, reddish to brownish, clayey to loamy soils derived from basic and acid rocks with Munga and Miombo as dominant vegetation (Hollingsworth, et al., 2015). The second major landscape, the Escarpment Complex is a transition zone to the Rift Trough (the Luangwa Valley). The soils are shallow and gravelly derived from acid rocks with Miombo vegetation while the last major landscape, the Rift Trough covers the Lupande Game Management Area and the South Luangwa National Park. The soils are of variable texture, mainly of alluvial origin with Mopane, Munga or Miombo vegetation (Mwakikagile, 2010).

3.6. Climate

In so far as the climate is concerned, the city of Chipata has a tropical savannah climate with mean annual temperatures ranging from 15 degrees Celsius to 26 degrees Celsius (Hollingsworth et al. 2015). The city lies in the medium rainfall belt of Zambia with average annual rainfall of up to 1,000mm (Mwakikagile, 2010) representing the most favoured agro-ecological conditions in terms of rainfall, soil quality and absence of tsetse flies (Sitiko *et al.*, 2011).

Chipata lies in the region II of the three Agro-Ecological Regions (AER) (Chirwa *et al.*, 2015), a region with a growing period of 120 -150 days (GRZ, 2002). The region supports high value crops, mix of crop and livestock enterprises (Sitko *et al.*, 2011). Eastern province is the largest maize producer in Zambia followed by the Southern and Central Provinces, all located in AER II (Japanese Association for International Collaboration of Agriculture and Forestry (JAICAF), 2008). Most of the rains fall within the wettest months of the year from December to March. The higher southern zone of the town receives more rain compared to the north. Overall, Chipata has a favourable climate for different agricultural activities, which, among others, include growing of crops such as maize, groundnuts, tobacco, cotton and soya beans (Hollingsworth, et al., 2015).

CHAPTER FOUR

METHODOLOGY.

4.1. Introduction

This chapter discusses the methodology that was used in conducting the study. It outlines the research design, sampling process, data collection methods, and data analysis which were used for the study.

4.2. Research Design

The study adopted a survey design supported by qualitative and quantitative approaches. By utilizing both quantitative and qualitative techniques within the same framework, it ensured the incorporation of the strengths of both methodologies (Onwuegbuzie and Leech, 2007). The survey design was used because it helped the researcher to collect data on respondents using questionnaires and interview guides.

4.3. Study Sample

The study sample comprised of residents of Kalongwezi, Kapata and Hollywood townships of the city of Chipata.

4.4. Sampling Procedure

To select the three townships in Chipata city, stratified sampling technique was used so that, the low, medium and high density residential areas were all represented. The stratified random sampling technique was used because of the three subdivisions (three groups) following their population densities, that is, low, medium and high, then samples were taken from each township. First, the study area consisting of nine formal residential areas was divided into three groups according to residential density, namely; high residential density (HRD) area, medium residential density (MRD) area and low residential density (LRD) area. The HRD area consists of Kapata, Chimwemwe, Umodzi, the MRD consists of Hollywood, New Houses, Kapata Site and Service (KSSP) and LRD consists of Moth, Little Bombey and Kalongwezi. Then simple random sampling was used to select the three townships; Kapata, Hollywood and Kalongwezi.

Then one hundred and twenty households (120), forty households (40) from each of the three townships within Chipata city were selected. Note that the equal sample of 40 households was chosen on a judgemental basis to allow a fair representation, comparison and an independent generalization of the outcome. In order to find the 120 households, 20 percent of the total number of households (602) was considered. Mege (2014) states that for descriptive studies, at least 10 percent or above of the accessible population is enough for the entire study. Therefore, for this study 20 percent was considered to arrive at 120 households. This ensured that all households had an equal chance of being selected to avoid bias (Msabila and Nalaila, 2013).

The hundred and twenty households were the ones to whom the questionnaires were administered. In order to determine the composition and quantity of the household wastes in Kapata, Hollywood and Kalongwezi townships, eight (8) households per township were used. To obtain the 8 households per township, the study used 20 percent of the total number of households per township (40). A systematic approach was then adopted where households were sampled at an interval of 5, within the total sample of 40 per township. At each sampling point, a big black plastic bag was given per household. From each of the townships, eight households were chosen and each given the plastic bag. They were told to throw in all the waste they produced in that particular day and the plastic bags were collected the following morning. The waste was weighed before and after being sorted out. Simple additions were used to find the total weight of the waste streams in the three townships.

4.5. Quantitative Data Collection Methods

Quantitative data were collected by the use of questionnaires because questionnaires are an effective way of quantifying data from a sample group, and statistical testing. In addition, questionnaires offer an objective means of collecting information about people's knowledge, beliefs, attitudes, and behaviour (Sapsford, 1999). The questionnaires were distributed to each household and then collected the following day and about 25 households did not fill in the questionnaires because of the low level of education by the respondents. The same questionnaires were then used as interview schedules for the same households in order to get all the 120 questionnaires back. Questionnaires were administered to the selected households in the three townships of Chipata city. For those households that managed to fill in the questionnaire

upon collection of the questionnaire the researcher made follow ups on questions which had not been answered to ensure that the household understood the questions.

4.6. Qualitative Data Collection Methods

Qualitative research was naturalistic because the data was gathered in a situation where generation and disposal of household waste naturally occurs (Kombo, 2006). The use of qualitative methods gave the researcher a chance to probe and get clarification on how household waste is managed in Kapata, Hollywood and Kalongwezi townships of Chipata town (Figure 3.1). Qualitative data was collected through in-depth interviews, as well as observation methods.

4.6.1. In-depth Interviews

In-depth interviews were very suitable for this study because, interviews enable face to face discussion with human subjects and since this topic is somehow sensitive, it can make people feel uncomfortable discussing in a focus group. Interviews are also most appropriate where little is already known about the study phenomenon or where detailed insights are required from individual participants (Sidhu, 2014). Ten (10) key informants were interviewed using interview guides. These were 5 council workers who work under the Health department, 2 private contractors and 3 health workers from the Clinic. For the type of questions that were asked refer to appendix 2.

4.6.2. Observations

Observational research methods were used because these methods of research helped the researcher to view the participants in their natural environment. Observational research offers a social researcher a distinct way of collecting data (Denscombe, 2010). They are research methods that draw on the direct evidence of the eye to witness events at first hand and not to rely on what people say or think. The researcher used a checklist so that a lot of variables were considered and pictures on the composition and some management strategies were also captured using a camera. For the checklist, refer to appendix 2. The use of a checklist was important in this case because a wide range of variables were expected to be considered (for example, household waste composition and type of receptacle).

4.7. Data Analysis

In this study, quantitative data was analyzed using descriptive statistics with the aid of the Statistical Software Package for Social Sciences 20.0 (SPSS). Qualitative data which were gathered using open ended questions from the questionnaires and interviews schedule were analysed using thematic analysis. Thematic analysis involves the identification of themes through careful reading and re-reading. In thematic analysis the emerging themes become the categories for analysis (Rice and Ezzy, 1999). In this regard, qualitative data generated in this study were coded and emerging themes were grouped into categories and then interpreted.

CHAPTER FIVE

FINDINGS AND DISCUSSION

5.1. Introduction

The information that was gathered from the key informants was synthesized along with the information that was collected by the use of questionnaires and from the secondary data. With regard to information related to personnel, frequency of waste collection, and fees that are to be paid by households for the collection of waste, this was obtained directly from the authorities of Chipata City Council (CCC).

This chapter outlines and analyses the findings of the study according to the two objectives. Some of the findings are presented in tables and graphs and discussions follow.

5.2. Characteristics of respondents

The characteristics of respondents include age, level of education and employment status. Results show that the modal age group was 20-24 and 70 percent of the respondents were less than 35 years old (see Table 5.1). Some of the respondents were born in the townships under study hence they knew the problems that the residents experienced, therefore it was important to hear what problems the younger and older people would come up with. It is important to note that all ages contribute a considerable amount of waste to their respective townships and also the management of the waste generated was a concern for all the residents regardless of age.

Table 5.1: Age of respondents

Age Group	Number of Respondents	Percentage (%)
15-19	12	10
20-24	30	25
25-29	17	14
30-34	25	21
35-39	16	13
40 and above	20	17
Total	120	100

Source: Field data (2016)

The next variable examined by this study was level of education. This was important because there was need to know how far the respondents had gone with their education so as to establish what knowledge they had concerning the composition of household waste generated, efficiency in waste management and implications of indiscriminate disposal of household waste and if it was present in the three townships.

Table 5.2: Level of education attained by respondents

Education Level	Number of Respondents	Percentages (%)
Primary	25	21
Secondary	60	50
Tertiary	35	29
Total	120	100

Source: Field data (2016)

All the respondents have received some form of formal education. This means that they were able to explain in their own words what they understood about the inefficient management of household waste and implications of indiscriminate disposal of household waste on the environment and human health. They were also able to answer questions on the efficient management of household waste and what could be done to improve the management of household waste in their respective townships.

From Table 5.2, 50 percent of respondents have gone as far as secondary education while 21 percent of the respondents have gone as far as primary education. During the survey, it was recognized that a number of household respondents were exposed to solid waste management issues and understand the risk that improperly managed waste pose to human health and the environment.

The last variable that was looked at was employment status. This was considered because it was important to find out where people were employed and establish the type of waste they produced which was work related and the impact they had on the environment if any. Table 5.3, shows that

majority of the respondents were employed in the formal sector while less than 20 percent were unemployed.

Table 5.3: Employment status for respondents

Employment status	Number of respondents
Formal sector	71
Informal sector	36
Unemployed	13
Total	120

Source: Field data (2016)

Educational status, employment and age were important variables that were used in this study and they may be significant factors influencing the type and quantity of waste generated in Chipata city. This can be interpreted that as people acquire more education, get better jobs and experience rise in income levels, the pattern of consumption can change thereby generate different types of waste that reflects their new way of life. It is however imperative to note that, such factors were not used for this purpose in this study. The study did not investigate the correlation between the foresaid variables and waste generation in the study area. This was not within the scope of this study.

5.3. Categorization of Household waste in Chipata City.

In this study, the variables that were used are type, weight, composition, recyclability and usability. Figure 5.1 shows the categories of household waste and the quantities in the three townships.

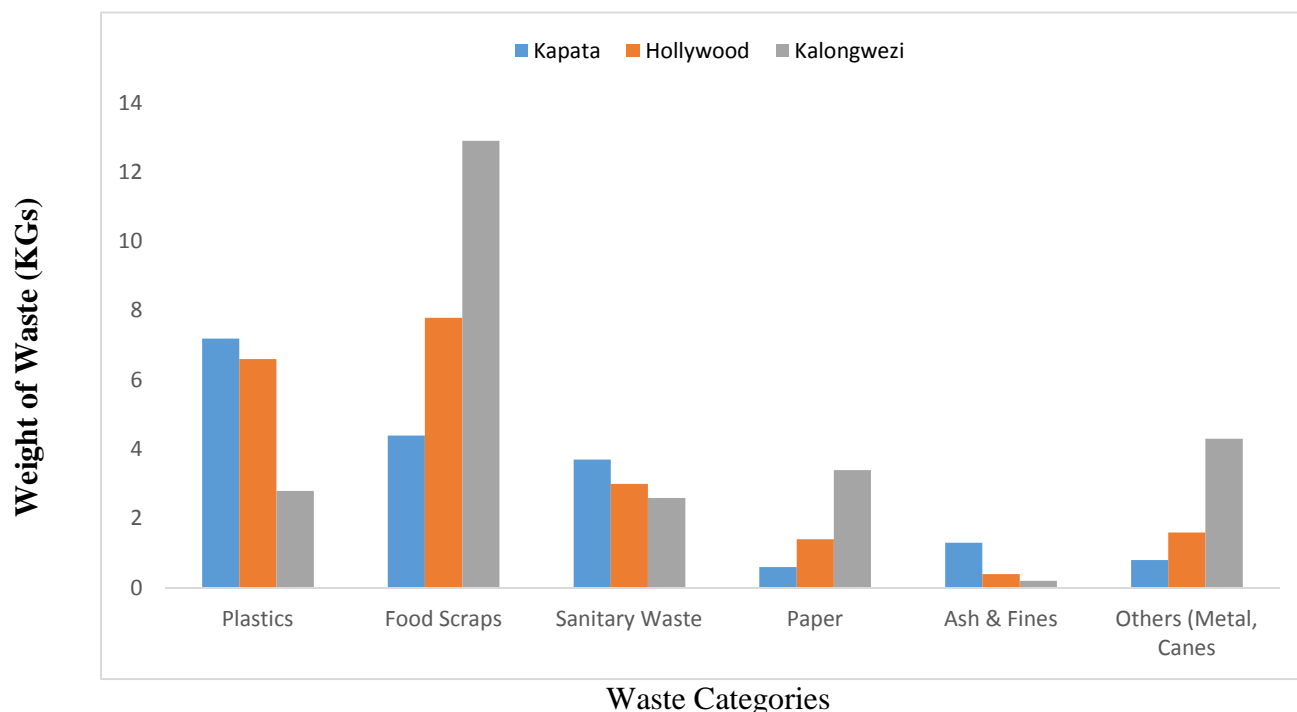


Figure 5.1: Quantity and Composition of the sampled household waste

Source: Field Survey, 2016

From the results, the mean weight of the waste produced per household was 2.7kg per day, that is, 19.0 kg per week. When this is broken down according to the type of materials, food scraps (mostly nshima, vegetables, bones) at 25.1kg were the dominant type of waste followed by plastic products (eg; plastic containers and bottles) (16.6kg) generated in the three townships. The total waste generated amongst the 24 households from the three townships was 65.0 kg per day. The relationship between the waste produced and the size of household was not considered because it was not within the scope of this study. Some of the types of waste that were observed are as shown in Plate 5.1.

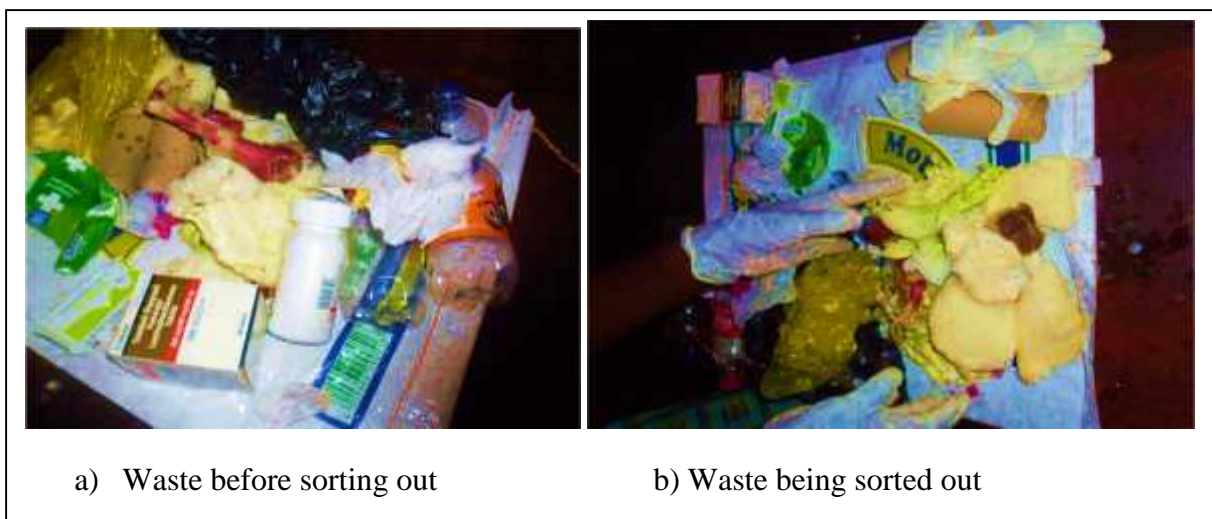


Plate 5.1: Types of waste observed in the three townships

Source: Field data, 2016

5.3.1. Waste generation by residential areas

From the result of the study, it is clear that all households in the study area generate household waste of various types. However, most of the waste is generated by residents of Kalongwezi, a low density residential area and the smallest amount of waste was observed in Kapata. These results suggest that despite some wealthier areas having much lower populations than poorer areas, they still generate more waste. The mean weight of waste generated by households was found to be 65.0 kg per day. The study found differences in the mean weight generated by residential area. While Kalongwezi households generated 26.2kg per day, in Kapata and Hollywood the mean waste generated was 18kg and 20.8 kg per day respectively.

5.3.2. Variations in waste type

The results in Figure 5.1 shows that there was a marked variation in domestic waste type and quantity generated across the three residential areas reflecting the income levels of the inhabitants. The households in Kalongwezi township generated a lot of biodegradable waste compared to Kapata township where the household waste was mainly characterised by a lot of plastics. Kalongwezi had more food waste, paper and other materials like metal, cans and bottles while in Kapata and Hollywood, plastics and sanitary waste like diapers were dominant.

The variation in waste being generated is apparently a reflection of the differences in income levels and consumer behaviour. The study only considered variations in population densities, and

from the data collected, it shows that Kalongwezi (a low density area) household waste contained at least 50 percent food waste of the total waste generated in the area while Kapata and Hollywood had 24 percent and 37 percent respectively, of the total weight of the household waste generated in their respective townships. This is in line with what Cointreau (2006) said about the differences in the generation of waste due to differences in income levels. Those with a higher income consume a lot of fast foods which normally require disposable containers, they tend to emulate the consumption patterns of the west.

5.3.3. Re-usability and Recyclability

The study also considered reusability and recyclability as the two variables under the characteristics of the household waste. As shown in Figure 5.1 the high income area (Kalongwezi) generated more waste which contained a lot of waste which could be recycled and reused. Recyclable materials that were observed include many kinds of glass, paper, cardboard, metal, plastic, tyres, textiles, and electronics while the reusable materials included food scraps, plastic and glass bottles, plastic bags and old clothes. It is imperative to mention further that waste generated in Kapata and Hollywood townships contained less reusable materials compared to Kalongwezi. It should also be noted that even the reusable waste generated in Kalongwezi was disposed of, the waste generated was neither reused nor recycled by the respondents.

It is however important to mention that, some small-scale recycling businesses were observed in the study area especially in Kapata township. These small-scale recycling businesses said they bought the waste products from itinerant waste pickers who got the waste from Kalongwezi. The small businesses involved in SWM are mainly recyclers of waste material products. They purchase items like glass, metal cans and plastics from the itinerant waste pickers and the scavengers who after picking items like bottles, plastics, wash them and then sell them to the small scale recycling businesses. The waste pickers and scavengers are self-sustaining operators that remain in existence as long as the demand for their product remains. They move from one open dump or deposit site to another in search of recyclable items (paper, plastic, tin, etc.) that can be sold to the informal business men to enable these urban poor to generate income. They may have informal linkage with the public sector as buyers of waste from the public sector SWM workers.

The small scale recyclers pick plastics, cloths and sacks from the open dump sites to make bags and rugs while plastic bottles are washed and refilled with water, cooking oil and paraffin which they later sell to the residents. There is no data on quantities recycled or reused because most of these recyclables are informally recovered from the MSW stream by waste pickers and scavengers.

5.4. Management Strategies carried out on Household Waste in Chipata City.

5.4.1. Waste Management Strategies adopted by Households

The findings show that there were various waste management strategies that were used to manage household waste in the three selected townships of Chipata town. The main strategies were storing, burning and burying. Figure 5.2 shows the strategies used by households to manage waste. As can be seen from the Figure 5.2 most households store their waste before disposing it. The results shows that 72 percent of the households in the study area store their waste and only 3 percent used other strategies other than the ones that many households adopted in the study area.

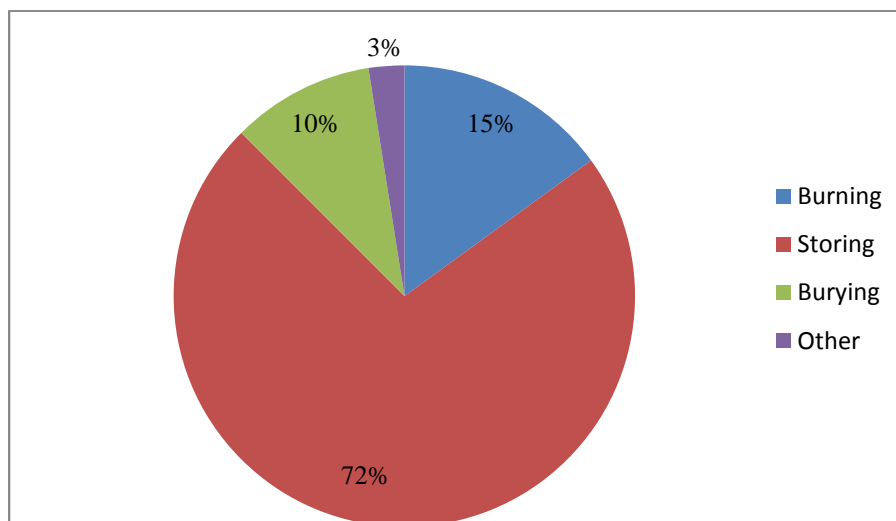


Figure 5.2: Ways in which Households manage their waste

Source: Field data (2016)

The data was later analysed and presented in the following table to show the common waste management strategies used in the three townships under study. The table below show how many respondents used the strategies mentioned (storing, burning, burying or other).

Table 5.4: Household Waste Management Options

Waste Management Strategy	Residential Areas					
	Kapata		Hollywood		Kalongwezi	
	No.	%	No.	%	No.	%
Burning	12	30	6	15	0	0
Storing	19	47.5	30	75	38	95
Burying	7	17.5	3	7.5	2	5
Other	2	5	1	2.5	0	0
Total	40	100	40	100	40	100

Source: Field data (2016)

The waste management strategies listed above were the main ones that were observed in the three townships. The management of domestic waste in this study shows that households have adopted several household management strategies which for the sake of this study would be put into two main categories, that is, those related to waste storage and those that relate to waste disposal.

5.4.1.1. Waste Storage Strategy

The waste that is generated is handled differently by many households. Some store the waste in receptacles while others just dispose of them directly without storing. The receptacles which are used vary from household to household as shown in Table 5.7. The results from Figure 5.4 indicate that several households stored the waste they generated in some improvised containers before disposing it off. The receptacles they used for storing their waste included; sacks, plastic bags, old buckets and other improvised containers. The results show that there were some households who did not have any receptacles, in Kapata 21 households, Hollywood 10 households and in Kalongwezi only 2 households. Table 5.7 shows the common receptacles used by households in the study area.

Table 5.5. Receptacles used in the three townships

TYPE RECEPTACLE	OF	NUMBER OF HOUSEHOLDS					
		KAPATA		HOLLYWOOD		KALONGWEZI	
			%		%		%
Old buckets		2	5.0	6	15.0	6	15.0
Baskets		1	2.5	3	7.5	0	0
Plastic containers		3	7.5	8	20.0	9	22.5
Plastic bags		10	25.0	6	15.0	2	5.0
Sacks		2	5.0	1	2.5	0	0
Boxes		1	2.5	4	10.0	0	0
Halved drums		0	0	1	2.5	10	25.0
Silver peddle bins		0	0	1	2.5	11	27.5
No receptacles		21	52.5	10	25.0	2	5.0
Total number of households		40	100.0	40	100.0	40	100.0

Source: Field data (2016)

The receptacles that were used in the three townships were captured as shown in Plate 5.2.





c) Metal Fabricated bin with lid



d) Silver Peddle bin



e) Sack



f) Plastics



g) Plastic peddle bin



h) Metal halved drum



i) Plastic in box

Plate 5.2: Receptacles used in the three townships

Source: Field data (2016)

The results in Table 5.5 show that many households in the study area store their waste before disposing of it. The waste they generate is stored temporarily in receptacles such as plastic bags, sacks and other improvised containers before it is removed and taken to the point where it was disposed of. This was the strategy used the most. Majority (72.5 percent) of the total number of the surveyed households in the study area, stored their waste before disposing of it and only about 27.5 percent disposed the waste immediately. The average number of days they store this waste depends on the type of receptacle used, although in Kapata township the receptacles would be filled to capacity and even overfills before they are taken to the nearest dumpsite for emptying.

The result clearly shows that more than 50 percent of the households in Kapata Township had no receptacles. This explains why the waste in the township was dumped indiscriminately along the roads, open spaces and in the backyards because their interest was to get rid of the trash in whichever way possible without thinking about the effects the waste can have on other residents. In addition, plastic bags were commonly used as receptacles in Kapata and Hollywood townships (25 percent and 15 percent respectively), but in Kalongwezi township the commonly used receptacles were halved metal drums and silver peddle bins. Waste littering was most common in Kapata and Hollywood characterised by overfilled receptacles. From the results shown in Table 5.5, it is evident that the common receptacles used in Kapata (13 percent) and Hollywood (38 percent) townships did have lids so they were normally left outside to overspill. Some receptacles had lids while others had none.

This waste later attracts vermin like flies, mosquitoes and rats that cause a lot of diarrhoeal diseases and so are a health risk. The houseflies that settle on this waste can act as vectors for various diseases by transmitting pathogens through direct contact or through their droppings. This may encourage the spread of diarrhoeal diseases and other infectious diseases like dengue fever, yellow fever, bancroftian filariasis and bubonic plague which are all caused by mosquitoes. According to Lewis and Dirksen (2009), Dengue fever is a type of infection which is sudden and severe and is caused by dengue viruses, Bubonic plague is an infection caused by an organism called *Yersinia pestis* and the patient has fever, headache, fatigue and swollen lymph

nodes and Bancroftian filariasis is a parasitic and infectious disease caused by a threadlike filarial nematode worms characterised by scrotal enlargement, fever and swollen limbs.

5.4.1.2. Waste Disposal Strategy

In terms of disposing of household waste, the strategies that were mainly employed in the three townships include, burning, dumping and burying. Some households disposed their trash by burning, dumping and burying it.

a) Kapata Township



i) Open space



ii) In a drainage



iii) Along a township road



iv) Behind a perimeter wall



i) Uncontrolled burning



ii) Roadside

Plate 5.3: Indiscriminate ways of Disposing Waste in the Townships

Source: Field data (2016)

It is also important to note that, open dumping was also observed. This can clearly be seen from Plate 5.3 which shows that the three townships face some indiscriminate methods of disposing household waste. The waste was dumped along the drains, roads, streets and backyards. Burying was reported more in Kapata Township with 18 percent of the respondents involved. Waste dumping in open spaces or near the road and streets was also common especially in Kapata and Hollywood Townships. The city council lamented that garbage disposal was really becoming a difficult task to handle especially that there has been a noticeable increase in disposable containers made from materials such as styro-foam and plastic including disposable diapers, paper towels and tetra pack containers for milk and juice.

Rubbish pits were also observed in some backyards of some households especially in households which lacked some receptacles. These rubbish pits were later on buried when they were full. In some cases, burning was also being done by some households. Open burning of waste was most popular in Kapata with 30 percent of the respondents involved but none in Kalongwezi and 15 percent in Hollywood where there are few open spaces. Kapata is an area of inefficient waste collection with pockets of surrounding bushes and underdeveloped plots. Some over filled backyard rubbish pits were observed in Kapata and Hollywood where the burying of waste was 17.5 percent and percent respectively. This may be attributed to the fact that, collection of waste by CCC was not frequent, sometimes it was not even collected at all because of lack of manpower and proper vehicles to do the transportation.

But it should be noted that, the burning was mainly done by some households behind their backyards. Many respondents said they only employed burning on waste like paper and plastics because combustion is effective in getting rid of this waste in comparison to unavailable collection. The resultant ash, however, received no further treatment.

5.4.1.3 Waste Collection from Households

According to the information that was obtained from the Council workers, the waste collection from the designated points in the various townships by CCC was scheduled on a weekly basis. There were arrangements that CCC should collect the garbage once per week when the households subscribe. However, the schedule was not strictly followed. The Department of Public Health under the CCC complained of having insufficient human resource, transport

challenges, erratic funding and that many households were not ready to pay for the collection of the waste they generate, they considered it as an unnecessary cost. The collection of household waste from townships was therefore, irregular.

The local authority has engaged some private licenced contractors to assist in the management of the household waste, that is, Sam-Klin-it and Catrone. These contractors were expected to collect the garbage from households twice per week after each household had paid the collection fee. The private licenced contractors said many households were not ready to pay for the service. The following was the schedule of fees that each household was expected to pay per month:

Table 5.6: Schedule of fees to pay for waste collection

TOWNSHIP TYPE	AMOUNT TO BE PAID
LOW COST	K30.00
MEDIUM COST	K40.00
HIGH COST	K50.00

Source: Field data (2016)

The residents complained that the charges were unrealistic and unaffordable, some said it was an unnecessary cost and preferred dumping waste in open spaces.

The waste that households generated was sometimes taken to the common skip bins which were placed by CCC in designated points so that these are picked and taken to their final deposit site at Jenda along Chadiza Road. This final deposit site of the waste is far, private contractors complained about the distance. In addition, the site itself is an open dump site along Chadiza road which is open to scavengers and illegal dumping occurs making it difficult to separate degradable from non-degradable waste (plate 5.4).



Plate 5.4: Dumpsite open to scavengers

Source: Field data (2016)

Some skip bins were observed but these were found only in a few designated areas like the markets. The lack of this had contributed to receptacles at many households to spill over. In addition, the few skip bins were not collected regularly leading to these bins to spill over at those designated points before they were finally emptied. There was also a problem associated with non-enforcement of the existing comprehensive legal framework in Chipata city. This was evident by the indiscriminate disposal of waste which was noticed in the three townships, especially in Kapata and Hollywood townships.

CHAPTER SIX

CONCLUSION AND RECOMMENDATIONS

6.1. Conclusion

The study was undertaken firstly to characterise household waste in Chipata city in terms of composition, weight, reusability, recyclability. The findings of the study indicated that overall, there was a marked variation in domestic waste type and quantity generated across the three residential areas reflecting the income levels of the inhabitants. The low density residential area generated more waste (40.3 percent) than the high density residential area (27.7 percent). Additionally, most of the biodegradable and re-usable waste was generated in Kalongwezi, a low density residential area.

Secondly, the study aimed at investigating the processes involved in handling, disposal and treatment of household waste in Chipata city. The study showed that majority (72.5 percent) of the total number of households in the study area stored their waste before disposing of it and only 27 percent disposed the waste immediately. The study further showed that waste was indiscriminately disposed especially in Kapata and Hollywood, a high and medium density residential areas respectively.

Household waste management is indeed one of the major challenges facing many cities and towns of Zambia. The findings of the study gave an insight to how waste is managed in Chipata city and provided some baseline data for the development of an enhanced waste management system in the country that could address some of the major issues that surfaced in this study. The result of this study could particularly explain why there is inefficiency in the managing of waste in the country. It is clear from the study that waste is indiscriminately disposed.

The findings indicate that household waste generation in Chipata city shows an increase in plastic components (more than 30 percent of total weight). Therefore, appropriate strategies should be determined in order to reduce generation of plastic waste because these have contributed to the abysmal state of the environment in Chipata city. Plastics are seen scattered everywhere in the townships, along the roads, streets, drains and market places.

Another problem is the dominance of biodegradable organic waste which has potential to emit greenhouse gases (GHGs). More than 28 percent of total weight of household waste produced in the three townships constituted the biodegradable materials which can lead to the production of methane and carbon dioxide during the methanogenic process. It is important therefore that compost is considered in this case as one of the most important waste reduction strategy considering the fact that Chipata is an agricultural area.

The management and disposal of household waste has not received much attention. There is insufficient data on key waste variables such as generation rates, composition, volume/weight, storage and transportation. For effective management of waste to be a reality, availability of accurate information on these variables is a prerequisite. There has been no comprehensive studies that have been conducted to cover almost all cities and towns of Zambia to characterize the waste generated and disposed on landfill. The policy-makers rely on the limited source of information available from few places thereby are unable to provide appropriate solutions for the kind of waste produced for a particular region.

The finding of this study clearly indicate that if nothing is done to improve the waste management system in the country, Zambia will continue facing the problem of waste management.

6.2. Recommendations

In view of the findings of this study, the following recommendations have been made to the government of Zambia, the local authorities at Chipata City Council and stakeholders to improve waste management in the country;

Both the government of Zambia and the local authorities should ensure that the data base of household waste generation and composition be established not only in Chipata but all towns in the country to ensure proper planning of waste collection and disposal.

Both the government of Zambia and the local authorities should encourage on-site minimisation of waste generation. The use of reusable food packages and cloth napkins can be encouraged so

that there is a reduction on waste caused by disposable products. In addition, the use of disposables like drinks and diapers, a fee should be attached. The government should ban the manufacturing of non-recyclable polyethylene bags or research should be initiated to develop biodegradable polyethylene. The local scientists should try to make flushable biodegradable diapers that could go through the plumbing system.

Further, the households should be encouraged by the local authorities to pay for the collection of waste and this should go with an incentive. For instance, the amount of money to pay should be equivalent to the amount of waste produced, if a household generates a lot of waste then that particular household should pay more while that household that generates less waste should pay less.

The local authorities should encourage households to practice on-site separation where households can make use of many different receptacles to throw in different kinds of waste. Since a lot of waste generated in many households, for instance, in Kalongwezi are the food scraps, nshima pieces can be put in a separate receptacle so that they can be used to make things like munkoyo (a local beverage) and fritters which can be drank and eaten respectively. The food remains can be used as animal feed for either dogs or pigs while plastic bags can be cleaned and used again for food packaging.

To curb the issue of insufficient trained personnel and erratic funds which is a common scenario to many municipalities in the whole country, the government of Zambia should encourage many private entities to take up the responsibility of managing waste. When the private sector is involved in waste management, the government's role is shifted from service provision to implementation of regulation (Simon, 2008). If the management of waste is privatized, many companies can come on board to help curb the problem of waste.

The government of Zambia should encourage Universities, colleges and schools to take up waste management in its curriculum. If students become aware of the implications of indiscriminate disposal of household waste at an early age, this would help to assist the community and the government on finding lasting solutions to waste management challenges in the country. The

assistance of academic institutions should also be solicited in the characterization of waste in their vicinity.

The stakeholders should help in the sensitisation stating the implications of having a dirty environment and also stating that collection of waste by either the municipality or the private contractors is a service which should be paid for by them just as they pay for water and electricity.

Both the government of Zambia and the local authorities should spearhead the construction of an ideal landfill for Chipata city, a properly fenced one to avoid scattering of waste by dogs and scavengers. Landfill as a final disposal site has the potential to emit greenhouse gases (GHGs). The effects of GHGs can be minimised by capturing them in order to produce electricity.

The other types of biodegradable waste like vegetable cuttings can be sorted out and turned into compost. This will assist in the use of organic fertilizers for the backyard gardens because composting offers a natural alternative to chemical fertilizers which are in fact expensive especially to small scale farmers. The government as well as private entities should encourage this by offering a good price to the people engaged in composting waste. Chipata being an agricultural region, the use of compost in place of inorganic fertilisers can be a very good option.

Further, the local authorities should provide bins or refuse bags at a fee and the residents that reduce their waste should pay a smaller fee or no fee at all. The local authorities should provide all households with branded refuse bags every week after subscribing. This can be integrated in ZESCO prepaid units together with the television levy. If this is followed, there will be a noticeable reduction in waste taken to Jenda deposit site in Chipata city.

The local government should encourage the adoption of a decentralised waste management system so that the residents are fully involved in the whole waste management system. In addition, the NGOs, CBOs and the stakeholders should equally respond to the unsightly environmental state of Chipata city by initiating some SWM operations through primary collection and street cleaning. NGOs can introduce new recycling technology or even extending

micro credit to the waste pickers in order to show some appreciation for the work they do so that the waste pickers can work even harder and in good working conditions.

It is hoped that these recommendations, when considered for action by the government, local authorities, and the people themselves would help address the household waste management problems and its related issues in Chipata town.

SUGGESTIONS FOR FURTHER RESEARCH

Building on this study, research could be undertaken to assess the generation rates of household waste in the country as well as the household waste composition and storage facilities.

Studies should also be conducted to find out if the variations in income levels, education, age and size of households have an effect on waste generated, quantity and quality of waste.

Studies to establish best practices for intervention of indiscriminate disposal of household waste could be undertaken in future research.

Further investigations must be made to ascertain the management of household waste in all the big cities, some emerging towns and small districts of the country. This will give a more realistic estimation of the problem of inefficient management of household waste and in turn take measures to help curb the situation to reduce the impact on the quality of the environment and the risk on public health.

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APPENDICES

APPENDIX 1: Questionnaire for the Households.

Dear Respondent,

I am a Masters student at the University of Zambia conducting research on the management of household waste in Hollywood, Kapata and Kalongwezi Townships of Chipata town. You have been selected to take part in this study by helping with the required information. Please answer the questions below as honestly as possible. Your response will be confidential and completely anonymous. Be informed that they are for academic purpose only.

Date

Name of Township

SECTION A: BIO-DATA

1. Head of household (Gender) Male Female
2. Size of household.....
3. What is your age? (Circle the right option)
 - (a) 15 - 19
 - (b) 20 – 24
 - (c) 25 – 29
 - (d) 30 – 34
 - (e) 35 - 39
 - (f) Over 40
4. What is your level of education? (Circle the right option)
 - (a) none
 - (b) Primary school
 - (c) Secondary/high school
 - (d) Tertiary/institution of higher learning
 - (e) Others (please specify).....
5. Employment status of the respondent (Circle the applicable option).
 - (a) Formal Sector
 - (b) Informal Sector
 - (c) Unemployed
6. How long have you been a resident in Kapata?
 - (a) One year
 - (b) 2 - 6 years
 - (c) 7 -11 years
 - (d) 12 – 16 years
 - (e) 17 years and above

7. Have you always lived in this part of the town? YES / NO
8. If the answer to Question 7 is no, where were you living before?.....
9. Why did you move to the present location?
10. What activities are you involved in sustaining your livelihood?

SECTION B: CHARACTERISTICS OF HOUSEHOLD WASTE

1. Is waste management a problem in this area? Yes/ No
2. In your opinion, how serious is the problem of waste management
 - (a) Very serious
 - (b) Somewhat serious
 - (c) Not serious
 - (d) Don't know
3. What forms of wastes are commonly generated in your household? (Circle the most applicable opinion).
 - (a) Plastic wastes like Polythene bags and other plastics.
 - (b) Food scraps
 - (c) Metal wastes
 - (d) Paper wastes
 - (e) Others specify.....
4. Approximately, estimate the quantity of waste produced in your household per week in Kilograms?
5. Does your household have a waste container? Yes / No
6. If yes what type of container?
7. Who provided the container that is used on your premise?
 - (a) Self
 - (b) Town Council
 - (c) Private company
 - (d) Others.....
8. If No, how do you collect your wastes

SECTION C: PROCESSES INVOLVED IN HANDLING, DISPOSAL AND TREATMENT OF HOUSEHOLD WASTE

9. How is household waste handled?
 - a) Separated before disposing
 - b) Disposed without separation
10. What do you use as household waste storage?
 - a) Plastic bags
 - b) Cardboard boxes
 - c) Halved drum
 - d) Plastic bin

- e) Galvanised steel bin
- f) Any other, specify
- 11. How long do you keep the waste before you can finally dispose it?
 - a) A day
 - b) 2 days
 - c) 3 days
 - d) 4 days
 - e) Any other, specify
- 1. How do you dispose of the household waste?(Circle the most applicable opinion).
 - a) In the rubbish pit
 - b) Use waste pickers
 - c) Incineration
 - d) Deposited in streets and open spaces
 - e) Deposit site
 - f) Any other, specify
- 2. What do you do with the waste that you generate?
 - a) It is just thrown in the rubbish pit
 - b) It is burnt
 - c) Waste pickers get it
 - d) Some of it is composited
 - e) Any other, specify
- 3. Which types of household waste do you composite?

.....

.....

SECTION D: OPTIONS FOR HOUSEHOLD WASTE MANAGEMENT

- 4. How often do you empty you container
 - (a) Several times each day
 - (b) Daily
 - (c) Three times a week
 - (d) Twice a week
 - (e) Once a week
 - (f) Less frequently
 - (g) Do not know
- 5. Where do you empty your container from?
 - (a) Within the same compound
 - (b) Just outside the house
 - (c) In the open space
 - (d) Onto the collection vehicle
- 6. How long does it take to collect that accumulated pile for disposal?
 - (a) Several times each day
 - (b) Daily

- (c) Three times a week
 - (d) Twice a week
 - (e) Once a week
 - (f) Less frequently
 - (g) Don't know
7. Does your household receive a collection service of any type? Yes / No
 8. If yes, who collects garbage from your neighbourhood or household?
 - (a) Self/private arrangement
 - (b) Town Council
 - (c) Private company
 - (d) others specify.....
 9. If No, how do you dispose of your wastes?
 21. What is your opinion of the service that you are receiving for collection of household waste you are currently receiving? Please write E-excellent, G-good, F-fair and p-poor.
 22. How do you rate the satisfaction with the frequency of garbage collection in your area?
Please write E-excellent, G-good, F-fair and p-poor
 23. Do you pay for solid waste collection and transportation? Yes / No
 24. How much do you pay as garbage collection fees?
 25. How would you rate the amount charged on collection (fees)?
 - (a) Very expensive
 - (b) Expensive
 - (c) Very fair
 - (d) Fair
 26. How often do you pay to the service providers?
 - (a) Daily
 - (b) Weekly
 - (c) Monthly
 - (d) Yearly
 27. What do you think is the cause of poor waste management in your neighbourhood?
.....
.....
.....
.....
 28. What are the indicators of poor waste management in this area?
.....
.....
.....
 29. Are you aware of any legal or institutional frame work that is there to address some of the poor waste management issues in your area? If so please list them
.....
.....
.....

30. To what extent do you think the issues of enforcement to ensure compliance with the waste law are taken seriously? Give your reason.

.....
.....
.....

31. What are some of the interventions you would propose to help in improving the Situation of waste management in your neighbourhood?

.....
.....
.....

32. Do you think waste can be of value? Explain

.....
.....

THANK YOU FOR YOUR COOPERATION.

APPENDIX 2: The Checklists

Check the composition of the household waste at each household and the receptacles and indicate where applicable.

Table 1: Quantities of household waste

TYPE	WEIGHT	KAPATA	HOLLYWOOD	KALONGWEZI
Food Scraps				
Plastic				
Sanitary waste				
Paper				
Ash and fines				
Others e.g metal, cans, cloth, furniture				

Table 2: Type of receptacle used

TYPE RECEPTACLE	OF	KAPATA TOWNSHIP	HOLLYWOOD TOWNSHIP	KALONGWEZI TOWNSHIP
Old buckets				
Baskets				
Plastic containers				
Polythene bags				
Sacks				
Boxes				
Halved drums				
Steel Pedal bins				
None				
Total				

APPENDIX 3: Interview Guide for Council Workers

My name is Namonje Blessing T, a Master student at the University of Zambia and I am doing this study as a partial fulfilment for the Award of a Masters of Science in Environment and Natural Resource Management. This guide is drafted by the researcher in order to develop the options for efficient management of household in Chipata town, Eastern Province. Please answer all the questions with honest. The information you will give is purely academic and it will be treated with a lot of confidentiality. I am requesting you to kindly participate in this study by responding to the following questions.

Background Characteristics

Area

Name of Respondent (Optional)

.....

1. What is the main aim of the health department under the Chipata Municipal Council?
2. How much personnel does the health department has?
3. How do you carry out your operations regarding the household waste in the townships of Chipata town?
4. How many times do you collect this garbage from the townships?
5. Do you have designated points where you collect the garbage from?
6. Do you provide the bins for waste disposal in those designated points?
7. Do you collect this garbage at a fee or it is free? If it is done at a fee, how much does each household pay?
8. Have you engaged any private companies to assist in garbage collection or this is done only by your department?
9. What challenges do you face as a department?
10. What challenges do you face when doing all your operations of collecting the garbage?
11. What are the main compositions of the household waste which is collected from the townships?
12. Have you noticed any increase in the household waste generated recently?
13. What materials have been dominating in household waste recently?
14. What is the explanation behind the waste littering in some compounds?
15. What are the common methods of disposal of household waste in your neighbourhood?
16. From your experience, how is this household waste supposed to be disposed?
17. Does this mode of disposal have effects on the community and whole town? Justify.
18. What advice has your company given to the community regarding the indiscriminate disposal of household waste?
19. How can this trend be stopped?

THANK YOU FOR YOUR COOPERATION

APPENDIX 4: Interview Guide for Private Licenced Contractors

Dear Respondents,

The researcher is carrying out a survey for the Master of Science in Environmental and Natural Resources Management with the University of Zambia. The title of the study is “ Options for Efficient Management of Household Waste in Chipata Town”. The information you will give is purely academic and it will be treated with a lot of confidentiality. I am requesting you to kindly participate in this study by responding to the following questions.

Background Characteristics

Area

Company name

Position of the respondent.....

1. Why did you enter the waste management sector?
2. How do you carry out your operations regarding the household waste in the townships of Chipata town?
3. How many times do you collect this garbage from the townships?
4. Do you have designated points where you collect the garbage from?
5. Do you provide the bins for waste disposal in those designated points?
6. Do you collect this garbage at a fee or it is free? If it is done at a fee, how much does each household pay?
7. What is the level of compliance regarding the waste collection fee?
8. What challenges do you face when doing all your operations of collecting the garbage?
9. What are the main compositions of the household waste which is collected from the townships?
10. Have you noticed any increase in the household waste generated since you started collecting waste?
11. What materials have been dominating in household waste recently?
12. What is the explanation behind the waste littering in some compounds?
13. What type of equipment do you use to carry out your operations?
14. What is the distance to the final dump site?
15. What are the common methods of disposal of household waste in your neighbourhood?
16. From your experience, how is this household waste supposed to be disposed?
17. Does this mode of disposal have effects on the community and whole town? Justify.
18. What advice has your company given to the community regarding the indiscriminate disposal of household waste?
19. How can this trend be stopped?

THANK YOU FOR YOUR COOPERATION

APPENDIX 5: Interview Guide for Health workers

Dear Respondents,

The researcher is carrying out a survey for the Master of Science in Environmental and Natural Resources Management with the University of Zambia. The title of the study is “Options for Efficient Management of Household Waste in Chipata Town”. The information you will give is purely academic and it will be treated with a lot of confidentiality. I am requesting you to kindly participate in this study by responding to the following questions.

Background Characteristics

Area

Clinic name

Position of the respondent.....

1. How long have you been working at this institution?
2. What can you say about the situation of waste management at your working environment?
3. What type of waste is commonly found at your work place?
4. Is this waste disposed of correctly by those who generate it?
5. How is this waste disposed of?
6. Who do you think throws this waste there?
7. Are disposable diapers part of the waste stream? What waste is found in the waste stream?
8. Have you ever seen people throwing waste at the health institution?
9. What did you do about it? Why do you say so?

10. From your experience, how is this waste supposed to be disposed?
11. Who is supposed to dispose it?
12. Does this mood of disposal have effects on the institution, community and the whole town? Justify.
13. What advice has your institution given to the community regarding the indiscriminate disposal of waste in Chipata town?
14. How can this trend be stopped?

THANK YOU FOR YOUR COOPERATION



THE UNIVERSITY OF ZAMBIA
SCHOOL OF NATURAL SCIENCES
DEPARTMENT OF GEOGRAPHY AND ENVIRONMENTAL STUDIES

Dear respondents,

I am Blessing Twavwe Namonje, a post graduate student at the University of Zambia studying Masters of Science in Environment and Natural Resources Management. The purpose of this note to you is to request you to provide information on the questions contained in this questionnaire/ interview guide. The questionnaire/interview guide has nothing to do with personalities of individuals or position in their communities. It is only trying to find out if proper management of household waste is being exercised in the management of Municipal Solid Waste (MSW) at household, municipalities and national levels. Remember participation in this study is voluntary and you have the right to discontinue if you decide otherwise, but of courtesy, communicate your non-participation in good time because I am counting on your contribution for this project to be successful.

Please, do not indicate your name on the questionnaire for purposes of confidentiality. I would appreciate if you could give the answers to the questions, reflecting the true picture of your experiences. Please, answer all the questions as required and give me feedback as soon as possible.

In advance, thank you for your assistance and cooperation.

Yours sincerely,

Blessing Twavwe Namonje

Student (UNZA).