RESIDENTS' PARTICIPATION IN SOLID WASTE MANAGEMENT IN SOLWEZI

By

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A dissertation submitted to the University of Zambia in partial fulfilment of the requirements of the degree of Master of Science in Environmental and Natural Resources Management

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DECLARATION

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This dissertation of Belina Mutobe has been approved as fulfilling the requirements for the award of a degree in Master of Science in Environment and Natural Resource Management by the University of Zambia

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ABSTRACT

Community participation in solid waste management is currently seen as a determinant of successful solid waste management. Cases of failed solid waste management are common in areas where waste management is regarded as a responsibility of local authorities while the community remains indifferent. Research has shown that public participation in solid waste management is marginal in most African countries. The study was aimed at analysing the residents' participation in solid waste management in three residential areas of Solwezi. Results are cardinal in designing more sustainable waste management strategies. It utilised systematic random sampling to sample 77 households of which 28 were from Kyawama Township, 23 from Stadium and 26 were from Kandundu Townships. Structured interviews, key informant interviews and observations were used to collect data on methods of waste disposal, residents' perceptions of solid waste management services available, and their willingness to pay for sustainable solid waste management. Data analysis was conducted using descriptive statistics, chi-square, correlation techniques and content analysis. Results showed that 65 percent of the residents felt that they did not participate in any formal waste management practices. The 35 percent who admitted to being participants felt they did this through waste separation, reuse and through their engaging a formal waste collector. In Solwezi, burying of waste (44.2 percent) was the dominant waste management practice followed by formal waste collection (35 percent) and burning (19.4 percent), while informal waste collectors accounted for2.6 percent of waste disposed and 1.3 percent of waste was disposed of through communal rubbish bins. Solwezi had a very low participation of the residents in a formal waste collection services with some residents not aware of the existence of such a service in the town (31.2 percent). Among barriers to community engagement in solid waste management in Solwezi were a lack of knowledge of the existence of formal waste collection systems (35 percent), failure by the local municipal council to provide waste bins either in residential areas or streets (13 percent), relatively high costs of engaging in formal solid waste management and a lack of alternative cheaper ways of managing domestic solid waste. There was general willingness by most residents to pay for sustainable solid waste management (57.2 percent) with only 2.6 percent indicating they felt that the local municipal council should treat waste management as a service that residents do not have to pay for. In conclusion, the low community participation in solid waste management in Solwezi was attributed to failure to adequately sensitize residents by the municipal council, residents' attitudes towards sustainable management of solid waste and token community engagement in decisions related to solid waste management by the local authority. The study recommended sensitization in community participation as well as incentivising champions of community waste management as a way of improving community participation in solid waste management.

DEDICATION

To God, my family and friends. Thank you all for the support.

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ABBREVIATIONS AND ACRONYMS

ADB	African Development Bank
CBOs	Community Based Organizations
CWG	Collaborative Working Group
DSA	District Situational Analysis
ECZ	Environmental Council of Zambia
EMA	Environmental Management Act
IBM	International Business Machines
ISWM	Integrated Solid Waste Management
ITCZ	Inter Tropical Convergence Zone
JCEET	Journal of Civil Engineering and Environmental Technology
LA	Local Authority
LC	Local Council
LSD	Least Square Difference
MEs	Micro-Enterprises
MMD	Movement for Multi-Party Democracy
MSW	Municipal Solid Waste
MSWM	Municipal Solid Waste Management
NGOs	Non-Governmental Organizations
PMC	Program Management Council
PPCB	Punjab Pollution Control Board
PPP	Public Private Partnership
RDF	Refuse Derived Fuel
SCP	Sustainable City Programme
SLP	Sustainable Lusaka Programme

SMC	Solwezi Municipal Council
SPSS	Statistical Package for Social Sciences
SW	Solid Waste
SWM	Solid Waste Management
UNSCP	United Nations Sustainable City Programme
UNZA	University of Zambia
USA	United States of America
WTERT	Waste to Energy Research and Technology Council
ZEMA	Zambia Environmental Management Agency

CHAPTER ONE: INTRODUCTION

1.0 Summary

This chapter discusses the background of solid waste management by giving a brief overview of public participation in solid waste management, it will also bring out the statement of the problem, rationale of the study as well as the aim and objectives of the study. The structure of the dissertation will also be outlined.

1.1 Background

Solid waste has become a recurring feature in urban environments. It is no longer in doubt that cities across the globe are inudated with the challenge of uncollected solid waste (Agwu, 2012). The increasing urban population, and affluent society as well as the ever changing production and consumption modes coupled with an evolution in living standards have contributed to increased solid waste generation (Kijewska et al., 2012). Many municipalities are struggling with the problem of management of solid waste. As such, many municipal authorities spend significant resources to address this problem, but the overall situation is far from satisfactory (Water Aid, 2008). Agwu (2012), adds that urban residents are often confronted with hazardous impact to their collective health and safety. Thus, an efficient Solid Waste Management planning system is needed which requires an integral waste management strategy that takes into account all the stages from the generation to the final disposal (Aranda et el., 2013).

According to Guerrero et al. (2012: 221):

> *Any waste management system globally is affected by the aspects or enabling factors that facilitate the perfomance of the system. The enabling factors include technical, environmental, financial, socio-cultural, institutional and legal and each of these factors affects the waste system differently and of these factors , financial factors affects the most municipalities*.

A study by Sharholy (2007) further reports that municipalities across the globe have failed to manage solid waste due to financial factors. Sujauddin et al. (2008) agree by saying that the huge expenditure needed to provide the service, the absence of financial support, limited resources, the unwillingness of the users to pay for the service and lack of proper use of economic instruments have hampered the delivery of proper waste management services. As a result, management deficiencies are often observed in municipalities.

Guerrero et al. (2012) further report that some researchers who have investigated the enabling factors have come to the conclusion that local waste management authorities have a lack of organizational capacities (leadership) and professional knowledge. Chung and Lo (2008) conclude on this matter by reporting that the information available on solid waste management systems is very scanty from the public domain. Seng et al. (2010) adds on to state that the extremely limited information is not complete or scattered around various agencies concerned, therefore it is extremely difficult to gain an insight into the complex problem of municipal solid waste management.

In most developing countries, solid waste management is made more complex because there is no practice of storing the waste generated at source in a segregated manner. Citizens have not been educated to keep domestic, trade and institutional bins for storage of waste at source and stop littering on the streets. There is no primary collection from the source of waste generation (Asnani,2005). The best or success stories that have ever been recorded across the world especially in developing countries are those that involved local initiatives with extensive participation of local communities and the private sector in addressing the problem of solid waste management in urban areas (Water Aid, 2008).

Hence, as waste is generated by people, their participation becomes essential to ensure a well managed system. Thus, it requires participation of government, private sector and the residents (Ezbilo and Animasaun, 2011). Some municipalities have realised this fact and initiated programmes to educate local communities and involve them in waste management (Water Aid, 2008). Kurian (2006), agrees to this by making a point that people's participation is essential for the success of the municipal solid waste management. With greater public participation, the community can co-operate with the public or private entities to set payment rates for service charges and this gives the community authority and control over operation of solid waste management. Community participation in waste management yields several benefits, including health and social benefits such as proper disposal of waste in special bins outside the homes, reduction in the quantity in the refuse dumped in rivers, on streets or burned and many other benefits (African Development Bank(ADB), 2002).

Thus, most municipalities have developed community based urban waste management systems that involve communities, households, community based organizations and small, informal enterprises engaged in collection and disposal, re-use and recycling of waste materials (ADB, 2002). However, it has been seen that most community initiatives in solid waste management

operate up to the stage of primary collection. Community contributions to small area based organizations, informal payments to municipal sweepers exist because the community needs a regular and reliable primary collection system and does not like to see waste in the immediate vicinity (ADB, 2002).

In most Third World countries, there is an absence of community participation and this has a direct bearing on efficient Municipal Solid Waste Management (MSWM). Most times, the municipal authorities fail to mobilize the community and educate citizens on the rudiments of handling waste and proper practices of storing it in their own storage bins at the household, shop and establishment-level. As a result of this situation, citizens are prone to dumping waste on the streets, open spaces, drains, and water bodies in the vicinity creating insanitary conditions.

In most African countries, community participation in solid waste management is influenced by apathy of municipal authorities. Elected representatives as well as the municipal authorities generally relegate the responsibility of managing municipal solid waste (MSW) to junior officials such as sanitary inspectors. This has affected the level of residents' participation in solid waste management in most African countries including Zambia.

In Zambia, a study on SWM in Kaunda Square by Sikazwe (2004) revealed that community based organizations in Lusaka worked hand in hand with the Lusaka City Council in the area of refuse removal. He further said that some community based organizations operated in refuse removal and the work accomplished or community participation successes related to donor agenda priorities and thus were donor funded. The community based organizations that were operational were PUSH-Zambia, CARE PUSH which was operational in Bauleni, Mtendere, Garden, Kalingalinga, Chaisa and Chainda. Others included STOP LIVE Anti-Cholera and the Irish Aid which operated in Kamanga township.

Programmes of this nature in SWM involving community based non-governmental organizations have been concentrated in large Cities like Lusaka. Although in the last few years, the Ministry of Local Government and Housing under the MMD government in 2008 had launched the 'Keep Zambia Clean Campaign', the programme yielded positive results but in some parts of the country like Solwezi, such a programme were highly unsuccessful because of different reasons.

Kamaruddin (2013) suggests that the many processes and activities characterizing waste generation to disposal entails that this is a collective reponsibility for all communities. The extent to which the residents were involved or participated in SWM in Solwezi are not clearly known.

1.2 Problem Statement

Despite significant efforts in the last decades by waste managers, most municipalities in developing countries are unable to manage the growing volumes of waste produced in their areas. This inability to manage urban solid waste consists of failures in adequate service provision, financing and inadequate understanding of complex systems (Klundert and Lardinois, 1995). However, most studies in community participatory solid waste management reveal that waste management is generally regarded as the sole duty and responsibility of local authorities and that the public is not expected to contribute (Vidanaarachi, 2006). This has resulted into lack of community awareness and societal apathy for contributing tothe solution of solid waste management (Moghadam et al., 2009).Consequently, public participation and cooperation in solid waste collection is very marginal in most African countries including Zambia (Ogunba, 2004).

Solwezi town in Zambia, is one of the urban areas that is in a transition from a rural district into a mining town and thus is expanding rapidly in all sectors of the local economy with corresponding waste generation increase. Like many other towns in transition, the town lacks an efficient solid waste management system as the local municipal council has limited capacity to adequately deal with the increasing generation of waste. The increase in the generation of waste is attributed to a high growth rate in population and improved incomes as a result of mining activities. Participatory community solid waste management offers a sustainable method of managing solid waste (Wilson et al., 2013). However, there is need to assess the degree to which the communities at different income levels participate in solid waste management in Solwezi town. The sustainability of solid waste management is only guaranteed with increased participation of residents accross the entire solid waste management value chain from collection to disposal of waste (Wilson et al., 2013). Currently, in most communities this responsibility entirely fall on the municipal council. This has contributed to solid waste pilling up in the town especially outside market places and residential areas,contributing to unsanitary environmental conditions. This situation creates the context for diseases like cholera and other diarhoeal diseases.

1.3 Aim of the Study

The aim of this study was to assess the residents' participation in solid waste management in Solwezi Town.

1.4 Objectives of the Study:

- **i.** To identify the solid waste management practices in Kandundu, Kyawama and Stadium residential areas of Solwezi town.
- **ii.** To rate residents' participation in solid waste management in Kandundu, Kyawama and Stadium of Solwezi town
- **iii.** To examine the role of residents in solid waste management in Kandundu, Kyawama and Stadium areas of Solwezi.
- **iv.** To establish the barriers to community participation in solid waste management in the three residential areas

1.5 Hypothesis

There was no significant difference in participation levels in solid waste management by the residents of Kandundu, Kyawama and Stadium of Solwezi town.

1.6 Research Questions

i. What solid waste management activities are practiced by the residents in Kandundu, Kyawama and Stadium areas of Solwezi?

ii. To what extent do the residents participate in solid waste management in the study sites?

iii. What factors hinder the residents' participation in sustainable solid waste management in the three residential areas?

iv. What is the role of residents in solid waste management in the study area?

1.7 Significance of the Study

Solid waste management is a growing environmental and financial problem in developing countries (Klundert and Lardinois, 1995) because huge sums of money have to be spent on collection, transportation and final disposal. Considering the numerous demands on the council resources, community based solution is the most sustainable and efficient way of solid waste management. Lewin (1948), theorised that people are likely to modify their own behaviour when they participate in problem solving and hence feel a part of the solution. Thus, community participation gives people control over their environment to participate, maintain and improve its aesthetic value. The role of local communities is to practice sanitary behaviour achieved by

keeping households and surroundings clean and storing waste in desgnated bins and dumpsites (Rigasa et al., 2017). Community participation is a means to enhance efficiency, effectiveness and sustainability (Chonge, 2016). This study is significant as it will show the levels of residents' participation in solid waste management and attempt to understand reasons for such levels of participation. It will also establish measures that can be applied in dealing with the barriers that hinder community participation in Solwezi town. Podgaiskyte (2010) suggested that the need for community participation is due to the dynamism and complexity of the waste management system and the various types of generated waste in need for sustainable disposal or treatment. To this end, results that will be generated from this study will help local management authorities in designing more sustainable waste management strategies in Solwezi as well as other towns and cities that have similar conditions. In addition, the study is expected to add to the body of knowledge regarding the levels of community participation and finally the results of the study will also be a guide to further research.

1.8 Structure of the Dissertation

This dissertation consists of six chapters. Chapter one gives the background of the problem from the global perspective narrowing down to the local perspective. It also brings out the aim, objectives, research questions and significance of the study. Chapter two provides a critical review of relevant studies done in the global south countries concerning participatory solid waste management. The main themes in this chapter are: solid waste generation in Zambia, methods of SWM in Zambia, solid waste generation and management in Solwezi, definitions, types of solid waste, waste management, types of solid waste management systems, methods of solid waste management, community participation, types of public participation, examples of community participation in SWM, and the theoretical framework. Chapter two also reviews the theories related to the study. Chapter three presents a description of the study area where the location, size and demography of the study area are discussed. Additionally, the chapter gives the justification for the selection of the study area. Chapter four presents the methods of data collection, sample size, sampling design, as well as data processing and analysis. In chapter five, the findings of the study are presented and interpreted. The discussion of the research findings, conclusion and recommendations are presented lastly in chapter six.

CHAPTER TWO : LITERATURE REVIEW

2.0 Introduction

This chapter reviews literature on solid waste generation, about participatory solid waste management and how it influences the overal solid waste management system. It further reviews types of solid waste and describes the methods of solid waste disposal. Sustainable solid waste management has also been reviewed, and discusses the theoretical framework of community participation of solid waste management and the chapter closes the discussion by bringing out a summary of the whole chapter.

2.1 Solid Waste Generation in Zambia

According to the Environmental Council of Zambia (ECZ) (2004), for about a decade now, "municipal waste production in Zambia has been in the ranges between 0.150-0.350 tonnes per year of which only 12.4 percent or about 0.0444 tonnes per year was disposed of and an average Zambian produced about 0.45kg of waste per day". Thereafter, annual generation as at December 2006 was estimated at 2,000,000 tones with about 20 percent of the waste generated being disposed of at designated disposal sites (ECZ, 2008).

The ECZ (2008) further reports that out of the 72 districts at that time, only a total of 16 districts had licensed municipal waste disposal sites as at the year 2006. This situation shows that the management of SW in the country has been a huge challenge and scavenging and open air burning of waste has been a common scenario in many districts. The ECZ further reports that the number of disposal sites has not matched the amount of waste generated by many local authorities in the country.

2.2 Methods of Solid Waste Management in Zambia

There are basically four (4) main methods of waste management which are practised in Zambia. These methods include waste collected through municipal waste management systems, indiscriminate disposal, waste disposed in pits and open burning of waste. Sustainable solid waste management such as recycling and reuse are also practised but are not very common (ECZ, 2008).

According to the ECZ (2008) now ZEMA (Zambia Environmental Management Agency), in order to promote the potential value of waste, recycling of waste such as paper, metal (scrap copper, alluminium, iron and many more) and plastics has been taking place in Zambia. The source type of scrap metal include manufacturing industries, agriculture, mining, domestic and include parts such of vehicles, building suppliers, surplus materials. However, the quantities of

waste recycled remain marginal. A significant percentage of collected waste for recycling was exported to Zimbabwe and South Africa in the year 2006. This method of recycling is not very common in Zambia because of the lack of awareness, lack of resources and so forth. Over the years, recycling activities have increased steadily with most of it taking place after disposal by waste collectors in the compounds and waste pickers at the landfills (Madekivi, 2017). Moyo (2017) reveal that the recycling industry is growing rapidly in Zambia. However, most recycling operations are done manually due to the poor state of machinary and lack of new technology in the recycling companies. They further reveal that there are currently more than 30 companies working with waste recycling, according to a comprehensive database they obtained from the patents and company registration agency.

2.3 Solid Waste Generation and Management in Solwezi

According to the Solwezi Municipal Council (SMC) (2013) Solwezi has become one of the fastest growing towns in Zambia interms of population and other economic activities. Currently, the population stands at 283,051 representing 33 percent of the total provincial population. Due to the economic activities that have come in the town, other economic opportunities have been attracted there. Largerly, the opening of the mines has brought about the boosting of economic activities. Like everywhere, urbanization and growth has created new challenges such as the commensurate increase in waste generation. This has not been followed by a corresponding investment in waste management infratructure. In recent years, two new copper mines have been developed in Solwezi. The growing population has contributed to the commensurate growth of solid waste generation and accumulation especially in the municipal boundary.

SMC(2008), further reports that the primary driving forces to uncontrolled solid waste generation in Solwezi is the unsustainable consumption patterns together with rapid population growth rate, culture and lifestyle. Some households and business houses utilize the private sector to collect and dispose their waste while others use backyards or burning. Illegal dumping is a serious problem in the district and as at the year 2008, there was no data available on illegal dumping and composition of littering. This has remained a huge challenge for the local authority.

However, SMC (2008) further reports that there have been plans by the local authority to extend the use of their dump site through partnerships with the private sector as well as the community. This will involve separation of waste into biodegradable and recyclable materials such as plastic bottles and metals will be sold to recycling companies.

2.4 Definitions of Terms

Medina (2000) defines solid waste or municipal solid waste as the materials generated as the result of human daily activities resulting from areas such as households, public places and city streets, shops,offices and hospitals. Mungure (2008) also states that municipal solid waste in developing countries is composed of waste from household refuse, institutional wastes, commercial waste, street sweeping and also remains from various construction works.

2.4.1 Solid Waste Stream

A waste stream is the flow of or movement of waste from the point of generation(for example a household or vertirinary practice) to final disposal like incineration, landfill and many other. There are various types of solid waste in a waste stream including municipal (residential, institutional, commercial) agricultural, and special (health care, household hazardous wastes, sewage sludge) (Waste, 2013).

2.4.2 Types of Solid Waste Stream

Residential waste comprises mainly of wastes that are generated from household activities. This normally includes such materials as waste paper, plastics, and wood off cuts, kitchen waste and yard waste. Institutional and Commercial waste is the waste stream that is generated from commercial and business houses and normally consists of such materials as discarded office paper, cardboard, plastic and general packaging waste. Agricultural is the category of waste which consists of discarded materials from agricultural activities. The major component of this type is the organic portion. Examples of this type include remains from vegetables as well as skins and bones of animal carcases. Other waste from agricultural activities are pesticide-containing waste which are classed as hazardous (ECZ, 2004).

Special waste include hazardous, healthcare and sewage sludge waste. Hazardous waste has characteristics such as flammability, irritability, ignitability, corrosivity and toxicity. Healthcare waste also includes waste from hospitals and other healthcare facilities. It is characterized by such types as sharps, swabs, and pathological and cytotoxic waste (ECZ, 2004). The final disposal of medical waste is at the incinerator where it is incinerated.

2.4.3 Waste Management

Waste management is the “generation, prevention, characterization, jm monitoring, treatment, handling, reuse and residual disposition of solid waste” (Waste Management,2013). Berstein (2004) reports that Municipal Solid Waste Management (MSWM) refers to the collection, transfer, treatment, recycling, resource recovery, and disposal of solid waste generated in urban areas. He further reports that MSWM is a complex service involving appropriate

organizational, technical, and managerial capacity and co-operation between numerous stakeholders in both the private and public sectors.

2.5 Types of Solid Waste Management Systems

Medina (2000) explains that most of the developing countries consist of mainly two systems of handling waste. He further reports that the first one is a formal system which is managed by the government. It normally involves the cities' municipalities whereby the municipality has the responsibililty to ensure safe, reliable and cost effective collection and final disposal of solid waste. This often requires large financial resources than in most cases are allocated on the public budget, therefore making it almost impractical to deal with the extent of the problem of waste management. Gombya (2000) further explains that this type of system is frequently characterized as efficient and expensive. The second is the informal system which engages mainly private dealers such as communities of scavengers and private associations. The private dealers represent a significant part of the economy as they recognize the potential part of certain materials such as plastics, bottles, paper and for domestic purposes. In some areas this operation include charging some amount of money to residents for picking up their garbage.

2.5.2 Methods of Solid Waste Management

Waste management practices are not uniform among developed and developing nations. Waste management methods such as land filling, incineration and composting have global utilization (Sharma, 2012). In certain developing countries such as India, a variety of technological options towards solid waste management and treatment have been used alongside composting, anaerobic digestion, biomethanation, incineration,gasification and pyrolysis,plasma pyrolysis,production of Refuse Derived Fuel (RDF), also known as pelletization and sanitary land filling /landfill gas recovery (Asnani,2005).

2.5.3 Community Participation

According to Bulle (1999:19),

> *Community participation is the sociological process by which residents organize themselves and become involved at the level of a living area or neighbourhood, to improve the conditions of daily life(water, sanitation, health, education). It comprises of various degrees of individual or collective involvement(financial and / physical contributions, social and or political commitment) at different stages of a project*.

Bulle (1999) further reports that in most case studies conducted in different countries, participation has to do with normal, everyday actions of residents at a domestic level (house-cleaning, cleanliness and food), that they often remain in the background or are not taken into

account in assesing a collective sanitary action nor, generally speaking considered in the formal definition of the concept of participation. In fact, the daily sweeping around the homes carried out by women may be considered a practice of responsibility as part of cycle of sanitary improvement. Coad (2003) reports that solid waste management requires participation from all waste generators to ensure that waste is past to the collectors at the right time and in the right form. Water Aid (2008) agrees to this by reporting that several municipalities have demonstrated ways to effectively manage waste using several simple measures such as involving the local communities in collection and disposal of waste.

Bulle (1999) further explains that the degree to which the public is involved in solid waste management is a critical determinant of the proper functioning of solid waste management systems. Participation strategies targeting various stake holder groups substantially differ from one another and from country to country.

Similarly, Rugumamu (2000) describes community participation as a process by which individuals and families assume responsibility for their own social economic political welfare. The community develops capacity to contribute to their own community's development such as solid waste management in collaboration with other stakeholders, especially the government as the principle custodian of public interests. The role of the government and other stakeholders is partly to ensure that community participation, as a process is incorporated to mass education and awareness creation program to empower the community members to realise the developmental problem through learning, seeing and doing, to define and play their roles in society that are likely to assume for better performance.

Community participation is also viewed as a process where beneficiaries or stakeholders influence the direction and execution of a development project. Participation in this sense occurs in the form of input or contribution towards a project in order to increase its chances of success and a corresponding, personal and economic benefits. It involves decision making process in implementing and evaluating such projects (Meshack and Sheaya, 2001).

However, Kalwani and Daudi (2009) report that effective community partcipation in social services goes beyond the poor urban residents organising themselves into groups. It requires meeting other basic conditions such as collective action which involve community based organizations, private and public sectors in municipal solid waste management.

2.6 Types of Public Participation

Community participation is a complex concept which has been associated with a wide range of participations as observed by Oakley (1991). However, a study by Moote (1997) states that public participation is a critical ingredient towards the success of any solid waste management system. They further report that participation can be in two forms, participation in solid waste management decision making process and participation in the system. Public participation in decision making is a critical component of good governance and for any process or plan to be successful. It is not only essential but should also be made an integral part of the decision making process.

However, Arnstein (1969) reports that participation involves the engagement of different actors in activities to effect decision making. Keen (2005), highlighted the fact that the concept of partcipation ranges from coercion to learning or manipulation to self mobilization. Kamaruddin et al., (2013) adds to this point by saying that the categories of participation describes the interplay between people's role, position of power and levels of knowledge transfer.

Table 1. Types of Public Participation

Types of participation	Description
Coercing	Token engagement Within a context of large-scale power imbalance where the will of one group is effectively imposed upon the other
Informing	Information is transferred in a one-way flow, there is no knowledge or sharing of decision making
Consulting	Information is sought from different groups, but one group(often the government) maintains the power to analyse the information and decide on the best course of action
Enticing	Different groups share information and jointly consider priority issues, but one group maintains power and entices other groups to act through incentives (such as grants).
Co-learning	Insiders and outsiders share their knowledge to create new understandings and work together to form action plans and define roles and responsibilities. Decision making power is negotiated within institutional and social constraints
Co-acting	People set their own agenda and mobilise to carry it out in the absence of outside initiators. Knowledge is shared between the groups engaged in the activity but knowledge flow and learning outside of this community are not assured. Power in decision making remains with initiators of the action.

(Source: Keen., 2005)

This study focuses on the consulting type of participation as it is the most common in Zambia. According to Table 1, consulting is a type of community participation in which information is

sought from different groups, but one group (often the government) maintains the power to analyse the information and decide on the best course of action for the community.

A study by Bulle (1999) shows that community participation comes neither automatically nor spontaneously. It must be understood as a collective system of different types of behaviour, leading back to different perception, representations and practices. Each and every attempt at analysing what community participation is all about implies that it may be divided into community awareness, education and management, and suggests that there is a clear understanding of the social scope of action.

Bulle (1999) further states that participation of the community in a neighbourhood actively should be considered as a voluntary act of a civic responsibility, a commitment by the residents to one or several stages of a collective project (control, awareness-raising, providing information ,promoting decision making), although the actual tasks may not always be visible. Waste collection or clean-up actions are most effective when residents gain genuine control over their content and their social sanitary scope; that is when they take an active part in informing people, monitoring the service or raising their awareness at neighbourhood level.

2.6.1 Examples of Community Participation in Solid Waste Management

Although many municipal authorities face alot of problems in their municipal solid waste service provision in most rapidly urbanising developing countries, there are isolated success stories of community participation in municipal soild waste management. A study by Liubarskaia (n.d), shows that in Europe, participation of residents in solid waste management is carried out in form of recycling programmes. Hence participation of residents is high because of a high enough deposit for packaging like plastics,bottles, cansand many more. The study further revealed that the population is much more involved and the percentage of recycling is very high.

The same study also revealed that in Russia and United States of America, participation of residents in solid waste management is very low because the two countries have not strengthened the use of economic incentives and thus does not bring any economic benefits to the population. Since participatory activities are very low,residents in different communities pay for collection, transportation and disposal of household waste. The fees are set at the local level and are included in general receipt for communal utilities. In the USA, SWMS are owned by government (state, county or local) or private for profit businesses. In some cases one entity

(government or private) performs all operations from collection through disposal/sale of recyclables. In othercases the waste may pass through the facilities of multiplentities.

A similar study to show where community participation has worked is one that has been done by the Department of Water and Sanitation in Developing Countries in the Swiss Federal Institute for Environmental Science and Technology cited in Berstein (2004). The study focused on 18 participatory schemes in Asia, Africa, and Latin America where municipal solid waste management schemes were operated and managed at the community level. The different types of participatory approaches ranged from community based organizations (CBOs) schemes in Indonesia, China and in some parts of Africa, to schemes of in Peru and Colombia operated and managed by micro-enterprises (MEs). Despite considering cultural differences prevailing between different countries, the study indicates that community participation involving non-governmental organizations primary refuse collection is suitable for increasing service coverage and has potential to ease part of the burden of responsibility for the public authorities.

Furthermore, a study by Muller et al. (2002) shows a good example of a country in which community participation in municipal waste management was established and has become successful. The study case on community participation in Nagapura ward 14 in India was conducted between the periods 1999 to 2001 and shows that a new door-to-door solid waste service had emerged as a result of a pilot project in solid waste management. This new door-to-door service had been established in several sectors of Nagapura Ward, which is managed by the waste management committee. The new service involved waste collectors transporting organic waste to the compost pits in the neighbourhood or handing it over directly to the council trucks. The degree of participation of households in the new collection scheme was said to be rising, especially after each round of awareness raising. It is difficult to quantify the increase in participation but, on average, there was an increase of about 15 percent in the number of participating households after each round of awareness raising. This also meant that more households werehanding over separated waste and that more households had begun paying the waste management committee for waste collection. As a result, the streets were looking cleaner, with less garbage being thrown out indiscriminately. It further revealed that since then, the residents have been exhibiting a considerable change in behaviour. From a system whereby they took their garbbage to street containers and did not have to pay, they changed to a door-to-door collection service which demands their daily efforts in waste storage and separation, and the payment of monthly service charges.

The same study shows that a similar project was undertaken in another city of India called Bangalore by the Bangalore City Council and the Waste Management Committee. The project's main approach was to recognize the role of residents in waste management and the immediate action was to employ community mobilization in the city. The result of this community mobilization was the introduction and establishmment of a door-to-door waste collection service to atleast 3000 households in a single ward. By the end of the pilot project, the operation of waste services had strengthened as more households subscribed to their services and paid service charges regularly.

The study further shows that a similar pilot project was carried out in Africa, in particular Bamako, Mali (Muller 2002). In the Bamako project, community development was the main objective which recorded a number of achievements among being the emergence of a new organizational structure that now serves as a channel for educating, mobilizing and monitoring and for identifying priorities for further improvement in environmental condtions. The development agency in Bamako considered community participation as an objective that was as important as improving the waste collection service. The pilot project used awareness raising methods in such a way that they served two purposes of education about waste issues, and strengthening social relationships on all organizational levels in the quarter so that community-based organizations could be created as partners in waste management.

The realised outcome of both projects (the Bangalore and Bamako) was that the residents increased their co-operation with the provided waste services. This also showed that community participation approaches apparently led to the establishing and strengthening a neighbourhood waste collection service which was sustainable. Sustainability in this case meant that the project had improved the primary waste collection service, together with the conditions that would sustain the service after the end of the present level of project support.

Another case study is one extracted from Plummer (2002) about the Billy Hattingh municipal solid waste removal scheme which was formed by partnerships of different stakeholders in municipal solid waste management. It included Billy Hattingh local community, local urban government and two local banks in 1992 to 1993 before the birth of a self ruled South Africa. The objectives were to assist in the development of micro-enterprise among poor black communities in South Africa. Their aim was to improve environmental conditions for poor communities in order to strengthen the communities that were being served. The scheme

involved establishing innovative municipal solid waste micro-enterprise in inadequately served urban communities. At the initial point of the project, things did not go well due to various reasons owing to maintenance issues. But later on, the scheme brought about a radical improvement of the environmental condition through reliable service delivery whereby communities became happy and working in support of a clean neighbourhood. The scheme was able to employ some people from the community who were able to provide adequate incomes for their households. Furthermore, the community complemented its limited resources allocated for municipal solid waste management. As a general outcome, the success of the scheme has been replicated to several local councils in the country by large number of solid waste micro-enterprises.

Similarly, Kubanza and Simatele (2019) observed that community participation in SWM has become an integral part of SWM in South African cities. For example, in the city of Johannesburg, informal waste pickers are now playing an important role in recycling municipal waste. Such community engagement has environmental and economic benefits by contributing to environmental sustainability and job creation (Gutberlet, 2010).

Another success story of community participation is one from Tanzania. According to Ishengoma (2010), community participation in SWM has worked very well in Moshi a small municipality north east of Tanzania to the extent that the city won the official title of the cleanest city in Tanzania for several years in a row. This was as a result of a broader commitment of the council and citizens to urban infrastructure and governances demonstrated by their active participation in various country initiatives such as the Sustainable Cities Programme and the Urban Sector Rehabilitation Programme.

In Zambia, some studies have been conducted on solid waste management. A study by Nchito and Myers (2003) revealed that community participation in solid waste management started as far back as the 1980s with the United Nations Sustainable Cities Program (SCP) in developing countries. The programme was launched first in Lusaka called Sustainable Lusaka Programme (SLP). It was a UN-Habitat led programme meant to help introduce community based organizations in tackling SWM in unplanned settlements (Nchito and Myers,2003). According to Nchito and Myers (2003:114), " the SLP officially ran from 18 November,1997 to 31 December 2001. Its solid waste initiatives have supposedly been channeled into a new program since 2002 within the Lusaka City Council". Nchito and Myers (2003) concluded that

SLP seemed to have done little in the long run for sustaining the community based enterprises because it was planned as a grand scheme that was imposed on people. It did not give chance to learn from the people's own specific experiences and situations. SLP seemed to have been more of a story of an incomplete empowerment of civil society despite it having done a lot of work such as creating and training of the CBEs. On the other hand, they also reported that SLP was a success program because their work (SLP) was later taken over by larger private firms that bidded to remove trash from the compounds mentioned above.

Another study was conducted by Chilinga (2014) on the analysis of public perceptions of domestic solid waste management by evaluating the make Zambia clean and healthy campaign that was conducted in Livingstone.The study revealed that the campaign was viewed to be unsuccessful by the residents and largely felt that they did not participate in the decision making and implementation of the programme, thus participation of residents in waste management was less.

2.7 Theoretical Framework

The study follows the Integrated Sustainable Waste Management (ISWM) model which is a model that allows studies of the complex and multi-dimensional systems in an integral way. The model was developed by waste advisers on urban environmental and development (Waste, 2004), and partners or organizations working in developing countries in the mid-1980s and further developed by the Collaborative Working Group (CWG) on solid waste management in the mid-1990's (Anschutz et al., 2004). CWG is an informal association of donors, international organisations, non-governmental organisations, municipal personnel, experts from NGOs and others with a particular interest in solid waste management in developing countries.

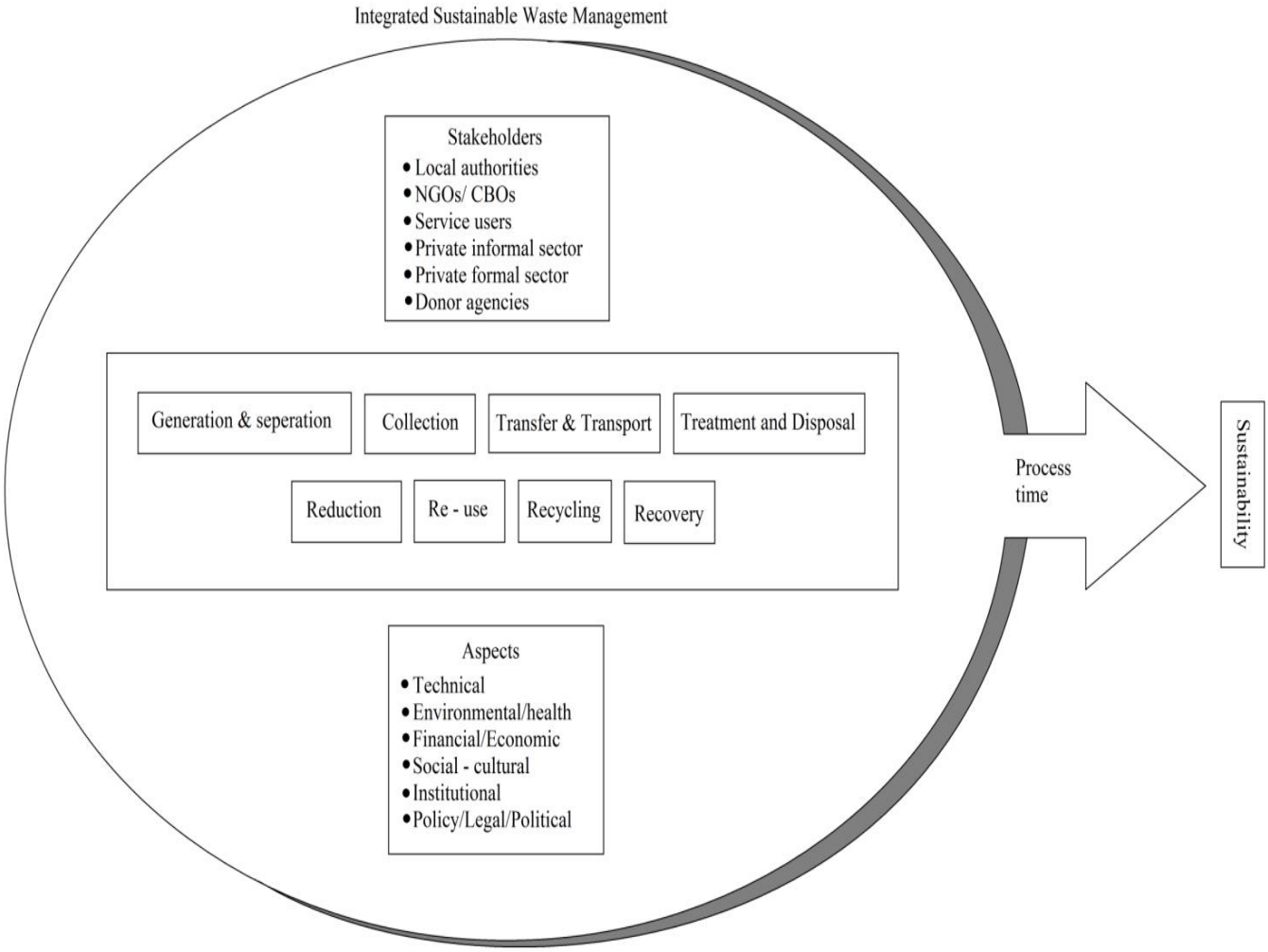

Figure 1. Original Version of ISWM Framework

Source:Anschutz & Van de Klundert, 2001:14

The model acknowledges the importance of three (3) dimensions when analyzing, developing or changing a waste management system. The dimensions include the stakeholders that have an interest in solid waste management, the elements or stages of the movement or flow of materials from the generation points towards treatment and final disposal and the aspects or "lenses" through which the system waste management is analyzed (Muller et al., 2002).

The present study is set within this adapted Integrated Solid Waste Model framework. It focuses on identifying the stakeholders who have an interest in the waste management system, identifying the nature of participatory solid waste management activities that take place in the three residential areas of Solwezi, the residents' action/behaviour and factors that influence the elements of the town's solid waste management system. It further examines the roles residents can play in solid waste management of Solwezi town.It also seeks to establish the barriers of

community participation in solid waste management in Kandundu, Kyawama and Stadium residential areas.

CHAPTER THREE: DESCRIPTION OF THE STUDY AREA

3.0 Introduction

This chapter gives a description of the study area, which is Solwezi town as well as the study sites. The main areas of focus are location, size and demography of the town and also brings out the socio-economic situation of the town. The reasons for choosing the study area are also highlighted in this chapter.

3.1 Location and Size of Solwezi

Solwezi district is located between $24^0$45' to $27^0$37' E and $11^0$32' to $13^0$28'S in the North-Western part of Zambia. The district covers an area of approximately 30.36 kilometres squared (km^2) and is bordered by Mwinilunga, Mufumbwe, Kasempa, Lufwanyama and Chingola Districts.

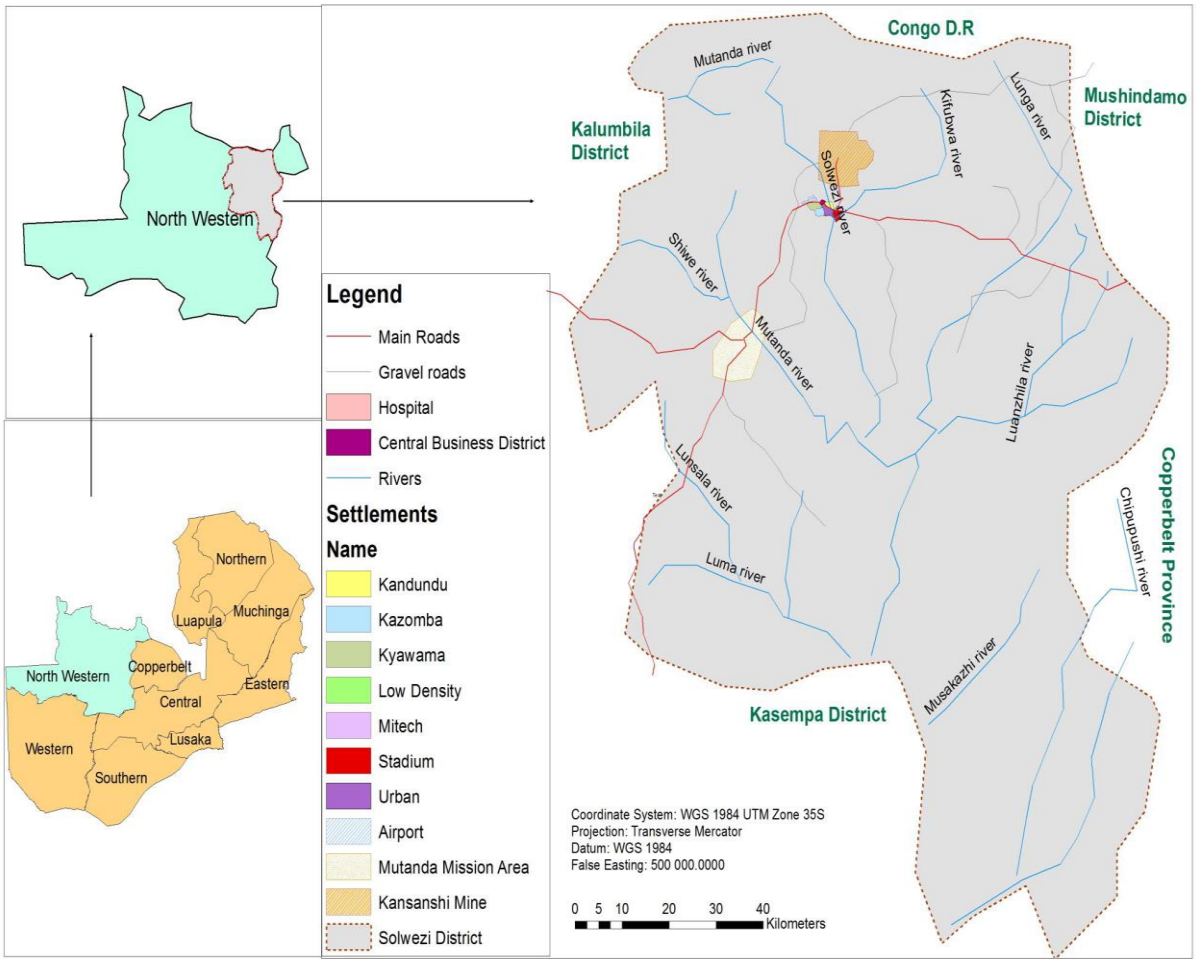

Figure 2. Location Map of Solwezi

Source: Field data, 2020

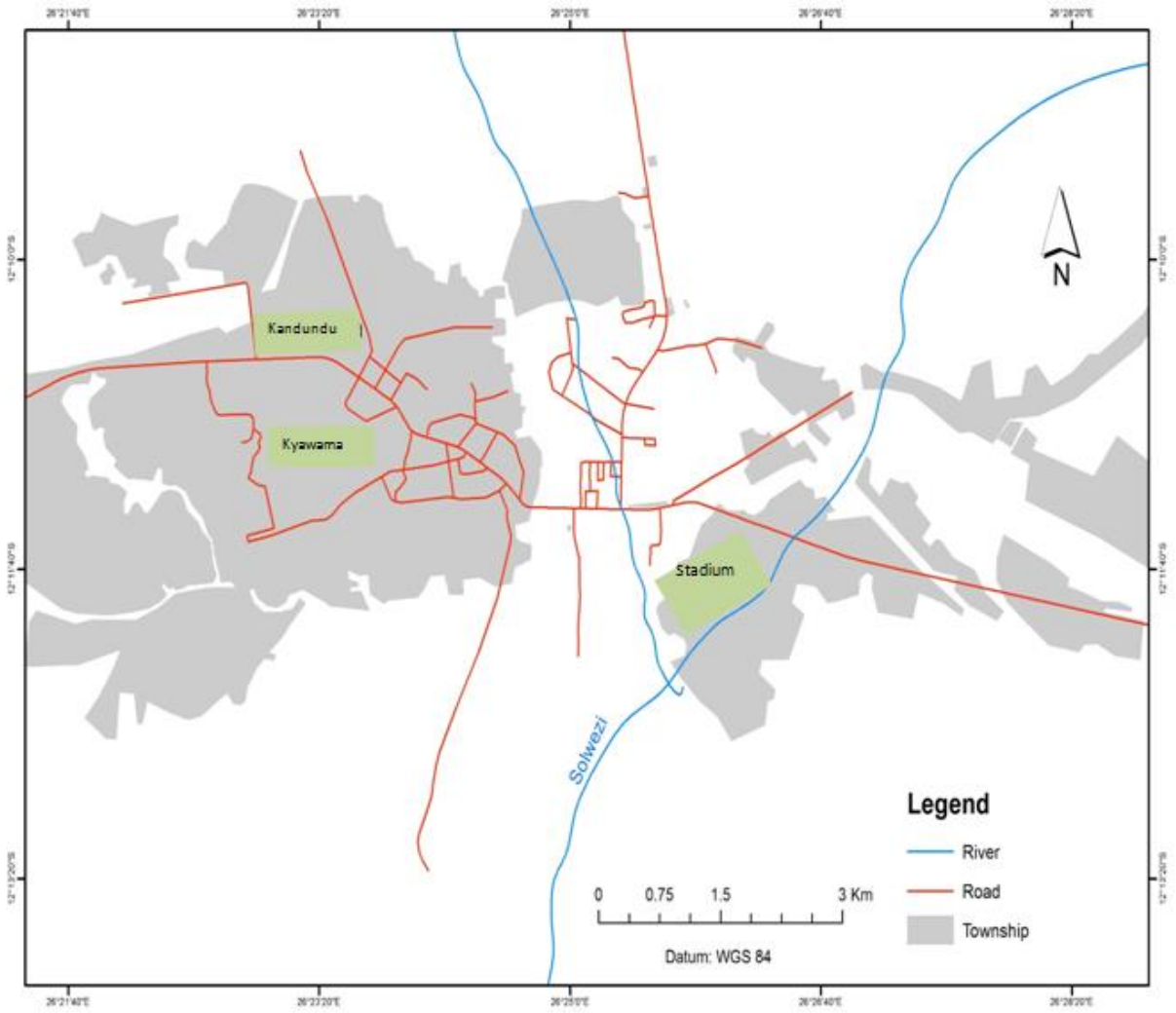

Figure 3. Location Map of the three Study Sites, Kandundu, Kyawama and Stadium of Solwezi.

Source: Field data, 2020

Solwezi town also shares an international boundary with the Democratic Republic of Congo in the north. Solwezi is the provincial headquarters located 175kilometres west of Chingola District in the Copperbelt Province.Solwezi town has two Chiefs, Chief Kapijimpanga and Chief Mujimanzovu. The local district administration is made up of management and (five) wards namely Kamalamba, Kimasala, Kapijimpanga, Tunvwang'anai and Sandan'gombe.

The three residential areas Kandundu, Kyawama and Stadium had been purposively selected as study sites based on their income levels with Stadium being a high income residential area, Kandundu being a middle income residential area and Kyawama being a low income level and one of the unplanned settlements in Solwezi town. Solwezi District was selected for study as it had experienced a transition from a rural district to a mining town and this resulted in

increased waste generation. This newly generated problem required a study that would help suggest solutions in solving the solid waste challenges that has hit the town.

3.2 Demographic Characteristics of Solwezi

The population of Solwezi was at 261,473 in the year 2011 according to the 2010 census results which is among the highest in the country. The population has grown from 203,797 in the year 2000 to 261,473 in 2011(CSO,2012). The current population projections taking into consideration the rate of population increase stood at 315,888 in 2018 (CSO,2012). The population density for Solwezi is 8.4persons per square kilometre which is very low when compared to Lusaka with a population density of 4,853.2 persons per square kilometre the capital city. Further, compared to Zambia, this population density is a bit lower because overall Zambia's population density is 17.4 persons per kilometre. Solwezi is one of the fastest growing towns in Zambia in terms of population, and this is due to the mining activities that have brought about the development of other economic activities. The recent population explosion has contributed to increased externalities such as unsustainable generation of solid waste.

3.3 Relief and Drainage

The topography of the district is dominated by gently rolling hills formed by erosion of the upland plateau and defined by the drainage pattern of the Kafue, Lunga and Kabompo rivers. The topography is generally undulating and slopes from North to South, but with a dividing ridge between Solwezi and Kasempa.

3.4 Geology and Soils

Unsustainable solid waste management can result into long term environmental problems such as pollution of both surface and groundwater, although in the short term, birds, vermin, fires, wind-blown litter, smell and visual intrusion are of more immediate concern. Whereas, contaminated surface water can be dealt with, groundwater contamination is less easily controlled, as contaminated leachate from the waste may readily percolate downwards into the groundwater depending on the geology (Allen and MacCarthy, 1991). Therefore, the geology of a place determines the rate at which ground water contamination takes place.

The geology of the district is part of the regional geology of the Copperbelt province. The district is generally underlain by the Lufilian Arc also known as the Katanga system which is the main dominant geology of the province. The main rock types which form part of the soils include shale's sandstone, quartzite and limestone, conglomerates granite and other volcanic rocks (Equinox,2005). There are eight main soil types that are found in North-Western province

and five of these occur in Solwezi district. The predominant soil types in Solwezi town include *Ferralsols, Cambisols*, and *Acrisols* while *Leptosols* and *Gleysols* are found in limited amounts.*Ferralsols,Cambisols* and *Acrisols* are classic red soils because of high iron content. *Ferralsols* and *Cambisols* may be poor in nutrient content but they can sustain agricultural productivity when used withinputs such as fertilisers.

3.5 Climate

Climate plays a very big role in either exacerbating or minimising negative impacts of untreated solid waste resulting into numerous environmental problems. The high rainfall and high temperatures experienced in some places globally, magnifies the problem of Leachate (pollution), as rainwater promotes reaction of the waste, releasing toxins which are then transported by the rainwater either as surface runoff, or carried downwards as the rainwater infiltrates into the ground, ultimately to reach the water table and perhaps pollute the groundwater (Allen and MacCarthy, 1991). Solwezi is one of the towns that receives high rainfall because it is found in agro-ecological region III. Agro-ecological III recieves between 1000mm and 1500mm of rainfall annually and constitutes 46 percent of the country's total land area comprising the Copperbelt, Luapula, Northern and North-western provinces. With the exception of the Copperbelt, the zone is characterised by highly leached, acidic soils which are moderately suitable for the production of all types of cereals, legumes, tubers, cassava, pineapples, rice, coffee and sugarcane. The area is the high rainfall zone of Zambia and has a long growing season of over 160days. The mean annual rainfall in Solwezi averages 1300mm with the maximum recorded of 1575mm and a minimum of 985mm. The rainfall in this area is linked to the southward shift of intertropical convergence zone (ITCZ) which creates a convergence of trade winds into a low pressure zone, resulting in pronounced convective activity which is associated with heavy tropical rainfall (Max et al.,2015). January is the wettest month with a mean monthly downpour of 273mm. Temperatures in Solwezi vary considerably between cold and hot months. The mean monthly maximum temperatures are about 27.4^{0}C while the mean minimum temperature are about 12.98^{0}C. The hottest months of the year are September and October while the coldest months are June and July.

3.6 Socio-Economic Characteristics of Solwezi

Solwezi town has 23 residential areas of which 12 are planned and 11 are unplanned (or informal) settlements. The town has two large markets, namely; Solwezi Main Market and Kyawama Market, and 11 small markets located in various residential areas(SMC, u. n.).

Socio-economic characteristics of Solwezi are closely related to the mining activities at Kansanshi, Kalumbila and Lumwana mines. This has contributed to the rapidly increasing human population in the district and growing urbanization. The increase in population is directly related to increasing volumes of waste generation as a result of consumption patterns, lifestyle and economic expansion in commercial and industrial development. Construction of houses and expanding homes through demolishing of old structures are also some of the factors leading to more waste generation in the district by the residential, industrial and commercial sectors. Other economic activities in town include subsistence farming in peri-urban areas, and quarrying (SMC, 2008).

CHAPTER FOUR: METHODOLOGY

4.0 Introduction

Research methodology is described as a set of systematic techniques that guides the reseach process (Igwenagu, 2016). Creswell (2013), described research methodology as the philosophical framework within which or the foundation upon which the research is conducted. Therefore, this chapter presents the methods used in this study such as the research design, data collection methods, sample size, sampling procedure and data analysis methods.

4.1 Research Design

A research design as defined by Taylor (2000) is a constructed plan and strategy that is developed to seek and discover answers to research questions. It is also defined as a plan for collecting and utilizing data so that the desired information can be obtained with sufficient precision so that a hypothesis is tested properly. A research design is relevant to the argument that the researcher wishes to present in a particular study. It is also necessary to ensure accurate data is collected, as well as in establishing causality, in situations where the researcher wishes to go beyond description to provide explanations (Ramatta, 2014).

The study utilized the descriptive and correlation research designs. The two research designs were useful when making inferences regarding the waste management strategies employed in Solwezi. The study utilized descriptive design when identifying solid waste management practices that were carried out in the three study sites. The descriptive design is ideal for gathering original data for purposes of describing certain perceptions, opinions, attitudes, relationships and orientations that are held by a population too large to observe directly (Tshuma and Mafa, 2005). Residents' participation in solid waste management required a research design such as a descriptive survey. This is because the descriptive survey design describes what we see, hence reveals the actual picture of a situation through the emerging trends from the study (Leed, 1997). The descriptive survey research design was only chosen to identify the solid waste management practices because it enables the researcher to obtain in-depth information. This design is highly qualitative in nature, hence could not be used to facilitate the generalization of one's findings to the larger population (Maree, 2007), hence other methods of study were used.

When analyzing data, correlation design was used when comparing and rating resident's participation in solid waste management activities in Kandundu, Kyawama and Stadium study sites. Correlation research design is intended to discover relationships among variables and

allow for the prediction of future events from present knowledge. It is usually concerned with measurement of relationships between two or more relevant variables and determines whether or not the variables are correlated (Susan, 2011). Correlation design was used because the study involved comparing three residential areas with different income levels. Cross-sectional research design was used when establishing roles and barriers that hindered the resident's participation in solid waste management in the three residential study sites. A cross sectional design involves looking at people who differ on one key characteristic at one specific point in time. The data were collected at the same time from people who are similar in other characteristics but different in a key factor of interest such as age, income levels, or geographic location (Kendra, 2019).

4.2 Research Approach

The study used mixed methods involving quantitative and qualitative research in the collection of data. Qualitative data is a categorized measurement expressed not in terms of numbers, but rather by means of a natural language description (Bowan, 2011). It is used to gain an understanding of underlying reasons, opinions and motivation. It provides insights into the problem or helps to develop ideas or hypothesis for potential qualitative research. Qualitative data is usually collected using unstructured or semi-structured techniques. Some common methods of collecting qualitative data include individual interviews and participation or observation (Susan, 2011). This study therefore utilized key informant interviews to collect qualitative data.

Quantitative research is a numerical measurement expressed not in terms of a natural language description but rather in terms of numbers. Quantitative research is used to quantify the problem by way of generating numerical data or data that can be transformed into usable statistics. It is used to quantify attitudes, opinions, behaviours, and other defined variables. Quantitative research data collection methods include surveys, questionnaires, structured interviews, or the Likert scale (Susan, 2011). Quantitative approach was used in this study through the use of semi-structured interviews to collect data from the respondents of Kandundu, Kyawama and Stadium residential sites. The semi-structured interviews were used because they give respondents time to open up about sensitive issues.

The qualitative and quantitative approaches are complementary and help provide a more complete analysis of the research problem (Maree, 2007) and offer the best chance of answering research questions (Nyaruwata, 2013). In this research, quantitative data was

collected through structured interviews. Demographic characteristics such as age, income levels, amount of solid waste generated as well as the number of years the residents lived in Solwezi at the time of the study were some of the quantitative data collected. Qualitative data collected in this study included gender of the respondents, educational levels, the residents' awareness on the role they could play in solid waste management and the barriers the residents thought hindered their participation in solid waste management. Other qualitative data collected included the residents views on measures they thought could encourage them to participate in solid waste management in their residential areas.

4.3 Data Collection

Data collection involved both primary and secondary sources. Primary data is information gathered directly from first hand sources such as respondents (Kombo and Tromp, 2011). Garner (2010) explains that primary data is aquired through questionnaires, interviews, focus group discussions, and observations. Primary data is gathered by people who can focus directly on the purpose in mind (Bowan, 2011). Kowalczyk (2015) defines primary research as factual, first hand accounts of the study written by a person who was part of the study. It is the original research. In this study, primary data was collected using semi-structured interviews, semi-structured interview guides for key informants, and observations.

Kombo and Tromp (2011) defines secondary data as data neither collected directly by the user nor specifically for the user. It involves gathering data that has already been collected by someone. For this study, secondary data was collected from published and unpublished sources such as situational analysis reports for Solwezi from Solwezi Municipal Council (SMC) library, Solwezi State of the Environment reports from the Zambia Environmental Management Agency (ZEMA) , news paper articles, the University of Zambia library, peer reviewed journals from the internet.

4.4 Sampling

Sampling is a the procedure a researcher uses to gather people, places or things to study. It is a process of selecting a number of individuals or objects from a population such that the selected group contains elements representative of the characteristics found in the entire group (Orodho and Kombo, 2012). The three residential areas in Solwezi were purposively selected because of their proximity to Solwezi town and also based on the income levels (low, medium and high income). Simple and systematic random sampling were used to collect data from the households. Systematic random sampling was used only in the two planned settlements Kandundu and Stadium residential areas. The first household selected was randomly sampled

while the rest of the sample was selected systematically based on the calculated sampling unit. As indicated by Tshuma and Mafa (2005) in a systematic sampling, the researcher identifies a random starting point on the population list and thereafter selects every n^{th} unit from the starting point. Hence, in this study, simple random sampling was used to determine the starting household while selection of the subsequant households was done using the calculated sampling unit of five. This means that every fifth house was chosen starting from the first house, though the population list was not provided for.

Table 2. Stratified Sampling Procedure for Kandundu, Kyawama and Stadium Township Residents

Type of Sampling Procedure	**Systematic Sampling**	**Systematic Sampling**	**Random Sampling**
Township	Stadium	Kandundu	Kyawama
Strata(Income Level)	High	Middle	Low

Source: Field Data, 2016.

In Kyawama compound , systematic sampling was used for the first two yards but thereafter, simple random sampling was used because most yards sampled using systematic sampling had no people around them. Therefore, simple random sampling was adopted to be used in Kyawama compound because the area is an unplanned settlement with both small and big yards (compounds). Simple random sampling was used in this study area because it is a very densely populated residential area such that the sample size was going to be too big if systematic sampling was to be followed. Each yard had three or more households, while a few other yards had one or two households. In both cases, only one household was picked out of each yards.

A total of 77 for households were sampled of which 28 households were from Kyawama, 23 from Stadium and 26 households from Kandundu townships. Purposive sampling was used to select twokey informants one from Solwezi Municipal Council and one from Wana Cleaning Services. Purposive or judgemental sampling is one that is selected based on the knowledge of a population and the purpose of the study. This sampling technique is used so that individuals are selected based on some defining characteristics that makes them the holders of specific data needed for the study (Maree, 2007). Purposive sampling also involves hand-picking certain groups or individuals to include in the sample on the basis of their relevance to the problem

under study (Tshuma and Mafa, 2005). In this study, the key informants were selected based on their knowledge of solid waste management in Solwezi town. One of the key informants that was purposively selected was the Director of Housing and Social Services at the local council. This person was incharge of solid waste management at the municipality level. The director was purposively selected because he had more information on the solid waste services the local municipality provided to the residents in the town. It was also expected that the key informant would provide useful information on which area among the three study sites had the highest participation in solid waste management. The Director was also expected to give out information on the role of the residents in solid waste management in the three residential areas. The barriers to community participation in solid waste management was also expected to be established during the interview. The second key informant selected was the Director for a private solid waste management company called Wana Refuse and Cleaning Service Company. This key informant was chosen based on recommendation from the first key informant Director of Housing and Social Services. She was choosen because it was believed that she would give out vital information concerning the levels of participation of the residents and their willingness to participate in formal solid waste management as well as the barriers to community participation.

4.5 Instruments for Data Collection

4.5.1 Semi-Structured Interviews

An interview is a two-way conversation or oral questionnaire initiated by the interviewer for the specific purpose of obtaining research related information and learn about ideas, beliefs, views, perceptions and options of the interviewees (Creswell, 2007). A structured interview was conducted to residents who were available for the interviews in Stadium, Kandundu and Kyawama. The first part of the semi-structuredinterview was made up of questions on socio-demographics. The second part comprised of questions about the residents' awareness on the role they could play in solid waste management and questions directed towards gaining information regarding the barriers that the residents thought hindered their participation in solid waste management. The third part comprised of questions about what the residents thought were the measures that could encourage them in solid waste management in their residential areas.

The questions in the structured interview were in the English language but during the interview, the questions were translated into *Kaonde, Lunda* and *Bemba* by the researcher and research assistants. The semi-structured interview had been chosen as a data collection instrument

because the researcher could probe for more information where insufficient information had been given by the respondents. It is also a good method of data collection because as the interview progresses, the interviewee is given opportunity to elaborate or provide more relevant information if he or she opts to do so. Furthermore, interviews can be very productive since the interviewer can persue specific issues of concern that may lead to focused and constuctive suggestions. During interviews, the selected respondents were asked several other questions which included methods of waste disposal, residents' perceptions of the solid waste management services the local authority provided to the residents and their willingness to embrace sustainable ways of disposing their waste, such as formal waste collection.

4.5.2 Key Informant Interviews

According to Kombo and Tromp(2011), key informant interviews are qualitative indepth interviews with people who know what is going on in the community. The purpose of key informant interviews is to collect information from a wide range of people including commuinty leaders, professionals, or residents who have first hand knowledge about the community. A key informant interview involves a loosely structured conversation with people who have specialised knowledge about the topic one wishes to understand. Thus, in-depth interviews were was used to collect data from the key informants. The study had two key informants, an official from the local government at Solwezi Municipal Council who was known before the interview, and another official from Wana Refuse and Cleaning Service Company. In order to be consistent with all participants, the interviewer had a set of pre-planned core questions for guidance.The key informant from the local authority was purposively chosen while the second informant was chosen during data collection(during an interview with the first key informant)through snowball sampling based on their knowledge about solid waste management systems in Solwezi.

4.5.3 Direct Field Observation

According to Kawulich (2012) observation is defined as accurate watching and noting of phenomena as they occur in nature with regards to cause and effect relation. Obsevation can be done while letting the observing person know that he is being observed or without letting him know. According to Miller and Brewer(2003) observation can be categorised into unobstructive observation and participant observation based on the degree of participation by the researcher, and into covert and overt observation based on the level of awareness subjects have of being observed. The phenomenon under study, solid waste, is one which leads itself to direct field observation (Bowan, 2011). In the course of the field study, the observation

undertaken were unobtrusive and photographs were taken of waste scenes such as street litter, chocked drains and waste storage containers. This was done in ways which did not attract the attention of people around. Thus, observations of waste disposed at the market area and residential areas especially Kyawama were used as ground truthing instruments in ascertaining the level of participation in solid waste management.

4.6 Data Analysis

Qualitative data from questionnaires, semi-structured interview schedule, key informant interview guides and focus group discussions were analyzed using content analysis in order to draw out themes and patterns. When analysing data to establish roles and barriers for residents participation in solid waste management, cross-sectional research techniques were used. Data were collected in three different study sites at the same time in order to determine the residents roles and barriers. This was later coded in SPSS 22 and analysed using thematic analysis with verbatim and content analysis. All the quantitative analyses conducted in this research was done in SPSS 22 (IBM Corp. 2013).

4.6.1 Quantitative Analysis

Descriptive statistics involving means, and standard deviations were used to describe the data and assess its characteristics. When comparing and rating residents participation in solid waste management, the chi-square test for association was used while the pearson product moment was used to test for the correlations in waste generation among the three residential areas of varying income levels.

4.6.2 Verbatim Analysis

This was used when analyzing data collected through key informant interviews and a focus group discussion. Lavrakas (2008) describes a verbatim analysis as one which involves responses an interviewer records as an answer to an open-ended question when writing down the exact words spoken by the respondent. Open ended questions are those that do not provide a respondent with predetermined response choices and instead allow, expect, and encourage a respondent to answer in his or her own words. In this study, verbatim was used to strengthen data analyzed thematically by presenting experiences of respondents in their own words.

4.6.3 Content Analysis

Content analysis involves both quantitative and qualitative content analysis . Quantitative content analysis (enumerative content analysis) entails identifying the core words, concepts, themes , phrases, or sentences within a set of text data (Grbich, 2007). It involves the reporting of frequencies of occurances of certain responses in the data. Qualitative content analysis on

the other hand which is also refered to as thermatic analysis involves a systematic process by which data such as field notes and photographs are analysed for themes. It involves identifying the underlying core consistencies and meanings in a text (Patton, 2002).

4.7 Testing for Validity and Reliability

Validity explains how well the collected data covers the actual area of investigation (Ghauri and Gronhaug, 2005). To deal with this issue, the researcher had a briefing with the resesrch assistants prior to data collection in which they were taught what kind of information was required from the respondents during the interviews. The research assistants together with the researcher had time to go through each question in the semi-structured interview schedules and clarifications were made where possible.

According to Huck (2007), testing for reliability is important as it refers to the consistency across the parts of a measuring instrument. In this study, reliability was ensured through the use of triangulation. For example, some respondents reported that there was no formal collection of waste in the town, but the research team observed refuse trucks for a private waste collection company collecting waste from the streets of Solwezi on two occasions.

4.8 Ethical Considerations

The rights and welfare of human subjects of the respondents involved were protected including their identities and interests. Confidentiality of the information supplied was also guaranted by assuring the respondents that the information they supplied was purely for academic purposes. Verbal consent was sought from all respondents after the purpose of the study was clearly explained to them. The researcher acquired an introductory letter from the University of Zambia, Department of Geography and Environmental Studies through the supervisor and the head of department. Upon reaching Solwezi town, the researcher had to ask for permision from the Municipal Council by presenting an introductory letter from the Univeristy. The researcher was given consent to carry out research in the three study sites by the local authority.

CHAPTER FIVE: PRESENTATION OF RESULTS

5.0 Introduction

This chapter presents the study findings. The presentation has been done based on objectives. It proceeds with a description of the demographic characteristics of the study area. The first subsection explains the rate of participation of residents in solid waste management. Subsection two shows the ways in which the respondents were participating in solid waste management.

In subsection three, the roles residents could play in solid waste management in Solwezi have been described. Subsection four explains the factors that hinder the residents' participation in solid waste management. This approach has been adopted in order to help the reader to follow the findings of the objectives without disruptions.

5.1 Demographic Characteristics of Residents in Solwezi Town in 2016

The study was carried out in three residential areas of Solwezi namely Kandundu, Kyawama and Stadium.Table 3 shows that more than half of the respondents in Kandundu, Kyawama and Stadium residential areas were in the age range of 26-31years (37.66 percent).

Table 3. Demographic Characteristics of Residents in Kandundu, Kyawama and Stadium Residential Areas of Solwezi Town in 2016

Age	**Frequency**			**Percentage**		
15-19	2			2.597		
	19			24.7		
26-31	29			37.7		
32-37	13			17		
38-43	10			13		
>44	4			5.2		
Education status	**Frequency**			**Percentage**		
Primary	19			24.7		
Secondary	10			13		
Tertiary	48			62.4		
Employment status	**Frequency**			**Percentage**		
	Ka*	Ky*	Sta*	Kan*	Ky*	Sta*
Formal	22	10	20	28	13	26
Informal	0	17	01	0	22	1
Retired	04	01	02	5	1	3

Gender	**Frequency**		**Percentage**
Male	28		36.4
Female	49		63.6
Sample site	**Frequency**		**Percentage**
Kandundu	Male	07	9
	Female	18	23.4
Kyawama	Male	11	14.3
	Female	18	23.4
Stadium	Male	10	13
	Female	13	17
Marital Status	**Frequency**		**Percentage**
Married	21		27.3
Single	05		6.5

Ka*= Kandundu, Ky*=Kyawama, Sta*=Stadium

Source: Field Data, 2016

This was followed by those found in the age between 20-25years (24.67 percent). Very few respondents were found in the age above 40 years. Table 3 shows that there were more female respondents (63.4 percent) than males in all the three residential areas of Kandundu, Kyawama and Stadium.

5.2 Solid Waste Management Practices in Kandundu, Kyawama and Stadium of Solwezi in 2016

The commmonly practised method of SWM in the low income area of Kyawama was burying (28.6 percent), while the high income areas of Kandundu and Stadium commonly utilised formal waste collectors (Stadium 22.1 percent; Kandundu12.9 percent) (Figure 4). Burning was practiced on a small scale in all the three areas of Kandundu (10.4 percent), Kyawama (6.5 percent) and Stadium (2.6 percent). Informal waste collectors, where individuals were contracted to collect waste on a small scale using wheelbarrows was also a management activity that was practiced in Kyawama (1.3 percent) residential area, but was not practiced in middle and high residential areas.

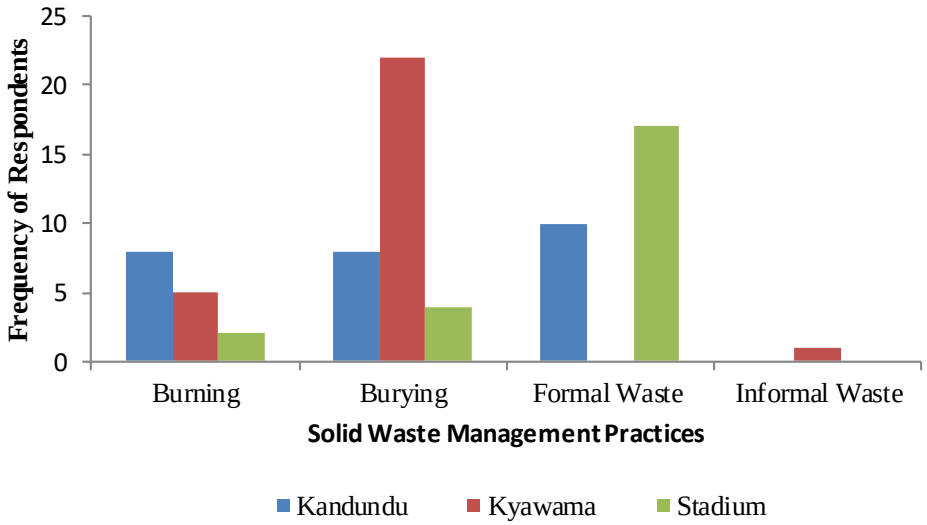

Figure 4. Solid Waste Management Practices in Kandundu, Kyawama and Stadium
Source : Field Data, 2016

Some of the residents interviewed in the three residential areas of Kandundu (32.4 percent), Kyawama (33.7 percent) and Stadium (29.8 percent) areas felt that solid waste management was a major problem while only a small number of residents in Kandundu (1.3 percent) and Kyawama (2.6 percent) felt that solid waste was not a problem (Figure 5).

On the other hand, the key informant from Solwezi Municipal Council narrated the followingduring an interview conducted on 19th February 2016:

> *Solid waste management is a huge problem in this town. It is for this reason that the local authority had decided to enter into a public-private partnership with a private firm or contractor by the name of Wana Cleaning and Refuse Collection Services on*

23rd June, 2008 to help manage the huge challenge of solid waste.The contractor started providingsolid waste collection services in the planned residential areas of Solwezi in the year 2008 based on the Public-Private Partnership (PPP) agreement. The local town is clustered into existing residential areas and the residents were required to pay ZMW 60 to have their waste collected.

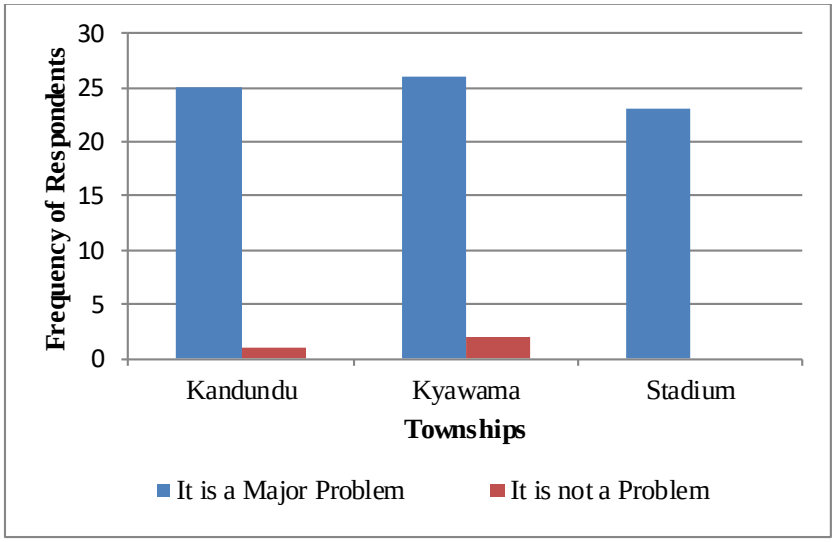

Figure 5: Residents Views of the extent of Solid Waste

Source: Field Data, 2016

5.3 Nature of Solid Waste Problem in Solwezi

Further more, some residents in Kandundu (29.9 percent) and Stadium (14.3 percent) felt that waste management was a problem becauseformal waste collector delayed in collecting in their residential areas (Figure 6). About 15.6 percent of the residents in Kyawama and (3.9 percent) in Stadium felt that waste was a problem because it was not well disposed off or it was improperly disposed off. Further more, some residents in Kyawama (14.3 percent) felt that waste management was a major problem because there was no more space for them to dig rubbish pits in the yards. Furthermore, a very small number of residents in Stadium (1.3 percent) felt that the dump sites were located very far from where they lived, that was why waste management was a major problem to them.

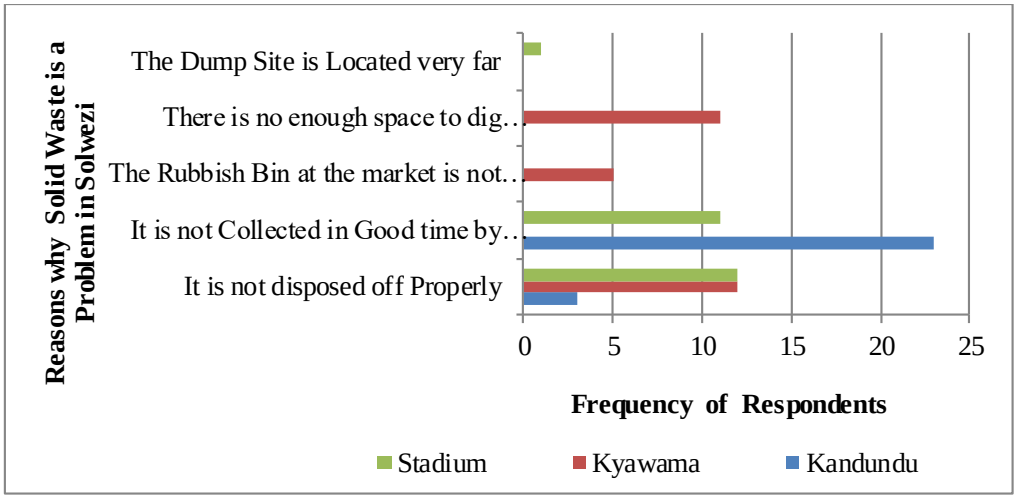

Figure 6: Reasons why Solid Waste is a Problem

Source: Field Data, 2016.

The response given by one resident revealed the general feeling of the residents in Kyawama residential area:

Because most of us have extended our existing household structures or built small houses commonly called midadada because of a general rise in demand for housing, digging rubbish pits is becoming a challenge. Therefore, some residents in Kyawama compound are being forced to illegally turn the compound roads in to rubbish bins(Figure 7).

Figure 7: Waste Dumped in a Compound Road in Kyawama Township

Source: Field Data, 2016

Solid waste management was a problem because waste was not collected in good time for those residents in Kandundu and Kyawama (6.5 percent) who lived and disposed their waste in receptacles or communal rubbish bins near Solwezi main market and Kyawama market. As a result, there was constant bad odour that came from there as the receptacles were found on the roads leading to the market from Kyawama and Kandundu residential areas (Figure 8).

Figure 8: Uncollected Waste Receptacles at Solwezi Main Market, 2016

Source : Field Data, 2016

5.4 Generation of Waste in Solwezi

All the sampled households in the three study sites exhibited weak correlations as regards amounts of waste generated (Table 4). The weak correlations were not significant at $p = 0.05$. However, there was a comparatively stronger correlation in the waste generated between Kyawama and Stadium ($r = 0.318$). On the other hand, Kyawama and Kandundu, also exhibited a weak correlation as regards waste generation ($r = -0.214$; $p = 0.268$).

There was a no significant difference in the amount of waste generated per household in the three residential areas (Table 4). This means that there was a weak correlation or an inverse relationship between Kandundu and Kyawama in the waste generated. On the other hand, Kyawama and Stadium exhibited a strong correlation in the waste generated. This means that, Stadium generated as much waste as did Kyawama.

Table 4: Household Pearson correlation Statistics to show the Difference in Household Generation of Waste among the three townships in Solwezi

Township	Statistic	Kandundu	Kyawama	Stadium
Kandundu	Pearson Correlation	1	-0.214	-0.054
	P-value	0.00001	0.463	0.848
Kyawama	Pearson Correlation	-0.214	1	0.318
	P-value	0.463	0.00001	0.268
Stadium	Pearson Correlation	-0.054	0.318	1
	P-value	0.848	0.268	0.00001

Source: Field Data, 2016

However, the difference was not statistically significant as the amount of waste generated was also analysed at household level in figure 9. Each household in Kandundu generated about 25000 kg, while each household in Stadium generated about 32000 kg and in Kyawama each household generated about 35000 kg of waste per year. This may be because residents in Kyawama residential area were employed by those in Stadium a high income area, thus the high generation of waste due to high consumption also affected Kyawama a low income area. Thus, it can be said that there was no significant difference in the total waste per capita household generation of waste.

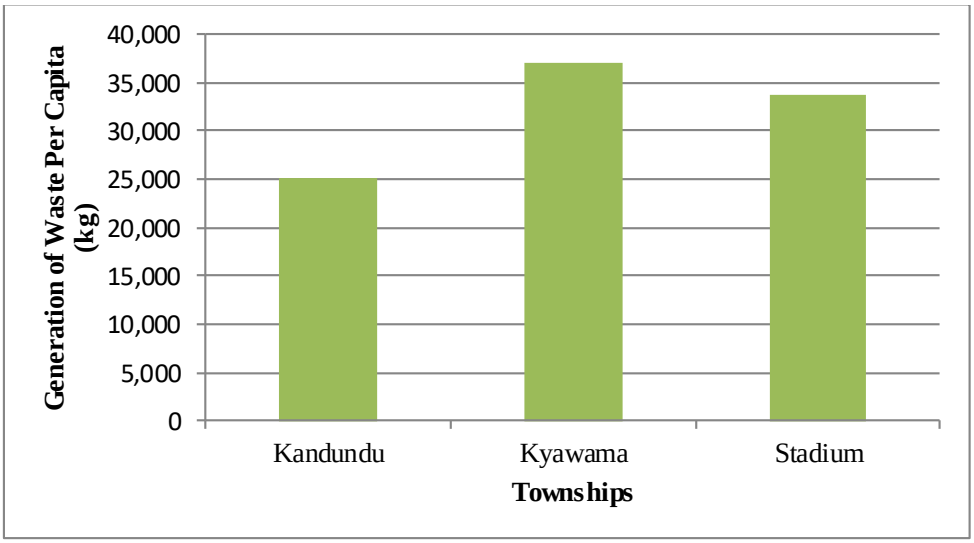

Figure 9: Generation of Household Waste Per Capita in the Three Residential Areas

Source: Field Data, 2016

5.5 Household Waste Management Strategies in Solwezi Town

Kyawama residential area had more residents (27.3 percent) who disposed off waste in pits than did Kandundu where only a small number (5.2 percent) disposed off in the bins (Figure 10). In Stadium residential area, more residents(20.8 percent) kept their waste in bins followed by Kandundu (12.9 percent) while Kyawama had the least number of residents (1.3 percent) who did the same. Furthermore, a small number of residents kept their waste in sacks in all the three residential areas with Stadium being the highest (9.1 percent) followed by Kandundu (6.5 percent) and Kyawama (6.5 percent). Lastly, a small number of residents in Kyawama (1.3 percent) kept their waste in metal drums.

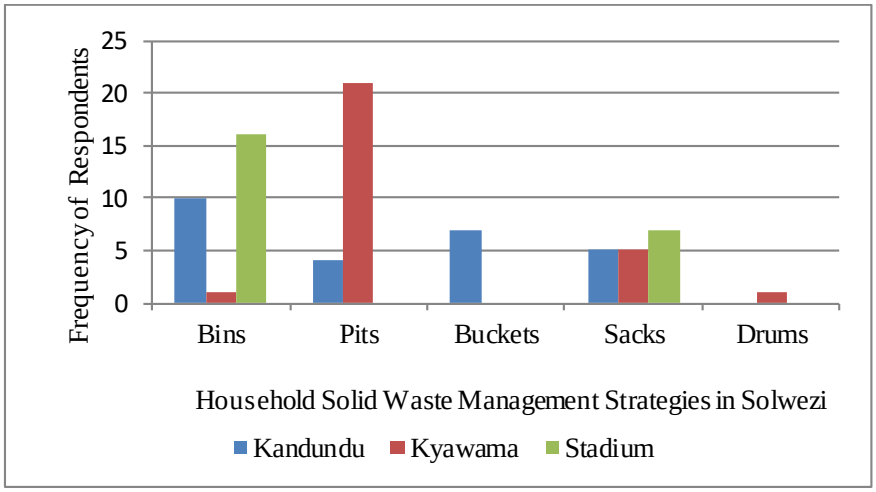

Figure 10: Household Solid Waste Management in Residential Areas of Solwezi

Source: Field Data, 2016

5.6 Participation of the Residents in Solid Waste Management in Solwezi

There was a significant difference in the participation levels in a formal waste collection service among the residents of three townships (χ^2=46.93; p=0.001) (Table 5). Therefore, the null hypothesis which says that there was no significant difference in the levels of participation among the residents of Solwezi in solid waste management has been rejected. The three townships were delineated into different income levels. Kyawama which was a low-income residential area recorded low participation while Kandundu and Stadium had higher participation. The Least Square Difference (LSD) method was used to compare the significance of differences in levels of participation in solid watse management among the three townships. The level of participation was assessed through paying for waste collection service and adoption of sustainable waste management practices.

Table 5: Chi-square Test Showing the Significance of the Difference in Residents' Participation in Formal Solid Waste Management among Residents in Solwezi

Township	Observed and Expected Counts	Participants	Non-Participants	Total		Test Statistic	Chi-square Value	Df	P-value
Kandundu	Count	18	8	26		Pearson Chi-Square	46.936	2	0.001
	Expected Count	13	13	26					
Kyawama	Count	0	28	28		Likelihood Ratio	60.425	2	0.001
	Expected Count	14	14	28					
Stadium	Count	21	2	23					
	Expected Count	11.5	11.5	23		Linear-by-Linear Association	2.058	1	0.151
Total	Count	38.5	38.5	77					
	Expected Count	38.5	38.5	77					

Source: Field data, 2016

Generally, there was a significant difference in the levels of participation in solid waste management among the three townships in Solwezi (F =59.697; p = 0.001). There wasa significant difference in levels of participation among all the areas of different income levels (Table 5). Residents of the high income area of Stadium generally had higher participation compared to the other two areas, while residents of the middle income Kandundu also participated more than did the residents in low income areas of Kyawama.

Table 1: Pair wise Comparison of the Levels of Participation among Residents of Different income levels in Formal Solid Waste Management

Townships		**Mean Difference**	**Std. Error**	**P-Value**
Kandundu	Kyawama	-.692	0.086	0.001
	Stadium	.221	0.09	0.017
Kyawama	Kandundu	.692	0.086	0.001
	Stadium	.913	0.089	0.001
Stadium	Kandundu	-.221	0.09	0.017
	Kyawama	-.913	0.089	0.001

Source: Field Data, 2016

The key informat from Wana Refuse and Cleaning Company Services on 19th of February, 2016 revealed that:

Participation in formal waste collection service is very low among the residents of Solwezi. Statistically, out of the entire population, only 400 residents pay for the solid waste collection

service. Most residents think that it is the responsibility of the local authority to collect waste from their residential areas free of charge, as well as from the streets in town. Generally, the willingness of the residents to pay for the collection of solid waste is very low and this in turn affects their participation in a formal waste collection service.

Only a small number of the residents in Stadium (27.3 percent)and Kandundu (20.8 percent) were aware of the availability of services for collection of solid waste for those who paid for it. On the other hand, in Kyawama, about 26.9 percent of the residents reported that there was no collection of solid waste taking place in their residential area and that they were unaware of the existence of such a service in Solwezi town (Figure 11).

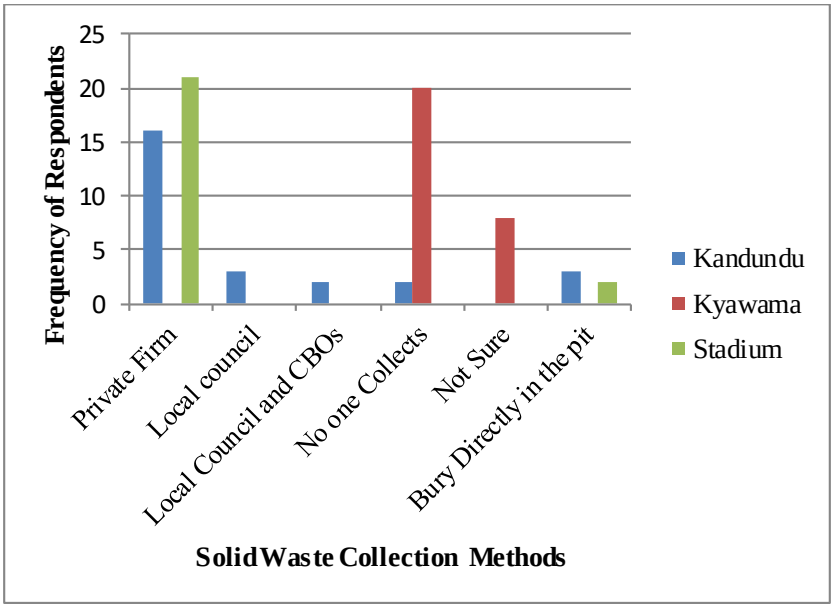

Figure 11. Collection of Solid Waste in Residential Areas of Solwezi

Source: Field Data, 2016

5.7 Willingness to Participate in Formal Waste Management by the Residents of Solwezi

Residents in the two high income residential areas, Kandundu (28.6 percent) and Stadium (28.6 percent) expressed the same willingness to participate in a formal solid waste management (Figure 12). Nonetheless, a small number of residents were willing to participate in formal solid waste management in the low income area of Kyawama (14.3percent). On the other hand, some residents in Kyawama(10.4 percent) and Kandundu (2.6 percent) were willing to participate only if the fee attached to formal waste collection was affordable. Kyawama residential area had a higher number of residents who were not willing to participate in any formal waste management system because they felt the monetory charge attached to it was

high.In the high income residential areas, only a small percentage of the residents in Kandundu (1.3 percent) and Stadium (1.3 percent) were not willing to participate (Figure 12).

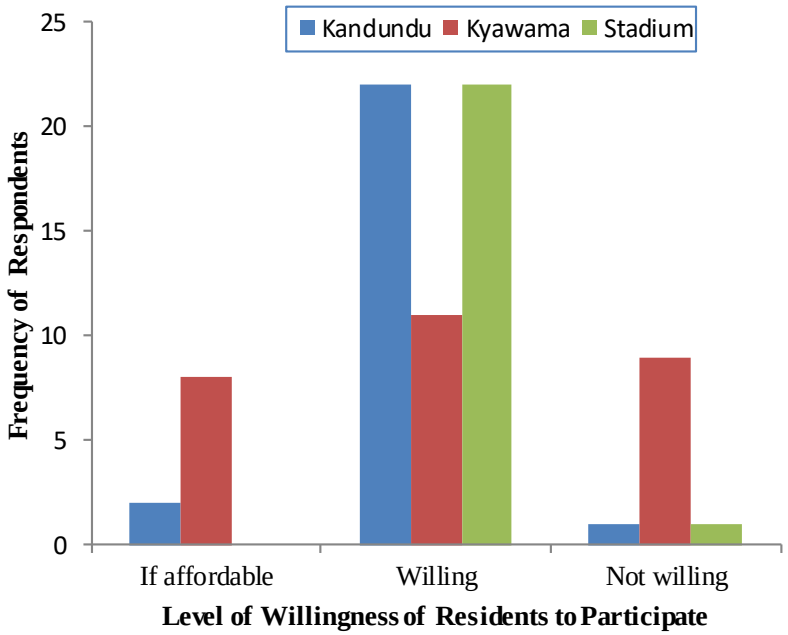

Figure 12: Willingness to Participate in a Formal Solid Waste Management System

Source: Field Data, 2016

5.8 Gendered Awareness of the Role of Residents in Solid Waste Management in Solwezi

Nearly half of the female residents (50.6percent) in all the three residential sites were more aware of the roles they could play in waste management, Kandundu(16.9percent), Kyawama (16.9 percent) and Stadium (16.9percent) than the male (Figure 13). Nonetheless, Kandundu and Kyawama had the highest number of males (11.7 percent) who were aware of the roles they could play in SWM while Stadium had the lowest number of males (5.2 percent) who were aware of the roles they could play in a SWM system. This does not mean that most male in Stadium were unaware of the roles they could play in SWM, but could imply thatmost of the men in Stadium were unavailable at the time of the study. At the time of the study, most of the men were away at work as this was done during working hours of the week. The other reason is that most waste management issues are better dealt with by women, thus on three occassions, the male respondents delegated the interview to the women in the house.

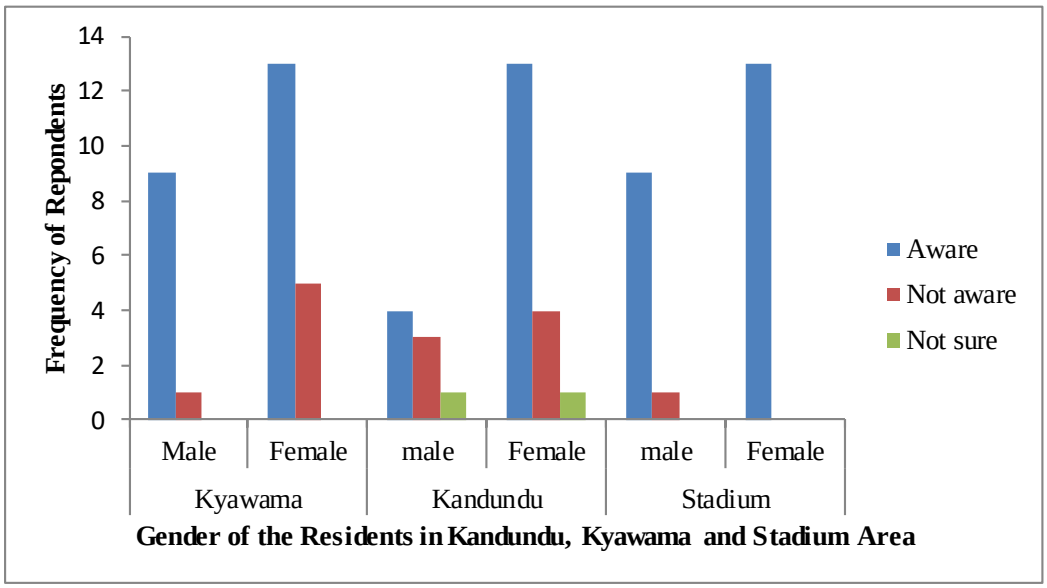

Figure 13: Awareness of the Roles Residents Play in Formal Waste Management

Source: Field Data, 2016

The key informant from Solwezi Municipal Council (19th February, 2016) narrated that:

The residents of Solwezi are aware of the role they can play in a formal waste management system. The majority of the residents know but still a few people do not know. Now, even if the majority know, their awareness does not influence them in a positive way of wanting to participate in it. The major factor that is affecting the residents' awareness is their attitude owing to the fact that Solwezi town is in a transition from a rural district to a mining town. Hence the local municipal council is faced with a challenge of a lack of knowledge on part of the residents on the need to follow a formal waste management system that will involve collection of waste at a fee by the municipal and later on disposing it off at Kyansununu disposal site.

5.9 Modes of Residents' Participation in Formal Solid Waste Management in Solwezi.

More than half of the residents in Stadium(33.7percent), Kandundu (28.6 percent), Kyawama (22.1 percent) residential areas participated in formal waste collection by paying for the waste collection service. However,a small number of residents in Kandundu (9.1 percent) and Kyawama (5.2 percent) felt that they would participate in a formal waste management service by disposing off their waste at the formally designated points such as a communal dumpsites or communal rubbish bin. Futher, some residents in Stadium (9.1 percent), Kyawama (5.2 percent) and Kandundu (1.3 percent) participated by separating waste into decomposable and non-

decomposable waste (plastics and paper) before disposing it off (Figure 14). There was a small number of residents in Kyawama (5.2percent) who felt they would still continue to bury their solid waste as a way of participating in a formal waste management service. Only a small number of residents in Kandundu (5.3percent) felt that they would stop burning as a way of participating in formal waste management service. Notably, there was no one in all the three residential areas who felt that re-use was also a role which they could play in a formal waste management service. This entailed the need for sensitization as a way to improve residents' awareness of sustainable solid waste management techniques.

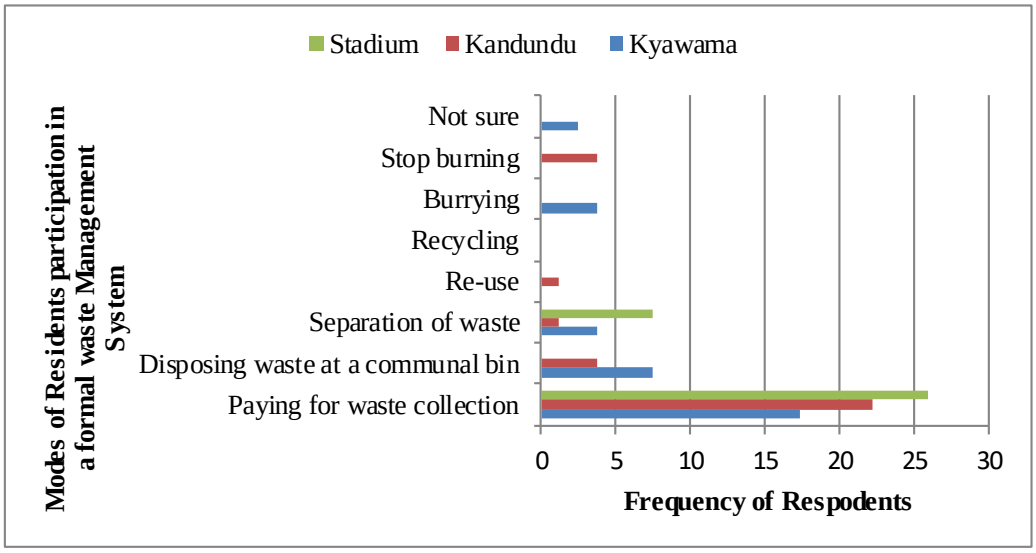

Figure 14: Modes of Resident Participation in a Formal Waste Management System in Solwezi

Source: Field Data, 2016

The key Informant from Solwezi Municipal Council in an interview on the 19th of February, 2016, narrated that:

> *The main role residents of Solwezi town can play is that of participating in a formal waste collection service operated by Wana Refuse and Cleaning Company Services on behalf of the local authority, of course with a cost attached to it. Most residents are aware of the existence of this service because this service is mostly advitised on the local television and radio stations, and also the refuse van is mostly seen moving around town. The other roles the local authority expects the residents to play, are waste separation and recycling, though recycling is not being done at the moment because the local authority is the only waste management agent managing solid waste in the whole town of Solwezi*.

5.10 Factors that Hinder the Residents' Participation in Solid Waste Management

Several factors hindered residents'participation in formal waste management in Solwezi. Some residentsin Kyawama (18.2 percent) felt that "no formal collection waste service was available in their residential area", and this hindered them from participating in a formal solid waste management system. Only 1.3percent in Stadium were not aware of the existence of such a service (Figure 15). The second hindrance was that waste collector delayed in collecting waste from their residential areas and the greater percentage of those who felt this hindered them was in Stadium (15.6 percent) and Kandundu (6.5 percent). A few residents of Kyawama (12.9 percent) felt that a "lack of money" was their greatest hindrance while Kandundu recorded a smaller number (6.5 percent). In Kandundu and Stadium, about 10.4 percent and 2.6 percent, respectively, felt that lack of street bins around town hindered them from participating in a fomal waste collection. On the other hand, 5.2 percent of the residents in Kyawama and Kandundu (10.4 percent) and Stadium (10.4 percent) felt that lack of communal rubbish bins in the residential area hindered them from participating in a formal waste collection.

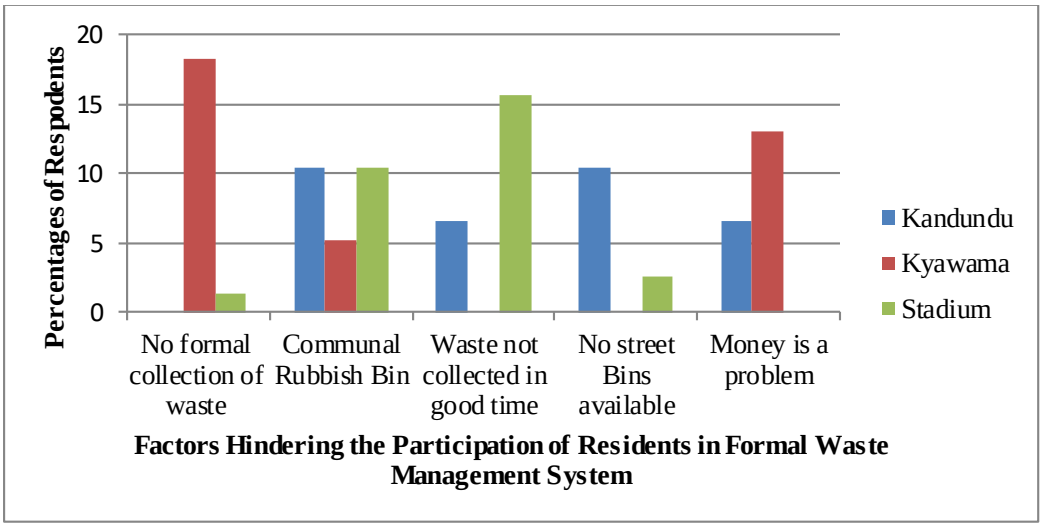

Figure 15: Factors Hindering the Participation of Residents in Formal Waste Management

Source: Field Data, 2016

5.11. Availability of Public Awareness Campaigns on Formal Waste Management

Nearly all the residents (72.9 percent) in the three residential areas Kandundu (24.7 percent), Kyawama (25.9 percent) and Stadium (22.3 percent) respectively, were not aware of any public awareness campaigns or sensitization activities that were aimed at educating the residents on the practice of sustainable waste management. Residents had not observed posters or banners that had depicted waste management activities. Only a small number of the residents in

Kyawama (6.5 percent) reported that they had heard of some sensitization programs on waste management through the media on some program once or twice on the local radio and television station in Solwezi at one point in time, while some residents in all the three residential Kandundu (9.1 percent), Kyawama (3.9 percent) and Stadium (2.6 percent) were not sure of the whole idea (Figure 16).

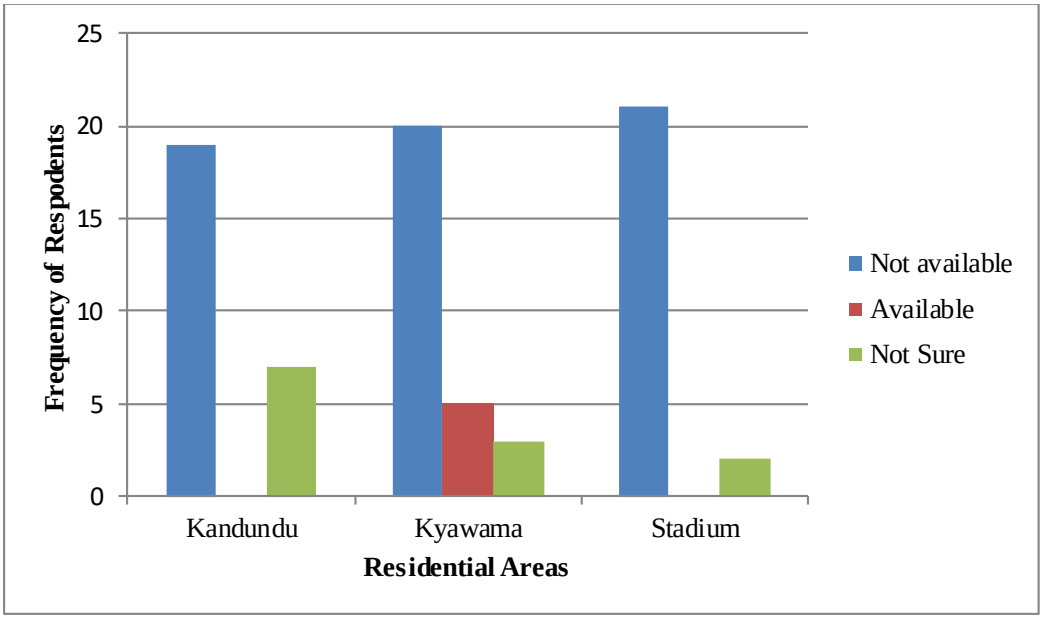

Figure 16: Availability of Public Awareness Campaigns in Solid Waste

Source: Field Data, 2016

5.12. Perception on the Effectiveness of Solwezi Municipal Council's Solid Waste Management

A small number of the residents of Stadium (12.9 percent), Kandundu (10.4 percent) and Kyawama (9.1 percent) felt that the local authority was not effective in the area of SWM. In both Kandundu (11.7 percent) and Kyawama (11.7 percent) residents felt that the local authority was poorly organized in their waste management activities. Stadium (9.1percent) had the lowest number of residents who felt that the local authority was poorly organised. Furthermore, some respondents in Stadium (7.8 percent), Kyawama (5.2 percent) and Kandundu (3.9 percent) felt that the local authority was trying their best in as far as managing waste is concerned.Furthermore, in Kyawama (10.4 percent) and Kandundu (9.1 percent) the respondents felt that the local council was not doing enough in management of waste adding that they had completely failed to manage waste in the town (Figure 17).

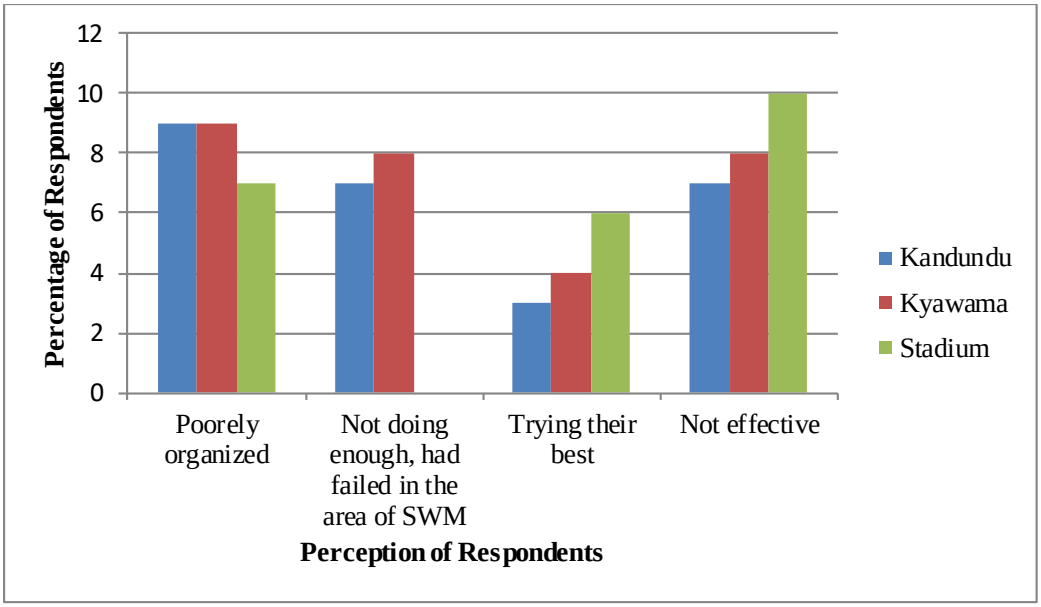

Figure 17: The Residents 'Perception on the effectiveness of the Solwezi Municipal Council's Solid Waste Management

Source: Field Data, 2016

5.13. Conclusion

This chapter sought to present the results of the study. The presentation of the results has been divided into five main themes which have subsections. The first theme is the demographic characteristics of Solwezi town, which explains the age ranges of the residents as well as their educational and income levels. The second theme describes the solid waste management practices carried out in the study sites. Thus, under the first theme, the most common waste management activities carried out in the three study sites include burying, burning and waste collection. Thus, under the first and second subsection, the study showed that there was a high increase in waste generation in Solwezi and therefore waste management had become a major problem for most of the residents. Regarding the nature of the solid waste problem, a number of reasons have been discussed as highlighted by the key informants. The levels of participation of residents in solid waste management have been discussed in the third theme. Participation of the residents was based on the residents' ability to participate in sustainable waste management activities such as waste collection, recycling and waste separation. The forth theme focused on the willingness of the residents to participate in formal waste management which had a subsection on gendered awareness of the roles the residents. The fifth theme was an assessment of the factors that hindered the residents from participating in solid waste management activities. The factors included lack of waste collection service among other reasons.

CHAPTER SIX: DISCUSSION

6.0 Introduction

This chapter presents the discussion of the results. The chapter begins with the solid waste management practices carried out in Solwezi town. The roles and resident's participation in solid waste management are presented in section two and the willingness of the residents in section three. The chapter closes with the conclusion and recommendations of the study.

6.1 Solid Waste Management Practices in Low, Medium and High Income Residential Areas of Solwezi town

The most common solid waste management practices in the three different income level areas of Solwezi were burying, burning and waste collection service. In thelow income residential areas like Kyawama, the most common Solid Waste Management (SWM) practice was buryingand burning. This is because the residents in this area had less disposable income for them to engage in paying for formal waste collection service. Further, few residents in this area were engaged in formal employment where as most of them were into informal employment. Hence, some residents contracted informal waste collectors whose fees were relatively lower than the formal waste collectors. In the middle and high income residential areas, formal solid waste collectionusing waste collectors approved by the local authorities was the main solid waste management strategy utilised. These middle and high income level residential areas were also well planned settlements with proper access routes.These well planned residential areas included Kandundu and Stadium. However, in the middle income area of Kandundu, some residents were also engaged in burning and burying of waste despite availability of formal waste collection services albeit at a cost. This implies that income levels are a factor in solid waste management practices in the case of Solwezi. In the high income area of Stadium, the majoriy of the residents hired waste collectors to collect their waste, though burning was taking place at a small scale.This may be due to the fact that many of the residents in Stadium had more disposable income to hire waste collectors than those in the low income residential area of Kyawama. The residents in high income residential areas like Stadium were more into formal employment and their educational levels were generally higher than those for the low income level residential areas like Kyawama. Thus, it can be said that the more educated one is the more aware they are of good and sustainable solid waste management practices.

Additionally, it was found that burning was being practiced in all the three residential areas but it was more commonly practiced in Kandundu and Kyawama and on a very small scale in

Stadium. This can be explained in such a way that, may be burning was being carried more in Kandundu because most of the residents were not burying the solid waste but were burning as opposed to Kyawama where they were burying without burning it first. Both these methods of waste disposal are unsustainble and are discouraged in the Environmental Management Act (GRZ, 2011) for Zambia. Hence the fact that these were common methods of disposal in Solwezi puts the town at high risks of substantial negative environmental impacts such as pollution of air, soil and water.This study agrees with Nemerow et al. (2009), who wrote that the currently applied methods by the residents to manage MSW which involve open dumping, open burning, have a negative impact on both the environment and public health.

Furthermore, Nguyen et al. (2011) reported that serious situations of environmental degradation and health risks due to the poorly developed Municipal Solid Waste Management (MSWM) system is now a reality in many cities in developing countries. Studies by Tchobaanoglous et al. (1993), Anjaneyulu, (2005), Anand et al. (2005) and Beigl et al. (2009), reveal that illegal or indescriminate dumping of solid waste leads to its accumulation bringing about contamination of ground and surface water because of its toxic nature. MSW also becomes breeding grounds for insects and flies which in turn are the sources of several diseases and percolation of leachate to ground water sources may cause severe health problems if used for drinking water purposes.Thus, the problem of solid waste management is causing a great concern to the environment of Solwezi town, especially that the town has under gone transition from being a rural district into a minning town. Similarly, Rotich et al. (2006) reported that the handling of MSW becomes a huge challenge when rural settlements grow into towns and cities very rapidly with no system in place to handle the increased generation of solid waste due to the increased human population in the area.

Thus, there was a rise in the generation of solid waste in Solwezi (SMC, 2008). The huge generation of solid waste in the town of Solwezi generally was a result of an increase in population arising from the introduction of mining activities in the town.The study found that all three different income level residential areas generated statistically similar amounts of waste. Taken absolutely, low income residential areas like Kyawama, households generated more waste than the high and middle income level areas. Each household in the low income area of Kyawama generated about 35000 kg per capita as compared to 25000 kg for Kandundu and 32000 kg for Stadium. However, the difference was not statistically significant ($p=0.001$). The generation of waste in Stadium township exibited a direct relationship with that of Kyawama. This could have been because as the income increased in Stadium so did the income

of residents of Kyawama likely because most residents of Kyawama were employed as maids or casual workers in Stadium residential area.Thus, low residential areas increased waste generation at the rate the high residential areas increased their generation of waste. On the other hand, high density areas such as Kyawama generated a lot of waste due to their dense population. This is similar to what the Punjab Pollution Control Board (PSCST, 2010), reported that the increasing population and improved standard of living in cities and urban areas have led to an increased generation of varied categories of wastes. However, this has not been accompanied by adequate investment in solid waste management in most cities of the less developed countries. A study by Rotich (2006), found that the generation of MSW has been very rapid, while at the same time the capacity to collect and safely dispose of the material has been on a general decline in developing countries.

According to the Solwezi Municipal Council, (2008:48),

> *Solid waste in Solwezi town is generated by different groups such as Shoprite which generates about 269Kg per day, other business houses generate about 1000Kg, main market about 3000kg, other markets 2000kg per day, residential areas generate about 3000kg while the industrial waste generate about 5000kg per day totalling to about 969kg/day. However, much of the waste in peri urban areas is not accounted for.*

Munawar etal. (2013), Mor et al. (2006), and Deng etal. (2006) reported that the quantity of municipal solid waste generated depends on factors such as food habits, standard of living of people, seasonal variations and the number of commercial activities taking place. Therefore, though Kyawama was a low income level residential area, it generated a lot of waste as much as Kandundu and Staduim residential areas because it was highly or densely populated.

6.2 Residents' Participation in Solid Waste Management

Residents had adequate awareness of the roles they could play in a formal SWM system except for a small number of residents in Kyawama and Kandundu who were unaware of the existence of a solid waste collection service in the town. This means that in as much as the local authority thought it had done its best interms of advertising their waste collection service, much needed to be done because some small sections of Solwezi were still unaware. Gendered assessment indicated that nearly half of the female residents in the low, middle and high income residential areas of Solwezi were more aware of the roles they played in waste management which was more than the males. This could have been due to the fact that more women were involved in domestic waste management compared to the males. However, this result could have also been

influenced by the fact that more females were interviewed compared to the male because the female were more available at home during the time of data collection in all the three different income levels.

The various roles residents played in solid waste management included separation of waste at source, disposing waste at the designated points and paying for a collection service. The study showed that mostof the residents in the low, middle and high income residential areas would be willing to pay for waste collection services as it was a way of keeping their residential areas clean. Further, majority of the residentsin the low and middle income areas were interested in participating in the free aspects of formal waste management such as waste separation, as few were willing to pay for the service. The lack of willingness to pay for waste management revealed an attitude among residents that could contribute to unsustainable environmental management of waste. This was so because there were still residents who felt that they would still continue to either bury or burn their waste as this was a cheaper method of waste disposal. While these residents felt that by burning or burying, they were also participating in a sustainable solid waste management, such participation represents maladaptation and is unsustainable and highly discouraged by policy (GRZ, 2011).

The level of participation was assessed through paying for waste collection service and adoption of sustainable waste management practices. The study found that there was a significant difference in the levels of participation in a formal waste collection service as well as adoption of sustainable waste management practices among the residents of the three different income level residential areas. Therefore, the null hypothesis which says that there was no significant difference in the levels of participation among the residents of Solwezi in solid waste management was rejected. The three townships were delineated into different income levels. Kyawama which was a low income residential area recorded low participation while Kandundu and Stadium had higher participation. In Kyawama compound all the residents felt they were not participants in the waste collection service by paying for it because such a service was not available in their residential area. Thus, perceptions on levels of participation in formal waste management was related to levels of income in areas of study. High income areas are generally high participants in formal solid waste management while low income areas are low participants in formal waste management. This is largely due to the low income areas' failure to prioritise sustainable household environmental practices. Further, in low residential areas, economic sustainability is prioritised more than environmental sustainability, hence

when residents have a choice between aportioning resources to domestic use or to environmental management, they would usually chose household domestic use.

6.3 Willingness of the Residents to Participate in Formal Waste Management System in The Low, Medium and High-Income Residents Areas of Solwezi

Residents in high income and middle income residential areas expressed similar levels of willingness in participating in a formal solid waste management. In the low income area of Kyawama, few residents were willing to participate in formal solid waste management. A study by Ebikapade (2015) revealed that a higher public involvement in environmental issues is empowered by the willingness of the people to do so and is likely to ensure a clean and healthy environment. Nonetheless, some residents in Kyawama and Kandundu were willing to participate only if the fee attached to formal waste collection was affordable. Therefore, affordability seems to be the determinant of willingness to participate in paying for a formal waste collection service and sustainable waste management practices. Kyawama residential area had a higher number of residents who were not willing to participate in any formal waste management system because they felt the monetary charge attached to it was high.

In as much as some residents were willing to participate in a formal waste management system, they were hindered by several factors. Some residents in the low income area of Kyawama felt that "no formal waste collection services were available in the area". In the high and middle income level areas of Stadium and Kandundu, the greatest hindrance was that waste was not collected in good time by the waste collectors. Rana (2014) reports that most solid waste management systems in developing countries particularly African countries have reflected poor collection efficiency of the municipal solid. Studies by Asnani (2005) and Annepu (2012), reported that for an effective solid waste management system, the collection capacities have to be greater than or equal to the solid waste generation rates. However, in most developing countries collection capacity provided is often less than the actual waste generated which is a major drawback in proper implementation of solid waste management systems.

In the middle and high income level areas,residents felt that lack of street bins around town hindered them from participating in a fomal waste collection.This was comfirmed by the observations made at the time of the study in 2016. The streets in the town of Solwezi did not have any waste bins. As a result, there was alot of littering especially in the street roads. Studies done by Guria (2010), Das (2014) and Bhoyar (1999), revealed that in India and other developing countries, generally common bins are provided for collection of decomposable and

non-decomposable waste. This was not the case for Solwezi town. On the other hand, some residents in Kyawama felt that lack of communal rubbish bins in the residential area hindered them from participating in a formal waste collection.

The awareness of residents on the availability of public awareness campaigns in the communities of the three residential areas varied tremendously. Nearely all the residents in the three different income level residential areas were not aware of any public awareness campaigns or sensitization activities that were aimed at educating the residents on the sustainable waste management practices. Most residents had not observed any posters or banners that depicted waste management activities. However, only a small number of the residents in Kyawama reported that they had heard of some sensitization programs on waste management through the media on some program once or twice on the local radio and television station in Solwezi at one point in time, while some residents in all the three residential Kandundu, Kyawama and Stadium were not sure of the whole idea. Public awareness and education are important tools capable of increasing public participation in sustainable waste management programs.

According to Ebikapade et al. (2015:191),

> *The attitude and awareness of the participants is likely to be positively influennced with increased publicity on waste management issues. The more the public are informed on waste management the better their perception and attitude towards environmental issues.*

Nonetheless, awareness campaign activities were being conducted by the local municipal council that were aimed at educating the local community in Solwezi on the need to be involved in a formal waste collection management system. The campaign activities were done through local drama programmes on North-western television, community radio stations, and press releases.

6.4 Policy Implications of Residents' Participation in Solid waste Management in Solwezi.

Solid waste if not properly handled can bring about serious environmental and health implications. This can lead to pollution of land, air and water. The local authority in the town like many authorities embarked on the Keep Zambia Clean. Solid waste in Solwezi is managed through practices such as burying, burning and through waste collection by the residents

(households). The mines surrounding Solwezi manage their town waste and are regulated directly by the environmental agent (ZEMA) and have their own dumpsites. The private company Wana Refuse Collection and Cleaning Services Company has been contracted to collect waste from business houses and households where waste management fees can be charged. The local authority concentrates on public areas including six markets and areas near bus stations where it is more difficult to collect fees.

Wana is the only company currently contracted by the Solwezi Municipal Council. The conditional monopoly is a deliberate arrangement because Wana is mandated to perform some functions that do not generate income. The PPP agreement is for ten (10) years. This time frame is intended to give Wana time to stabilise and develop the system. Once waste management reaches a large scale there are plans to introduce competition.

Most of the town's waste management activities are entirely financed by the local economy. Economic activity within Solwezi is not yet enough to maintain proper waste management and the community's willingness to pay for waste collection is very low. The town faces challenges in SWM such as the informality of many business and traders in Solwezi, lack of public awareness and a lack of clear policy and regulation. Thus, the local authority can come up with some policies which can help them source for funding to deal with the ever increasing waste generation in an event that they fail to cope with the situation.

CHAPTER SEVEN: CONCLUSION AND RECOMMENDATIONS

7.0 Introduction

Solwezi town in Zambia is one of the urban areas that is in a transition from a rural district into a mining town and thus expanding rapidly in all sectors of the local economy. However, the town lacks an efficient solid waste management. Because of the absence of a well-coordinated solid waste management system, serious environmental problems are likely to continue putting the environment and the public health at risk. Since solid waste is an environmental health hazard, its effective management by local authorities is posing problem. Despite these negative implications, residents' participation in solid waste management is required in order to help the local authority deal with the ever increasing waste generation in Solwezi town.

7.1 Conclusion

Therefore, the study was significant in that it has brought out an understanding that shows that solid waste management is a growing environmental and financial problem in Solwezi. It also provides an understanding that due to the numerous demands on the council resources, community based solution is the most sustainable and efficient way of solid waste management. An understanding on the need for community participation in solid waste management has given an input to the waste management authorities in designing more sustainable waste management strategies in Solwezi as well as other towns and cities that have similar conditions.

The solid waste management practices in Solwezi were somewhat unsustainable. Such SWM practices included burning, burying, indescrimnate dumping in open space as well as formal collection of waste at a lower level.

There were more women who participated in waste management compared to the male. This was because the women were found to be more aware of the roles they could play in SWM. Roles such as separation of waste among others were some of the waste practices known by the women. This could have been due to the fact that more women were involved in domestic waste management compared to the males.

The general pattern of participation was influenced by income levels as well as education levels. High income areas whose educational levels were higher than the middle and low income areas had more participation of residents paying for formal waste collection services and a likelihood of adopting sustainable waste management practices.

Finally, the residents in the three study sites had many challenges that hindered them fom participating in sustainable waste management activities. It was found that public awareness campaigns or sensitization activities that were aimed at educating the residents on the sustainable waste management practices were available but the majority of the residents in the three study sites were not aware of them.

7.2 Recommendations

The following policy measures are recommended to help the solid waste service providers in providing more efficient SWM in Solwezi:

- Though the problem of solid waste management is a complicated issue, several municipal corporations are continuously seeking new management strategies to deal withthe huge quantity of solid waste generation in urban cities. Solwezi municipal council can learn from other SWM service providers to develop new strategies of efficiently dealing with the ever increasing generation of solid waste in the town.Therefore, the government through the municipal council has an important role to play in initiating a move in sustainable waste management in solwezi. Some measures should include the provision of incentives such as free waste disposal bins in some selected parts of the town. Furthermore, some form of reward to those residents engaged in good waste management practices should be carried out by the municipal council. However, some sustainable measures should include educating the residents to engage in separation of waste before disposal. This will reduce the amount of waste generated awaiting collection and disposal.
- With the increasing volume of solid waste, the municipality in Solwezi has not been able to collect and dispose of the waste satisfactorily, plus cost recovery poses a critical problem. Therefore, residents participation, public-private partnerships should be encouraged and formulated into policy instruments. Since solid waste generation is increasing with increasing population in Solwezi, one contractor company currently serving the entire town is not enough. Therefore, the municipal council should increase the number of private companies or contractors who want to engage in waste collection services.
- The municipal council, the private sector and the residents (households), which are the primary producers of solid waste and suffer the effects of uncollected solid waste more directly, should be able to participate in municipal discussions on improving SWM and structuring effective public-private partnerships to deliver such services. The service

provider (the municipal authority) and Private firm (Wana Cleaning Company) needs to better understand households' demands and motivation.

- The lack of information on how and where the wastes are to be disposed, unwillingness of the public due to waste and environmental levies, lack of adequate support from the government and other stakeholders and poor government policies amongest others are some of the barriers that prevent members of the public from taking an active role in waste mannagement. Therefore, the local authority should adequately educate and sensitise the local people on some of the waste management systems that they provide to ensure a well educated society, in order to ensure a clean and healthy Solwezi.

7.3 Areas of Future Research

This research covered residents' participation in solid waste management in Solwezi. Solid waste management is a wide topic, meaning that there are certain areas or concepts this study did not consider. Such areas include the entire process of waste management from collection, transportation to final disposal at the dumpsites in Solwezi. Therefore, future researchers can take up such concerns.

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APPENDICES

APPENDIX 1A: INTERVIEW GUIDES FOR THE RESIDENTS

Dear respondent,

This is an academic interview towards the partial fulfilment of a master of science in environment and natural resource management. The results of the research will be used for academic purposes and the responses will be kept confidential.

Questionnaire #	
House #	
Name of interviewee	
Date of interview	
Start time	
Finish time	
Name of Enumerator	

Instructions to respondents:

Tick in the brackets ( ) and in case of a space, fill in appropriately. So please feel free to give your responses as accurate as possible.

DEMOGRAPHIC INFORMATION

1. Name of respondent.....
2. Sex of respondent: male ( ) Female ( )
3. Age of respondent.....years

INFORMATION ON THE NATURE OF SOLID WASTE MANAGEMENT

4. Do you think solid waste has become a major problem in Solwezi town?
   Yes ( ) No ( )

5. How much household waste do you produce per week?

6. How do you dispose off your household waste?

7. What is the nature of Solid Waste Management in this residential area?

Informal ( ) formal ( )

8. Does the private sector participate in the provision of Solid Waste Management?

9. Do you have any company or the local authority coming to collect your household waste?

10. Are you aware of the role you can play in managing your household Solid Waste?

Yes ( ) No ( )

11 .What role can you play in household solid waste management?.....

12. Are you willing to take part in a formal solid Waste Management by means of paying for the service?

Yes ( ) No ( )

Explain briefly the reason for your answer.....

13. What factors hinder your participation in a formal Solid Waste Management?.....

14. Are there any public awareness campaigns available for waste management in the community by the local authority that are aimed at improving the residents' level of participation in Solid Waste Management?

Yes ( ) No ( )

Name the activities.....

15. What is your perception of the organization of the municipality in Solid Waste Management (Solwezi Municipal Council?).....

APPENDIX 1-B: INTERVIEW GUIDE FOR KEY INFORMANTS

1. What nature of Solid Waste Management does the local authority provide to the residents of Solwezi town?

   Informal ( ) Formal ( )

2. Which Management System does the local council prefer between informal and formal solid waste management?

   Informal ( ) Formal ( )

3. Which of the above two mentioned Management Systems does the local authority intend to continue using in the townships of Solwezi?.....

4. What is the current level of participation of the residents in Solid Waste Management in Solwezi town?

   Very high ( ) High ( ) Low ( ) Very low

5. Do you think the residents are aware of the role they can play in Solid Waste Management?.....

   Aware ( ) Not aware ( ) Not sure ( )

6. If the residents are not aware of the role they can play in Waste Management, what is the local authority doing to ensure that the residents become aware?.....

7. If the residents became aware of the role they can play in Solid Waste Management, do you think they can be willing to pay for the Waste Management service? .....

8. Between the informal and formal systems of Waste Management, which one do you think the residents would go for?

   Informal ( ) Formal ( )

9. Explain briefly the reason for your answer.....

10. Is there any private sector involvement in the solid waste management in Solwezi town?

    Yes ( ) No ( )

11. If yes to what extent is the private involved in solid waste management in the town? .....
    .....

12. If the answer to question 9 is No, what do you think are the reasons for non involvement of the private sector in Solid Waste Management in the town?

……

……

13. Are stakeholders willing to participate in Solid Waste Management Solution?

    Yes ( ) No( )

14. Who are these stakeholders?.....

15. How is the relationship between the Local Council and the residents' in terms of Solid Waste Management?

    Good ( ) Bad ( )

16. Are public awareness campaigns available for Waste Management in Kandundu, Kyawama and Stadium residential areas?

    Yes ( ) No ( )

17. Do you face any problems in providing Solid Waste Management services to the residential areas such as Kandundu, Kyawama and Stadium residential areas?

    Yes ( ) No ( )

18. If yes what kind of problems do you face in the delivery of Solid Waste Management as a Local Authority (municipal)? .....

19. What major factors really influence the delivery of Solid Waste Management in Solwezi town? .....

20. How is the attitude of the residents towards taking responsibility of managing waste in their residential areas?

    Good ( ) Average ( ) Bad ( )

    Give a reason for answer your answer.....

    ……

    ……