

**IMPACT OF SOLID WASTE DISPOSAL ON SANITATION STANDARDS AND
WATER SOURCES IN MBALE MUNICIPALITY,
EASTERN UGANDA**

BY

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DECLARATION

I **Masajage Eria** do declare that this dissertation is my original study compiled through research and it has never been submitted to any University or Institutions of higher learning for any degree award. The citations used in this work have dully been acknowledged and referenced.

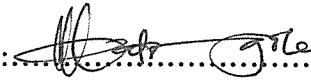
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APPROVAL

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DATE : 3rd AUG 2014

DEDICATION

This dissertation is dedicated to Jehovah (God), my dear parents Mr. and Mrs. Balodha Steven for their endless love, prayers and good morals. I will for treasure you so much.

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I take this opportunity to acknowledge and thank the almighty God for His guidance and good health from the beginning of this research to the very end.

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LIST OF ACRONYMS

CBO	Community Based Organization
CFC	Chloro Floro Carbons
EfW	Energy from Wastes
ISO	International Standards Organization
LCA	Life Cycle Analysis
MSW	Municipal Solid Wastes
NEMA	National environment management authority
NEA	National Environment Act
NGO	Non Governmental Organization
UBOS	Uganda Bureau of Standards
URN	Uganda Radio Network
UNDP	United Nations Development Programme
UNEP	United Nations Environment Policy
WCED	World Commission on Environment and Development
WtE	Wastes to Energy

ABSTRACT

This piece of work includes information on the impacts of solid waste disposal on sanitation and water standards of Mbale municipality. Despite the fact that Mbale was considered one of the cleanest towns in East Africa in 1960s (URN Report), It's now a shadow of its former self. This has been majorly attributed to the poor solid wastes disposal which has affected the sanitation and water standards of the municipality. Poor policies, lack of funds, low staffing, ignorance, among others have led to poor management of wastes which in turn have resulted into poor health.

This research therefore was aimed at establishing the different means of solid waste disposal and their effect on sanitation and water standards of the people of Mbale municipality. This was achieved through checklist/ observation, questionnaires, and interview guides.

It was observed that most of the wastes in Mbale municipality are not collected due to lack of funds, low staffing, corruption, reluctance of the masses and poverty among others which has resulted in poor sanitation. Low water supply has also affected the sanitary activities in the municipality especially in Namatala zone in industrial information.

It was upon this background that the researcher sought to provide some solution in the conclusion which included; the residents should be trained and sensitized in the field of solid wastes from the point of generation, collection, transport and disposal, there should be an increase in the funds allocated to the department of solid wastes so as to increase on the number of workers for efficiency, the workers in the department should be provided with protective gears against diseases related to sanitation, there should be fines levied on the people who carelessly dump wastes around the skips and on the streets among others.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Uganda like many countries in the world suffers from poor waste management. Poor waste management is increasingly becoming a big problem in many cities in sub-Saharan Africa and Mbale is no exception. The existence of adequate sanitation facilities and practices is therefore a pre requisite for promoting and maintaining public health status and general wellbeing of any community for sustainable development.

In Uganda like in many other developing countries, typically one to two thirds of the waste generated is not collected Zerbock (2003). As a result, the uncollected waste, which is often also mixed with human and animal excreta, is dumped indiscriminately in the streets/wards, water bodies and in drains, contributing to flooding, breeding of insect and rodent vectors and the spread of diseases such as cholera because of poor sanitary activities. Most researchers, have linked Waste generation directly to the size of population and the various activities undertaken by different categories of the population including large scale industries, small-scale industries, trading/businesses, municipal, farming, household, schools and hospitals among others. Hence, it clearly means that waste generation will increase with increasing population growth.

In Kampala city alone, waste generation estimations have been rated at 0.2 metric tons per person annually on average Ngategize *et al.*, (2001). Therefore, considering an urban population of 3.7 million people that is; 13.4% of the total population, Uganda Population secretariat (2007), it means that approximately 740,000 metric tons of solid wastes are generated in urban areas per year. Of this, only 41% solid waste generated is disposed off properly UNDP, (2005). The remaining 51% is left uncollected thereby ending up dumped in drainage and sanitary drainage channels, natural water courses, manholes, undeveloped plots and road sides among other unfit places NEMA (2004).

For instance, Studies indicate that each person in Kampala city produces 1 Kg of solid waste per day Tenywa *et al.*, (2007). The waste generated in towns in Uganda, Mbale inclusive is hardly

collected and even what is collected is not sorted and the gazetted area is not well utilized in the Namatala area in industrial division. Additionally, even the government development programs and international interventions like construction of the disposal site in Namatala by the World Bank rarely put waste management aspects into consideration for instance the health facilities, public markets, schools among others. Furthermore, there are limited appropriate technologies and practices for waste management and also the limited capacity among stakeholders (technocrats, extension agents, private sector) in addressing waste management issues.

With the steadily increasing population in Uganda especially urban areas due to rural urban migration, there is need for an increased demand for good sanitation with the creation of slums around towns. The 2002 national census put the population of Mbale at 71,130. In 2008, the Uganda Bureau of Statistics (UBOS) estimated the population of the town at 84,100. In 2011, UBOS estimates the population of Mbale at about 91,800. In many parts of the country both rural and urban setting, significant percentage of the population does not have access to good sanitation services like water. This relates to factors like income, economic life style, awareness and to some extent cultural practices among others.

September 24, 2010, the UN Human Rights Council adopted a binding resolution recognizing that the human right to water and sanitation are a part of the right to an adequate standard of living. It affirms that the human right to safe drinking water and sanitation is derived from the right to an adequate standard of living and inextricably related to the right to the highest attainable standard of physical and mental health, as well as the right to life and human dignity.

Mbale which was once ranked the cleanest town in East Africa during the 60's and 70's is now a shadow of its former self, URN report (2010). Heaps of uncollected garbage litter the central business district, and the surrounding areas. In 2009, Mbale Municipality launched multi-billion shillings World Bank funded solid waste decomposing project to turn waste into manure but all has not yielded great success at all. The town has continued to be filthy as it was before the project was launched in August due to negligence by the concerned local government officials. However with the recent studies carried out, it's increasingly being polluted with garbage all over the streets which has greatly affected the health and sanitation of the people. A combination of various factors have led to poor sanitation and water standards, it was upon such mischief that the study was warranted in pursuit for solutions.

1.2 Problem statement

Despite several efforts, legal and institutional frame work that are in place to enhance proper waste management in Uganda, there is still continued poor waste management in urban areas of Uganda and Mbale inclusive. Legal frame works like the constitution of the Republic of Uganda 1995 Article 245 (a) provides measures intended-To protect and preserve the environment from abuse, pollution and degradation,” The National Environment (Waste Management) Regulations, S.I. No 52/1999; The Local Government Act 1997, all have provisions.

People seem not be caring about the way wastes are handled due to lack of awareness about the likely dangers of poor waste management. Poorly managed solid wastes have far reaching problems to community livelihoods and environment; posing great health risks such as release of toxic gases, bad odour/air pollution, water and land pollution. Wastes have got enormous opportunities for instance metallic containers can be used to make paraffin candles (tadoba), children toys, simple local measuring cans, wrapping paper and envelopes out paper wastes, and waste can be an alternative to generate fuel. This problem of poor waste management requires innovative solutions and one of the solutions could be a participatory approach after providing sufficient information through this research, where the local people are involved to define the problem and then propose the solutions. The data gathered in this study provides leaders with information relating to how they may address or mitigate factors responsible for poor waste management.

1.3 Objectives of study

General:-To establish the different means of solid waste disposal and their effect on sanitation and water standards of the people of Mbale municipality.

Specific objectives

- a) To identify the modes used in garbage, collection, transport, disposal and management
- b) To find out the effect of solid waste disposal on the sanitation standards and water sources.
- c) To establish the underlying causes of poor waste management in Mbale Town Council from both the leaders and the local people.
- d) To propose possible solutions to the effects of poor garbage disposal on the sanitation and health standards.

1.4 Research questions

- i). What is the impact of solid waste disposal on sanitation and water standard?
- ii). What mechanisms are in place to collect, transport and dispose off wastes in the town council?
- iii). What kinds of solid waste are generated in Mbale municipality?
- iv). Are there ways that can be employed to deal with poor waste management in the council?

1.5 Purpose of the Study

With the global wave of acquiring good sanitation and health through living in a clean and health environment as a basic right to every Ugandan (article 39 of the amendment act), towns in Uganda with Mbale municipality as a case study, it has been hoped the findings will be helpful in the following;

The findings are of much help to policy makers in the sanitation and health sector so as to check on the loopholes in the systems and administration.

The findings also benefit the whole community so as improve on the sanitation through proper waste management in urban areas.

The findings can help in drafting appropriate policies and the council will be in position to initiate programs that will empower citizens and make them aware of the dangers of poor waste management so that both the council and citizens would join efforts to solve the problem at hand.

In addition to the above, the study provides future scholars and researchers with information regarding the causes of poor waste management.

1.6 Scope of Study

The study focused on the impact of solid waste disposal on sanitation and health standards and it will be conducted in Mbale municipality which is part of Mbale district in eastern Uganda. Mbale is a city in Eastern Uganda. It is the main municipal, administrative and commercial center of Mbale District and the surrounding sub-region. The district is named after the town.

Mbale lies approximately 245 kilometers (152 mi), by road, northeast of Kampala, on an all weather tarmac highway. The coordinates of the city are: 01 04 50N, 34 10 30E. The city also lies on the railway from Tororo to Pakwach. Mount Elgon, one of the highest peaks in East

Africa lies nearby. It has an area of 2,466.7 square kilometers. The people of Mbale municipality have differing jobs they are mainly in trade or commercial business. The main crops are coffee, beans, bananas, maize, onions, Irish potatoes, carrots and sweet potatoes, (this is in rural areas). In town it's majorly small scale and medium enterprises.

The ethnical origins of these people are 'Bamasaba' or 'Bagisu' tribe, whose language Lugisu is the one commonly spoken throughout the district.

The study was conducted in three divisions namely; Industrial, Wanale and Northern Division. It involved; politicians and stake holders, employees working in garbage disposal business, the business community living in Mbale town

1.7 Limitations and Delimitations of the Study

In the course of study, the following obstacles were encountered;

An inadequate financial resource to conduct the entire research since the researcher was a student with no vivid financial sources.

However, the researcher borrowed and use part of the pocket money to ensure most paramount research process is accomplished.

1.8 Definition of Key Concepts

Waste:- Waste is a man-made substance in a given time and places which in its actual structure and state is not useful to the owner or is an output without an owner and purpose, Zake (2007).

Sanitation:- In accordance to the National Environmental Health, sanitation is the safe management of human excreta and associated personal hygiene, the collection storage and disposal of solid wastes, drainage and protection of runoff, protection from vermin and other diseases.

Waste management:- Waste Management' includes all issues and processes associated with the generation, processing, and disposal of all categories of wastes produced by human activities. It includes, therefore, the stages of production and minimization, collection, handling and transportation, reuse and recycling, and treatment and disposal of all such wastes. (Zake J, 2007).

Sustainable development:- This is the development that utilizes the available resources to meet the needs of the present generation without compromising the resources of the future generation to meet their own needs, WCED (1987).

CHAPTER TWO

LITERATURE REVIEW

2.1 Types of solid wastes produced

Solid waste can be classified into different types depending on their source:

- a) Household waste is generally classified as municipal waste,
- b) Industrial waste as hazardous waste, and
- c) Biomedical waste or hospital waste as infectious waste.

2.1.1 Municipal solid waste

There are different categories of waste generated, each take their own time to degenerate. Municipal solid waste consists of household waste, construction and demolition debris, sanitation residue, and waste from streets. This garbage is generated mainly from residential and commercial complexes. With rising urbanization and change in lifestyle and food habits, the amount of municipal solid waste has been increasing rapidly and its composition changing. In 1947 cities and towns in India generated an estimated 6 million tonnes of solid waste; in 1997 it was about 48 million tonnes. More than 25% of the municipal solid waste is not collected at all; 70% of the Indian cities lack adequate capacity to transport it and there are no sanitary landfills to dispose of the waste. The existing landfills are neither well equipped nor well managed and are not lined properly to protect against contamination of soil and groundwater.

2.1.2 Hazardous waste

Industrial and hospital waste is considered hazardous as they may contain toxic substances. Certain types of household waste are also hazardous. Hazardous wastes could be highly toxic to humans, animals, and plants; are corrosive, highly inflammable, or explosive; and react when exposed to certain things e.g. gases. India generates around 7 million tonnes of hazardous wastes every year, most of which is concentrated in four states: Andhra Pradesh, Bihar, Uttar Pradesh, and Tamil Nadu.

Household wastes that can be categorized as hazardous waste include old batteries, shoe polish, paint tins, old medicines, and medicine bottles.

Hospital waste contaminated by chemicals used in hospitals is considered hazardous. These chemicals include formaldehyde and phenols, which are used as disinfectants, and mercury, which is used in thermometers or equipment that measure blood pressure. Most hospitals in India do not have proper disposal facilities for these hazardous wastes.

In the industrial sector, the major generators of hazardous waste are the metal, chemical, paper, pesticide, dye, refining, and rubber goods industries. Direct exposure to chemicals in hazardous waste such as mercury and cyanide can be fatal.

2.1.3 Hospital waste

Hospital waste is generated during the diagnosis, treatment, or immunization of human beings or animals or in research activities in these fields or in the production or testing of biological. It may include wastes like sharps, soiled waste, disposables, anatomical waste, cultures, discarded medicines, chemical wastes, etc. These are in the form of disposable syringes, swabs, bandages, body fluids, human excreta, etc. This waste is highly infectious and can be a serious threat to human health if not managed in a scientific and discriminate manner. It has been roughly estimated that of the 4 kg of waste generated in a hospital at least 1 kg would be infected.

2.2 Solid Wastes and Modes of Disposal

2.2.1 Land Filling

Disposal of waste in a landfill involves burying the waste, and this remains a common practice in most countries. Landfills were often established in abandoned or unused quarries, mining voids or borrow pits. A properly designed and well-managed landfill can be a hygienic and relatively inexpensive method of disposing of waste materials. Older, poorly designed or poorly managed landfills can create a number of adverse environmental impacts such as wind-blown litter, attraction of vermin, and generation of liquid leachate. Another common product of landfills is gas (mostly composed of methane and carbon dioxide), which is produced as organic waste breaks down anaerobically. This gas can create odor problems, kill surface vegetation, and is a greenhouse gas.

Design characteristics of a modern landfill include methods to contain leachate such as clay or plastic lining material. Deposited waste is normally compacted to increase its density and stability, and covered to prevent attracting vermin (such as mice or rats). Many landfills also have landfill gas extraction systems installed to extract the landfill gas. Gas is pumped out of the landfill using perforated pipes and flared off or burnt in a gas engine to generate electricity.

2.2.2 Incineration

Incineration is a disposal method in which solid organic wastes are subjected to combustion so as to convert them into residue and gaseous products. This method is useful for disposal of residue of both solid waste management and solid residue from waste water management. This process reduces the volumes of solid waste to 20 to 30 percent of the original volume. Incineration and other high temperature waste treatment systems are sometimes described as "thermal treatment". Incinerators convert waste materials into heat, gas, steam and ash.

Incineration is carried out both on a small scale by individuals and on a large scale by industry. It is used to dispose of solid, liquid and gaseous waste. It is recognized as a practical method of disposing of certain hazardous waste materials (such as biological medical waste). Incineration is a controversial method of waste disposal, due to issues such as emission of gaseous pollutants.

Incineration is common in countries such as Japan where land is more scarce, as these facilities generally do not require as much area as landfills. Waste-to-energy (WtE) or energy-from-waste (EfW) is broad terms for facilities that burn waste in a furnace or boiler to generate heat, steam or electricity. Combustion in an incinerator is not always perfect and there have been concerns about pollutants in gaseous emissions from incinerator stacks. Particular concern has focused on some very persistent organics such as dioxins, furans, PAHs which may be created which may have serious environmental consequences.

2.2.3 Recycling

Recycling is a resource recovery practice that refers to the collection and reuse of waste materials such as empty beverage containers. The materials from which the items are made can be reprocessed into new products. Material for recycling may be collected separately from general waste using dedicated bins and collection vehicles are sorted directly from mixed waste

streams and are known as kerb-side recycling, it requires the owner of the waste to separate it into various different bins prior to its collection.

The most common consumer products recycled include aluminum such as beverage cans, copper such as wire, steel food and aerosol cans, old steel furnishings or equipment, polyethylene and PET bottles, glass bottles and jars, paperboard cartons, newspapers, magazines and light paper, and corrugated fiberboard boxes. The type of material accepted for recycling varies by city and country. Each city and country has different recycling programs in place that can handle the various types of recyclable materials. However, certain variation in acceptance is reflected in the resale value of the material once it is reprocessed.

2.2.4 Sustainability

The management of waste is a key component in a business' ability to maintaining ISO14001 accreditation. Companies are encouraged to improve their environmental efficiencies each year by eliminating waste through resource recovery practices, which are sustainability-related activities. One way to do this is by shifting away from waste management to resource recovery practices like recycling materials such as glass, food scraps, paper and cardboard, plastic bottles and metal.

2.2.5 Biological reprocessing

Recoverable materials that are organic in nature, such as plant material, food scraps, and paper products, can be recovered through composting and digestion processes to decompose the organic matter. The resulting organic material is then recycled as mulch or compost for agricultural or landscaping purposes. In addition, waste gas from the process (such as methane) can be captured and used for generating electricity and heat (CHP/cogeneration) maximizing efficiencies. The intention of biological processing in waste management is to control and accelerate the natural process of decomposition of organic matter.

2.2.6 Energy recovery

The energy content of waste products can be harnessed directly by using them as a direct combustion fuel, or indirectly by processing them into another type of fuel. Thermal treatment

ranges from using waste as a fuel source for cooking or heating and the use of the gas fuel (see above), to fuel for boilers to generate steam and electricity in a turbine. Pyrolysis and gasification are two related forms of thermal treatment where waste materials are heated to high temperatures with limited oxygen availability. The process usually occurs in a sealed vessel under high pressure. Pyrolysis of solid waste converts the material into solid, liquid and gas products. The liquid and gas can be burnt to produce energy or refined into other chemical products (chemical refinery). The solid residue (char) can be further refined into products such as activated carbon. Gasification and advanced Plasma arc gasification are used to convert organic materials directly into a synthetic gas (syngas) composed of carbon monoxide and hydrogen. The gas is then burnt to produce electricity and steam. An alternative to pyrolysis is high temperature and pressure supercritical water decomposition (hydrothermal monophasic oxidation).

2.2.7 Resource recovery

Resource recovery as opposed to waste management uses LCA (life cycle analysis) attempts to offer alternatives to waste management. For mixed MSW (Municipal Solid Waste) a number of broad studies have indicated that administration, source separation and collection followed by reuse and recycling of the non-organic fraction and energy and compost/fertilizer production of the organic material via anaerobic digestion to be the favored path.

2.2.8 Avoidance and reduction methods

An important method of waste management is the prevention of waste material being created, also known as waste reduction. Methods of avoidance include reuse of second-hand products, repairing broken items instead of buying new, designing products to be refillable or reusable (such as cotton instead of plastic shopping bags), encouraging consumers to avoid using disposable products (such as disposable cutlery), removing any food/liquid remains from cans, packaging and designing products that use less material to achieve the same purpose (for example, light weighting of beverage cans).

2.3 Solid Wastes on Water Sources

2.3.1 Solid Waste impacts on Water Quality

Water is essential to life. Solid waste impacts water quality through the release of leachate from landfills into water sources. As water comes in contact with decomposing solid waste, it will dissolve together with soluble inorganic and organic wastes producing polluted liquid known as leachate or waste juice.

The concentration of leachate increases as it seeps into deeper layers of the landfill; this contributes to the light brown/black colour of leachate and its horrible stench. It has a high polluting potential impact due to its high concentrations of organic contaminants and high ammonical nitrogen. Once leachate is discharged into water bodies or/and aquatic environment, it will have an acute and chronic impact. If toxic metals are present, this can lead to chronic toxin accumulation in organisms that depend on it and may consequently affect humans if we feed on these organisms e.g. fish, prawns, crabs etc.

2.4 Health impacts of solid waste

Modernization and progress has had its share of disadvantages and one of the main aspects of concern is the pollution it is causing to the earth – be it land, air, and water. With increase in the global population and the rising demand for food and other essentials, there has been a rise in the amount of waste being generated daily by each household. This waste is ultimately thrown into municipal waste collection centers from where it is collected by the area municipalities to be further thrown into the landfills and dumps. However, either due to resource crunch or inefficient infrastructure, not all of this waste gets collected and transported to the final dumpsites. If at this stage the management and disposal is improperly done, it can cause serious impacts on health and problems to the surrounding environment.

Waste that is not properly managed, especially excreta and other liquid and solid waste from households and the community, are a serious health hazard and lead to the spread of infectious diseases. Unattended waste lying around attracts flies, rats, and other creatures that in turn spread disease. Normally it is the wet waste that decomposes and releases a bad odour. This leads to unhygienic conditions and thereby to a rise in the health problems. The plague outbreak in Surat is a good example of a city suffering due to the callous attitude of the local body in maintaining cleanliness in the city. Plastic waste is another cause for ill health. Thus excessive solid waste that is generated should be controlled by taking certain preventive measures.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Research Design

The study followed research design. Both qualitative and quantitative methods were employed. The quantitative were used to collect data on the impacts of solid waste disposals on sanitation standards and water sources of Mbale municipality as well as the responses from the stake holders. It involved the use of questionnaires to gather information.

The qualitative techniques were used to access information on the role played by stakeholder and leaders in improving the sanitation and water quality through improved solid waste management.

The observation method was also used by the researcher herself with the help of checklist to find out some information on the topic of study.

3.2 Population of the Study

The population of the study comprised of residents and workers in the three divisions of Mbale municipality that is, industrial, northern, and Wanale division. These included the residents, traders, government workers, NGO staff members, local leaders and students. The distribution is shown in the Table 1 below.

Table 1: Population distribution

Category of respondents	population	Sampling methods
Local leaders	16	Purposive
Government officers	08	Purposive
NGOs	06	Random
Residents only	22	Random
Traders only	21	Random
	07	Random
Total	80	

Source: Field study

3.3 Sampling Techniques

The study used a combination of random and purposive sampling techniques to select a sample. Random sampling involves the selection of respondents by chance. In this way, every member within the population has an equal chance of being selected. Random sampling allows generability to a larger population with a margin of error that is statistically determined Mugenda (1997).

Purposive (Judgmental sampling (is most likely to be employed because it is a meaningful way of investigating the impacts of solid waste disposal and the obligation of key actors. This method was aimed at gathering information that is specialized in the area under research.

3.4 Sample size

A sample of 80 people was drawn since it is considered appropriate for the study and it cut across different age, sex, and professional groups. The study involved 30 business persons and 35 local and religious leaders, 5 health providers, 10 civil servants and others workers and laborers such as masonry etc.

3.5 Data collection procedures

A supporting letter from the department of environment management, faculty of Humanities signed by the university Administrator was attached to the questionnaires explaining the objectives of the research to give respondents assurance of anonymity of the data they provided.

3.6 Data collection instruments.

The following instruments of data were employed during the study.

3.6.1 The interview guide

The interview guide contained questions that were asked to selected respondents particularly the local leaders and stake holders, government officials and NGO staff. Saunder (2003 defines a structured interview as those questionnaires where the interviewer physically meets respondents face to face and asks them questions. This method is good because the interviewer can make clarification on questions that are not clear to the interviewee.

3.6.2 Self administered questionnaire

These were administered to the residents, traders and some NGOS and local leaders. It was targeting the key actors in solid waste department and the generators of processing wastes. The method was chosen because, it was ideal for handling a larger number of respondents. Since the questionnaire would be anonymous, it was hoped that the respondents would provide accurate information without fear of being victimized.

3.7 Data processing

Qualitative data analysis:- Data that was in form of views and opinions of respondents about the impact of solid waste disposal on sanitation standards and water sources was categorized in form of meaningful categories that enabled the researcher to establish the number of respondents sharing the same views or opinion.

Data collected was processed for analysis by checking the data for completeness, accuracy, errors and consistence. This process involved editing the data, coding and entering the data into computer using Microsoft word and Microsoft excel and summarizing it in form of tables, charts and bar graphs.

3.8 Data analysis

The summarized data was analyzed so as to make sense of them for people to understand. The data was analyzed using both descriptive and inferential statistics. Descriptive statistical measures helped the researcher to meaningfully describe many pieces of data.

3.9 Limitations of the Study

There were a number of limitations encountered during the research process and these included the following.

- Difficulty in accessing the related literature to the study which made it hard and took a lot of time searching for the necessary information.
- Limited funds to cater for the requirements of the research like transport, typesetting and printing.
- Some respondents were not willing to release sensitive information.
- Obtaining the sample of respondents also posed a challenge to the researcher.

CHAPTER FOUR

RESULTS, ANALYSIS AND DISCUSSIONS

4.1 Categories of Respondents

Table 2: Questionnaires for Residents and Traders

Category	Frequency	Percentage
Residents only	22	27.5
Traders and residents	21	26.5
Traders only	7	8.75
Total	80	100

Source: field study



Fig. 1: Bar graph representing the data for questionnaires

Source: Field study

It was observed that the categories of people used for research by the research for the general questionnaire (questionnaire to municipal residents and traders) were grouped into three as indicated above. The finding showed that the number of residents alone who don't carry out business within the municipality were 22 totaling to 27.5% of the total sample size. The percentage of traders and residents within the municipality was 26.5% and only traders but reside

outside the municipality was 8.5%. This shows the percentage of people residing with the municipality is 53.75% of the total population in Mbale town. Basing on this the researcher therefore concluded that given the high population of residents and traders, the waste generation rate increases corresponding to the number of people.

Table 3: Interview Guide for Leaders and Stakeholders

Category	Frequency	Percentage
Local leaders	16	20
Government officials	08	10
NGOs	06	7.5
Total	80	100

Source: Field study

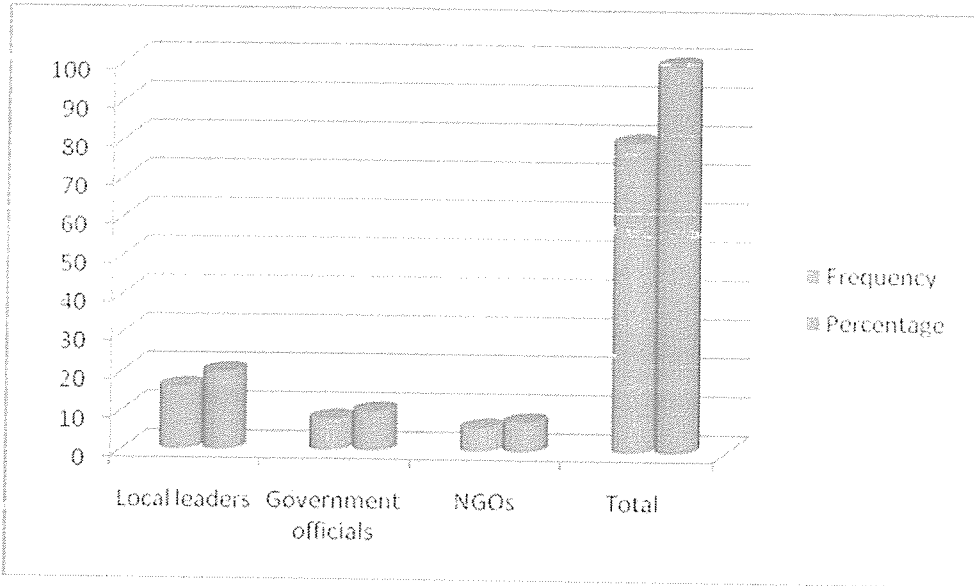


Fig. 2: Bar graph representing interview guide

Source: Field study

4.2 Socio Economic Factors

4.2.1 Age of Respondents

Research shows that most of the population was youth between the age of 26-35 and 16-26. These were the biggest generators of wastes as they were involved in trade activities and others married.

Table 4: Age of respondents

Age	Frequency	Percentage
16-26	23	28.75
26-35	31	38.75
36-45	16	20
46 above	10	12.5
Total	80	100

Source: Field study

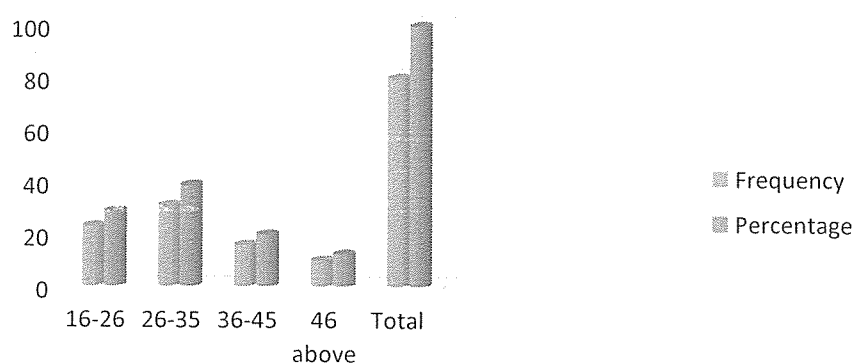


Fig. 3: Bar graph representing age of respondents

According to data collected from the field, it showed that 38.75% of the total population is between the age of 26 and 35 and 28.75% are between the ages of 16-26, this showed the researcher that majority of the people in Mbale municipality are youth. This showed that most people who get involved in the activities of leadership and business among others.

4.2.2 Sex of the respondents

Table 5: Sex of respondents

Sex	Frequency	Percentage
Male	42	52.5
Female	38	47.5
Total	80	100

Source: Field study

The table above shows that 52.5% of the population is male and 47.5% of the population is female meaning that males are more waste generators than females. This is because of the different occupation especially in business which is highly dominated by males. The women who stay at home generate much waste as well do to domestic needs.

4.2.3 Occupation of Residents

Table 6: Occupation of respondents

Occupation	Frequency	Percentage
Salaried worker	29	36.25
Housewife	28	35
Self employed	23	28.75
Total	80	100

Source: Field study

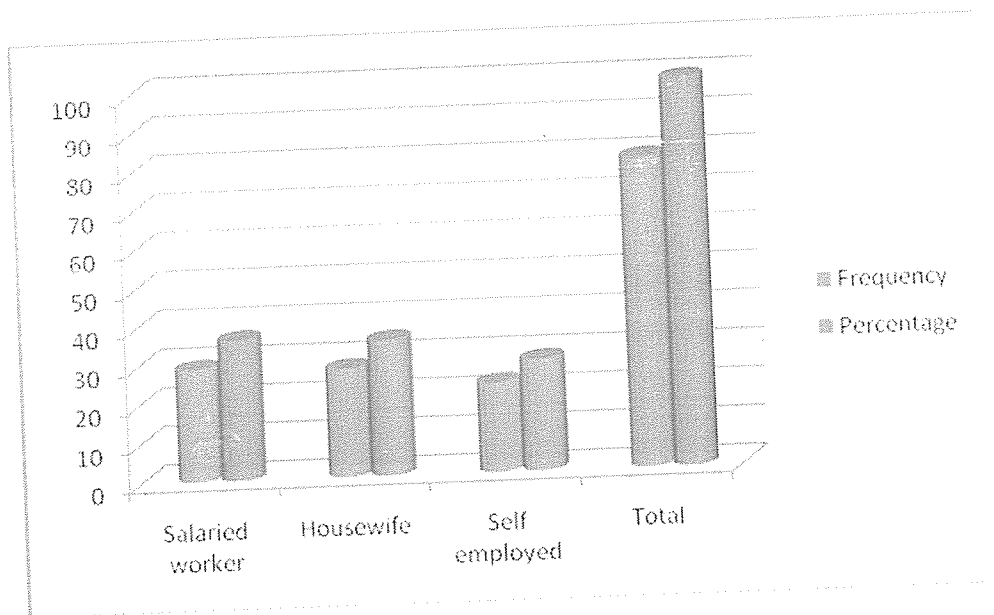


Fig. 4: Bar graph representing occupation of residents

The researcher found out that the highest population is for salaried worked at 36.25% followed by 35% of housewife. This indicated that this high population of housewives generated a lot of waste and the self-employed also generated a lot of waste because of the different jobs especially in the markets.

4.2.4 Type of Housing

Table 7: Type of housing

Type	Frequency	Percentage
Hut	7	8.75
Singled roomed	26	32.5
More than one room	30	37.5
Flat	12	15
Bungalow	5	6.25
Total	80	100

Source: Field study

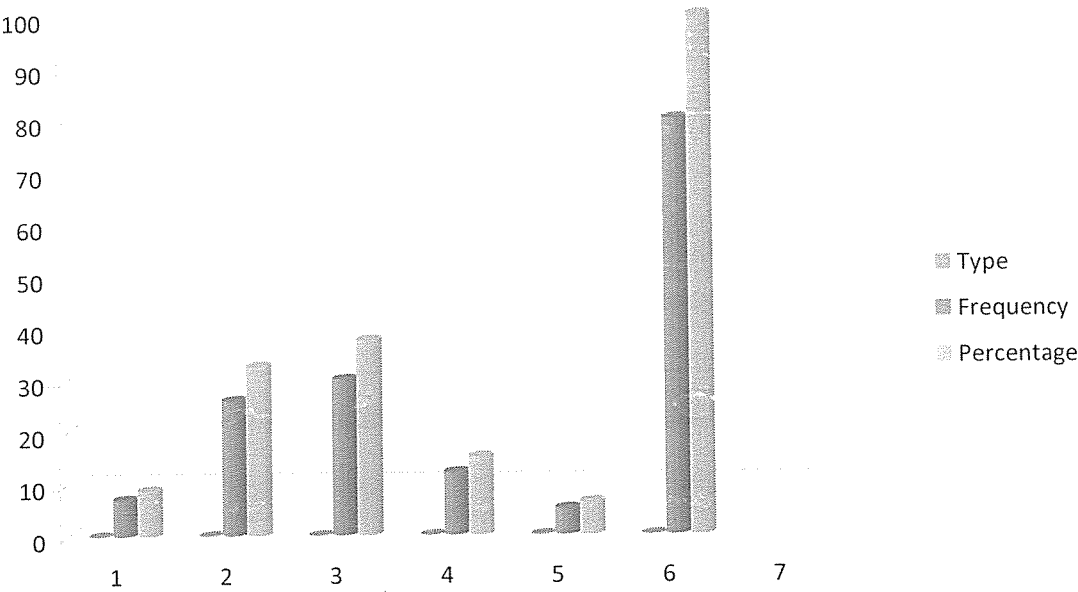


Fig 5: Bar graph representing type of housing

4.2.6 Number of People in Household

Table 8: Number of people in household

Number	Frequency	Percentage
2-4	19	23.75
5-7	22	27.5
8-10	31	38.75
11 above	8	10
Total	80	100

Source: Field study

The research findings showed the amount of wastes produced was dependant on the number of people per household. This was because of the increase in the amount of food prepared, clothing, and all household activities that generated many types of wastes.

4.2.7 Number of people with central solid waste

Table 9: Number of people with central solid waste

	Frequency	Percentage
Yes	29	36.25
No	51	63.75

Source: Field study

There were few solid waste facilities in the three divisions of Mbale municipality with the highest number being in industrial division. This made it hard was the collectors and transporters thus making the whole process of solid waste management so difficult to the key actors.

4.2.8 Types of solid waste facilities used

The researcher found out that the people municipality used different used different solid waste facilities but with the highest percentage being polythene bags, and old containers. This was simply because they were inexpensive and easily accessed by all people. This made management very hard for stake holders and collectors. It also encouraged development of rodents and others vectors like mosquitoes, flies and above all generating bad smell.

Table 10: Types of solid waste facilities used

Type	Frequency	Percentage
Dustbin	09	13.75
Polythene bag	48	60
Old containers	12	15
Sacks	11	11.25
Total	80	100

Source: Field study

4.2.9 Ways of disposing off wastes

Table 11: Ways of disposing off wastes

Burn	29	36.25
Compost	12	15
Transport	36	45
Recycle/Reuse	3	3.7

Source: Field study

The information shows that the population in Mbale municipality dispose off their wastes through four ways of which the highest percentage transport majorly through collection at communal sites, this followed by burning especially in the suburbs of Mbale like Namatala, Nakaloke and Namatala among others. The study shows that only 3.7% of the population recycle and reuse wastes. Some of these wastes include plastic bottles, metals, and bottles, among others that do not require much technology and skills.

4.2.10 Distance between water source and waste facility

Table 12: Distance between water source and waste facility

Distance	Frequency	Percentage
Less than 100m	55	68.75
100m-200m	16	20
More than 300m	9	11.25
Total	80	100

Source: Field study

Since Mbale municipality is a town, most of the water sources are near waste disposal sites which make it hard to manage wastes alongside water quality. This has reduced the water quality leaving the population of Mbale vulnerable to diseases like cholera, dysentery, typhoid, among others water borne and water based diseases.

4.3 Causes of poor Solid Wastes

4.3.1 Lack of Awareness

The researcher found out that over 50% of the general population interviewed was not aware of good solid waste management practices like recycling, reducing, re-using and sorting of wastes among others. This according to the environment officer had led to poor solid waste management in the municipality thus deteriorating the sanitation standard and contaminating the water sources.

Table 13: Lack of Awareness

Response	Frequency	Percentage
Yes	9	11.25
No	71	88.75
Total	80	100

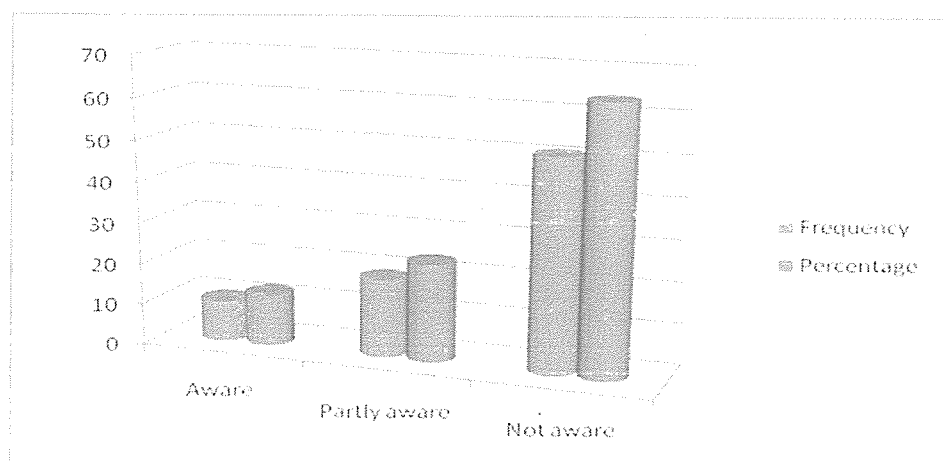
Source: Field study

Table 14: Number of people aware of good management practices

Number	Frequency	Percentage
Aware	10	12.5
Partly aware	19	23.75
Not aware	51	63.75
Total	80	100

Source: Field study

Fig. 6. Line Graph for People Aware Of Methods of Good Disposal



4.3.2 over Population

The increase in population of Mbale municipality had led to poor solid waste management. This is because it increases the amount of waste generated by the people as the consumption of resources increase. The population of Mbale is represented in the table below

Table 15: Over Population

Year	Population
2002	71130
2008	84100
2011	91800

Source: field study

4.3.3 Few Central Collection Sites

The researcher observed that there were few solid waste collection sites at communal levels. This encouraged littering of wastes around the municipality. This also was geared by the time taken to transport the wastes from the communal sites.

4.3.4 Low Staffing

According to the interviewees, the number of labour force in the solid waste department was not enough to cater for the increasing population pressure in the municipality. The assistant CAO noted the resources were not enough to cater for many workers which had led to work over load yet low salaries were given. As the population of Mbale municipality increases, there was need to increase the number of workers especially in solid wastes because of the increase in the amount of wastes generated.

Table 16: Number of Employees in Waste Management

Number of staff	Frequency	Percentage
Enough	0	0
Not enough	72	90
Not certain	8	10
Total	80	100

Source: Field study

4.3.5 Lack of Funds

The research finding showed that there were little funds to allocate for solid waste activities and of which these funds delayed to come which slowed down the activities in the department. These activities included

- Purchase of solid waste skips
- Collection of solid wastes
- Transport of solid wastes
- Recycling of waste
- Cleaning of streets and commercial centers

4.3.6 Poor Planning of Households

The research findings showed that houses in the municipality were poorly planned. There were no places demarcated for industries, commercial, institutions, and residential areas. This makes it hard to manage wastes in the municipality because of the different types of wastes produced.

Types of solid wastes produced include:- Food stuffs, Polythene, Metals, Clothing, Timber, Plastics, Glass and Papers.

4.4 Challenges Experienced By Key Actors in Wastes

There were many challenges experienced by the key actors in solid waste management which hindered the process of solid waste management starting from waste generation, disposal, transport and management.

4.4.1 Inadequate Funds

The research findings showed that there were little or sometimes no funds to run the projects and activities geared towards improvement of solid waste handling. This resulted in delays in salaries of employees who frequently laid down their tools until they were paid. This delayed the activities thus leading to poor sanitation and contamination of water sources.

4.4.2 Poverty

According to the findings, it showed that over 70% of the population can't afford dustbins or proper disposal containers for wastes. Most of these used polythene bags, old tins/jerry cans, sacks among others. Thus failed the sorting and during wet seasons could yield many diseases bad odor to the rotating garbage.

This also led to poor solid waste management practices like burning of wastes and open dumping which encouraged spread of diseases.

4.4.3 Old equipments

According to the municipal council, they had a problem of old equipments/tools like forks, spades and vehicles for transporting skips from the collection site to the disposal site. These old vehicles broke down quite often leading to delays in collection and transportation.

4.4.4 Poor technology

The researcher found out that there was a challenge of technology access and affordability. The available technology was not sufficient to manage wastes well like recycle, reuse, reduce sort, and decompose wastes to get other useful products.

According to the warden at the disposal site in industrial division, Namatala Zone, the wastes which could be sorted out manually by workers at the site could not be recycled because of poor technology. These wastes included broken glasses and bottles, among others.

4.4.5 Poor community response

The research findings showed that the community members had poor attitude towards waste. They didn't know or care what happen to waste after their homes. This lack of responsibility and poor attitude towards waste had greatly contributed to increased litter and open dumping unnecessarily in town because of the "I don't care attitude."

Table 17: Number of people who know about waste process

Number of people	Frequency	Percentage
Know	8	10
Know partly	17	21.25
Don't know	45	56.25
Total	80	100

Source: Field source

4.5 Impact of Solid Waste Disposals

The researcher found out that impact of solid waste disposal range from social, economical and health effects.

4.5.1 Poor Health Status

According to the district health inspector, solid waste disposal in Mbale municipality resulted in poor deteriorating health status of the people. If wastes are poorly managed, they lead to outbreak of diseases like malaria as the containers were not covered and acted as breeding sites for mosquitoes. They also encouraged rodents which spread diseases and flies.

4.5.2 Water Contamination

According to research findings, poor waste management led to pollution of water sources. The water sources used in Mbale municipality like wells , rain water, tap, were affected by practices open like open dumping, burning of wastes, which deteriorated the quality of water sources in municipality.

4.5.3 Other Impacts

Poor solid waste management resulted into the following impacts

- Deteriorating water quality
- Loss of lives
- Poor drainage systems
- Weak population

4.6 Management Strategies

The research findings showed that the municipal council and some NGOS, together with the district have come up with some management strategies to improve on the management of wastes in Mbale Municipality. These included the following,

4.6.1 Establishment of central collection sites

According to the research findings, it showed that one of the major causes of poor solid waste disposal was lack of collection sites in the divisions. Therefore the municipal council was looking forward to improving it by demarcating the sites for communal collection activities in all zones. This was intended to avoid littering of wastes around the municipality and to ease the work of the collectors during collection and transportation process.

4.6.2 Fines and taxes for waste dumping

In relation with the polluter pays principle and Environmental restoration orders, research findings showed that Mbale Municipal council together with Mbale local government had put fines for dumping wastes in areas within town/municipality. These fines ranged from 20,000 to 50,000 with clear notice informing people that Dump wastes here, fine 50,000. This according to

the Environment officer of Mbale Municipal Council had reduced dumping carelessly with the fear of payment.

4.6.3 Increasing the number of Skips

It was important according to the environment officer to increase the number of skips in the communities. This was because one of the major reasons for poor solid waste management was bad methods of disposal like open dumping, littering among others.

4.6.4 Proper Methods of Disposal

The research findings showed that there was need to improve on the methods of disposal so as to properly manage the wastes in the municipality. The methods people used were not proper and this affected the sanitation and health status of the people. These methods included open dumping, burning, and littering around the town. The proposed methods by the municipal council were the following

- Recycling
- Re-use
- Incineration
- Land filling

4.6.5 Awareness of Masses

It was important according to the research findings to inform the general public on matter concerning wastes. This was to range from the generation of wastes and there impacts and the methods of disposal and the general impacts of wastes on the health of the people if mishandled. Most of the people according to the field study were not aware of what happened to the wastes after generation and they did not want to associate with the wastes with the feeling that it dirt and should be thrown far away.

4.6.6 Other Management Strategies

The research findings showed that there were a number of strategies used and others were in the process of coming to board and these included the following

-
- Establishment of a recycling plant
 - Treatment of liquid wastes
 - Treatment of water for domestic use and drinking
 - Frequent collection of wastes from the sites
 - Maintenance of vehicles and machines to avoid breakdown

CHAPTER FIVE

5.0 SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary

The study was set to examine the impacts of poor solid waste disposal on sanitation standards and water sources of Mbale municipality. It focused on Mbale municipality but in essence, it applies to all towns and cities in Uganda.

The major aim of carrying out research was to investigate the impacts of solid waste disposal on sanitation standards and water sources. The study was based on three research questions and these were,

What are the types of solid waste produced in Mbale municipality?

What modes of disposal are used?

What is the impact of the disposal methods on sanitation standards and water sources?

However, it's important to note that the study established the following findings,

- Mbale municipal council with the aid help of World Bank had established a recycling plant in Namatala Zone opposite BCU head quarters to manage wastes through recycling.
- Mbale municipal council had also ensured that the streets are cleaned by the workers through serious monitoring.
- The research also showed that there were few workers in the department which increased work load of the few with little pay.
- The funds to take care of solid waste activities were not enough and the little that was allocated was delayed in the state of bureaucracy. This hindered and most times delayed the activities.
- The facilities used were not enough to accommodate the wastes generated and the rate of generation of wastes. The facilities included tools and vehicles which were old and poorly managed because of the inadequate finances.
- The general public was not aware of the proper solid waste disposal methods and management techniques like sorting, reducing, reuse, recycling, among others.
- The management of solid waste was still a big challenge in Mbale municipality despite the recycling plant in industrial division.

- The poor waste management had greatly impacted the sanitation standards through polluting the water source. This resulted in frequent outbreaks of cholera and malaria cases increased especially in Namatala zone, industrial division which was not to the sewage treatment, ponds and the disposal site for the entire municipality.

5.2 Conclusions

- The study showed that much as the municipality had established solid waste collection sites and the disposal site with the recycling plant, its role was not satisfying because it played a limited role. The reason for this was that funds were not enough to cater for the frequent activities as far as the process was concerned.
- The issue of finances also hindered the number of employees got in the department both skilled and unskilled. It also determined the time and rate of collection of wastes and their handling.
- There was also a challenge of limited supervision and monitoring of employees by the Head of departments, managers and supervisors when carrying out their activities. This encouraged dodging of to clean and collect wastes in some places.
- The study also concluded that some of the workers especially at the recycling plant and municipality did not poses the necessary skills and those who did were not well trained.
- The study also concluded that the workers lacked protective gears which endangered their lives during management of these wastes. This case was well observed by the researcher at the collection and disposal sites.
- The researcher also concluded that the masses were not informed about management techniques that were proper which resulted into carelessness of the members/residents about wastes.
- The study also concluded that there were weak legislations in the municipality.
- The research also concluded that waste disposal contaminated water sources which affected the sanitation and water standards.
- The research further concluded that improving the solid waste disposal and proper management of wastes could improve the sanitation standards and water sources quality of Mbale municipality.

5.3 Recommendation

This section discusses the measures that are recommended for proper solid waste management and how it can improve sanitation standards and water sources. The following recommendations were put forward.

- The residents should be trained and sensitized in the field of solid wastes from the point of generation, collection, transport and disposal. This will help to manage wastes through sorting.
- There should be an increase in the fund allocated to the department of solid wastes so as to increase on the number of workers for efficiency.
- The workers in the department should be provided with protective gears against diseases related to sanitation.
- There should be fines levied on the people who carelessly dump wastes around the skips and on the streets.
- There should be increased supervision and monitoring of workers so as to ensure efficiency in their work.
- There is need to increase the number of workers in the department so as to carry out the activities needed effectively.
- There should be frequent collection and transportation of wastes from the collection sites to the disposal site. This will help to reduce the bad smell and infestation of rodents and stray dogs.
- There should be an increase in the number of skips and other proper solid waste facilities in the municipality.
- The district and municipal council should plan the town well and ensure that houses are built on good plans and also areas are demarcated for residential, industrial, institutional and commercial are made known to people.
- The wastes should not be collected or disposed near water sources. This is because such practices increase the chances of pollution of water.
- Proper methods of waste disposal should be undertaken to ensure that it does not affect the environment around the area or cause health hazards to the people living there.

- At the household-level proper segregation of waste has to be done and it should be ensured that all organic matter is kept aside for composting, which is undoubtedly the best method for the correct disposal of this segment of the waste. In fact, the organic part of the waste that is generated decomposes more easily, attracts insects and causes disease. Organic waste can be composted and then used as a fertilizer

5.4 Areas for further Research

Based on the research completed for this study, the following have been suggested for further researchers. This research has been established in order to improve sanitation standards and water sources. It was necessary to improve on the solid waste disposal methods. There is need to research on how solid wastes can be managed properly in the municipality.

Despite the fact that a solid waste recycling plant exists in the municipality, there was still a big challenge in the management of solid waste. The research ought to be done in this field to find out why there is still a big challenge in solid waste management in the municipality.

APPENDICES

APPENDIX 1: QUESTIONNAIRE TO MUNICIPAL RESIDENTS AND TRADERS

Dear respondent,

I Masajage Eria, a student of Kampala International University-Uganda, is conducting an academic research in Mbale Municipality. I am requesting to ask you some questions about issues related with the impacts of solid waste disposal on sanitation standards and water sources in Mbale Municipality. The information you give to me will be treated as confidential and be used for academics, but shall also help to improve the sanitation levels of Mbale Municipality.

SECTION A: DEMOGRAPHIC CHARACTERISTICS

(Please tick in one or more of the boxes appropriately)

- a) . Way of living/ occupation
- | | |
|--|--------------------------|
| 1. Resident and trader | ☐ |
| 2. Resident only | ☐ |
| 3. Trader only but resides outside the municipal | ☐ |

b). Age of respondent

- | | |
|-----------------|--------------------------|
| 1. 16-26 | ☐ |
| 2. 26-35 | ☐ |
| 3. 36-45 | ☐ |
| 4. 46 and above | ☐ |

c) Sex of respondent

- | | |
|-----------|--------------------------|
| 1. Male | ☐ |
| 2. Female | ☐ |

d) Occupation of respondent.

- | | |
|--------------------|--------------------------|
| 1. Salaried worker | ☐ |
| 2. Housewife | ☐ |
| 3. Self employed | ☐ |

4. Others (please specify)

e) Marital status of respondent

1. Married ☐ 2. Single ☐ 3. Divorced ☐ 4. Widowed ☐

f) What types of housing are you in? Is it

a) Hut ☐

b) Single room house ☐

c) More than one room ☐

d) Flat ☐

e) Bungalow ☐

g) How many people do you stay/work with?

1. 2-4 ☐

2. 5-7 ☐

3. 8-10 ☐

4. 11 and above ☐

5. Others (please specify)

.....

h) In which division do you stay?

.....

SECTION B. SOLID WASTES AND MODES OF DISPOSAL

a) What type/s of solid wastes do you generate in your household or work place?

1. Foodstuffs ☐
2. Vegetables ☐
3. Cloth cuttings ☐
3. Polythene bags ☐
4. Others (please specify).....

b) How do you store solid wastes at your household or place of work?

1. Dustbins ☐
2. Polythene bags ☐
3. Old containers ☐
4. Solid waste sacks ☐
5. Others (please specify)

c) Do you have a central collection point (facility) to put solid waste from your household?

- 1) Yes ☐
- 2) No ☐

d) If yes, how far is the facility from your house or work place?

1. Less than 50metres ☐
2. 50-100metres ☐
3. More than 200metres ☐
4. Others (please specify).....

e) If no, how do you dispose off your solid waste?

- ☐
1. Open pits ☐
2. Open dump ☐
3. Collected by municipal council ☐

4. Others (please specify).....

f) What do you use to carry solid waste from the household to the collection site?

1. Dustbins ☐

2. Solid waste sacks ☐

3. Old containers ☐

4. Polythene bags ☐

5. Others (please specify).....

g) After the solid waste has accumulated at the collection site, what is done to it?

1. Burn ☐

2. Compost ☐

3. Transport ☐

4. Others (please specify).....

h) Do you sort solid waste before disposing it?

1) Yes ☐

2) No ☐

i) Do you incur any costs or problems in solid waste handling?

1) Yes ☐

2) No ☐

j) If yes, mention these problems or costs in the order shown below

1.

2.

3.

4.....

k) Has the local government put any efforts to properly manage or dispose the solid wastes in Mbale municipality?

1. Strongly agree ☐ 2. Agree ☐ 3. Disagree ☐ 4 strongly disagree ☐

5. Undecided ☐

l) In your own opinion, what do you think can be done to reduce on the problems of solid wastes in Mbale Municipality?

1.....

2.....

3.....

4.....

SECTION C. SOLID WASTES ON WATER SOURCES

a.) Which types of water sources do you have in your area?

1) tap water

2) bore hole

3) well

4) rain water

5) others specify

b.) How reliable are the water sources named above?

1) very reliable

2) reliable

3) not reliable

c.) What distance is between the solid waste facility and water source named?

- 1) less than 100metres
- 2) 100metres and 200metres
- 3) More than 300metres

d.) If less than 100metres from the water source, what impact do you think it has on the water quality?

.....
.....

e.) what have you than to minimize the impacts above?

.....

f.) As a trader or resident in this community, how do rate the level of sanitation in your community?

- 1) Very good
- 2) Good
- 3) Not good

g.) If not good, what do you think are the causes of poor sanitation in your area?

.....

h.) What have you than to solve the above challenges?

.....
.....

Thank you

i) Poor solid wastes management in Mbale Municipality is due to (list the reasons in the order shown below)

- 1.....
- 2.....
- 3.....
- 4.....
- 5.....

j) What are the challenges experienced by the key actors in solid waste management?

- 1.....
- 2.....
- 3.....
- 4.....
- 5.....

k) What role/s has your office or organization done in the management of solid wastes in your area of jurisdiction/control?

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

l) What has your organization or office done regarding providing the population in Mbale Municipality uncontaminated water/safe water for domestic use?

- 1.....