

**ASSESSMENT OF THE EFFICIENCY OF SOLID
WASTE MANAGEMENT SYSTEMS IN EASTERN
DIVISION, SOROTI MUNICIPALITY.**

BY

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DECLARATION

I Eniru Emmanuel Innocent, Registration number BEM/12484/61/DU solemnly declare that all the information provided in this piece of art apart from those which the authors have been clearly indicated there in is a result of my own efforts and has not in any case been submitted by any student to this institution or any other university for the award of a Bachelors degree or rather its equivalent.

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DEDICATION

I dedicate this work with profound pleasure to my parents Major Eniru John Jorem and Mrs. Alubo Agnes Eniru, my uncles Mr. Edigu John Henry &family, Mr. Oboi John Charles &family, Dr.Rose Omaria and Mr. Elelu Stephen.

To my brothers and sisters Esemu James, Ebitu John Joseph, Ekotu Morris Arnold, Akol Monica Rebecca, Amuge Gloria, Amuge Joan, Anyimo Rachael Bobrine, Achuga Maureen and Aliba Esther Ivon.

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DEFINITION OF KEY TERMS

Assessment: is a process in which you make a judgment about a person or situation after thinking carefully about it.

Efficiency: is the quality of doing something well and effectively, without wasting time, money or energy.

Management: is the judicious use of means to achieve an end. “An end” is the removal of the rejected material from the material flow pattern.

Solid waste management: is the process by which products generated by business and industry are collected, stored, transported, treated, disposed of, recycled or reused in an effort to reduce their effect on human health or local aesthetics or amenity.

Solid waste management systems: are a group of related, proved and effective tools that work together as a whole to reduce the volume of solid wastes from the generation points, storage, collection, treatment, recycling and disposal of the remaining waste material.

ACRONYMS

AMREF	African Medical Research Foundation
DED	Deutscher Entwicklungs Dienst (German Development Service)
EIA	Environment Impact Assessment
EPA	Environment Protection Agency
DSOER	District State of Environment Report
SOER	State of the Environment Report
MSW	Municipal Solid Waste
IWM	Integrated Waste Management
NEMA	National Environment Management Authority
USA	United States of America
3R's	Reducing, Recycling and Reusing.

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ABSTRACT

Solid wastes are materials that have been discarded from the material flow pattern because they lack value to the owner.

Solid waste management systems are a group of related, proved and effective tools that work together as a whole to reduce the volume of solid wastes from the generation points, storage, collection, treatment, recycling or reusing and disposing off the remaining waste material in an effort to reduce their effect on human health or local aesthetics and amenity.

The study was conducted in Eastern Division, Soroti municipality, Eastern Uganda to assess the efficiency of solid waste management systems. The objectives of the study were to identify the collection and disposal systems of solid waste management, to find out the efficiency of these systems, to explore the challenges associated with these systems and establishing the measures put in place to ensure efficient solid waste management. This was achieved by using purposive and simple random sampling to select the population.

The data was collected using both open and closed ended questionnaires, interview guides, observation and photography for obtaining primary data while secondary data was obtained from reviewing of literature.

The findings of the study indicated that the most common ways of collecting solid wastes being used include vehicles, wheel barrows, bicycles, old jerry cans and used containers, sisal sacks and polythene. The disposal methods being used include open dumping, burning or burying, litter bins, rubbish pits, sanitary landfills, others are cremation, latrine dumping, incineration, pig or animal feeding.

However, the results indicated that these methods were inefficient and this was attributed to indiscriminate and ignorant disposal, lack of awareness, mixing of bio degradable and non biodegradable wastes, inadequate equipments, pollution, inadequate funds hence delayed payment of workers, low frequency of waste collection for disposal, weak laws and regulations.

With this, I concluded that the existing solid waste collection and disposal methods were inefficient in this area in relation to the high population growth rates hence I suggested the following recommendations;

More incentives for solid waste collection and disposal such as timely payment of employees, timely collection and disposal, modern machinery for handling complicated wastes. Great emphasis on community participation, monitoring and surveillance, increased allocation of funds towards environment management by the Local government, environment education programs for creating further awareness, strict laws and policies.

CHAPTER ONE

INTRODUCTION

1.0 BACKGROUND

The management of the vast quantities of solid wastes generated by urban communities is a very complex process in which a variety of social, political, economic, and technical factors dictate the final solution for a specific community or region (Pfeffer, 1992).

The efficient and long term disposal of urban solid waste is one of the most pressing problems facing municipalities and this document therefore focuses on identifying both the historical prospective and modern technology for managing urban solid waste.

According to Enger et al (2006), the EPA in 2002 discovered that the United States alone produces 11 billion tons of solid waste each year. Nearly half of that amount consists of agricultural waste such as crop residues and animal manure, which are generally recycled into the soil on the farms where they are produced.

The problem of solid waste management commenced from the days of primitive society whereby humans and animals have used the resources of the earth to support life and to dispose of wastes. In early times, the disposal of human and other wastes did not pose a significant problem for the population was small and the amount of land available for the assimilation of wastes was large.

NEMA (1998) stated that refuse management in the low income areas is very pathetic with garbage thrown all over the place.

Enormous problems are therefore being faced by the state, local government and private enterprises in managing solid wastes especially in Soroti district.

The several kinds of wastes produced by a technological society can be categorized in many ways some kinds of wastes are released into the air and water some are purposely released while others are released accidentally many wastes that are purposely released are treated before their release. Wherever people exist, waste disposal is a problem. Archaeologists are eager to find the middens or waste leaps of ancient civilization. The kinds of articles discarded can tell us a great deal about the nature of the society that produced them. In modern society, many products are

discarded when they are broken or worn out while others have only a temporary use. Those that have only temporary uses make up the majority of solid waste.

It has been noted that nations with high standards of living and productivity tend to have more municipal solid waste per person than less developed countries (L D Cs). The United States and Canada therefore are world leaders in waste production (Enger, 2006).

The Eastern division of Soroti municipality has been experiencing a gradual increase in the amount of solid wastes generated over the past years. People produce multiple wastes each day and the population is increasing rapidly to meet the demands of the growing population. They also produce more and more wastes that are difficult to handle for example, tin and steel cans that rust and become part of the soil are being replaced by aluminium cans that stay in their original state for many years. Paper packaging that decays and burns so easily has been replaced by plastic packaging that decays slowly and gives off gases when burnt (NEMA NEWS, 2003). Conflicting land uses between the authorities and the local communities are interfering with proper solid waste management systems.

1.1. Statement of the research problem

Although solid waste management is problematic in various parts of the world, its severity is enormous in Eastern division of Soroti municipality and often alarming.

Eastern division which is the centre of business of the three divisions in Soroti municipality, has a very rampant growth in population leading to the emergence of slum areas with all its associated environmental evils especially solid wastes management systems that in generation storage, Collection up to the disposal sites. Indeed, the disposal of solid wastes once taken for granted has become an issue of immense proportions. Over the past four decades these problems are in the news, with political concerns overshadowing the technical and economic issues. Construction and operation of landfills, material recovery systems and incineration systems are few and improperly managed because they are too costly for municipalities given the recent decentralization policy in Uganda.

The quality of waste has been limited both by the per capita production as well as the total population.

This prompted the concern for improving the quality of the environment to be expressed in the 1960's and 1970's, as it was clear that solid waste disposal practices were contributing to the deterioration of environmental quality. Since then, there has been a steady increase in the control exercised over solid waste disposal and other management practices.

There has been a gradual increase of nuisances which arise from crude dumping of solid wastes described as being unsightly implying that the wastes are plenty, they attract insects and vermin particularly house flies, rats and cockroaches, they cause fire outbreaks that pollute the atmosphere, produces offensive smell and further causes land and water pollution. In addition, the wastes lead to the spread of communicable diseases through contamination of water and providing breeding grounds for mosquitoes.

These nuisances have prompted the concern for improving the quality of the environment management systems by the relevant authorities in the Eastern division of Soroti municipality such as DED. However, despite this concern, the collection and disposal systems of solid wastes appear not to be efficient enough to ensure proper solid waste management. These inefficient management practices of solid wastes have inspired various researches to be carried out in order to reduce the effects of poor solid waste management from increasing beyond the current level.

1.2 Objectives of the study

1.2.1 General objective

To assess the efficiency of solid waste management systems in Eastern division, Soroti municipality.

1.2.2 Specific objectives

1. To identify the collection and disposal systems of solid waste management.
2. To find out the efficiency of these systems.
3. To explore the challenges associated with the solid waste management systems.
4. To establish the measures put in place to ensure efficient solid waste management.

1.3 Research questions

1. Which solid waste management systems exist in your community?
2. How efficient are the collection and disposal systems of solid wastes in your community?
3. What are the challenges associated with solid waste management in your community?
4. What are the effects of poor solid wastes management in your community?
5. What measures have been put in place to ensure efficient solid waste management in your area?

1.4 Scope of the study

The study was conducted in Eastern division, Soroti municipality. The participants of the study included the general public but limited to the NGOs, staff of Eastern division offices, local leaders, youth, men and women. The respondents were of 15 years and above but gender sensitive in nature. The study focused on identifying the various solid waste collection and disposal management systems, finding out the efficiency of these systems, exploring the challenges associated these solid waste management systems, and to poor waste management, and establishing the measures put in place to ensure efficient solid waste management.

1.5. Significance of the Study

The study will be used to establish the most practical approach of how to manage the various solid wastes at all levels.

The study will provide literature to future researchers and eventually raise criticisms on the content of the report and other reports about the same problem in the area.

The policy makers, government agencies, NGOs and planners will use the results of the research to make appropriate plans and formulate better policies for further development in the area.

The study is expected to create awareness among the local people about the effects of their activities towards solid waste management and improvement of environmental quality.

CHAPTER TWO

2.0. LITERATURE REVIEW

2.1 Introduction

This chapter will review related literature that exists about the solid wastes and assessment of the solid wastes management systems in communities. There has been less literature on the assessment of solid waste management systems in Uganda but the problems of solid wastes are a global concern.

There are differences in many nations on the matters related to the solid wastes.

The literature review will focus on the different sources of solid wastes various solid waste management systems the challenges and effects of poor solid waste management systems and the measures for ensuring efficient solid waste management.

2.2. The various solid waste collection and disposal systems.

There are a number of different operations associated with a solid waste management system. Each operation accomplishes a specific purpose in the chain of actions required to manage the solid wastes satisfactorily, hence understanding each of these steps is necessary in order to develop an efficient management system. The operations are mandatory for any management system and will indicate the absolute number of operations required. The operations include a source of producer of refuse, on-site storage, collection frequency, transfer station or container to a transporting vehicle and finally either to a processing or system of a sanitary landfill. For economic reason, small solid wastes management systems generally use the collection vehicle to haul the refuse to the landfill.

Solid wastes are generated all over the world and various options have to be taken to deal with them. The first option will be to reduce or minimize the solid wastes that are generated. In such cases there will be identification of development of manufacturing processes that use little matter and energy as possible and manufacturing of products that last longer and are easy to recycle and reduce waste generation tremendously (Goldstein, 1989).

The dominant concept in managing waste is known as integrated wastes management (IWM), which is best defined as a set of managements alternatives that includes reuse, source reducing, reuse and recycling, composting, landfill and incineration. The ultimate objective of the three Rs is to reduce the amount of urban and other wastes that must be disposed off in landfills. Study of the wastes stream, that is the wastes produced, in areas that utilize IWM technology suggests that the amount by the wastes of urban refuse at least 50% and perhaps as much as 70% (Botkin, 2005). He further noted the recycling option IWM has been seriously attempted for over two decades. Recycling has been responsible for generating entire systems of wastes management that have been produced tens of thousands of jobs in the United States and reduced the amounts of urban wastes sent from homes to landfills from 50%-90% in the 1980s to about 65% today.

Sanitary landfills as solid wastes disposal methods are designed to concentrate and contain refuse without creating a nuisance or hazard to the public health of safety. The idea is to confine the wastes to the smallest practical area, reduce it to the smallest practical volume, and cover it with a layer of compacted soil at the end of each day operation or more frequently if necessary. The compacted layer restricts but does not eliminate continued access to the wastes by insects, rodents and other animals such as pigs. It further isolates refuse, minimizing the amount of surface water seeping into and gas escaping from the wastes (Botkin, 2005).

If wastes buried in a landfill comes into contact with water percolating down from the surface or which ground water moving laterally down through the refuse, leach ate an obnoxious liquid and material having capacity of carrying bacteria produced as surface or ground water comes into contact with solid wastes. When properly conducted, land filing offers an acceptable and economic ways for disposal of wastes in developing countries (McEldowney and Waite, 1993).

Miller (1990) noted that another option to solid waste management is the throwaway approach where wastes are buried or burnt. Some waste is burnt to generate steam and electricity. In the mass burning plants, there is no pre screening or sorting. What is not burnt is hauled to a landfill. Some wastes are burnt in the open unplanned landfills. Mass burning can reduce the volume of the waste by 90% and it had proved successful in the developed countries.

However, air pollution and the risk of increase of dioxin and acid gasses in the atmosphere resulted into the outlawing of this practice. In USA this was made illegal by the Clean Air Act of 1997.

Composting is a bio-chemical process in which organic materials such as lawn clippings and kitchen scraps decompose to a rich, soil-like material. This process involves rapid partial decomposition of moist solid organic wastes by aerobic organisms. Although simple backyard compost piles may come to mind, as wastes management option, large-scale composting is generally carried out in the control environment of mechanical digesters. This technique is popular in Europe and Asia, where intense farming creates demand for compost. A major drawback of composting is the necessity of separating organic materials from other wastes (Botkin, 2005).

Nyang'echi George Nicholas (1992), asserted that crude or open dumping and or rather indiscriminate disposal is a method of solid wastes disposal in which solid wastes are disposed off without any precaution. They are either disposed off in a chosen area or dumped anywhere. Such dumping causes a lot of nuisance and many health hazards arise as a result of their decomposition.

The amount and type of solid wastes produced varies greatly from one community to another. These methods of getting rid of solid wastes also vary from one community to another, for example, single farming family in the rural area compared to multi-farming set ups in urban areas.

The small amounts of solid wastes they do produce are normally got of either by burning or burying. It is obvious, therefore that, crude dumping is an in sanitary method of solid wastes disposal creating a nuisance by being unsightly, providing breeding grounds for pests, creating health hazards, polluting the air, and sometimes ground water and surface water. Fortunately, open dumps are giving way to better, planned and managed sanitary landfills.

Today, about 15% of Municipal wastes in the United States are incinerated. Canada incinerates about 8%. Incineration is the process of burning the refuse in a control manner. While some incinerators are just used to burn trash, most are designed to capture the heat, which is then used to make steam to produce electricity.

In incinerators, combustible waste is burned at temperatures high enough (900°C-1000°C, or 1,650°C - 1,830°F) to consume all combustible material, leaving only ash and non-combustible to dispose of in all landfill. Under ideal conditions, incineration may reduce the volume of wastes by 75% - 95%.

Incineration of urban waste is not necessarily a clear process because it may produce air pollution and toxic ash.

In modern incineration facilities, smoke stacks are fitted with special devices to trap pollutants, but the process of abatement is expensive. Furthermore, the plants themselves are expensive, and government subsidization may be needed to aid for example their establishment (Enger et al, 2006).

Furthermore, another important method is the pig or animal feeding in which garbage is collected from hotels, hospitals, and other institutions and fed to animals such as pigs. This method is practiced mainly in urban centers where a lot of garbage is generated. Although garbage in the main element is solid wastes, it is difficult to handle these wastes in a sanitary manner. The solid wastes are responsible for the diseases like trichinosis in man and other diseases in pigs due to consumption of improperly cooked pork and pork products.

The garbage is collected by pig owners authorized for the purpose. The method requires proper enforcement of specifications regarding frequency of garbage collections. The foods fed to the animals should be cooked before hands, but many pigs' owners ignore this requirement and as a result the about diseases occur (Nyang'echi, 1992).

He further asserts that disposal of the dead is the process of getting rid of corpses in a sanitary manner. There are many methods of disposing of the dead in the world. These methods also vary among tribes in our countries. The methods used are intimately connected with religious beliefs, superstitions and sentiments.

It is important to consider these when disposing off the dead. In most cases, earth burial and burning of cremation are the methods considered in most communities. Other methods are used in some communities although they are not hygienically accepted such as leaving bodies in the open isolated to be eaten by animals and birds of prey especially during wars, casting bodies into

lakes or rivers, burying corpses in the beds of streams, sea burials by sawing up a corpse in canvas and then dropping it into the sea with some weight to ensure that it sinks and burying under floor of houses.

Cremation is defined as a process of burning dead bodies to ashes in crematoria. This process involves placing dead bodies on a bed of finally broken quartz and then heating from beneath by mixture of dust and air, electricity or oil. The body burns with almost invisible flame; neither smell nor smoke is observed. It is the most acceptable method amongst Asian communities.

2.3. The efficiency of Solid Wastes Management Systems

Landfills have historically been the primary method of waste disposal because it's the cheapest and most convenient, and because the threat of ground water contamination was not initially recognized. Problems associated with poorly designed landfills have attracted substantial efforts to reduce the amount of material placed in landfills. A modern municipal solid waste landfill is typically constructed above an impermeable clay layer that is lined with an impermeable membrane and includes mechanisms for dealing with liquid and gas materials generated by the contents of the landfill (Enger et al, 2006).

He further asserts that each day's deposit of garbage is covered with a layer of soil to prevent it from blowing around and to discourage animals from scavenging for food. Selection of a landfill is based on an understanding of local geologic conditions such as the presence of a suitable clay base, groundwater geology, and soil type. In addition, monitoring system is necessary to detect methane gas production and groundwater contamination.

Cunningham (2001) noted that as far as collection and transportation of solid wastes is concerned as a management system, the practice has proved to be dangerous. Although this has prompted most industrialized nations in the World to agree halting the exportation of hazardous toxic wastes to LDCs, the practice still continues. In 1999, for example 3,000 tons of incinerator wastes from a plastic factory in Taiwan were unloaded from a ship in the middle of the night and dumped in a field near the small coastal Cambodian village in Bet Tran g prompting the village residents to think that they had been blessed with a windfall. They emptied chunks of crumbling

residue so they could use the white plastic shipping bags as bedding, roofing material and rinsed out bags to use for rice storage. In the following weeks, the villagers discovered that, rather than a treasure, they had a calamity portrayed by the death of one of the dock workers and five others were hospitalized with symptoms of nerve damage and respiratory diseases.

Integrated Waste Management is the dominant concept which entails all the three Rs of recycle, Reduce and Reuse with an ultimate objective of reducing the amount urban and other wastes that must be disposed off in landfills (Buskin, 2005).

Recycling is one of the best environmental success stories of the twentieth century. In United State, recycling including composting diverted about 30percent, of the solid waste stream from landfills and incinerators in 2001, up from about 16percent in 1990. Several kinds of programs have contributed to the increase in the recycling rate. Some benefits of recycling. Some benefits of recycling are resource conservation, pollutant reduction, and energy savings, job creation, and reduced need for landfills and incinerators. However, incentives are necessary to encourage people to participate in recycling programs (Enger et al, 2006).

According to Nyang'echi (1992), collection and disposal of solid wastes for pig or animal feeding is equally important for the management of solid wastes. Garbage is collected from hotels, hospitals, schools, and other institutions and later on fed to animals mostly pigs. This method has proved to be efficient manly in urban centers like Soroti municipality with a lot of activities which generates surplus garbage. In most cases, garbage is collected by authorized pig owners and this method requires proper enforcement of specifications regarding the frequency of garbage collection to avoid unusual accumulation.

Pfeffer (1992) reported that refuse is produced at the source. The quantity and composition of refuse are determined by the characteristics of the source. Most refuse is produced over a long period of time, requiring on-site storage until such time as it can be collected. The storage may be conventional trash cans for large single-family residences or a large storage bin for large producers. Frequency of collection will depend on a number of factors, the most important being the production rate.

He noted that collection will be accomplished by a special vehicle that is compatible with the storage systems. Collection in a single-family residential area will require a side-or-rear loading

packer truck into which the cans can be emptied manually. Areas served with a large container will require a vehicle with mechanical mechanisms to transfer the refuse from the container to the vehicle. After the refuse has been collected, it must be transported to either a processing system or a sanitary landfill. For economic reasons, small solid waste management systems generally use the collection vehicle to haul the refuse to the landfill.

Cunningham et al (2001) reported that garbage imperialism also operates within richer Countries as well whereby poor neighborhoods and minority populations are most much likely than richer ones to be recipients of dumps, waste incinerators, and other Locally Unwanted Land Uses (LULUs). The growing piles of garbage and rubbish coupled with a lack of available landfills at any price, however, public officials investigated incinerators are specially designed burning plants capable of burning thousands of tons wastes per day. In some plants, refuse is sorted as it comes in to remove unburnable or recyclable materials before combustion, a process called refuse-derived fuel because the enriched burnable fraction of has a higher energy content than raw thrash. Mass burn is another approach whereby everything smaller than sofas and refrigerators is dumped into a giant furnace and burnt as much as possible. This technique avoids the expensive and unpleasant job of sorting through the garbage for non burnable materials, but it often causes greater problems with air pollution and corrosion of burner chimneys.

Solid waste management agencies or rather authorities are defined as the units of local government such as the village or city, the Country, or a special management district, by a private contractor, or a combination of public and private agencies who are responsible for conducting the collection and disposal of the refuse generated in metropolitan areas, small towns, municipalities, and rural areas (Pfeffer, 1992).

He emphasized that in larger cities it is common for residential collection to be the responsibility of the city. The larger producers' apartment complexes, commercial and industrial sources often contract with private haulers to collect their refuse. Disposal may be at a municipality or at a privately owned site. It is difficult therefore to generalize the agencies since there are a large variety of combinations of public and private refuse collection and disposal operations.

2.4. Challenges associated with solid waste management systems.

Wastes have become a serious environmental problem in most developing world urban centers. Some of the major causes of this are increasing industrialization, urbanization and the rapid population growth among others. This has come along with a lot of in migrations where a good number of people leave the rural areas to settle in towns where they hope to find “Greener Pastures” or better livelihoods (NEMA NEWS, March 2007).

In relation to this News, the urban populations expand as settlement becomes more difficult, waste management more complex thus the who it may it concern or “not in my backyard” practice where people dump or throw indiscriminatingly, including into drainage channels so long as it is a little far away from their vicinity increases (NEMA NEWS, March 2007).

DSOER Soroti (1997) reported that the population of Soroti district has exhibited generally a fair rate of increase mostly during the period of 1969-1980 when the population increased from 379,913 in 1969 to 476,626 in 1980 thereby implying an annual rate of growth of about 2.2%.

A negative growth rate of 0.93% was rescored between 1980 and 1991 far below the national average of 2.5% in the same period.

Further, Soroti district is one of the less densely populated in Uganda with an overall average land density of 51 persons per square kilometer (1991 census report), compared to the national average of 85. Much of 89% of the population is rural, a situation which reflects basically agricultural nature of the districts’ economy. Soroti municipality and Serere are densely populated which makes the proper management of management of solid wastes appear to be inevitable.

The SOER (1994) indicate that the population density in some counties in Soroti district increased to 100-150 persons per square kilometers as compared to national average stated above. This was in search for employment and other social services in Soroti municipality. Therefore, natural resources allocation, use, manipulation, degradation and environmental impact take place within a human settlement context.

Still according to (DSOER Soroti 1997), solid waste management problems are mainly caused by poor disposal techniques. The commonest methods of disposal in Uganda are burning and

open dumping. This is due to a number of factors such as inadequate service coverage, poor accessibility to waste collection sites due to unplanned settlements referred to as slums, limited awareness and poor attitudes among the people and implementation of policies and poor laws.

This report further states that, communities have the potential to effectively manage their own wastes. However, this can only be achieved if environmental education and awareness campaigns are intensified, enhanced by enforcement and compliance of our communities sorting the wastes to recover what could be re-used and composted, then we shall not have waste to talk about, as some such as the metals and plastics will be sold to recycling companies. In response to this, plastic water bottles have also got ready market.

Poor solid waste disposal and management is mainly a problem caused by domestic refuse and individual processes in urban areas approximately 80% of the population use common bins and dumping sites while 20% dispose it off by burning. The situation is often worse in the slums where congestion makes disposal more difficult (National report on the Environment and Development, 1991).

Many cities generate more solid wastes than they can collect or dispose off. The volume increases with income. In low and middle-income countries municipal waste services often swallow between a fifth and a half of city budgets, yet much solid waste is not removed. About 30% of solid wastes generated in Jakarta, four-fifth of refuse in Dares-salaam and more than two-thirds of solid wastes in Karachi go uncollected. Poor neighborhoods generate lower amounts of solid wastes per capita but receive the least service, often because roads are so congested that conventional collection methods are nearly impossible (World Development Report, 1992).

According to Cunningham and Saigo (2001), the cost effectiveness of garbage incinerators is the subject of heated debates. Initial construction costs are high-usually between 100 million and 300 million for a typical municipal facility. Tipping fees at an incinerator the fee charged to hawkers for each ton of garbage dumped are often much higher than those at a landfill. As landfill space near metropolitan areas becomes scarcer and more expensive, however, landfill rates are certain to rise. They insist that it may pay in the long run to incinerate refuse so that the life time of existing landfills will be extended.

Furthermore, they consider the environmental safety of incinerators as another point of concern. The EPA has found alarmingly high levels of dioxins, furans, lead and cadmium in incinerator ash. The EPA, which generally supports incineration, acknowledges danger is very slight. The EPA estimates that dioxin emissions from a typical municipal incinerator may cause one death per million people in 70 years of operation.

NEMA NEWS (2007) noted that so many metric tons of plastic waste including polyethylene bags (kaveera) have accumulated in Uganda's environment. Like poor waste management in general, plastic bags (kaveera) have a number of effects on the environment hence hindrance of water penetrating in the soil, limited soil air circulation, plant root penetration due to soil compaction and poor soil fertility.

Sometimes, polyethylene bags find their way into livestock's digestive tract (mainly through feed) and since the animals' enzymes cannot digest the plastic, they remain inside the animals and most times it leads to death of the animals.

Sinha (1998), reports that landfills contaminate the soil causing changes in its micro ecology. Leachates from landfills further still contaminate surface and ground water with their harmful compounds, making such water unusable and a threat to biota and human health.

The classic example of the dangers of landfill disposal of hazardous wastes in the case of Love Canal, a small town in the USA, close to Niagara falls. Buildings were erected on a site previously used as a dump for waste chemicals. Heavy rains, years later created ponds of contaminated water, forcing the relocation of residents and site remedial measures costing about \$US100million a good example of a "chemical time bomb".

Enger (2006) noted that there are many health risks associated with hazardous wastes since they contain chemical wastes, controlling chemicals and their waste products are a major issue in most developed countries. Every year, roughly 1000 new chemicals join the nearly 70,000 in daily uses. Many of these chemicals are toxic, but they pose little threat to human health unless they are toxic, but they pose little threat to human health unless they are used or disposed off improperly. For example, many insecticides are extremely toxic to humans.

The federal agency for toxic substances and disease registry identified 20 top toxic materials; some of them include arsenic, Dieldrin, DDT with effects such as possible long-term effect on liver, reproductive problems, impaired nervous system functions, kidney damage.

2.4. Measures put in place to ensure efficient solid waste management.

Generally, waste management could be classified into two main categories, preventive (addressing the causes of waste generation) and the curative (controlling the harmful effects of wastes). Both could be considered within a hierarchy of approaches. (Sinha, 1998).

- Dematerialization of production (reducing material and energy inputs)
- Recycling wastes back into production process
- Recovery of some ingredients , and for treatment of wastes , and
- Disposal, dumping or storage.

Sinha (1998), further stated that dematerialization of production, recycling, and the concepts of cleaner production, industrialization metabolism and industrialization ecosystems, addressing both the preventive and the curative approaches.

However, no matter what efforts are made to address the causes of waste generation within the current state of technology there will always be some waste generation a long way from realization.

When such wastes are of the hazardous variety, they pose serious problems.

Treatment of hazards wastes has so far involved physical, chemical, thermal or biological processes.

More recently , biotechnology has provided new options for dealing with some hazardous wastes but some of these methods ,using micro-organisms , have not yet been applied on a scale that would allow proper assessment of their effectiveness.

NEMA NEWS (2007) asserted that there is need to support the waste recycling industries as this will boost waste picking and sorting among the communities. Since Local government, Non government organizations (NGOs) and community based organization (CBOs) have an

outstanding advantage of touching base with the local communities, donor support agents should put more emphasis on them especially those dealing with solid waste management so as you increase their will to focus on waste management among other environmental issues.

This news noted that Policies on waste management should be reviewed to consider local community participation through continuous consultation and must encompass some economic incentives to ensure continuity.

Environment management in Uganda is decentralized. Local governments should come up with by-laws or ordinances that suit their local conditions to manage the solid waste generated within their own jurisdiction.

Like the Polluter Pays Principle suggests that let there be serious monetary fines in case one is caught dumping unnecessarily.

Enger et al(2006) , emphasized that wastes can often be trade in such a way that their amount is reduced , or their hazardous nature is modified by neutralization of dangerous acids , biodegradation of organic materials by the actions of microorganisms , air stripping to remove volatile chemicals from water , carbon absorption tanks which contain specifically activated particles of carbon to treat hazardous chemicals in gaseous and liquid waste , production involving adding special materials to a liquid waste.

Waste management regulations are part of the Ugandan policies relating to landfill use whereby operators of a waste disposal site (landfill) must be licensed by NEMA. The license can be applied for within ninety days before commencement of business and is valid for one year and is renewable.

In addition, an environmental impact assessment (EIA) must be carried out before the establishment of waste disposal site or landfills and thereafter an operator of a disposal site shall carry out an annual environmental audit of his site or plant and shall submit the reports to NEMA.

EIA was established under the national environment Act Cap 153. An EIA is an assessment of the project and aims at mitigating any negative impacts that the project may have on the environment. (NEMA NEWS, 2003).

The report further indicated illegal traffic in waste under section 55 set which states, that it's an offence to import into Uganda, any waste except under license issued by NEMA, and that any person who imports any waste into Uganda is responsible for its removal from Uganda and for its disposal.

Involving private sector of the proven ways of obtaining efficiency gains in solid waste management that is when the key success factors of competition, transparency and accountability are present. The private sector efficiency and lowers costs by introducing commercial principles such as limited and well focused performance objectives, financial and managerial autonomy , a hard budget constraint, and clear accountability to both customers and providers of capital. The private sector plays other important roles by mobilizing needed investment funds, and by providing new ideas, technologies and skills.

In the solid waste sector , one form of private sector that creates live hood for urban poor in through the incorporation of micro-enterprises and informal waste recycling cooperatives in the municipal solid waste management system (Cointreau and Gopalan,2000).

CHAPTER THREE

3.0 DESCRIPTION OF THE STUDY AREA AND METHODOLOGY.

3.1 Description of the study area.

Soroti district is located in Eastern Uganda. It is bordered by Kumi in the East, Kaberamaido in the West, Katakwi in the North, Kamuli and Pallisa in the South. Soroti town is one of the country's ten largest urban centers.

Soroti district is situated approximately 320kms north east of Kampala city. It covers an area of 2,257sqkm of land and 406sqkm of water.

3.1.1 Rainfall

The climate is characterized by two seasons that is, the dry and wet seasons. During the wet season, Soroti district receives annual rainfall ranging from 1200mm to 1500mm heavy rainfall to thunder storms. But changing weather patterns in Uganda over the last 30years have led to increased uneven distribution of rainfall in Soroti resulting into flooding and prolonged dry seasons.

3.1.2 Temperature

In Soroti district, the records from the weather departments show that temperatures have slightly increased from an average of 18.4°C over the 30year period to 18.2°C in 2008 showing an increase by 0.5°C. The mean annual maximum temperature generally recorded ranges from 30°C to 32.5°C.

3.1.3 Population

The district has a population of about 320,000 inhabitants. The main inhabitants are the Itesots; the Kumams are equally a dominant tribe whereas tribes from other ethnic groups exist in far less small numbers.

The main economic activity carried out by the population for generating income are agriculture and fishing. Cotton is the main cash crop grown in the district while the main food crops are sweet potatoes, cassava, sorghum, beans and maize. Fishing is carried out in the district's main water body that is, Lake Kyoga.

3.1.4 Soils

The main soil type in the district is the ferrosols characterized as being sandy sediments, clay, and sandy loam. The soils are chemically poor with a low inherent or natural fertility, have deep soil profile, weak soil structure, they are strongly weathered, they are red and yellow in color with a high content of sesquioxides(iron oxides, aluminum oxides and hydroxides). The soils are of high clay content hence they have a strong water retention capacity. The infiltration rates are also in some parts of the sandy nature of the soils.

3.1.5 Vegetation

The dominant vegetation cover is the savannah grasslands dotted with shrubs and trees. The grasslands favour the raring of large herds of cattle that attracts other pastoralist tribes like the Karamojong.

METHODOLOGY

3.2. Research design

A general survey was conducted to assess the efficiency of solid waste management systems in Eastern division, Soroti municipality.

The variables used include; the various collection and disposal systems of solid waste management, the efficiency of these systems, the associated challenges of these management systems and the measures put in place to ensure efficient solid waste management.

Further, the researcher collected data from both primary and secondary sources. Primary data was obtained from qualitative data collection methods such as interviews, recording observations and photography. Quantitative data was sought from questionnaires while secondary data was obtained through documentary analysis.

Quantitative methods were in form of simple descriptive and analytical statistical data such as percentages, recording of figures, presenting tables and pie charts where necessary.

3.3 Sampling framework

Soroti municipality has three divisions including Eastern, Western and Northern divisions. Eastern division was chosen because of its high population density and being the center of

business in Soroti district which has led to the generation of several solid wastes and requires efficient solid waste management systems.

3.4. Sample population

The sample population was composed of the key respondents that is, NGOs representatives for example DED(Deutscher Entwicklungs Dienst) known as German Development Service, management of Eastern division offices and local leaders from the community. The general respondents included youth, men and women at household level.

Eastern division consists of four (4) wards namely; Kengere, Moru apesur, Akisim, and Central (Town area) ward.

3.4.1 Sampling procedure

Purposive sampling was used to sample main respondents. This is because they are the implementers and service providers of the collection and disposal systems of solid waste management, so they could be having sufficient knowledge regarding the subject matter of study. 6 respondents from staff of eastern division offices, 4 from NGOs, and 5 local leaders from the community. Simple random sampling was used to select the other respondents in the 4 sample wards. This was done using lottery method, where the researcher was keen not to replace or repeat any wards or respondents. From each ward 15 people were selected and included in the sample; they included youth, men and women. Therefore, the total samples that represented the entire population were 75 people. The local leaders will be chosen because they are assumed to be aware of most of their community activities while the youth, men and women were sampled because they carry out activities that generate various solid wastes and are agents of poor solid waste management.

3.5. Data collection methods and tools

3.5.1 Questionnaires and interviews.

Questionnaires were administered to the staff of Eastern Division offices, NGOs representatives, and local leaders from the community, youth, women and men at household level. The questions were both open and closed ended.

The reason for using this method is that large sums of data from a large group of people in a short period of time could be collected because the respondents are familiar with the study area.

Interviews method was also used and it involved involve face to face interactions with the main respondents. This was done using an interview guide.

3.5.2 Observation

This method was used by the researcher to observe what is happening in a real life situation while recording the findings. It supplemented other methods in order to acquire important data which the respondents could not reveal. It involved careful watching and noting the events as they occurred. It also helped the researcher to critically evaluate the direct conditions regarding the solid waste management systems in Eastern division.

3.5.3 Photography

Several photographs were taken in the field by the researcher. These photographs helped to provide a basic reflection on the issues surrounding solid wastes management systems in Eastern division.

3.5.4 Secondary data

Relevant information related to the study was also used. This data was obtained from newspapers, library text books, pamphlets, journals, governmental and non- governmental statistical studies and reports. This method was useful since it acted as a comparative tool in research and helped to avoid duplication, learning methodology the other people had already used and serving as a blue print in developing new ideas. It also helped me to relate my work to what other people have already done and putting forward an entirely original idea or theory that discovers an already unexplored horizon of knowledge among others.

3.6 Data Analysis

The data was analyzed using both quantitative and qualitative methods.

Quantitatively data was presented using frequency distribution tables and pie-charts.

Quantitative data analysis was used where by the researcher before leaving the field made sure that he edited the data in order to cross check for uniformity, accuracy, consistency, legibility and comprehensibility of the results.

Qualitative data analysis was used to describe whether the existing collection and disposal methods are efficient, indicate the challenges faced by these management systems, and the measures that have been put in place to ensure proper solid waste management.

3.7 Challenges of the study

The researcher encountered the following challenges during the period of study;

Time as a constant factor caused a big challenge in that the time allocated for this research was not adequate for systematic study to take place because of various commitments by the research, that were equally of noble cause.

Another problem was non cooperation, hostility and non- reliability on the side of the respondents. This happened due to the fact that they assumed I was doing research for my own private benefits at their expense.

Illiteracy within respondents was major problem. Those who did not know how to read and write gave wrong information, concealed or just decided to lie about the issues on study.

Financial constraints hindered the researcher's desire to obtain the relevant information and also analyze it. This led to the adjustment of the data collection instruments hence poorly designed and analyzed data that may affect the quality of the research and report. The respondents at the end of the interview or questionnaire also requested for some form of boosting or compensation for their time in terms of money.

Language barrier was not exempted because the researcher found a problem of translating the questionnaire in the local languages in existence due to the community's heterogeneous nature. This is because corresponding answers would be easy for the respondents in the local languages.

CHAPTER FOUR

4.0 RESEARCH FINDINGS AND DISCUSSION

4.1 Introduction

This chapter presents the research findings and discussion of results that was obtained from the data collection in Eastern Division of Soroti municipality, principally on the efficiency of solid waste collection and disposal systems in this community. The study included several issues but not limited to the background information of respondents, waste collection and disposal systems, efficiency, challenges and measures put in place to ensure efficient solid waste management.

4.2 Table 1: Socio-economic characteristics of the respondents.

Sex	Frequency	Percentage
Male	27	39
Female	43	61
Total	70	100
Age interval(Years)		
15-25	7	10
26-35	30	43
36-45	27	39
46+	6	8
Total	70	100
Education level		
Primary	35	50
O'level	10	14
A' level	8	11
Vocational	2	3
University	2	3
Not applicable	13	19
Total	70	100
Occupation		

Peasant	38	54
Doctor	1	1
Teacher	4	6
Businessman	11	16
Housewife	7	10
Others	9	13
Total	70	100
Marital status		
Married	39	56
Single	20	28
Widow	7	10
Widower	4	6
Total	70	100
Population		
Two parents existing with less than 5 dependants	10	14
Two parents existing with more than 5 dependants	25	36
Single parents existing with less than 5 dependants	6	9
Single parents existing with more than 5 dependants	20	28
Others	9	13
Total	70	100

Source: Primary researched data

The figures in table 1 indicate that more females respond as compared to males as it is clearly seen from the percentages. This was as a result of administration of questionnaires and interviews at household level to females. It implies that most of the women in these wards are household heads and are business oriented. Even then, the Uganda population and housing census shows a big range between female and male population, this might be supportive evidence to this finding.

The percentages in table 1 show that most responses were obtained from those aged between 26 and 45 years. This shows that there is a large population of youth in the study area and as well they were able to attempt during the answering of the questionnaires and interviews since this

were all people in their active ages. Therefore they were able to present well thought out ideas as regards solid waste collection and disposal with proper guidance.

About half of the populace here has attained primary level of education as it is shown in table 3. This may be so because most of the responses were obtained from females more over there has been a high school drop out by females compared to males as a result of insurgencies such as the Lord's Resistance Army in 2003 and Karamojong warriors who have spent almost 40 years in wars through cattle rustling, reproductive health related issues, cultural dominance (bride price) and inferiority complex, among others.

As regards population, the percentages show that most of the population in Eastern Division despite being urban and peri urban respectively are peasants (54%), business oriented community (16%) which is well explained by the environment in which they live, the conditions together with the factors of urbanization such as the push and pull factors hence uneducated and peasant kind of population finds its way in town as one way of trying to make ends meet.

It was observed that most of the respondents were between the ages 26 and 45 years who therefore according to the Uganda constitution are liable to marriage under all circumstances (The Uganda constitution recommends that every Ugandan male or female above 18 years of age is free to marry). This further explains the statistics in table 1 which indicates most responses being obtained from the married population whether all the partners are alive or one is dead.

The results further show that families of more than five dependants with father and mother alive, together with single parents with an equal number of dependants are dominant in Eastern Division. This clearly indicated that there is a high dependency ratio amongst this population which therefore affects the life of the inhabitants that is why the largest population stays in the peri urban areas and slum areas of Moru apesur because of the standard of living in terms of provision of basic needs like food, shelter, clothing, education and health.

4.3 The collection and disposal systems of solid wastes.

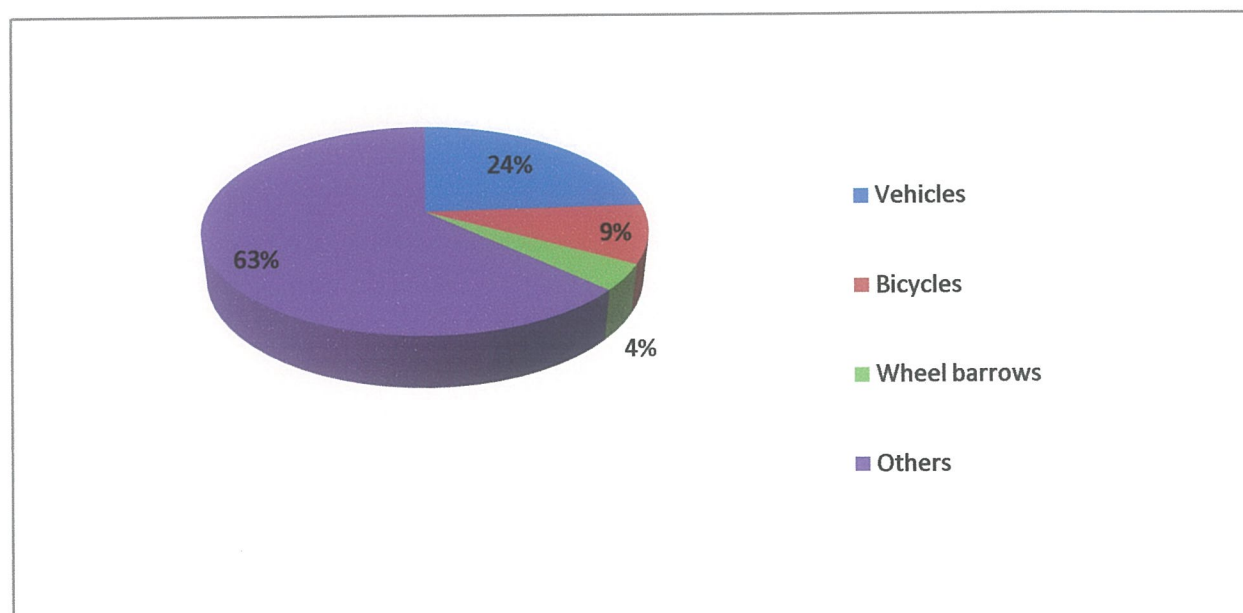
4.3.1 Collection of solid wastes.

Table 2: Ways of collecting solid wastes.

Means	Frequency	Percentage
Vehicles	17	24
bicycles	6	9
Wheel barrows	3	4
Others(old jerry cans and used containers, sisal sacks, polythene bags)	44	63
Total	70	100

Source: Primary researched data

Figure 1: Ways of collecting solid wastes.



Source: Primary researched data

Table 2 shows that the population collects its wastes using other measures such as taking wastes to dump along the streets, on any open ground or site, behind houses of residents, footing up to the open dumping sites which are not efficient measures for waste disposal.

However, closely linked to that is the facility provided by the Local government, NEMA and DED (for example tractor trail, dumping lorry, trucks, payment of workers, among others) these have also facilitated in the routine collection of solid wastes in Eastern division hence improving people's state of health reducing the burden of disease that would affect their cost of living.

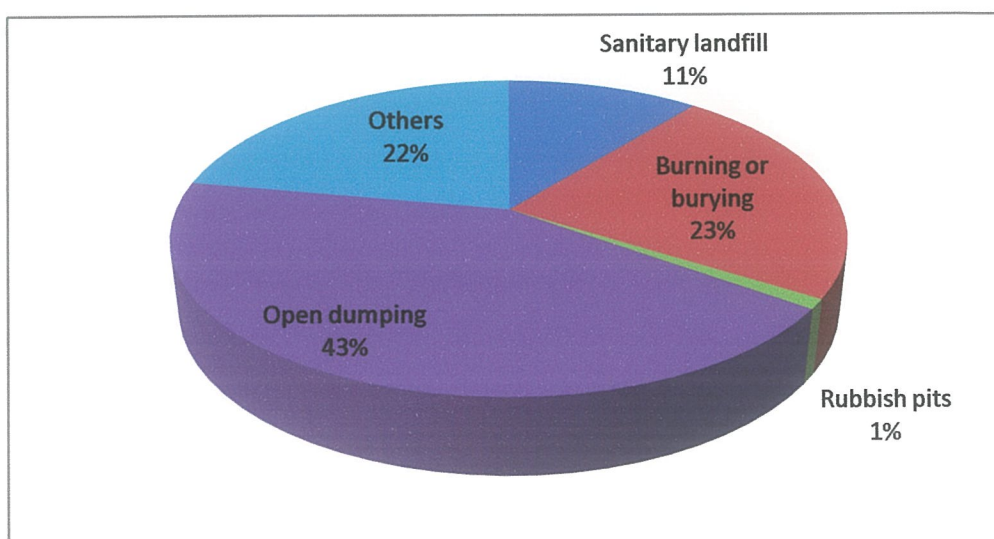
4.3.2 Disposal of solid wastes

Table 3: Disposal methods of solid wastes

Disposal measures	Frequency	Percentage
Sanitary landfill	8	11
Burning or burying	16	23
Rubbish pits	1	1
Open dumping	30	43
Others(cremation, latrine dumping, incineration, pig or animal feeding)	15	22
Total	70	100

Source: primary researched data

Figure 2: Disposal methods of solid wastes



Source: Primary researched data.

The results in table 3 show other measures of disposal being dominant, such include and not limited to litter bins, skips, dust bins which are ways of dumping encouraged in Soroti Municipality management because of the ease of use and somewhat efficiency that can be exhibited. However, some of the inhabitants may be tempted to burning and burying the wastes and dumping in an open dumping ground. These measures are not good as they may lead to pollution of different forms to different components of the environment such as the water aquifers (underground and surface water sources), air and soil, aesthetic conditions, litter of the environment hence depriving the environment of its scenic beauty.

However, although sanitary landfills may be a recommended form of solid waste disposal, it is not highly used. Also the communities here have not been encouraged to use rubbish pits because of the concentrated nature of settlement.

Mode of operation of the solid waste disposal methods;

- Sanitary landfill.

Under normal circumstances, sanitary landfills as a solid waste disposal method are designed to concentrate and contain refuse without creating a nuisance or hazard to public health or safety.

The main objective is to compress the waste to the smallest practical area, reduce it to the smallest practical volume, and covers it with a layer of compacted soil at the end of each day of operation or more frequently if necessary. Despite the required criteria, the situation of sanitary landfills in Eastern division does not conform to the above measures therefore the landfills appear to be like open dumping sites without restriction to insects, rodents and animals such as pigs.

- Burning or burying:

Burning and burying appear to be the most dominant methods of solid waste disposal. Refuse is always supposed to be sorted before burning that substances that can easily be burnt are dumped in mass burning plants like in the USA, thus what is not burnt is hauled to a landfill.

However, in Eastern division, the wastes are burnt at any site with less consideration of the effects like air pollution. Burning is usually for toxic substances for example hospital wastes found in homes, animal wastes especially dung, infected intestines of chicken.

As regards dead human beings (corpses), some are transported to the municipal cemetery or graveyard in Camp Swahili in Northern division especially Muslims whereas the greatest percentage is transported to their ancestral homes (villages).

- Rubbish pits:

Due to limited land, this method is accorded less attention by the resident, which is only 1%. It involves digging a pit or large hole in the ground hence every type of solid waste is dumped in the pit. This is true for most households but not communal dumping sites.

- Open dumping:

This involves dumping solid wastes without any precaution especially with an attitude of “to whom it may concern.” It can be in a designated area or anywhere. Due to lack of awareness, a majority of people have considered it as one of the best methods of disposing off solid wastes at about 22% of all the disposal methods and this has led to creation of breeding grounds for pests, pollution of the environment and ground water contamination.

- Others are (Cremation, latrine dumping, incineration, and pig or animal feeding);

Cremation is the most accepted method among the Asian community in Eastern division just like other Asians in other parts of the world. It involves burning dead bodies to ashes in crematoria using a bed of quartz, heating from beneath by a mixture of gas and air, electricity or oil.

Latrine dumping is also considered to be the favorite method for disposing solid wastes ranging from human excreta, sanitary pads, used up panties, hospital wastes like syringes, expired drugs, containers of toxic chemicals, among many.

Garbage is collected from restaurants and hotels, markets, hospitals, schools, and financial institutions. The garbage is supposed to be collected by pig owners authorized for the purpose with proper specifications such as the frequency of garbage collection.

4.4. Efficiency of solid waste management.

Management of solid wastes actually starts from the point of its generation, till its disposal whether in an open dump site, skips, rubbish pits, dust bins, incinerators, ash pits, or better still sanitary landfills. The collection and disposal of the solid wastes in the four different residential and commercial apartment Wards of Eastern division in Soroti Municipality seems efficient according to the responses from the officials (Civil Servants) for instance the LC III Chairperson of Eastern division during an interview session said that “the most efficient means of disposing and collecting wastes encouraged in the area, is use of litterbins. The tractor trail is meant to move daily along the sanitary lanes collecting the wastes while the lorry dumper picks filled up skips to empty at the land fill on daily basis.” This is not achieved because of insufficient funds to aid the collection and disposal of solid wastes. This response indicates the efficiency and effectiveness of the system.

- Frequency of skip collection:

The rare collection of skips is an issue that has always led to the accumulation of solid wastes of solid wastes to the extent of wastes pouring out of the skips and littering the surrounding location of wastes.

Plate 1: Accumulation of solid wastes in a skip at Kengere ward



This poor collection at a rate of once in a week is escalated by vehicle breakdown and use of obsolete transportation equipments for example old tractors, old trucks, among others.

- Use of the skips by the local people;

The research revealed that most residents in the community prefer direct household disposal to the areas where the skips are located. In case the skips are filled up they are not afraid of dumping outside the skips. Some people are comfortable disposing wastes to the collection vehicles and trucks. Distance also dictates on whether a person transports to the communal disposal sites or engages in open dumping.

- Inadequate funds:

Poor allocation of funds for fair or rather accurate management of solid wastes has led to the delay in the collection of skips, scattering of wastes all over the area, and poor payment or delayed salaries of workers. These problems have led to indiscriminate disposal of solid wastes.

The disbursements collected from revenue are persistently inadequate for fuel and repair or maintenance of vehicles, monitoring and enforcement of laws and policies.

In spite of low sensitization in form of environmental education to the communities, it was observed that it is one of the most successful measures in ensuring proper solid waste management in the area, the solid wastes are still a problem in that sensitization ought to be supplemented by all the other measures put in place to ensure efficiency such as laws and policies, monitoring, 3R's coupled with community participation.

- Inadequate equipments:

The equipments available for handling solid wastes are inadequate in that some places like Akisim housing estate have only one (1) skip, Moruapesur ward has only two (2) skips.

There are only 2 dumper trucks and 1 tractor for collecting and disposal off the solid wastes.

However, responses generated from the respondents working in different areas and those in household residential areas had a different view about solid wastes management in Eastern division.

The collection and disposal of solid wastes is not efficient, the response is not negative towards government programs but the poor practice is on ground resulting from issues like; delay to

collect the filled up skips, scattering of wastes all over the area by scavengers, poor pay or delayed salary of workers, frequency of wastes collection, this, together with challenges of wastes management (collection and disposal) affect the efficiency of solid wastes management system.

Despite other incompetencies in wastes collection and disposal efficiency, responses indicate that government and Non-Governmental Organizations initiatives on the venture would be sufficient and efficient actually operating better under adequate supervision of personnel, community especially conducting constant inspection of the health standards.

4.5. Challenges associated with the collection and disposal systems.

There are a number of challenges that were generated from respondents among which include;

The indiscriminate and ignorant disposal of solid wastes; Here the community dispose off their wastes in a manner that does not suit environmental health standards of public health. The communities here engage in disposal of solid wastes along the high ways, open dumping in nearby plots of land unoccupied, disposal of both biodegradable and non-biodegradable wastes in some collection and disposal container.

Plate 2: Scattered wastes due to open dumping in Moru apesur ward.



This brings about resultant effects of rotting of the biodegradable wastes hence pollution of different sources in the short run, lowering scenic value, aesthetic conditions and disease prevalence in these communities (malaria since wastes will act as breeding ground, other air borne diseases accruing from pollution). Like other big towns, in Soroti Municipality, Eastern division, solid wastes are transported some times by rain water as garbage is dumped in the drainage channels hence blocking the drainage and causing other externalities.

In addition, there is little or lack of awareness or creation about solid wastes collection and disposal especially the appropriate mechanisms in the municipality despite a few attempts by the NEMA radio program on Voice of Teso radio station (in Soroti) every 1st and 3rd Tuesdays of the month broadcast which may not have its focus on solid wastes management either. This mode of communication appears to be the cheapest because almost all households have radios hence many people listen to the program due to frequent advertisements.

This implies that it normally focuses on wetlands management, better farming practices and issues pertaining tree management practices. The lack of or inadequate information on proper collection and disposal of solid wastes makes complex problems to exist amongst the populace hence affecting their conditions of living, increasing living costs of treating its effect on cleaning of the environment afterwards.

There is collection and disposal of wastes in these communities without separation. This occurs from household level, commercial places, markets, and at the disposal sites that is, the open dumpsite in Eastern division at Moru apesur ward and sanitary landfills in Aminit produce offensive odors, provide poor scenic values, and accumulation of the non-biodegradable wastes. The non separation of biodegradable wastes from non biodegradable may lead to aesthetic problems, air pollution resulting from decay of biodegradable wastes, poisonous gases may escape, may affect the re-use of some items like, “NOMI” detergent containers, these may also act as breeding grounds for disease causing vectors.

More to that, the communities where the disposal facilities have been situated besides the houses of residence or business complain of diseases resulting from the garbage, that is to say, the wastes acting as breeding ground for mosquitoes, rodents, houseflies, and cockroaches. This has increased the burden of treatment, control, transporting patients to hospitals, absenteeism from

work that has led to less time allocation by individuals for carrying out activities that earn the local community income for improving their standards of living.

The disposal facilities are situated by the government such as, skips, ash pits, litter bins, open dumpsites and landfills while to some extent, communities may at one time start up their dumpsites in somebody else's plot or open area near them henceforth, they suffer the consequences. Given the inadequacy of the equipments, it was noted that the skips are not always located in various strategic communal collection and disposal sites leading to indiscriminate dumping of solid wastes hence providing comfortable breeding grounds for mosquitoes, houseflies and vermin, to mention but a few. This has led to increase in cases of diarrhoea during the wet season.

These vermin have increased the burden of treatment by the residents and local; government's revenue allocation to the health sector to treat diseases, control and transport patients, and the time allocated for productive work has been affected tremendously.

The delay in payment of laborers and finances for procurement of fuel, maintenance of the mechanical condition of the machines and mobilization of revenue for use are other constraints which may result in reduced commitment of worker man ship (machinery) and therefore leaving the communities to their fate as far as proper solid waste collection and disposal is concerned. Another challenge as was said by the LC 111, "we are not supported by the lower LC's (LC 1, LC 11)" in matters of waste management yet the component of water and sanitation is usually their responsibility. This has led to shortage of information about proper solid waste collection, and disposal, poor revenue mobilization and ignorant disposal among others and the resultant effects.

The time of collection and disposal of wastes was cited as a bottleneck, as the garbage given its nature of mixing of biodegradable and non biodegradable, takes long before it is collected in (skips, open dumping areas, litter bins, among others) and the time interval from the previous collection date has its impacts especially when the garbage rots, that's to say, aesthetic conditions, air pollution, acts as a breeding ground. The skips are collected once in a week.

According to NEMA (2003), waste management regulations are part of the Ugandan policies relating to landfill use where by operators of a waste disposal site must be licensed by NEMA.

The license can be applied for within ninety (90) days before commencement of business and is valid for one year and is renewable. In addition, an EIA must be carried out before the establishment of waste disposal site or landfills and there after an operator of a disposal site shall carry out an annual Environmental Audit of his site or plant and shall submit the reports to NEMA. In this regard, the establishment of an open dumpsite at Moru apesur ward for the dumping of all sorts of wastes from all corners of Eastern division did not take into consideration the above regulations. Hence like the saying that “when two elephants fight, it is the grass that suffers” here the communities are left to their fate.

4.6 The measures put in place to ensure efficient solid waste management.

Several measures pertaining efficiency of solid waste management as far as collection and disposal is concerned have been put in place some of which include but not limited to;

The Management of Eastern division, the government of Uganda, NEMA and DED together with the local grass root environment committees with help from the municipality most profoundly environment department have conducted awareness campaigns through use of radio programs(Voice Of Teso radio from 8:15pm to 8:45pm every 1st and 3rd Tuesday of the month). The television programs on UBC(Uganda Broadcasting Television) on Mondays 7:30-8:30pm (NEMA, 2007) as one means by which information on environment and waste management may reach communities on the other hand, community meetings may also be organized, use of Newspapers especially the local dailies like ETOP, New vision and Daily monitor, Newsletters like NEMA news, workshops, tree talk(straight talk) programme are avenues through which the populace gets information of proper waste collection and disposal.

The management of Eastern Division has tried as much as it can to restrict the medical waste dumping since they are very harmful to the local residents in the area (most of these wastes are either dumped in a pit latrine or burnt in an ash pit) which still does not conform to environmental standards.

There has been routine collection of wastes in open dump sites, litter bins and disposed off to the sanitary landfill by the use of machinery (municipal solid waste collection vehicles). These first

and foremost , speeds up the process of removal unwanted materials from the communities before the expected effects in case of delays in waste collection and disposal hence little or no impact on human health.

Also, enforcement of laws that exist on public health regulations is one measure being undertaken to ensure efficient waste collection and disposal by the responsible authorities like NEMA, local government, DED and the local communities depending on the task each is subduded to fulfilling for instance NEMA provides tractor trials and skips for waste dumping and transportation respectively without deviating from the set guidelines in the national constitution. There has been provision of inputs that facilitate the solid waste management for instance; NEMA has given this division some items like tracks, decomposing manure facility, self-loading and offloading tractor, turning equipment, maintenance costs chattered and payment of laborers to some extent. Also, as an incentive NEMA, local government, DED carryout sensitization of communities on waste management (solid waste) this in time both short and long run helps have a clean environment for everyone.

Community participation has also been embarked where by the effected population are engaged in activities to do with decision making for instance on the placing of skips, litter bins, open dumpsites and landfills; this is so because the community suffer directly from sustainability, so by involving them, then they will own this facility hence running smoothly of the venture.

The local governments, NEMA, DED NGO always conduct routine monitoring/inspection of the public health in the division with special emphasis on solid waste management. Monitoring therefore, makes communities change their attitude on ways of collection and disposal, improve on health and conduct efficient solid waste management thus improving on public health.

Whereas reducing, recycling and reusing are some of the measures of solid waste management under the different stages of collection and disposal, the populace in Eastern division practices these measures unaware. The most common one is the reuse of some items like containers for potting of flowers and other seedlings as observed in one of the homes in Akisim estate.

CHAPTER FIVE

5.0. CONCLUSION AND RECOMMENDATION

5.1. Conclusion

Generally, solid waste management in Soroti municipality, Eastern division is still unsustainable despite efforts by the local government, NEMA, DED NGO and local communities to ensure that the communities interact in harmony with unwanted material.

Management of solid wastes always begins from the point of generation then follows until the time it is disposed off in the sanitary landfill, this process requires special attention from stakeholders responsible together with the community that is affected hence efficiency in solid waste management.

The findings of the study therefore indicate that the methods of collection and disposal of solid wastes are still inefficient given the high population growth rates in Eastern division.

The collection methods include use of vehicles (24%), wheel barrows (4%), bicycles (9%), others are (63%) that is, use of jerry cans, sacks, polythene bags and other containers transported by human beings through carrying on heads. The vehicle and trucks have been donated by NEMA through Soroti district local government to the Environment department which in turn allocated them to management of Eastern division.

The disposal methods are comprised of sanitary landfills (11%) burning or burying (23%), rubbish pits (1%), open dumping (22%), indicating that burning or burying and open dumping are preferred by most residents. Others include use of latrines, incinerators and cremation, pig or animal feeds accounting for 43%.

Lack of collaboration between the collection and disposal systems coupled with lack of awareness among other issues is the basic foundation of inefficiency of these systems. Inefficiency in the sense that; the frequency of skip collection is low, limited use of the skips by the residents, and inadequate funding thus delayed salaries of workers.

The challenges associated included indiscriminate and ignorant disposal of solid wastes hence enhancing open dumping leading to environmental pollution, lowering scenic values, diseases

prevalence like malaria and air borne diseases. There's lack of awareness by the residents regarding solid wastes, lack of separation or sorting skills of the solid wastes, poor location of skips.

Measures put in place include; creating awareness through radio talk shows, local dailies like ETOP, NEMA newsletters, workshops, new vision and Daily monitor.

Emphasis on strict handling of medical wastes, routine collection of wastes by municipal collection vehicles, enforcement of laws, community participation, monitoring, and the 3R's.

5.2 Recommendations

Waste management being a complex issue in such a growing urban town, I would recommend that the authorities responsible like NEMA, DED, Local Government provides more incentives for waste collection and disposal, such as machinery, timely collection and disposal of solid wastes, timely payment of workers and others, hence efficiency in solid waste management.

In addition, community participation in this venture should be treated as a special case if solid waste management is to become a success especially in ensuring proper public health in these communities.

Monitoring and surveillance should be emphasized by the local governments and the relevant authorities to ensure that the local communities follow the proper guidelines that are set up by the environmental departments.

Further, there should be increased allocation of funds by the Local Government towards environment management especially the neglected solid wastes. This will help to facilitate proper execution of better environment management like timely payment of laborers for monitoring and enforcing laws, among others.

More environmental education programs should be incorporated in order to create awareness to the local communities about proper solid waste management should equally become a priority if environmental sustainability is to be achieved.

The laws and policies must be made very clear to all the stakeholders in order to avoid frequent conflicts between the law enforcers and the local communities.

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RESEARCH QUESTIONNAIRE:

Am called Eniru Emmanuel Innocent from Soroti district, Arapai Sub County, pursuing a Bachelors of Science degree in Environmental Management from Kampala International University. Am carrying out research on assessing the efficiency of solid waste management systems in Eastern Division of Soroti municipality. I will be sincerely grateful towards your cooperation in making this research a success. The information that you provide shall be kept very confidential.

RESEARCH TOPIC

ASSESSMENT OF THE EFFICIENCY OF SOLID WASTE MANAGEMENT SYSTEMS IN EASTERN DIVISION, SOROTI MUNICIPALITY, EASTERN UGANDA.

(Tick once in the boxes for each question with options and fill in the spaces provided below with the necessary information).

BIBLIOPGRAPHY

Respondent number.....

Cell (LC 1).....

Ward (LC 2).....

Division (LC 3).....

District

Country.....

RESPONDENT'S BACK GROUND

1. Sex: Male ☐ Female ☐

2. Age interval: 15-25 ☐ 26-35 ☐ 36-45 ☐ 46-55 ☐

3. What is your level of education?

Primary ☐ O'level ☐ A' Level ☐ vocational ☐
University ☐ Not applicable ☐

4. What is your occupation?

Peasant ☐ Doctor ☐ Teacher ☐ business ☐
Housewife ☐ any other ☐

5. Marital status

Married ☐ single ☐ widow ☐ widower ☐

6. How many are you in the family?

Parents ☐ children ☐ others ☐

For the management of Eastern Division offices, Local leaders and NGOs

7. What are the different methods of collecting solid wastes in this community?

.....

8. What are the different disposal methods of solid wastes that you encourage?

Sanitary landfills ☐ Burning/burying ☐ open dumping ☐
Incineration ☐ Any other, specify

9. Are you contented with the existing collection and disposal systems in this area?

Yes ☐ No ☐

If not, why?

10. Do you manage the solid wastes independently?

Yes ☐ No ☐

If not, then to which NGOs do you tender the management of solid wastes?

11. What are the equipments that you use for the collection and transportation of solid wastes to the disposal sites in this community?

12. Does the frequency of collection and transportation meet the unending solid wastes generated in this community?

Yes ☐ No ☐

If not, then why?.....

13. Do your disposal methods contain the solid wasters to the required standard hence avoiding environmental pollution?

Yes ☐ No ☐

If yes, then how?

14. In your own view, do you think the private individuals and organizations perform efficient solid waste management services?

15. What are the biggest challenges facing your office regarding the management of solid wastes in this community?

16. What have you done in an attempt to overcome these challenges?

17. What are the related authorities associated with the management of solid wastes doing to overcome these prevalent challenges?

.....

18. Do you provide basic information in form of environmental education to the local community regarding proper solid waste management?

Yes ☐ No ☐

If yes, then what kind of information and how do you deliver it?

.....

19. What has your office done to ensure proper solid waste management?

.....

20. What inputs has the government provided to facilitate proper solid waste management systems?

21. Which is the commonest measure that you have put in place to enhance proper solid waste management? Environmental education ☐ Laws and policies ☐

Community participation ☐ reducing, recycling and reusing ☐

Monitoring ☐ Any other, specify

22. Has any of the above measures brought improved the management of solid wastes?

Yes ☐ No ☐ If yes, then how?

.....

.....

Thank you very much and May God Bless You Abundantly.

RESEARCH QUESTIONNAIRE:

Am called Eniru Emmanuel Innocent from Soroti district, Arapai Sub County, pursuing a Bachelors of Science degree in Environmental Management from Kampala International University. Am carrying out research on assessing the efficiency of solid waste management systems in Eastern Division of Soroti municipality. I will be sincerely grateful towards your cooperation in making this research a success. The information that you provide shall be kept very confidential.

RESEARCH TOPIC

ASSESSMENT OF THE EFFICIENCY OF SOLID WASTE MANAGEMENT SYSTEMS IN EASTERN DIVISION, SOROTI MUNICIPALITY, EASTERN UGANDA.

(Tick once in the boxes for each question with options and fill in the spaces provided below with the necessary information).

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District

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University Not applicable

4. What is your occupation?

Peasant ☐ Doctor ☐ Teacher ☐ business ☐

Housewife ☐ any other ☐

5. Marital status

Married ☐ single ☐ widow ☐ widower ☐

6. How many are you in the family?

Parents ☐ children ☐ others ☐

For the general respondents (youth, men and women)

7. What are the different methods of collecting solid wastes in this community?

Vehicles ☐ Bicycles ☐ Wheel barrows ☐

Any other, specify.....

8. What are the different disposal methods of solid wastes that you encourage?

Sanitary landfills ☐ Burning/burying ☐ open dumping ☐

Incineration ☐ Any other, specify

9. Are you connected with the existing collection and disposal systems in this area?

Yes ☐ No ☐

If not, why?

10. Does the frequency of collection of solid wastes by the relevant authorities conform to your desires? Yes ☐ No ☐

If yes, then why?

11. Do you think your methods of disposing solid wastes meet the required environmental standards? Yes ☐ No ☐

If yes, then how?

12. In your own perspective, do you think the private individuals and NGOs perform efficient solid waste management activities? Yes ☐ No ☐

If yes, then how?

.....

13. What are the biggest challenges facing the proper management of solid wastes in this community?

.....

14. What have you done in an attempt to overcome these challenges?

.....

15. What have the relevant authorities associated with the management of solid wastes done to overcome these challenges?

.....

16. Have you ever accessed any information concerning proper management of solid wastes?

Yes ☐ No ☐

If yes, then what kind of information?

.....

.....

.....

17. What measures have the concerned authorities put in place to ensure efficient solid waste management?

Community participation ☐

Laws and policies ☐

Monitoring ☐

Environmental education ☐

Recycling and reusing ☐

any other, specify.....

18. Do the above measures interfere with your daily activities?

Yes ☐

No ☐

If yes, then how?

.....

Thank you very much and May God Bless You Abundantly.

Structured interview guide for the NGOs and local leaders in Eastern division.

1. Which solid waste management systems exist in your area of jurisdiction?

.....

.....

.....

2. What is the most efficient solid waste management system in your area?

.....

3. What methods do you apply for the collection of solid wastes?

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.....

.....

4. What methods do you use for disposing off the solid wastes in this area?

.....

.....

.....

5. How many sanitary landfills exist in this area?

6. How do you manage these sanitary landfills?

.....

.....

.....

7. How many municipal incinerators do you have and what type of solid wastes do they receive and burn?

.....

8. Where do you dispose the ash from the incinerators?

9. What is the most convenient and common method of solid waste disposal by your community?

Open dumping ☐ Burning ☐ Rubbish pits ☐

Sanitary landfills ☐ Recycling, reusing and reducing ☐

10. What is the frequency of solid waste collection from the designated areas?

.....

11. Which equipments do you use for the collection of solid wastes and are they sufficient enough?

.....

.....

.....

12. What are the challenges facing your office regarding the management of solid wastes?

.....

.....

.....

.....

13. What is your main source of funding for efficiently managing solid wastes?

.....

14. What is the response of the local community towards your services?

.....

.....

.....

15. How many NGOs exist in this area regarding solid waste management?

.....

16. What role do they play regarding solid waste management?

.....

.....

.....

17. What measures have you put in place to ensure efficient collection and disposal of solid wastes in this area?

.....

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.....

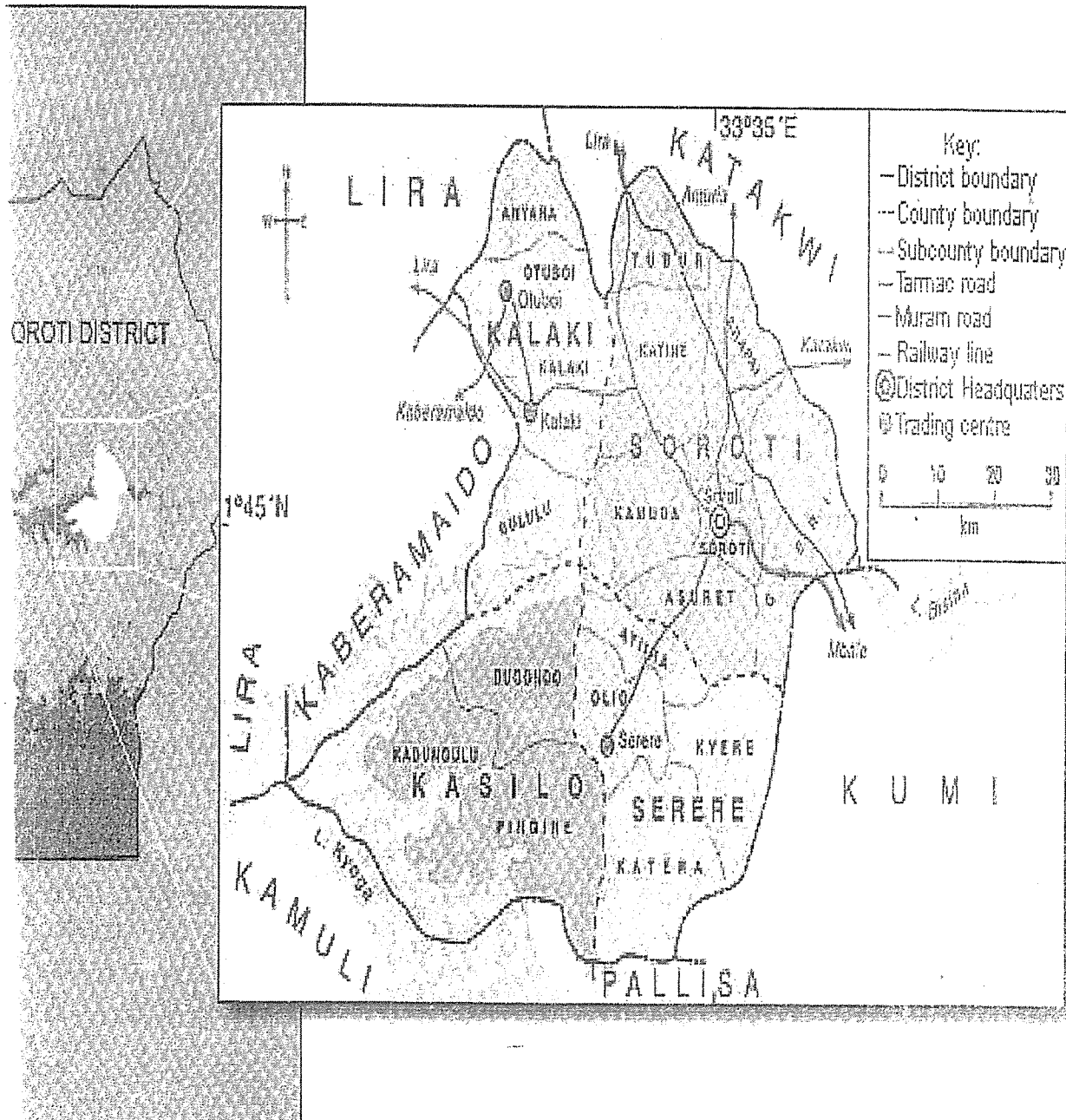
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Structured interview guide for the staff of Eastern division offices

1. Which solid waste management systems exist in your area of jurisdiction?
.....
.....
2. What is the most efficient solid waste management system in your area?
.....
3. What methods do you apply for the collection of solid wastes?
.....
.....
4. What methods do you use for disposing off the solid wastes in this area?
.....
.....
5. How many sanitary landfills exist in this area?
6. How do you manage these sanitary landfills?
.....
.....
7. How many municipal incinerators do you have and what type of solid wastes do they receive and burn?
.....
8. Where do you dispose the ash from the incinerators?
.....

9. What is the frequency of solid waste collection from the designated areas?
.....
.....
10. Which equipments do you use for the collection of solid wastes and are they sufficient enough?
.....
.....
11. What are the challenges facing your office regarding the management of solid wastes?
.....
.....
12. Do you receive enough funding from the local government for the management of solid wastes?
13. What alternative means do you employ to raise enough revenue for the proper management of solid wastes?
.....
.....
14. How many NGOs exist in this area regarding solid waste management?
.....
15. What role do they play in regard to efficient solid waste management?
.....
16. What measures have you put in place to ensure efficient collection and disposal of solid of solid wastes?.....

THE MAP OF SOROTI DISTRICT

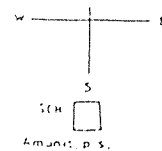




P.O. Box 109
Soroti-Uganda



Scale 1:25000



KEY

- HC Health Centre
- SCH School
- H Hospital
- SMC Soroti Municipal Council Offices
- L.G.D. HO Local Government District Headquarters
- p.s. Primary School
- Forest Plantation
- Estate Cadastral Boundary
- Existing Soroti Town Boundary
- Internal Divisions Boundary
- Roads

