ETERMINANTS OF EFFECTIVE SOLID WASTE MANAGEMENT IN KAKAMEGA MUNICIPALITY, KENYA/[7]

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DECLARATION

This research project is my original work and has neve* been presented for any award in any other university.

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This research project has been submitted for examination with my approval as the university supervisor.

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DEDICATION

This project is dedicated to my wife Jackline Kerubo for the moral support she offered to

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ABBREVIATIONS AND ACRONYMS

EMS	Environmental Management System
H&S	Health & Safety
IHEI	International Hotels Environment Initiative
ISO	International Organisation for Standardisation
KMC	Kakamega Municipal Council
LCA	Life Cycle Assessment
MOH	Ministry of Housing
MRF	Material Recovery Facility
NEMA	National Environmental Management Authority
NGO	Non-Governmental Organisation
NIMBY	Not in My Backyard
4Rs	Waste Reduction, Reuse, Recycling and Recovery
SWM	effective Solid Waste Management
UNEP	United Nations Environment Programme
US-AEP	United States - Asia Environmental Partnership
WTO	World Tourism Organization

ABSTRACT

Management of increasing amounts of solid waste has become a major challenge in many cities in developing countries. Municipalities are spending significant resources to address this problem, but the overall situation is far from satisfactory and rapid and haphazard urban growth is making the problem worse. In developing countries, municipal solid waste contains on average around 50% organic matter and 30% recyclable materials, meaning that potentially 80% of waste can be recycled. The purpose of this study vyas to establish the determinants of effective Solid Waste Management in Kakamega Municipality, Kenya and explore opportunities for waste reduction and recycling. The study had the following objectives: to examine how economic factors influence effective Solid Waste Management in Kakamega Municipality; to establish the extent to which technical factors influence effective Solid Waste Management in Kakamega Municipality; to determine how institutional factors influence effective Solid Waste Management in Kakamega Municipality and to establish how social factors influence effective Solid Waste Management in Kakamega Municipality. The study employed descriptive survey research design whose purpose was to determine Municipality Solid Waste (SWM) management challenges of Kakamega Municipality in Kenya. The target population consisted of all four respondents from NEMA. 62 employees from Kakamega Municipality. 40 employees from Ministry of Public Health and Sanitation and 16 employees from the Ministry of Housing (MOH), since a census study was carried out. The respondents were selected through cluster sampling and purposive sampling techniques. The research instruments used were the questionnaire and an interview schedule. On the validity of the instruments, the researcher used content validity while pilot testing process was used to test reliability of the research instruments comparing with a Pearson product moment of 0.5. The researcher then analysed the data and presented the results in form of frequency tables. The study found out that economic factors had low levels and this led to inefficient effective Solid Waste Management in Kakamega Municipality. Technical factors had margi[na]' associations on the effectiveness of effective Solid Waste Management. Institutional factors like municipality's lack of public awareness on SWM. the municipal council's lack of [a] policy on waste reduction at the source and on involving community groups and lack of clear authorities and sanitation rules negatively and significantly influenced the effectiveness of effective Solid Waste Management. Social factors such as social conditions °f social workers, stakeholders' participation and distance of dumpsite/contaiH[er an]d deep rooted corruption in the councils that made it hard to follow the stiputed environmental laws by NEMA negatively and significantly influence effectiveness of effective Solid Waste Management on effective Solid Waste Management. The study therefore made the following recommendations: the government should allocate enough finances for provision of SWM services within municipality and to increase the MSW's capacity to manage waste from a larger number of hotels, more employees need to be hired for collection, sorting, composting and management. Educational activities such as the organisation of conferences, seminars and workshops, publication of training manuals, case studies and best practices, and provision of technical and financial assistance should be conducted. The findings of this study may be useful to the Ministry of Health, academicians, [r]esearchers and other stakeholders in Ministry of Health in their improvement of policies and Practice

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Solid wastes could be defined as non-liquid and nongaseous products of human activities, regarded as being useless. It could take the forms of refuse, garbage and sludge (Leton and Omotosho, 2004). Solid waste is a serious dilemma for environment and health in the whole world and particularly in Palestine. Consistently garbage is not collected or disposed properly. Solid waste is left on the streets uncollected, randomly dumped, and sometimes burned. All these practices severely harm Palestinian environment and health in many ways. Waste left on the streets create unpleasant odors and is breeding ground for vermin and insects causing illnesses; hazardous materials from randomly and incorrectly dumped waste can seep into and pollute water resources, including groundwater -main drinking-water source in Palestine. Polluted earth and water reach the human body, via drinking water, vegetables, and animal products, while burning solid waste pollutes the air, causing serious health risks, including respiratory infections, cancer, and other illnesses (ARIJ, 2009).

Dealing with the environmental costs in rapidly growing economic development, urbanization and improving living standards in cities have led to an increase in the quantity and complexity of generated waste, representing a phenomenal challenge (UNDP, 2004). This is particularly true in the area of effective Solid Waste Management. While cities are generating an ever-increasing volume of waste, the effectiveness of their solid waste collection and disposal systems are declining. In urban centers throughout African regions, less than half of the solid waste produced is collected, and 95 percent of that amount is either

indiscriminately thrown away at various dumping sites on the periphery of urban centers, or at a number of so-called temporary sites, typically empty lots scattered throughout the city (Mohammed 2003).

Municipal solid waste (SWM) management constitutes as one of the most crucial service provision challenges facing African towns and cities (Achankeng, 2003). Due to the economic melt-down experienced in Zimbabwe during the ten years, between 2000 and 2010, many challenges militated against sound urban effective Solid Waste Management. These challenges included the inability of municipalities to supply safe water to residents, inability to dispose of, sewage and the breakdown of infrastructure and service delivery in SWM management activities from waste generation, storing, collection, and safe disposal. Uncollected garbage is a serious environmental hazard for all, especially in areas where the roads are not accessible for collection by the municipality. These cause bad smells and attract various disease vectors and pests resulting in deteriorated aesthetic quality of the city. Thus, the health situation of the community is under serious threat (ENDA 2006). This study focuses on key elements of institutional and financial arrangements, regulatory frameworks, economic instruments, privatization, technology choices and occupational health and safety of solid waste workers (Habitat 1994).

Administration of urban areas in Kenya is the responsibility of local authorities and the Ministry of Local Government. In 1991, there were 109 local authorities in Kenya. These are divided into four categories: 20 municipalities (including Kakamega); 22 town councils; 39 county councils; and 28 urban councils (Bubba and Lamba, 1991). Services provided by

municipal governments in large urban areas include: primary education, health services, road construction and maintenance, water supply, sewerage, housing, effective Solid Waste Management, drainage, markets, and social services.

These problems are exacerbated by political difficulties at the Kakamega County level. Councillors are more concerned with the private accumulation of wealth than with the efficient management of urban services (Bubba and Lamba, 1991: 42). There are also poor relations between the politicians and chief officers in the Municipality. The Kakamega Municipality has been at the centre of these controversies. These organizational, fiscal and political problems faced by central and local government in Kenya have resulted in an inability to cope with the staggering rates of population growth and rural to urban migration. There is excessive strain on existing facilities and under-investment in new ones. Education, health facilities, and urban services (including waste management) are especially affected. Some communities receive little (in some cases no) solid waste collection services because local governments have no resources to cover all households. Thus, in the absence of collection services, households use forms of disposal most of which are heavily polluting. According to ENDA (1999), the city has a limited sewerage system,

1.2 Statement of the Problem

Inaccessibility due to the geographical and urban structure, lack of properly designed collection route system and time schedule, inadequate and malfunctioning operation equipment. open burning of garbage, poor condition of the final dump site, littering of the corner around the skips which encouraged illegal dumping are the main technical problem

facing most municipalities. Insufficient funds as well as lack of promotion on-waste reduction: recycling, absence of cost recovery, practice of energy option, waste separation and composting are among the financial challenge. Social problems encountered include: lack of public awareness, illegal dumping, poor condition of waste workers, lack of private sector and community involvement. Incompetence of organizations in terms of equipment required for operation and man power/staff qualifications, training and human resource developments/ and unreliable service are the institutional challenge that the municipalities encounter (Regassa, Sundaraa and Seboka. 2011).

Kakamega Municipality does not have sufficient funding, lacks technological know-how and improper legislation, thus, influencing negatively effective Solid Waste Management process. There is also deep rooted corruption that makes it hard to follow the stipulated environmental laws by National Environmental Management Authority (NEMA). Inadequate garbage dumping sites and negative attitudes from the community have led to unsatisfactory effective Solid Waste Management (Mwaura, 1991). This study therefore, sought to establish the determinants of effective Solid Waste Management in Kakamega Municipality, Kenya.

1.3 Purpose of the Study

The purpose of the study was to establish the determinants of effective Solid Waste Management in Kakamega Municipality, Kenya.

1.4 Objectives of the Study

The objectives of the study were:

1. To examine how economic factors of Kakamega Municipality influence effective Solid Waste Management.
2. To establish the extent to which technical factors of Kakamega Municipality influence effective Solid Waste Management.
3. To determine how institutional factors of Kakamega Municipality influence effective Solid Waste Management.
4. To establish how social factors of Kakamega Municipality influence effective Solid Waste Management.

1.5 Research Questions

The research questions which were used in this study were:

1. How do economic factors of Kakamega Municipality influence effective Solid Waste Management?
2. What is the extent to which technical factors of Kakamega Municipality influence effective Solid Waste Management?
3. How do institutional factors of Kakamega Municipality influence effective Solid Waste Management?
4. How do social factors of Kakamega Municipality influence effective Solid Waste Management?

1.6 Significance of the Study

The high rate of population growth and urbanization, together with economic growth, not only accelerates consumption rates in developing cities, but it also accelerate the generation of waste. The amount of waste is rising to levels that are both difficult and costly to manage. It is envisaged that the study findings will be of significant benefit to the Municipal Council, Ministry of Housing, NEMA, Ministry of Health, future researchers, academicians and policy makers. It will give an insight into the SWM management affecting performance of Municipal Councils in Kenya and globally. It will provide the policy makers with information on the national policies because these policies are now being formulated in several countries, but a lack of effective enforcement of environmental regulations is a major problem. Therefore, the findings from this study will be useful in addressing the determinants of effective Solid Waste Management in Kakamega Municipality, Kenya.

1.7 Delimitations of the Study

This study was delimited to Kakamega municipality in Kakamega County. Secondly, the study confined itself to the waste disposal by the households and businesses. Thirdly, the study focused only on Municipal Council Staff, Ministry of Public Health and Sanitation, **NEMA** staff and Ministry of Housing. The study did not include households and business people as the respondents. Sludge and human waste which were regarded as liquid waste problem were outside the scope of SWM.

1.8 Limitations of the Study

The researcher encountered the following barriers and challenges: the interviews used in the data collection although had many advantages, it was time consuming and costly and the researcher overcame this by setting timeframes within which the interviews were conducted to save time and reduce costs.

1.9 Assumptions of the Study

The study was based on the following assumptions: SWM is a challenge and affects Kakamega Municipality; the respondents were co-operative and gave voluntarily accurate information; all respondents were honest, objective and found appropriate time to fill the questionnaires and respond interview schedules. It was also assumed that the findings and recommendations of the study may be useful to the relevant stakeholders, Ministry of Health, Ministry of Housing, future researchers, academicians and policy makers.

1.10 Definition of Significant Terms

Waste: is as any substance or object which the holder discards or intends or is required to discard. Wastes are substances or objects which are disposed of or are intended to be disposed of or are required to be disposed of by the provisions of national law.

Solid **Waste (SW):** - broadly defined as including non-hazardous industrial, commercial and **domestic** refuse including household organic trash, street sweepings, hospital and **institutional** garbage, and construction wastes. Generally sludge and human waste are

regarded as a liquid waste problem outside the scope of SWM. SWM, commonly known as trash or garbage (US), refuse or rubbish (UK) is a waste type consisting of everyday items that are discarded by the public. SWM can be classified in several ways:

a. Biodegradable waste: food and kitchen waste, green waste, paper (can also be recycled).
b. Recyclable material: paper, glass, bottles, cans, metals, certain plastics, fabrics, clothes, batteries etc.
c. Inert waste: construction and demolition waste, dirt, rocks, debris.
d. Electrical and electronic waste (WEEE) - electrical appliances, TVs, computers, screens, etc.
e. Composite wastes: waste clothing, Tetra Packs, waste plastics such as toys.
f. Hazardous waste including most paints, chemicals, light bulbs, fluorescent tubes, spray cans, fertilizer and containers
g. Toxic waste including pesticide, herbicides, fungicides
h. Medical waste.

Local Authorities: Local authorities in Kenya are the bodies controlling local governance in Kenya. Kenya has four classes of local authorities: *City, Municipality, Town* and *County* council. Currently there are three authorities with city status: Nairobi, the national capital, Mombasa and Kisumu. A Municipalities and towns are other forms of urban authorities and generally named after their central town. County councils are essentially rural. Each district has a maximum of one county council, such that they cover all area not taken up by urban authorities. County councils are usually named after their respective districts, which

often bear the same name as the district capital. Thus county councils are often named after a major town, but their land area may cover the surroundings, not the town itself.

Stakeholders: term that is often used to describe those participating in a decision making process, including those potentially affected by a decision and those knowledgeable about the subject of a decision. It also implies those individuals or groups that have specific concerns and roles to play in the subject of SWM.

1.11 Organisation of the Study

This study has been organised into five chapters: this chapter one looks at the background of the study on the determinants of effective Solid Waste Management of Kakamega Municipality, Kenya and explore opportunities for waste reduction and recycling, statement of the problem, purpose of the study, objectives of the study, research questions, significance of the study, assumptions of the study, scope of the study, limitations and delimitations of the study and definitions of significant terms used in the study. Chapter two is comprised of literature review that is relevant to the research topic, and includes SW generation, collection, transfer, processing and disposal; determinants of effective Solid Waste Management ; strategic options for SWM improvement and optimal performance and conceptual framework. Chapter three provides a detailed methodology to be used into this research in terms of research design, target population, sample procedure and size, research instruments, validity and reliability of instruments, data collection procedures, data analysis techniques and operational definition of variables. Chapter four provides data analysis and discussions

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CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter reviews the literature of some of the municipalities in the world on the determinants of effective Solid Waste Management in Kakamega Municipality, Kenya. The literature focuses on the purpose of identifying major the key determinants, challenges and suggesting possible solutions.

2.2 SW Generation, Collection, Transfer, Processing and Disposal

Waste management has always been part of human society and its study reveals a wealth of details over the way of life it results from. For example, paleontology relies for a large part on the study of wastes (such as bones or broken utensils) to generate the knowledge we have of prehistoric civilizations. Waste management consists of waste prevention, reuse, material recycling, composting, energy recovery and final disposal. Today, unlike in previous historical periods, this covers a very wide variety of materials, activities, industrial sectors and actors. A typical feature of the current reality is too often the lack of involvement and feeling of responsibility of the generator of waste for its fate. For example, in the Western World, too few households are concerned by their municipal solid waste beyond the regular [a]nd barely noticed visit of the garbage truck. The same holds true for some companies. It is therefore essential, for an efficient waste management, to develop and maintain a sense of [res]Ponsibility and a good common understanding of the materials and operations involved [0Ve]nhe whole range of actors concerned, leaving the door open to the use of common sense.

The functional elements of effective Solid Waste Management system typically include: waste generation (sources, quantity, composition, storage); collection; transfer and transportation; processing or treatment; and final disposal (Jindal *et al*1998). In developing countries, municipal solid waste contains on average around 50% organic matter and 30% recyclable materials, meaning that potentially 80% of waste can be recycled (Habitat, 1994). Compared to industrialised countries, the waste is dense and has high moisture content since it is composed primarily of organic matter (Habitat, 1994). Per capita waste generation rates are lower in developing countries than in industrialised countries because of lower levels of prosperity and consumption, and extensive recovery and reuse of materials before and during waste collection (Jindal *et a*/., 1998). In Indonesian cities, it is estimated that waste pickers reduce refuse quantities by one third (Furedy, 1990).

Growing urban populations and increasing consumption levels result in increased waste generation. As well, industrialisation and modernisation result in changes in waste composition as products such as plastic bags replace banana leaves. The use of plastic bags to package and carry goods has proliferated in Asia. Asians produce a higher proportion of plastic waste than Europeans and Americans (Jindal *et al*., 1998). Uncontrolled dumping is widely practiced in Asian developing countries because of rapid urbanisation and lack funding, resources and space for landfills (Jindal *et al.,* 1998). Household source separation is not very popular in developing countries because people view the handling of waste as

of solid waste increases inefficiencies in the recycling system because materials become contaminated and dispersed (Jindal *el al*., 1998).

Recycling through source separation has been found to provide more materials that are of better quality compared to waste picked out of mixed waste streams (Furedy, 1997). However, source separation is a relatively new topic compared to studies of waste pickers (Furedy, 1997). Waste reduction, reuse, recycling and recovery (the 4Rs) is being promoted as a way of reducing disposal costs, reducing the burden on landfills and reducing environmental impacts. The environmental benefits of the 4Rs include: reduction of greenhouse gases, reduction of pollution of air, land and water, conservation of water, energy and resources, and reduction of the amount of waste requiring disposal (Center for the Study of Law and Politics, 1991). In the major cities of Asia, the recycling industries already have the technological skills, equipment and processes for recycling most kinds of wastes (Habitat, 1994). However, large quantities of solid wastes still remain for disposal in Asian countries, indicating that the potential to recycle larger quantities of waste exists (Jindal *el al.,* 1998). A study of waste management in Bangkok, Jakarta, Kanpur, Karachi and Manila indicated that the average recycling rate is 7.5%, however, the estimated potential recycling rate is between 70-80% (Habitat, 1994).

The viability of recycling operations depends on local circumstances and technical, organisational and economic considerations (Jindal *el al*., 1998). The success of hundreds of reprocessing enterprises in developing countries demonstrates the viability of recycling endeavours (Marti, 1991; Lardinois and van de Klundert, 1995). However, "virtually all of

the opportunities for easy and profitable recovery are already being exploited" (Jindal *el al.,* 1998:94). Making recycling a viable endeavour is challenging because of collection, transportation, sorting, cleaning and processing costs involved with upgrading the quality of recycled materials (Jindal *el al.*, 1998). Waste management planners interested in the possibility of increasing waste recovery must address the challenges associated with "mixed wastes which make up most of the solid waste currently disposed of without recovery" (Jindal *etal.,* 1998:94).

Waste is viewed as a resource when economic incentives exist. A clear economic incentive to recover materials exists when materials "are available in pre-separated, concentrated and relatively uncontaminated form, e.g.. in industrial sectors, and where the materials have high inherent value and, collection and processing costs are comparatively low" (Jindal *et al.,* 1998:94). Local small-scale reprocessing industries can make reasonable profits when investment requirements are relatively low, waste materials are cheap, and production processes are relatively reliable and technically uncomplicated (Lardinois and van de Klundert, 1995; Thanh, Lohani, Tharun, 1978).

In most cities of Asian developing countries, resource recovery is managed predominantly by the informal sector (Jindal *et al*1998). These traditional waste recycling activities provide employment opportunities and are cheaper to operate than western systems of waste management (Haight, 1995). The informal sector's recycling activities are common not because of ecological concerns, but because they are a means of alleviating poverty and •mproving economic livelihoods (Razeto and Hemelryck, 1991; Fernandez, 1997a).

Materials of value are recovered at various stages of the waste management system (that is, storage, collection, transfer and disposal). Although seeming to be casual, the informal sector's waste recovery activities can be highly organised (Jindal *et al*., 1998). There can also be a high level of specialisation in materials selected for recovery and a high level of creativity involved with home-based recycling activities (Thomas-Hope. 1998). Itinerant waste buyers travel door-to-door purchasing waste items from householders. Waste pickers recover items of value along streets, at transfer stations and at dumpsites. In some countries, municipal waste collectors salvage materials during collection (Jindal *et al*1998). Materials are sold to waste dealers, who in turn sell the materials to waste wholesalers and manufacturers (Furedy, 1990).

There are a limited number of studies into the amount of waste produced in Tasmania, or Australia generally. In 1985 the average production of waste material in Australia was 800 kg per capita (Waste and Resources Advisory Committee, 1985). A survey conducted in 1989 estimated that councils in Australia collect an average of 370 kg of waste per person each year (APE. (2001). The APE (2001) found that in 1996-97 21.2 million tonnes of solid waste was received and disposed of at landfills.

A survey was conducted by Dowson (1991) of 356 households in Greater Hobart. The average household waste generated for collection was 9.1 kg per week or 472.5 kg each year. The survey found that waste deposited for each year for kerbside disposal collection constituted the following. While the survey provides a useful baseline study, it is important

that current studies are undertaken to better understand changes in the patterns of household waste generation.

Solid waste generation in Maine increased from 2006 to 2007, from 1,989,266 tons to 2 066,448 tons. Recycling efforts of both public and private programs continued but were unable to maintain the 2006 recycling rate of 36.2 percent, with it slipping to 34.8 percent, due to the increase in the tonnage of waste generated. The state has unused, permitted disposal capacity that will meet Mainers[1] needs until at least 2015, with potentially permittable capacity for another 15 to 20 years beyond that. Residents and businesses in Maine generated 2,066.448 tons of waste in 2007, a three (3) percent increase over waste generation experienced in 2006. This increase varies from recent year's solid waste generation, where it has been fairly stable. Residents and businesses in Maine generated 2,066,448 tons of waste in 2007, a three (3) percent increase over waste generation experienced in 2006. This increase varies from recent year's solid waste generation, where it has been fairly stable.

In Palestine, solid waste generation is growing rapidly, an estimated 4.0% growth per year, promising a future of increased costs, along with greater human health and environmental impacts. The total daily tonnage of household-produced solid waste in the West Bank is 1,728.2 tons (PCBS, 2006). As for waste composition it varies; 67% is organic waste, Paper/paperboard and plastic comprise up to 19% and 17% respectively, while other Materials comprise small fractions of the waste stream (Doug and AL-Khateeb). Composting

and recycling are not undertaken in a formal sense. Recycling by the informal sector occurs, but its impact on the waste stream has not been quantified.

Waste collection systems have left large areas (estimated to be 27.8%) of towoMI^ without coverage. The majority of solid waste (99%) is managed through land disposal in landfills and 69% in open dumps. Open dumps have proliferated in recent years as a result of restrictions on access to established waste disposal sites; at least 450 illegal dumps have been established in the West Bank, even as municipalities were taking steps to rehabilitate established dumps (Doug and AL-Khateeb) (ARIJ. 2009).

The results from 250 households interviewed in the Town of Chinhoyi, ZimfcsN that there was a high amount of biodegradable waste (47.1%) made up of as Pflt (which included hedge cuttings, tree and shrubs pruning, and weeds) and food Has generated in Chinhoyi urban. Plastics (24%) also constituted a high percentage of the generated. The amounts of biodegradable waste generated in Chinhoyi Townajrii other towns and countries. In the European Union the average biodegradable®^ from households was 40% (Wullt, 2010). In the Kenyan Capital, NairoBliiaiffij Otiato (2007) reported a biodegradable component of 40% of the total SWMfeii border post, the biodegradable levels were 72%, while in Marondera, the tail Technology Consultants (1998) reported 43% of SWM being biodegradabk(.Weib <2011).

The results also revealed that each household generated an average of 2.7 kilograms per day, which was translated to 985.5kg per year, per household. Results from the survey showed that there were, on average, 8 people per household in Chinhoyi town, with a population of 56,000. This was translated into 7,000 households in the town. The residents of the town generated, on average, 6,895 tons of SWM per year, of which 47% is bio-degradable (3,240 tons). The amount generated per household, per day was about three times the 0.8kg level of the Sakubva suburb with a population of 62,419 in Mutare (about 5,600 more people in Sakubva than Chinhoyi Town), which was reported by Manyanhaire, Sigauke, and Munasirei.(2009). The figures for Sakubva high density suburb appeared very low. compared to Chinhoyi town, due to the fact that the Sakubva study was done when the country was experiencing severe food and commodities shortages due to the economic meltdown (Musademba, *et al*., 2011).

The major waste generated by businesses surveyed, which included retail supermarkets, hotels and restaurants included plastic bags and boxes, food waste from catering services, food spoilage from failure of cold storage facilities due to electricity power outages, and butchery food waste. However, the quantities generated by the businesses could not be quantified. Indications showed that the amounts could be as much as that which was generated by households (Musademba, *et al*, 2011).

2.3 Determinants of Effective Solid Waste Management

Using the instrument of questionnaire, interview and personal observations, this study also [see]ks to evaluate the common solid waste disposal options, the level of awareness on waste

management; the effect of gender, age and educational status on effective Solid Waste Management and reasons for not using an appropriate waste collection service (WCS) in traditional cities in Nigeria, taking Abeokuta as a case study. Age, educational status, and amount charged for waste collection services had been identified as factors influencing effective Solid Waste Management in highly populated cities like Ibadan and Lagos (Ajani, 2007; Sridhar *et al.,* 1985):

Several factors influence the solid waste generation in many municipalities and cities. Lack of advanced technology, facility for separation at source, strength of effective Solid Waste Management policy and enforcement, environmental education and awareness and income status of individuals among others, are factors affecting solid waste scenario in Nigeria. Abel (2009) showed that education, income and social status are important factors influencing per capita solid waste generation in Ogbomosho, Oyo state. Age, location, occupation and amount charged for waste collection are determinant factors for using public waste collection services in Ibadan (Ajani, 2007). The quantity and categories of solid waste generation also varies with socio-economic groups in which the high and middle groups take the lion share (Sridhar *et al.,* 1985).

With regard to composting, the households practicing composting are very few, while 95% of this refuse is largely plant origin /biodegradable/organic waste. According to Gardner (2001), as cited in Bezaye (2008), composting is an ancient practice where more cities in the world nowadays are reclaiming the benefits of reusing solid organic waste material. It is a natural way to prepare the waste for use. It was observed that there are people who know at

least the use of organic waste for soil fertility improvement. There are also some people who have training in composting, but are not practicing. The major limitation for not practicing compost as indicated by the respondent is lack of market and a piece of land for urban agriculture (Regassa, Sundaraa and Seboka, 2011).

2.3.1 Economic Factors and Effective Solid Waste Management

Poor effective Solid Waste Management in the developing countries consists of a major threat to Ministry of Public Health and Sanitation and environmental quality, and reduces the quality of life, particularly for the poorer residents in both urban and rural areas. One of the principal reasons for the inefficient SWM systems in the developing countries is the financial constraint. As SWM is given low priority in the developing countries, except in capital and large cities, very limited funds are provided to the SWM sector by the government. This is especially true for the small towns and rural areas, where the local taxation system is inadequately developed, and therefore the financial basis for public services, including SWM. is very weak (Wang, He, Kim and Kamata, 2011).

From an economic point of view, the —public goodll nature of SWM services means that there are important social benefits that need to be taken into account in deciding the level of services to be provided, even though governments may have limited financial capacity. Gomes and Nobrega (2005) show that, if the economic, social and environmental components are all quantified, the benefit-cost ratio for a separate household waste collection a northeast region of Brazil could range from 1.27 to 1.77 depending on the economic quantification of the direct and indirect benefits.

To economically justify the need for better SWM services in the developing countries, good valuation studies on the potential benefits of such services are necessary. Several techniques for assigning economic values to SWM services have been used in the literature, including travel cost (Anex, 1995), hedonic housing price (Arimah, 1996), choice modeling or experiments (Huhtala, 1999; Othman, 2002; Naz and Nazm 2005 and Boyer, 2006 and Jin et al. 2006). But the method that is used the most is the method of contingent valuation or ranking; a non-exhaustive research in the literature gives a list of 19 contingent valuation studies in this area (Caplan *et al.,* 2002; Othman, 2002; Bluffstone and DeShazo, 2003; Huang and Ho, 2005). Evidence from the existing research suggests that the estimates of environmental and public good benefits from well-designed and properly executed contingent valuation surveys appear to be at least as good as estimates obtained with other valuation techniques (OECD, 1994, Mitchell and Carson 1989, Whittington *et al*., 1990).

Insufficient funds as well as lack of promotion on-waste reduction: recycling, absence of cost recovery, practice of energy option, waste separation and composting are among the financial challenge. Households who have a better income do not use container services (only 2.2%). This is due to their access to door-to-door service since they can afford the payment for the service. In some areas of the study, especially in the formerly rural Kebeles, the containers were not even available the way they were in the former years. 73% households responded that there are no containers in their surroundings (Regassa *et al*., 2011).

Waste recycling is expensive. Though recent years have seen an increase in the number of waste recycling facilities the economics of recycling is still not very favourable. In many cases recycling waste is expensive compared to buying the product. Government support in terms of cheaper land for landfills, subsidies is often necessary for commercial viability. There is under developed market for recycled products. Insufficient demand for recycled products in the local market is another reason, which has hampered the growth of the waste recycling industry. There are a few units engaged in recycling waste paper, paperboard and plastics (Gautama, 2008).

Recycling of waste paper, paper board, metals and glass is already practiced in GCC albeit at very small scale. Currently around 88 percent of the total waste generated in Dubai sent to landfills, which is high as per international standards. With only 12 percent of the total waste being recycled (Data for Dubai) recycling is set to increase. As waste management practices become more efficient across the region, waste recycling is likely to be more attractive commercially. Waste to energy opportunity: planning authorities across the region are contemplating setting up waste to energy facilities. The market for such technologies is likely to see rapid growth over next few years. Dubai municipality has planned a waste to energy plant with capacity of 6000t/d. Equipment Suppliers: increased focus on waste management represents a growing market for suppliers of compactor trucks, garbage bins, incinerators and other auxiliary equipment (Gautama, 2009 and Yusuf and Oyewumi, 2008).

2.3.2 Technical Factors and Effective Solid Waste Management

Inaccessibility due to the geographical and urban structure, lack of properly designed collection route system and time schedule, inadequate and malfunctioning operation equipment, open burning of garbage, poor condition of the final dump site, littering of the corner around the skips which encouraged illegal dumping are the main technical problem facing most municipalities Sridhar *et cil*1985). The researchers observed the following technical and social problems: The site which is surrounded by residences is getting full; many human scavengers work continuously and obviously living nearby the site and interfering work operation at the site for collection of materials such as wood, scrap metals and discarded food. The site is characterized by no leached treatment, no odour or vector control, no rainwater drain-off, no fencing, the area is unprotected area for children, women and scavengers and there is no large scale composting facility available as a disposal option. All of waste collected from the city is dumped in this single place without separation of even organic waste Ukem, 2008).

One of the amazing actions observed in the dump site during data collection was that there is continuous burning of the dumped waste due to internal ignition by the waste itself. According to a study conducted in 2005, the organic waste that goes to landfill sites not only pollutes the land and water but also contributes to global warming by producing methane (CH4). So there should be a way to divert the organic fraction of the waste from the landfill to where it can be used for soil fertility (Regassa *et ai,* 2011).

The current practice of collecting, processing and disposing municipal solid wastes is also considered to be least efficient in the developing countries. The typical problems are —low collection coverage and irregular collection services, crude open dumping and burning without air and water pollution control, the breading of flies and vermin, and the handling and control of informal waste picking or scavenging activities (Bartone, 1995). Although some cities do spend significant portions of their municipal revenues on waste management (Coitreau, 1984, 1994; Thomas-Hope, 1998; Schubeler, 1996 and Bartone, 2000), they are often unable to keep pace with the scope of the problem. Senkoro (2003) indicated that for many African countries, only less than 30% of the urban population has access to —proper and regular garbage removal.

According to the Mogale City Local Municipality State of Environment Report (SOER, 2003), 2003), the following are major challenges that face Mogale City in terms of effective Solid Waste Management: (i) the rapidly growing population has resulted in increasing volumes of domestic waste; (ii) lack of refuse removal service in the rural area and informal settlements; (iii) the refuse removal service is ineffective, mainly due to old trucks and equipment as well as staff shortages; (iv) waste management is fragmented in view of the lack of integrated waste management planning and systems; (v) non-prioritisation of waste management by the municipality and other spheres of government (National and Provincial), Particularly in terms of budget allocation and funding of waste programmes; (vi) non-payment of services by the communities and businesses in the area; (vii) illegal dumping and Ottering in open spaces and unmanaged parks; (viii) the various mining and industrial activities in the area result in waste production, which includes hazardous waste and the type

and quantity of hazardous waste produced per sector per year is unknown; (ix) lack of community awareness in terms of waste management issues, particularly issues pertaining to waste prevention, minimisation, re-use and recycling and increased costs of waste disposal in view of the stringent legislative requirements in this regard.

2.3.3 Institutional Factors and Effective Solid Waste Management

Generally, there are three basic types of collection equipment: these are human powered, animal powered, and engine powered. Under the Addis Ababa situation, both human and motorized collection equipment are being used. With regard to the human aspect, transportation of wastes to the containers is possible using hands and hand pushed carts. In each Kebele, strategic locations are assigned where collectors make ready for the motorized collection. Most of the areas in the city are inaccessible for motorized collection; therefore, the human powered collection system is mostly used. The current trend of storage bins used in the city of Addis is not standardized bins, and dust bins are located only on main roads with the assumption that those roads are the popular ones. For temporary storage, households prepare different types of receptacles such as baskets, card boxes, and bamboo made containers, cans, plastic bags and barrels. Only 65% of the SWM generated in Addis Ababa is collected and disposed off by the municipal in the land fill, about 5% is recycled, 5% composted and the rest 25% is dumped in uncontrolled environment like on/in streets, empty spaces, and river banks (AASBPDA, 2003).

Sometimes the dumpsite construction was not done according to stipulated regulations. It was not compacted, and was without lining at the base. Leachates were forming ponds at the

dump site. Further tests need to be carried out to determine the effect of the leachate on underground water sources, as the land slopes towards an approaching settlement. The study observed that wastes at the site comprised plastics, paper, glass, metals, used oil debris, asbestos car brake linings, medical waste, and pop cans. There was no segregation of waste done prior to or during the waste disposal. The mixture of waste poses health hazards to scavengers who are active at the site. Some mothers were seen feeding their babies at the site. The Chinhoyi dumpsite was characterized by indiscriminate fires and several leachate ponds. The dumpsite attendant reported that the waste remained uncovered for more than 5 months due to lack of equipment. Such a condition promoted the breeding of disease vectors, such as houseflies. The leachate from the dumpsite could pollute the underground water, which is an important alternative water source for the residents situated close to the dumpsite (Musademba *el al*., 2011).

2.3.4 Social Factors and Effective Solid Waste Management

Social problems encountered include: lack of public awareness, illegal dumping, poor condition of waste workers, lack of private sector and community involvement. Incompetence of organizations in terms of equipment required for operation and man power /staff qualifications, training and human resource developments/ and unreliable service are the institutional challenge that the municipalities encounter. Folorunso and Awosika (2001) related flooding in Lagos to clogging of drainage channels by dumped solid wastes. There is abundant release of gaseous toxic substances into Nigerian environment as well as Jeopardizing of health of scavengers as a result of burning of obsolete e-wastes. Due to

contact with smokes from burning of solid wastes and gaseous emission from dumpsites, cases of several diseases have been recorded (Oyelola *el al.*, 2009).

According to Gautama (2008), the following are some of the challenges and opportunities presented by the SWM sector are as follows: weak waste collection, transportation and handling infrastructure. In most GCC countries the existing waste handling capacity is insufficient. There is need to streamline the waste collection and transportation operations as intermingling of hazardous waste and municipal waste is not uncommon. In addition, the efficiency of the sorting process needs to be improved. Presently recyclable recovery rate is low. Further, in the absence of local recycling facilities, there is no alternative except to dump the otherwise recyclable material at Landfills.

Waste collection and transportation services: a number of private players are active in the waste collection and transportation market. At present around 70 percent of the total waste in Dubai is collected by private sector. There is good growth potential for such services in the market. Management of landfill operations by municipalities and private companies, for example, Singapore-based Keppel Corporation is setting up an integrated waste management facility in Qatar. Once the facility is operational, the company will also be responsible for its operations and maintenance for 20 years (Abel, 2009). (see further details of plates 1, 2 and 3 containing dumping sites and dustbins in Kakamega Municipality).

Municipal solid waste (SWM) management has become a major issue of concern for many under-**developed** nations, however, especially as populations increase. The problem is

compounded as many nations continue to urbanize rapidly; 30-50% of populations in many developing countries is urban (Thomas-Hope, 1998) and in many African countries the growth rate of urban areas exceeds 4% (Senkoro, 2003). Although developing nations do spend between 20 and 40% of municipal revenues on waste management (Thomas-Hope 1998, Schubeler 1996, Bartone, 2000), this is often unable to keep pace with the scope of the problem. In fact, when the governments of African countries were asked by the World Health Organization to prioritize their environmental health concerns, the results revealed that while solid waste was identified as the second most important problem (after water quality), less than 30% of urban populations have access to "proper and regular garbage removal" (Senkoro, 2003).

Some of the central sustainability issues surrounding waste management in Kakamega include: Inefficient resource use the land filling of materials that still have value, perhaps in a different form, the increasing shortage of land where waste can be buried, the large distances over which waste is transported , health implications of hazardous waste and recent implications about landfill sites , polluting effects of landfill sites gas (including methane) emissions and liquid runoff , the economic folly of unnecessary and excess packaging .excess consumption driven by the forces of lifestyle marketing and designed obsolescence

The relationship between waste pickers and society is an important issue in SWM in developing countries. The contribution of waste pickers to waste recycling is often not appreciated by governments and residents who tend to view waste pickers as outcasts who are a nuisance and security threat (Chaturvedi, 1998). Many politicians and residents oppose

waste pickers because they can interfere with collection and dumping operations (Jindal *et al*1998; Thomas-Hope, 1998). In general, people involved with waste management have "very low social and economic standing because society perceives that dealing with something which is dirty and thrown away by others is demeaning" (Habitat, 1994).

The informal sector often comprises of poor and lowly educated people who have migrated to the cities from rural areas in search of employment (Habitat, 1994). Waste pickers face low social esteem, long work hours, precarious conditions and health hazards (Jindal et al. 1998). Within the informal recycling sector, waste pickers receive the lowest profit margins and are often vulnerable to exploitation by waste dealers (Habitat, 1994). Changes to the waste management system can threaten the means of survival for people working in the informal sector (Lardinois and van de Klundert, 1995).

To improve the welfare of waste pickers, integration of waste pickers into the SWM system has been promoted (Chaturvedi, 1998). However, this can be challenging because of resistance to waste pickers who are suspected to be involved with illegal activities (Furedy, 1997). Furedy (1997) promotes source separation efforts, as well as continuing efforts to improve living and working conditions for the poor, with recognition that the different goals of stakeholders in SWM can lead to conflict regarding street picking, Ministry of Public Health and Sanitation concerns and efficient management of solid waste.

2.4 Strategic Options for SWM Improvement and Optimal Performance

Considering the serious challenge currently faced by all municipalities in managing their waste and the large amount of resources that is being wasted in this process, there is an urgent need for municipalities to learn from the few successful innovative practices and replicate them. There has been an emergence of biodegradable solid waste in the production of organic fertilizer and possible use in the production of biogas. Some researchers have studied the great potentials in Nigeria's municipal solid wastes to produce enormous amount of methane gas (Yusuf and Oyewumi, 2008). Mixtures of manure and ashes from burning of urban solid wastes have been used for soil amelioration to boost agricultural productions in Jos (Pasquini and Alexander, 2003). . For this to happen, the following strategic options need to be taken seriously (SWMRMC, 2004 and Pokhrel *et al*2005):

a) All municipalities should develop strategies to establish effective and efficient integrated waste management systems with private sector and community participation. The central government and other partners can provide technical support and guidance in this process. Furthermore, the strategies have to be formulated in a participatory manner and they have to be followed up with annual plans and budgets and the progress should be carefully monitored.

Municipalities need to design systems that will maximize separation and management of waste at source in order to reduce the total amount of waste that is disposed and the cost associated with it. This will require active engagement with local communities to raise awareness, skills and motivation to do household composting and recycling. Source

separated collection systems, distribution of compost bins and "Suiro" system for plastic waste collection are innovative systems that have been tried out and can be replicated.

c) As waste collection is the most expensive part of any waste management system, municipalities need to increase the efficiency of their waste collection systems. This may be done by introducing on-time or door-to-door collection system. The practice of dumping waste on the street so that it can be swept and collected has to stop as it is highly inefficient and results in environmental pollution.

d) In order to maximize waste recycling the private sector should be encouraged to set up and operate waste recycling and composting facilities.

e) Non-recyclable waste should be managed in sanitary landfills with appropriate systems for pollution control such as buffer zones, proper drainage, and covering material.

f) Hazardous medical waste should not be mixed with ordinary waste. They should be collected and managed separately.

g) As the cost associated with municipal waste management can be very high, the **municipality** should seek ways to optimize the system and collect service fee from the people **to in** order to ensure that the waste management system as a whole is financially sustainable.

h) The private sector and community groups can be involved in waste management to **reduce** cost and increase efficiency. However the process of involving the private sector **should** be clear and transparent and the municipality should carefully monitor the **performance** of the private operator.

Zimbabwe National Waste Management Strategy objectives include the following: to ensure involvement and participation of all stakeholders in waste management; to develop

waste management enterprises among Central Business Organizations and Industries; to develop a sound technical National Waste Management Strategy for the collection, transportation, treatment, and final disposal of all types of waste in Zimbabwe, with the aim to improve and safeguard Ministry of Public Health and Sanitation and welfare; and to further promote resource recovery and environmental protection, among other objectives (Madebwe and Madebwe, (2006).

In Asian countries, the general public is "still unmindful of its crude ways of disposing of wastes" (Jindal *et al.,* 1998:43). Vandalism, social alienation and disregard for property are not uncommon (Thomas-Hope 1998). Premature introduction of SWM reforms could result in adverse effects such as "illegal dumping, burning of household garbage and the bribing to collection staff to take up materials for which they are not responsible" (Figueroa, 1998:39).

In developing countries, a cultural transformation is needed to solve waste management problems (Figueroa 1998). Cultural transformation can be measured in terms of changes in perceptions regarding roles and responsibilities concerning waste and the environment in **general,** and participation in formal and informal organisations (Figueroa, 1998; Thomas-**Hope,** 1998). Environmental education and student involvement are needed to cultivate **ecological** literacy and empower the public to investigate issues, make decisions and take **action** (Collins-Figueroa, 1998; Figueroa. 1998). Education and public awareness are key elements of any strategy involving public participation and source separation, however, it **[ta]kes time** to raise awareness and gain public support. The minds and behaviour of the

population need to be redirected towards the shared goal of maintaining a beautiful, clean and healthy environment (Thomas-Hope, 1993).

Environmental awareness and the willingness of people to voluntarily participate in waste reduction and sorting programs are indicators of social capital in the environmental field (Figueroa. 1998). In response to SWM problems and growing environmental awareness, citizen groups have begun to participate in waste management projects in Asian cities (Furedy, 1997). Community participation, incentives and legislation must be based on citizens understanding environmental issues (for example, resource use, waste production, waste management costs) and being prepared to change their daily lives (Working Group III 1992, Figueroa, 1998). Development of this social capital involves cultivating popular consciousness, knowledge, organisation and experience to support significant changes in behaviour patterns, social interactions and relationships between individuals and between the individual and society (Figueroa, 1998).

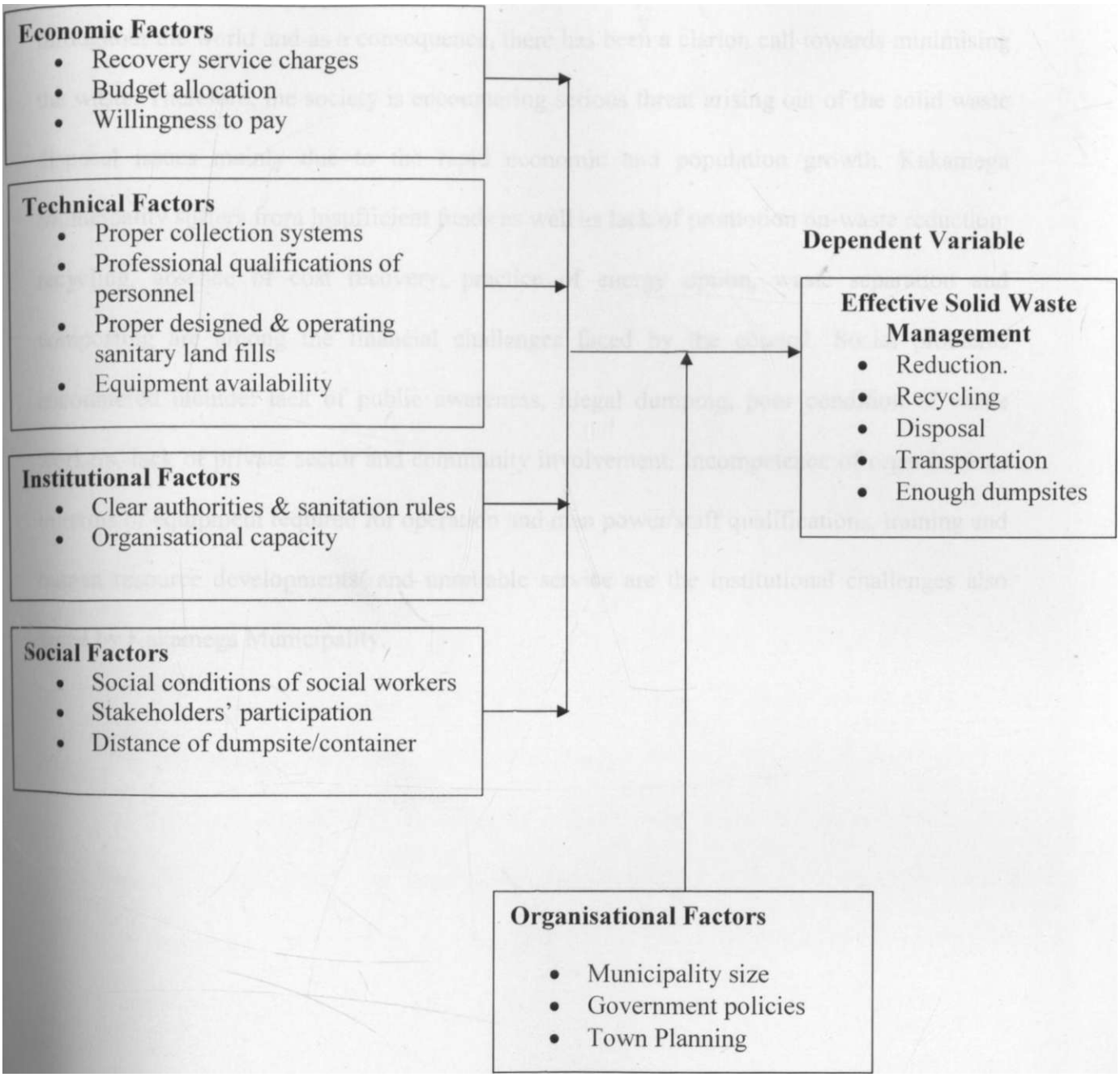
2.5 Conceptual Framework

According to UNDP (2004), effective Solid Waste Management is a complex task which must go beyond purely technical considerations to political, institutional, social, financial, and economic aspects. Based on literature review, discussion with experts, empirical studies, and personal observation, the conceptual framework for the study is formulated. The study hypotheses that technical factors, political factors, institutional factors, social factors, economic factors (independent variables) have a direct influence on the effective Solid ^asle **Management** (SWM) as shown in Figure 1. The arrows show the interrelationships

among the variables of the study. This study will be moderated by organisational factors like municipality size, resource base and government policies on SWM.

Conceptual Framework

Independent Variables



Moderating Variables

•Surely

•tree-u ''nce Ptual Framework showing Interrelationships between Key Variables of the Study

Marcher (2002)

2.6 Knowledge Gap

The rapid growth in population and change in life style has increased the household wastes throughout the world and as a consequence, there has been a clarion call towards minimising the waste. Therefore, the society is encountering serious threat arising out of the solid waste disposal issues mainly due to the rapid economic and population growth. Kakamega Municipality suffers from insufficient funds as well as lack of promotion on-waste reduction: recycling, absence of cost recovery, practice of energy option, waste separation and composting are among the financial challenges faced by the council. Social problems encountered include: lack of public awareness, illegal dumping, poor condition of waste workers, lack of private sector and community involvement. Incompetence of organizations in terms of equipment required for operation and man power/staff qualifications, training and human resource developments/ and unreliable service are the institutional challenges also faced by Kakamega Municipality.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter consists of the research methods to be used in carrying out the study. It includes research design, location of study, target population, sampling procedures and sample size, research instruments, validity and reliability of research instruments, data collection procedures and data analysis techniques.

3.2 Research Design

This study adopted a descriptive survey design. Descriptive survey research is a research method involving the use of questionnaires and/or statistical surveys to gather data about **people** and their thoughts and behaviours. A survey is an attempt to collect data from members of a population in order to determine the current status of that population with **respect** to one or more variables. Yin (1984) argues in favour of the use of descriptive surveys in fact-finding because they provide a great deal of accurate information. The **intention** of survey research is to gather data at a particular point in time and to use it to **describe** existing conditions. The descriptive nature of research will be used in order to gain **information** on the determinants of effective Solid Waste Management **in** Kakamega **Municipality,** Kenya.

3.3 Area of Study

The study was carried out in Kakamega Municipality located in Kakamega Central District, Western Province of Kenya. Kakamega District is one of the eight districts of Western Province. It borders Butere/Mumias and Bungoma District to the West, Nandi District to the East, Vihiga District to the South and Lugari District to the North. It is inhabited mainly by the Luhya people. The District lies between longitudes 34032" and 350 57'30"east of the prime meridian and latitudes 0007'30" North and North 0015" of the equator. There are seven administrative divisions comprising 27 locations and 97 sub-locations covering a total area of 1,394.8km^2. Quakerism is widely practised here. In 2009 the total population was of 73,607 inhabitants with an urban population of 57,128 within an area of 8,361 km^2 (Census Report, 2009).The climate is mainly tropical, with variations due to altitude. Kakamega district is mainly hot and wet most of the year. The dependency ratio stands at 100:108 an indication that most of the population is made up of dependants and hence the need to improve income levels to guarantee better standards of living.

Welfare Monitoring Survey II (1997) found out that 57.47 of the population were living below poverty line. The poverty situation in the district is attributed to high population growth rate, HIV/AIDs and poor economic performance. The most vulnerable groups include the landless, female-headed households, subsistence farmers, unemployed youths, street children, the elderly and HIV/AIDs orphans. The district lacks industries and hence agricultural produce are poorly marketed.

There are three local authorities in the district, namely Kakamega Municipal Council, Kakamega County Council and Malava Town Council. The three local authorities have thirty-seven electoral wards. Kakamega country council has 13 wards, Kakamega Municipal Council has thirteen wards, and Malava Town Council has four wards. There are four constituencies in the district namely, Ikolomani, Shunyalu, Malava and Lurambi. Municipality division had the highest population density of 1.485 persons per Km", followed by Ikolomani, Lurambi. Ileho, Navakholo, Kabras, and Shinyalu respectively (Kakamega District Strategic Plan 2005-2010) (see Appendix 4).

3.4 Target Population

The research was conducted in Kakamega Municipality having four major players in SWM that was, four employees from NEMA, 62 employees from Kakamega Municipality, 40 employees from Ministry of Public Health and Sanitation and 16 employees from the Ministry of Housing (MOH) who formed the target population (Kakamega Municipal Council, Ministry of Housing and Ministry of Public Health and Sanitation, 2012).

3.5 Sample Size and Sampling Procedure

The sampling procedure was guided by the general rule in most social science research which **suggested** that the use of the largest sample will facilitate generalization (Kline 1980). **Stratified** random sampling was used to categorise the four players into public health; **municipal** council, NEMA and MOH. A census study was carried out in all the four players, **that was, all** four respondents from NEMA, 62 employees from Kakamega Municipality, 40

employees from Ministry of Public Health and Sanitation and 16 employees from the Ministry of Housing (MOH).

3.6 Methods of Data Collection

The research instruments used in conducting this research were the questionnaires and interview schedules. The questionnaire as a tool will be used because it is familiar to most people (Berdie, Anderson, and Niebuhr. 1986). Nearly everyone has had some experience completing questionnaires and it generally does not make people apprehensive. When respondents receive a questionnaire in the mail, they are free to complete it on their own time-table. The questionnaire is a convenient tool especially where there are large numbers of respondents to be handled because it facilitates easy and quick derivation of information within a short time (Kerlinger, 2004).

The structured (closed-ended) and unstructured (open-ended) were used so as to get the responses from respondents (NEMA, MOH, Ministry of Public Health and Sanitation and Kakamega Municipality). The closed-ended questions provide a greater uniformity and more easily processed (China and Oteng'i, 2007). The structured questionnaires were accompanied by a list of all possible alternatives from which respondents select the suitable answer that describes their situation by simply ticking (Mugenda and Mugenda, 2003). The questionnaires were administered by the researcher or research assistants to avoid misinterpretation of questions by 'drop and pick* technique. Questionnaires are easy to analyze, and most statistical analysis software can easily process them. The responses are

gathered in a standardised way, so questionnaires are more objective. Generally it is relatively quick to collect information using a questionnaire.

The researcher used interview schedule since it provided face-to-face interaction with respondents and enabled the researcher to adapt the questions as necessary, clarify doubts and ensure that the responses were properly understood, by repeating or rephrasing the questions. The researcher can also pick up nonverbal cues from the respondent. This tool also gave the researcher an opportunity to get a chance to probe the key informants on issues that may not be captured in the questionnaire. Prior to taking part in the interviews, the researcher intended to give respondents an opportunity to adequately prepare themselves for the interview. It was anticipated to enable the interviewees to give accurate and relevant information.

3.7.1 Validity

Validity refers to the degree of accuracy and meaningfulness of inference based on research **results.** Content validity refers to the degree to which the content of the items reflects the **content** domain of interest. Is the content about what we say the test is about? (Miller, 2003). **Best** and Khan (2005) suggest that the validity of the instrument is asking the right questions **framed** from the least ambiguous way and based on study objectives. Validity of the data was **done** using content-related validity. This was done by presenting the instrument to the **supervisor** to evaluate the applicability and appropriateness of the content, clarity and **adequacy** of construction of the instrument and suggestions made and modified appropriately. This measures the degree to which data collected using a particular instrument

represents a specific domain of indicators or content of a particular concept (Mugenda and Mugenda, 2003). The indicators of variables were clearly defined and scrutinized and instruments developed to match them.

3.7.2 Reliability

Reliability of a research tool is realized if it yields consistent information or data after repeat measurements are taken under the same conditions. The tools were pre-tested (pilot testing) with the respondents from Bungoma Municipal Council and the data obtained was not included in the final analysis. The main purpose of pre-testing the research instrument was to identify any weaknesses and improve them. The pre-test was likely to give an indication of the time required to complete the tool. These respondents were retested a second time two weeks later and their consistency between the two sets of the score were computed using Cronbach's alpha coefficient which yielded an alpha of 0.88. Therefore, the instruments were found reliable since the alpha value obtained was to >0.7 (Nunally, 1998).

3.8 Methods of Data Analysis

Primary data collected from this study were analyzed using descriptive statistics including **cross** tabulation and frequency tables. Cross tabulation were used to understand two different survey items and how they related. Inferential statistics involving Pearson correlation **coefficient** and regression analysis were used to establish associations between the determinants of effective Solid Waste Management and effectiveness of effective Solid **Waste** Management. Data was analyzed by feeding it in a statistical package for social

3.9 Operational Definition of Variables

This section looks at the operational definition of variables as shown in Table 1.

Table 1: Operational Definition of Variables

Research Objectives	Data Collection Instruments	Source of Data	Measuring Scales	Data Analysis Techniques
To examine how economic factors influence effective Solid Waste Management in Kakamega Municipality	Questionnaires and interview schedules	Public health, Kakamega municipal council, NEMA MOH	Nominal, ordinal and interval	Descriptive statistics like frequencies, percentage and mean. Pearson correlation coefficient and regression analysis
To establish the extent to which technical factors influence effective Solid Waste Management in Kakamega Municipality	Questionnaires and interview schedules	Public health, Kakamega municipal council, NEMA MOH	Nominal, ordinal and interval	Descriptive statistics like frequencies, percentage and mean. Pearson correlation coefficient and regression analysis

To determine how institutional factors influence effective Solid Waste Management in Kakamega Municipality	Questionnaires and interview schedules	Public health. Kakamega municipal council, NEMA MOH	Nominal. ordinal and interval	Descriptive statistics like frequencies. percentage and mean. Pearson correlation coefficient and regression analysis
To establish how social factors influence effective Solid Waste Management in Kakamega Municipality.	Questionnaires and interview schedules	Public health, Kakamega municipal council, NEMA MOH	Nominal, ordinal and interval	Descriptive statistics like frequencies, percentage and mean. Pearson correlation coefficient and regression analysis

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION, INTERPRETATION AND DISCUSSION

4.1 Introduction

This chapter presents the results obtained from the study analyzed as per the four objectives of the study. The study had the following objectives: to examine how economic factors influence effective Solid Waste Management in Kakamega Municipality; to establish the extent to which technical factors influence effective Solid Waste Management in Kakamega Municipality; to determine how institutional factors influence effective Solid Waste Management in Kakamega Municipality and to establish how social factors influence effective Solid Waste Management in Kakamega Municipality. The questionnaire return rate was 100% since all 122 questionnaires were filled and returned.

4.2 Socio-Demographic Characteristics of the Respondents

4.2.1 Age

The study sought to find out the age brackets of the respondents in NEMA. Kakamega Municipality, Ministry of Public Health and Sanitation and the Ministry of Housing (MOH) by asking them to state their age ranges. This was to help determine the age distribution for the respondents. Their responses are shown in Table 2. Results in Table 2 showed that most respondents were in the age brackets of 21-50 years had a score of 86% and those above 50 years had 14%. From this statistics it is clear that majority of the respondents were in the age bracket of 21-50 years. This meant that majority of the respondents were mature middle age

people and understood the determinants of effective Solid Waste Management in Kakamega Municipality, Kenya.

Table 2: Age Distribution of Respondents in Kakamega Municipality, Kenya

Age distribution in years	Frequency	%
21-30 years	30	24.6
31-40 years	43	35.2
41-50 years	32	26.2
Above 50 years	17	14.0
T ^ l	122	100.0

This was the age group carrying the highest proportion of the population that is actively engaged in effective Solid Waste Management in Kakamega Municipality. These findings were consistent with the research carried out by Barth *et al* (1993) who found out that on the one hand, older workers were thought to be more reliable and to have better skills than average workers. On the other hand, older workers had higher health care costs, lower flexibility in accepting new assignments and then may be less suitable for training. Age alone was found to be a poor predictor of individual performance. There were wide variations although older workers were generally considered to be more consistent, cautious, and conscientious.

4.2.2 Gender

The study sought to find out the gender distribution among the respondents in NEMA, Kakamega Municipality, Ministry of Public Health and Sanitation and the Ministry of Housing. The respondents were asked to indicate their gender and the results were recorded in Table 3.

Table 3: Gender of Respondents in Kakamega Municipality, Kenya

Gender	Frequency	%
Male	77	63.1
Female	45	36.9
Total	**122**	**100.0**

From the results in Table 3, majority of the respondents were males (63.1%) while the rest were females (36.9%). It was an indication that more males participated in effective Solid Waste Management in Kakamega Municipality than females. Rekha and Gaonkar (2009) had noted that women in most developing countries have a low social and economic status and thus their participation in effective Solid Waste Management in Kakamega Municipality was hampered. The sentiments by Nnadozie and Rahman (2008) contradicted these findings by illustrating that woman play important roles and their position in meeting the challenges of agricultural production and development are quite dominant and prominent. Their relevance and significance, therefore, cannot be overemphasized. Findings from a study financed by the

United Nations Development Programme (UNDP) revealed that women make up some 60-80 percent of agricultural labour force in Nigeria.

4.2.3 Working Experience

The study sought to find out the experience of the respondents this was aimed at determining the number of working years and in turn know how much experience they had been exposed to concerning effective Solid Waste Management in Kakamega Municipality. The results are shown in Table 4. The results illustrated that 35.2% of the respondents had been working for less than 5 years, 16.4% had been working for a period of 5-10 years. 21.3% had been working for 10-15 years, 14% for 15-20 years and 13.1% for more than 20 years. This indicated that most respondents had enough experience, knowledge and skills concerning effective Solid Waste Management in Kakamega Municipality. The results seemed to indicate that experience, knowledge, competencies and skills increase with increase in years of performing the job.

Table 4: Working Experience of Respondents in Kakamega Municipality, Kenya

Years	Frequency	%
Less than 5 years	43	35.2
5-10 years	20	16.4
10-15 years	26	21.3
15-20 years	17	14.0
More than 20 years	16	13.1
	122	**100.0**

Competencies can be thought of as the state or quality of being well qualified to perform a task. A person gains competency through education, training, experience, or natural abilities. Klemp (1980) defined competence as '*an underlying characteristic of a person which results in effective and/or superior performance on the job." The study findings were supported by Bott *et al* (2003) regarding job performance and job experience. The findings showed that job experience impacts on task and contextual performance in distinct ways. Based on the assumption that task performance reflects proficiency in carrying out tasks detailed in a formal job description, it will increase as employees obtain specific job knowledge that allows them to perform the tasks at a higher level (Hattrup *et al*., 1998).

4.2.4 Educational Level

The study sought to find out formal educational levels of respondents in NEMA, Kakamega Municipality, Ministry of Public Health and Sanitation and the Ministry of Housing in Kakamega Municipality. This was to determine whether educational levels of respondents **had** an influence on the effective Solid Waste Management in Kakamega Municipality. To **help** understand this, respondents were asked to state their formal educational level. The results are recorded in Table 5. Results in Table 5 pointed out that 25.4% of respondents had certificates, 37.7% had diploma education level, 21.3% had degree education level, 14% had **masters'** degrees while 1.6% of respondents had PhD education levels. This showed that the **majority** of the respondents of in Kakamega Municipality had attained certificates and diploma (63.1%) educational level to understand the benefits and challenges of effective **Solid** Waste Management in Kakamega Municipality.

Table 5: Educational level of Respondents in Kakamega Municipality, Kenya

Educational level	Frequency	%
Others (Certificates)	31	25.4
Diploma	46	37.7
Bachelor's degree	26.	21.3
Masters	17	14.0
PhD	2	1.6
Total	**122**	**100.0**

With reference to results in Table 6, the respondents were asked to indicate whether educational level of respondents determined effective Solid Waste Management. The results indicated that the respondents who had acquired KCSE certificate had the following scores: strongly agree (20%), agree (5.4%) and strongly disagree (0%). Those respondents who had diploma certificates responded as follows: strongly agree (13.7%). agree (14%) and strongly disagree (10%); degree certificate holders had the **following** scores: strongly agree (14%), agree (7.3%) and strongly disagree (0%); master's holders had strongly agree (8%), agree (6%) and strongly disagree (0%) and PhD holders had strongly agree (0%), agree (1.6%) and strongly disagree (0%). This was a further prove that education levels of the respondents played a vital role on effective Solid Waste Management in Kakamega **Municipality.**

Table 6: Cross Tabulation Results between Educational Level and effective Solid Waste Management

Variables		Educational level of respondents					
	Responses	Others Certificate %	Diploma %	Bachelor's Degree %	Masters	PhD	**Total %**
effective Solid Waste Management	Strongly disagree	0.0	10.0	0.0	0.0	0.0	**10.0**
	Agree	5.4	14.0	7.3	6.0	1.6	**34.3**
	Strongly agree	20.0	13.7	14.0	8.0	0.0	**55.7**
Total		25.4	37.7	21.3	14.0	1.6	**100.0**

These findings agreed with the findings of Jackson *et al* (1991) who established that heterogeneity in whether group members had an undergraduate or graduate degree in business administration was associated with turnover at a marginal level of statistical significance. This was because educational diversity may enable a broader range of perspectives to be applied to strategic problem-solving, but this diversity may also result in efficient effective Solid Waste Management.

4.3 Economic Factors and Effective Solid Waste Management

This section focuses on how economic factors like recovery service charges, budget **allocation** and willingness to pay influence effective Solid Waste Management in Kakamega Municipality which was the first objective of the study.

Table 12: Institutional Factors and Effective Solid Waste Management

Variables	SA	A	U	D	SD
There is enough budget allocation for provision of SWM services within municipality	17(13.9%)	28(23%)	12(9.8%)	41(33.6%)	24(19.7%)
Municipality has the capacity to pay for those involved in collection of litter	10(8.2%)	28(23%)	7(5.7%)	45(36.9%)	32(26.2%)
Very limited funds are allocated for SWM sector by government	24(19.7%)	39(32%)	12(9.8%)	40(32.8%)	7(5.7%)
There is sufficient of funds for promotion of waste reduction, recycling and recovery	10(8.2%)	25(20.5%)	9(7.4%)	51(41.8%)	27(22.1%)

N = 122

Key: SA = strongly agree, A = agree, U = undecided, D = disagree and SD = strongly disagree

From the results in Table 7 on whether economic factors influence effective Solid Waste Management in Kakamega Municipality, showed that there were very limited funds allocated for SWM sector by the government: strongly agree (19.7%), agree (32%), undecided (9.8%), disagree (32.8%) and strongly disagree (5.7%); there is insufficient of funds for promotion of waste reduction, recycling and recovery: agreed (63.9%) and disagree were (28.7%). The results further pointed out that the municipality does not have the capacity to pay for those involved in collection of litter: strongly agree (8.2%), agree (23%), undecided (5.7%), disagree (36.9%) and strongly disagree (26.2%) and that there was no enough budget allocation for provision of SWM services within municipality: strongly agree (13.9%), agree **(23%),** undecided (9.8%), disagree (33.6%) and strongly disagree (19.7%).

Table 12: Institutional Factors and Effective Solid Waste Management

	Effective Solid Waste Management					
Economic Factors	Strongly disagree	Disagree	Undecided	Agree	Strongly agree	**Total**
Strongly disagree	11	1	2	5	8	27
Disagree	6	1	3	11	30	51
Undecided	0	3	2	0	4	9
Agree	3	2	1	5	14	25
Strongly agree	2	2	1	4	1	10
Total	**22(18%)**	**9(7.4%)**	**9(7.4%)**	**25(20.5%)**	**57(46.7%)**	**122(100%)**

According to the results from Table 8. the respondents were asked to indicate whether economic factors of respondents determined effective Solid Waste Management. The results illustrated that 67.2% of respondents agreed that economic factors indeed influence effective Solid Waste Management; 29.4% disagreed while 7.4% of respondents were undecided. The study findings disclosed that economic factors in terms of recovery service charges, budget allocation and willingness to pay influence effective Solid Waste Management were inadequate to promote effective effective Solid Waste Management in Kakamega Municipality. The research done by Wang. He, Kim and Kamata (2011) revealed that one of the principal reasons for the inefficient SWM systems in the developing countries is the financial constraint. As SWM is given low priority in the developing countries, except in capital and large cities, very limited funds are provided to the SWM sector by the government. This is especially true for the small towns and rural areas, where the local taxation system is inadequately developed, and therefore the financial basis for public services, including SWM, is very weak. This literature therefore, confirms the study

findings. Therefore, insufficient funds as well as lack of promotion on-waste reduction: recycling, absence of cost recovery, practice of energy option, waste separation and composting are among the financial challenge (Regassa *el al*., 2011).

Regression and correlation results in Table 9 revealed that there were low levels of budget allocation for provision of SWM services within municipality (B - 0.121, $p<0.05$ and r = 0.309**, $p<0.01$); municipality's capacity to pay for those involved in collection of litter (B = 0.266, $p<0.05$ and r = 0.384**, $p<0.01$) and sufficiency of funds for promotion of waste reduction, recycling and recovery (B = 0.180. $p<0.05$ and r = 0.223**, $p<0.01$) leading to inefficient effective Solid Waste Management. The findings from the interviews also confirmed that lack of finance, through inadequate budget allocation was never enough to purchase the livers which are used for segregation and disposal of the waste. Lack of enough financial allocation to the Municipal Council led to hiring of unskilled personnel who did not have adequate skills and knowledge in SWM.

Table 12: Institutional Factors and Effective Solid Waste Management

Dependent Variables	Unstandardized Coeffieients, 95% confidence level		Standardized Coefficients
	Regression coefficient, B	Std. Error	Pearson Correlation coefficient, r
There is enough budget allocation for provision of SWM services within municipality	0.121 p<0.05	0.089	0.309 (0.001)
Municipality has the capacity to pay for those involved in collection of litter	0.266 p<0.05	0.093	0.384" (0.000)
There is sufficient of funds for promotion of waste reduction, recycling and recovery	0.180 p<0.05	0.080	0.223" (0.011)

Dependent Variable: Effective Solid Waste Management

Constant/predictor variable: Economic Factor

** Correlation is significant at the 0.01 level (2-tailed).*

**Correlation is significant at the 0.05 level (2-tailed).Levels of significance, p-value for correlation coefficients are in parentheses.*

4.4 Technical Factors and Effective Solid Waste Management

This section focuses on the analysis of how technical factors like proper collection systems, professional qualifications of personnel, proper designed and operating sanitary land-fills and **equipment** availability influence effective Solid Waste Management in Kakamega **Municipality** which was the second objective of the study.

Table 12: Institutional Factors and Effective Solid Waste Management

Variables	SA		U	D	SD
Municipality is not efficient in waste generation, storage, collection, and safe disposal of waste	30(24.6%)	45(36.9%)	11(9%)	25(20.5%)	11(9%)
Municipality has enough equipment and personnel involved in SWM	9(7.4%)	25(20.5%)	9(7.4%)	57(46.7%)	22(18%)
Municipality has weak waste collection, transportation and handling infrastructure	36(29.5%)	40(32.8%)	10(8.2%)	28(23%)	8(6.6%)
There is a number of active private players involved in collection, transportation and disposal waste	15(12.3%)	33(27%)	7(5.7%)	36(29.5%)	31(25.4%)
There is very high waste generation within municipality which cannot be handled with available vehicles and equipment	30(40.2%)	43(35.2%)	7(5.7%)	38(31.1%)	4(3.3%)
Personnel involved in SWM have adequate qualifications and skills	7(5.7%)	22(18%)	8(6.6%)	44(24.6%)	41(33.6%)
Waste workers have poor working conditions	41(33.6%)	57(46.7%)	6(4.9%)	16(13.1%)	2(1.6%)

N = 122

Key: SA = strongly agree, A = agree, U = undecided, D = disagree and SD = strongly disagree

The results in Table 10 pointed out that the municipality was not efficient in waste generation, storage, collection, and safe disposal of waste: strongly agree (24.6%), agree **(36.9%),** undecided (9%), disagree (20.5%) and strongly disagree (9%); municipality did not **have** enough equipment and personnel involved in SWM: strongly agree (7.4%), agree **(20.5%),** undecided (7.4%), disagree (46.7%) and strongly disagree (18%); municipality had **weak** waste collection, transportation and handling infrastructure: strongly agree (29.5%), agree (32.8%), undecided (8.2%), disagree (23%) and strongly disagree (6.6%); there was

inadequate number of active private players involved in collection, transportation and disposal waste: strongly agree (12.3%), agree (27%), undecided (5.7%), disagree (29.5%) and strongly disagree (25.4%); there was very high waste generation within municipality which could not be handled with available vehicles and equipment: strongly agree (40.2%), agree (35.2%), undecided (5.7%), disagree (31.1%) and strongly disagree (3.3%); personnel involved in SWM did not have adequate qualifications and skills: strongly agree (5.7%), agree (18%), undecided (6.6%), disagree (24.6%) and strongly disagree (33.6%) and the results further showed that waste workers had poor working conditions: strongly agree (33.6%), agree (46.7%), undecided (4.9%). disagree (13.1%) and strongly disagree (1.6%).

Results in Table 11 show low levels of technical factors and had marginal association on the effectiveness of effective Solid Waste Management in Kakamega Municipality. For example, efficiency of Municipality in waste generation, storage, collection, and safe disposal of waste ($B = 0.030$, $p<0.05$ and $r = 0.211^{*}$, $p<0.05$); municipality having enough dumping sites ($B = 0.392$, $p<0.05$ and $r = 0.401^{**}$, $p<0.01$) and personnel involved in SWM have adequate qualifications and skills ($B = 0.064$, $p<0.05$ and $r = 0.239"$, $p<0.01$). This meant that technical factors were not efficient in addressing effective Solid Waste Management in Kakamega Municipality. The findings from interview schedules also confirmed the inability of the Municipal Council in handling solid waste because with an increase in population growth of 1.5 million people, the capacity of waste management has remained the same for **the** last 10 years, no additional dumpsites and instruments used in collection, storage and disposal of waste. The findings were supported by Sridhar *et al* (1985) who observed that inaccessibility due to the geographical and urban structure, lack of properly designed

collection route system and time schedule inadequate and malfunctioning operation equipment, open burning of garbage, poor condition of the final dump site, littering of the corner around the skips which encouraged illegal dumping are the main technical problem facing most municipalities. Findings from interviews mu interviews illustrated that the municipal Council did not have adequate resources in hiring 01 communis c community workers and other technical staff, Furthermore, the council did not have proper waste handling facilities such as waste bins and skps for temporarily holding domestic waste-

Table 11: Technical Factors and Effective Solid Waste Management

Dependent Variables	Unstandardized Coefficients, 95% confidence level Regression		Standardized Coefficients Pearson Correlation coefficient, r
Efficiency of Municipality in waste generation, storage, collection, and safe disposal of waste	0.030 p<0.05	0.091	0.211'(0.020)
Municipality having enough dumping sites	0.392 p<0.05	0. 085	0.401** (0.000)
Personnel involved in SWM have adequate qualifications and skills	0.064 p<0.05	0.092	0.239" (0.008)

Dependent Variable: Effective Solid Waste Management
Constant/predictor variable: Technical

"Correlation is significant at the 0-01 fed Correlation is significant at the 0.0o level V correlation coefficients are in parentheses.

b ofsignificance, p-value for

Table 12: Institutional Factors and Effective Solid Waste Management

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This section focuses on the analysis of how institutional factors like clear authorities and sanitation rules and organisational capacity influence effective Solid Waste Management in Kakamega Municipality which was the third objective of the study. The results on the intluence of institutional factors on effective Solid Waste Management in Table 12 pointed out that municipality lacked public awareness on SWM: strongly agree (30.3%), agree (37.7%), undecided (11.5%), disagree (13.9%) and strongly disagree (6.6%); there was lack of information about local initiatives concerning SWM management: strongly agree (25.4%), agree (45.9%), undecided (11.5%), disagree (14.8%) and strongly disagree (2.5%); The municipal councils lacked a policy on waste reduction at the source and on involving community groups: strongly agree (26.2%), agree (44.3%), undecided (8.2%), disagree (15.6%) and strongly disagree (5.7%) and the municipality lacked clear authorities and sanitation rules: strongly agree (27%), agree (36.1%), undecided (8.2%), disagree (19.7%) and strongly disagree (9%). The findings from the interview schedules indicated that the Municipal Council was inadequate in creation of awareness to the community on effective Solid Waste Management.

Table 12: Institutional Factors and Effective Solid Waste Management

Variables	SA	A	U	D	SD
Municipality lacks public awareness on SWM	37(30.3%)	46(37.7%)	14(11.5%)	17(13.9%)	8(6.6%)
There is lack of information about local initiatives concerning SWM management	31(25.4%)	56(45.9%)	14(11.5%)	18(14.8%)	3(2.5%)
The municipal councilslack a policy on waste reduction at the source and on involving community groups	32(26.2%)	54(44.3%)	10(8.2%)	19(15.6%)	7(5.7%)
Municipality lacks clear authorities and sanitation rules	33(27%)	44(36.1%)	10(8.2%)	24(19.7%)	11(9%)

N = 122

Key: SA = strongly agree, A = agree, U = undecided, D = disagree and SD = strongly disagree

Regression and correlation results in Table 13 revealed that municipality's lack of public awareness on SWM (B= -0.117, $p<0.05$ and r = -0.008, $p>0.05$), the municipal councils lack of a policy on waste reduction at the source and on involving community groups and lack of clear authorities **(B** = 0.37, $p<0.05$ and r = -0.273**,p<0-01) and sanitation rules negatively and significantly influenced the effectiveness of effective Solid Waste Management (B = -0.393, $p<0.05$ and r = 0.426**, $p<0.01$). The results conform to the findings of (AASBPDA, 2003) who found outiiat only 65% of the SWM generated in Addis Ababa is collected and disposed off by the municipal in the land fill, about 5% is recycled, 5% composted and the rest 25% is dumped in uncontrolled environment like on/in streets, empty spaces, and river banks.

Table 12: Institutional Factors and Effective Solid Waste Management

Variables	Unstandardized Coefficients, 95% confidence level		Standardized Coefficients	
	Regression coefficient, B	Std. Error	Pearson Correlation coefficient, r	P-value
Municipality lacks public awareness on SWM	-0.117 p<0.05	0.100	-0.008	0.927
The municipal councils lack a policy on waste reduction at the source and on involving community groups	-0.37 p<0.05	0.112	-0.273**	0.002
Municipality lacks clear authorities and sanitation rules	-0.393 p<0.05	0.098	-0.426"	0.000

Dependent Variable: Effective Solid Waste Management
Constant/predictor variable: Institutional Factors
*** Correlation is significant at the 0.01 level (2-tailed)*
** Correlation is significant at the 0.05 level (2-tailed')*

4.6 Social Factors and Effective Solid Waste Management

This section focuses on the analysis of how social factors such as social conditions of social workers, stakeholders' participation and distance of dumpsite/container influence effective Solid Waste Management in Kakamega Municipality which was the fourth objective of the study. Results in Table 14 on the influence of social factors on effective Solid Waste Management in Kakamega Municipality, disclosed that the community did not actively participate in the collection, transfer, disposal of the solid waste: strongly agree (4.1%), agree (18%), undecided (8.2%), disagree (32%) and strongly disagree (37.7%); waste workers had poor working conditions: agreed (80.3%) and disagree were (14.7%). The results further pointed out that there was deep rooted corruption in the councils that made it hard to follow the stiputed environmental laws by NEMA: strongly agree (31.1%), agree

(32.8%), undecided (16.4%), disagree (13.1%) and strongly disagree (6.6%). Therefore, social factors were inadequate in handling effective Solid Waste Management in Kakamega Municipality Results from interviews also cited poor attitude of people with an assumption that waste management was entirely the work of the Municipal Council as the community refuses location of dumpsites near their residences. The structures which were incomplete were usually turned into illegal dumpsites. Municipal Council lacked reinforcement on the measures put in place to ensure that occupants of the houses manage efficiently solid waste through recycling, reuse and proper disposal procedures.

Table 14: Social Factors and Effective Solid Waste Management

Variables	SA	A	U	D	SD
Community participates actively in the collection, transfer, disposal of the solid waste	5(4.1%)	22(18%)	10(8.2%)	39(32%)	46(37.7%)
Waste workers have poor working conditions	41(33.6%)	57(46.7%)	64.9%)	16(13.1%)	2(1.6%)
There is illegal dumping of solid waste	39(32%)	48(39.3%)	9(7.4%)	19(15.6%)	7(5.7%)
There is deep rooted corruption in the councils that makes it hard to follow the stiputed environmental laws by NEMA	38(31.1%)	40(32.8%)	20(16.4%)	16(13.1%)	8(6.6%)

N = 122

Key: SA = strongly agree, A = agree, U = undecided, D = disagree and SD = strongly disagree

With reference to Table 15, social factors like waste workers have poor working conditions (**B** = -0.095, $p<0.05$ and r = -0.247**, $p<0.01$), illegal dumping of solid waste (B = -0.086, **p**<0.05 and r = -0.244*". $p<0.01$) and deep rooted corruption in the councils that made it hard

to follow the stiputed environmental laws by NEMA (B = -0.148, $p<0.05$ and r = -0.070, $p>0.05$) negatively and significantly influence effectiveness of effective Solid Waste Management. Community active participation in the collection, transfer, disposal of the solid waste insignificantly influences the effectiveness of effective Solid Waste Management (B = 0.060, $p<0.05$ and r = 0.033, $p>0.05$).

Table 15: Social Factors and Effective Solid Waste Management

Variables	Unstandardized Coefficients, 95% confidence level		Standardized Coefficients	
	Regression coefficient, B	Std. Error	Pearson Correlation coefficient, r	P-value
Community participates actively in the collection, transfer, disposal of the solid waste	0.060 p<0.05	0.084	0.033	0.721
Waste workers have poor working conditions	-0.095 p<0.05	0.112	-0.247"	0.006
There is illegal dumping of solid waste	-0.086 p<0.05	0.090	-0.244"	0.007
There is deep rooted corruption in the councils that makes it hard to follow the stiputed environmental laws by NEMA	-0.148 p<0.05	0.086	-0.070	0.444

Dependent Variable: Effective Solid Waste Management

Constant/predictor variable: Social Factors

*** Correlation is significant at the 0.01 level (2-tailed)*

** Correlation is significant at the 0.05 level (2-tailed)*

According to Oyelola *et al* (2009), social problems encountered include: lack of public awareness, illegal dumping, poor condition of waste workers, lack of private sector and community involvement. Folorunso and Awosika (2001) related flooding in Lagos to clogging of drainage channels by dumped solid wastes. There is abundant release of gaseous

toxic substances into Nigerian environment as well as jeopardizing of health of scavengers as a result of burning of obsolete e-wastes. Due to contact with smokes from burning of solid wastes and gaseous emission from dumpsites, cases of several diseases have been recorded.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter presents summary of study findings, conclusions drawn, recommendations based on the conclusions and suggestions for further research.

5.2 Summary of the Findings

The study had the following objectives: to examine how economic factors influence effective Solid Waste Management in Kakamega Municipality; to establish the extent to which technical factors influence effective Solid Waste Management in Kakamega Municipality; to determine how institutional factors influence effective Solid Waste Management in Kakamega Municipality and to establish how social factors influence effective Solid Waste Management in Kakamega Municipality.

Majority of the respondents were in the age bracket of 21-50 years. This meant that majority of the respondents were mature middle age people and understood the determinants of effective Solid Waste Management in Kakamega Municipality, Kenya. This was the age group carrying the highest proportion of the population that is actively engaged in effective Solid Waste Management in Kakamega Municipality. There was an indication that more males participated in effective Solid Waste Management in Kakamega Municipality than females. The results illustrated that 35.2% of the respondents had been working for less than 5 years, 16.4% had been working for a period of 5-10 years, 21.3% had been working for 10-

15 years, 14% for 15-20 years and 13.1% for more than 20 years. The results further showed 25.4% of respondents had certificates, 37.7% had diploma education level, 21.3% had degree education level, 14% had masters' degrees while 1.6% of respondents had PhD education levels. There was a further prove that education levels of the respondents played a vital role on effective Solid Waste Management in Kakamega Municipality.

The study findings on the influence of economic factors on effective Solid Waste Management in Kakamega Municipality disclosed that economic factors with reference to recovery service charges, budget allocation, municipality capacity to pay for those involved in collection of litter and sufficiency of funds for promotion of waste reduction, recycling and recovery led to inefficient effective Solid Waste Management in Kakamega Municipality.

Technical factors like proper collection systems, professional qualifications of personnel, proper designed and operating sanitary land-fills and equipment availability were not efficient in addressing effective Solid Waste Management in Kakamega Municipality. There were low levels of technical factors and these had marginal associations on the effectiveness of effective Solid Waste Management in Kakamega Municipality.

Results on the institutional factors revealed that municipality's lack of public awareness on SWM, the municipal council's lack of a policy on waste reduction at the source and on involving community groups and lack of clear authorities and sanitation rules negatively and significantly influenced the effectiveness of effective Solid Waste Management.

Social factors such as social conditions of social workers, stakeholders' participation and distance of dumpsite/container and deep rooted corruption in the councils that made it hard to follow the stiputed environmental laws by NEMA negatively and significantly influence effectiveness of effective Solid Waste Management. Community active participation in the collection, transfer, disposal of the solid waste insignificantly influences the effectiveness of effective Solid Waste Management.

5.3 Conclusions

The study had the following conclusions:

i) Economic factors like recovery service charges, budget allocation, municipality capacity to pay for those involved in collection of litter and sufficiency of funds for promotion of waste reduction, recycling and recovery had low levels and this led to inefficient effective Solid Waste Management in Kakamega Municipality.

ii) Technical factors like proper collection systems, professional qualifications of personnel, proper designed and operating sanitary land-fills and equipment availability were not efficient in addressing effective' Solid Waste Management in Kakamega Municipality. Technical factors had marginal associations on the effectiveness of effective Solid Waste Management.

iii) Institutional factors like municipality's lack of public awareness on SWM, the municipal council's lack of a policy on waste reduction at the source and on involving

community groups and lack of clear authorities and sanitation rules negatively and significantly influenced the effectiveness of effective Solid Waste Management.

iv) Social factors such as social conditions of social workers, stakeholders* participation and distance of dumpsite/container and deep rooted corruption in the councils that made it hard to follow the stiputed environmental laws by NEMA negatively and significantly influence effectiveness of effective Solid Waste Management

5.4 Recommendations

The following recommendations were made based on the findings and the conclusions of the study:

i) Government should allocate enough budget for provision of SWM services within municipality which should be reviewed periodically to ascertain if the monies are put to correct use and to ensure efficient effective Solid Waste Management. The government should encourage the development of better waste management through waste reduction, reuse, recycling and composting. As the facilitator for waste management program development (using concepts such as the polluter pays principle and cleaner production), the government should support businesses and communities through pilot projects, funding, training, technical assistance, information exchange, follow-up support and monitoring.

ii) For waste management to be effective there has to be proper collection systems, professional qualifications of personnel, proper designed and operating sanitary

community groups and lack of clear authorities and sanitation rules negatively and significantly influenced the effectiveness of effective Solid Waste Management.

iv) Social factors such as social conditions of social workers, stakeholders* participation and distance of dumpsite/container and deep rooted corruption in the councils that made it hard to follow the stiputed environmental laws by NEMA negatively and significantly influence effectiveness of effective Solid Waste Management

5.4 Recommendations

The following recommendations were made based on the findings and the conclusions of the study:

i) Government should allocate enough budget for provision of SWM services within municipality which should be reviewed periodically to ascertain if the monies are put to correct use and to ensure efficient effective Solid Waste Management. The government should encourage the development of better waste management through waste reduction, reuse, recycling and composting. As the facilitator for waste management program development (using concepts such as the polluter pays principle and cleaner production), the government should support businesses and communities through pilot projects, funding, training, technical assistance, information exchange, follow-up support and monitoring.

ii) For waste management to be effective there has to be proper collection systems, professional qualifications of personnel, proper designed and operating sanitary

land-fills and equipment availability so as to reduce environmental pollution and prevent health hazards. MSW is an important raw material for sustainable energy and bio-fertilizer production. To increase the MSW's capacity to manage waste from a larger number of hotels, more employees need to be hired for collection, sorting, composting and management.

iii) The government should encourage better waste management practices and help create markets for waste materials through policy making, economic incentives, regulations, enforcement of regulations, and campaigns/promotions. By recognising and giving awards to best practices in waste management, the government would help increase the public's awareness of initiatives such as the SWM program and encourage others to adopt similar approaches.

iv) Educational activities such as the organisation of conferences, seminars and workshops, publication of training manuals, case studies and best practices, and provision of technical and financial assistance should also be conducted.

5.5 Suggestions for Further Research

The following suggestions were made for further research:

(i) A similar study should be conducted in other municipalities within the Republic of Kenya to ascertain if same results can be achieved.

(ii) A study should be carried out on the influence of Government policies on effectiveness of effective Solid Waste Management.

(iii) A study should be conducted to establish the influence of other stakeholders like NGOs and NEMA on effective Solid Waste Management.

(iv) A study should be conducted to establish the influence of public's awareness of initiatives on effective Solid Waste Management.

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APPENDIX 1: LETTER OF TRANSMITTAL

April, 2012.

Dear respondent:

I am a postgraduate student undertaking a Master of Arts in Project Planning and Management in the School of Continuing and Distance Education at the University of Nairobi. I am carrying out a study on **Determinants of Effective Solid Waste Management in Kakamega Municipality, Kenya. I** am using the attached questionnaire to collect information for the study. It is my kind request that you fill the questionnaire, providing the relevant information to facilitate the study. Please use the space provided to fill in the information required as objectively and honestly as possible. The information provided will be treated with strict confidentiality for the purpose of this study only.

Thank you.

Yours faithfully,

Nyayiemi Samuel Kerama

APPENDIX 3: INTERVIEW SCHEDULE FOR KEY INFORMANTS

SECTION A: BACKGROUND INFORMATION

1. Name of the organisation

2. Please indicate your age bracket?

21-30 years	[ ]
31-40 years	[ ]
41-50 years	[ ]
Above 50 years	[ ]

4. Please indicate your gender

Male	[j
Female	

3. State the number of years you have worked in the organization.

Less than 5 years	[ ]
5-10 years	[ ]
10-15 years	[ ]
15-20 years	[ ]
Above 20 years	[ ]

4. Please indicate the level of your education

PhD	[ ]
Masters	[ ]
Bachelor's degree	[ ]
Diploma	[ ]
Others	

SECTION B: DETERMINANTS OF EFFECTIVE SOLID WASTE MANAGEMENT (SWM)

In this section please tick (V) the most appropriate response for each of the questions in the table below. Strongly agreed (5), Agree (4), Undecided (3), Disagree (2), Strongly disagree (1)

Q.		Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
1.	There is enough budget allocation for provision of SWM services within municipality					
2.	Municipality has the capacity to pay for those involved in collection of litter					
3.	Very limited funds are allocated for SWM sector by government					
4.	There is sufficient of funds for on promotion of waste reduction, recycling and recovery					
5.	Municipality is not efficient in waste generation, storage, collection, and safe disposal of the waste					
6.	Municipality has enough equipment and personnel involved in SWM					
7.	Municipality has weak waste collection, transportation and handling infrastructure					
8.	There is a number of active private players involved in collection, transportation and disposal of wastes					
9.	Municipality has enough dumping sites					
10.	Solid waste is usually separated at the dumping sites					
11.	Personnel involved in SWM have adequate qualifications and skills					
12.	Community participates actively in the collection, transfer, disposal of the solid					

	waste					
13.	There is willingness from the community to collect litter, dump and sometimes burn					
14.	Municipality lacks public awareness on SWM					
15.	Waste workers have poor working conditions					
16.	There is illegal dumping of solid waste					
17.	There is a lack of information about local initiatives concerning SWM management					
18.	There is excessive strain on existing facilities and under-investment in new ones creating a big challenge on management of SWM					
19.	There is deep rooted corruption in the councils that makes it hard to follow the stipulated environmental laws by NEMA					
20.	There is poor accessibility to the dumping sites					
21.	There is very high waste generation within municipality which cannot be handled with available vehicles and equipment					
22.	The municipal councils lack a policy on waste reduction at the source and on involving community groups					
23.	Municipality lacks clear authorities and sanitation rules					
24.	Dumping sites construction are not done according to stipulated regulation					
25.	There is lack of reinforcement from agencies towards SWM					

26. What are some of the factors affecting effective Solid Waste Management in Kakamega Municipality?

27. What are some of the challenges facing SWM in Kakamega Municipality?

28. What are some of the strategic options available for SWM improvement and optimal performance?

26. What are some of the factors affecting effective Solid Waste Management in Kakamega Municipality?

27. What are some of the challenges facing SWM in Kakamega Municipality?

28. What are some of the strategic options available for SWM improvement and optimal performance?

APPENDIX 3: INTERVIEW SCHEDULE FOR KEY INFORMANTS

Introduction: Good morning or afternoon sir/madam. Thank you for having granted me permission to interview you. I would like to assure you that I will stick to all ethical codes of conduct with regard to conducting research as stated in my introduction letter.

The Interview Questions:

1. What are some of the steps involved in effective Solid Waste Management?

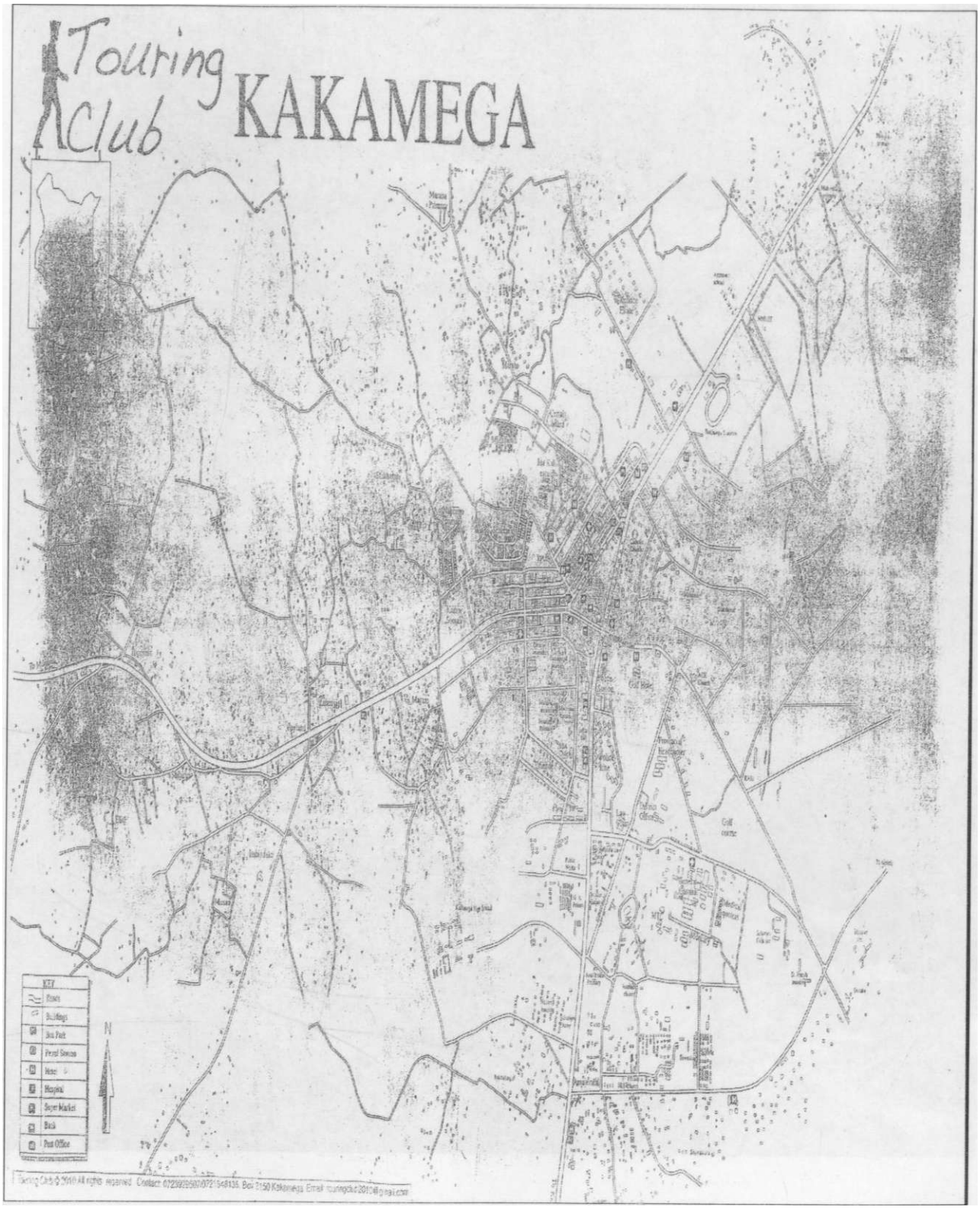
2. What are some of the factors affecting effective Solid Waste Management in Kakamega Municipality?

3. What are some of the challenges facing SWM in Kakamega Municipality?

4. What are some of the strategic options available for SWM improvement and optimal performance?

Conclusion: Thank you for your time, **1** hope your responses to the questions will contribute a lot to my research work.

APPENDIX 4: MAP OF KAKAMEGA MUNICIPALITY



APPENDIX 4: MAP OF KAKAMEGA MUNICIPALITY

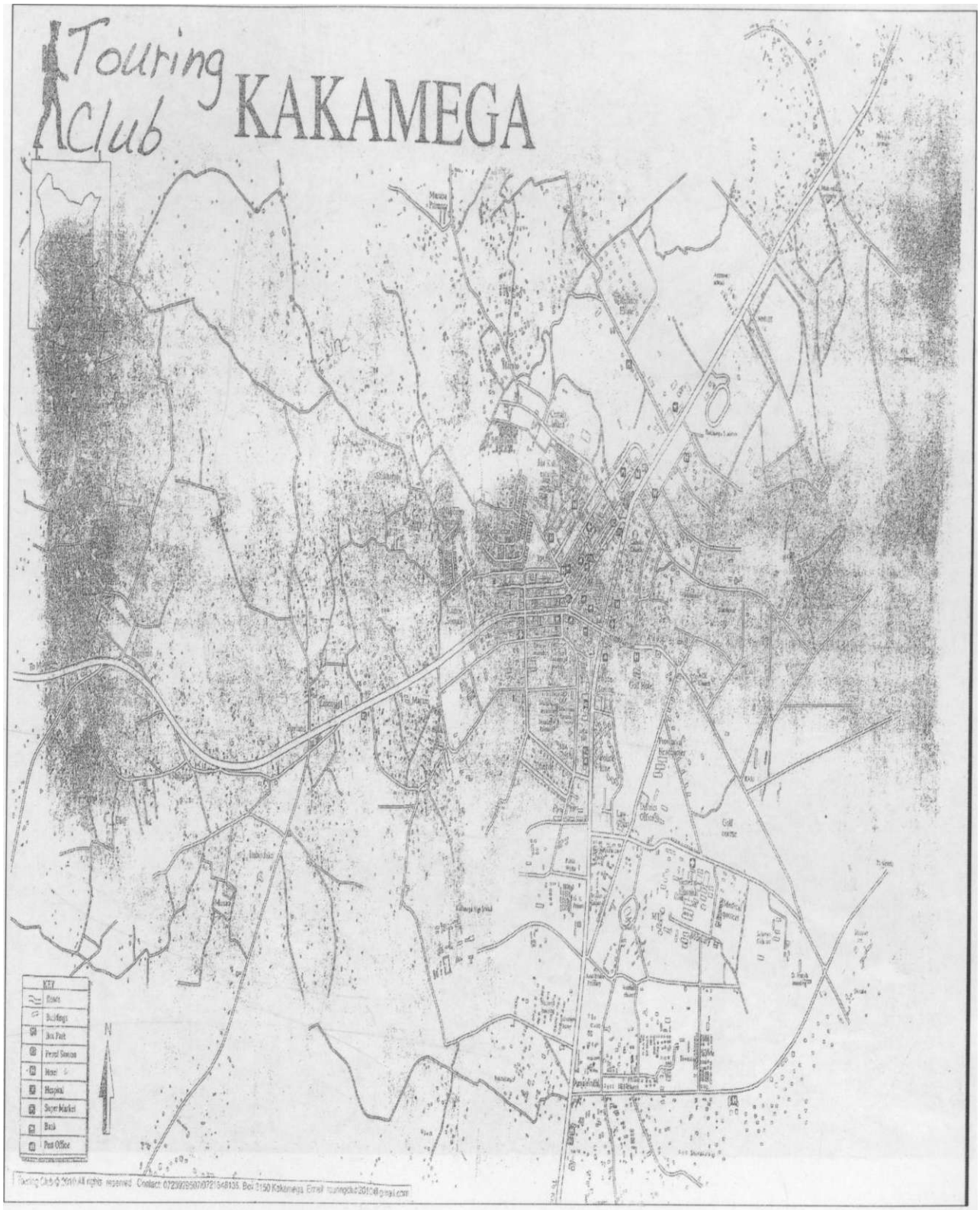


PLATE 1: DUSTBIN AT MULIRO GARDENS IN KAKAMEGA MUNICIPALITY

PLATE 2: DUMPING SITE AT ROSTERMAN IN KAKAMEGA MUNICIPALITY

PLATE 3: DUSTBIN AT BUSINESS PREMISES IN KAKAMEGA MUNICIPALITY