FACTORS INFLUENCING SUSTAINABILITY OF SOLID WASTE MANAGEMENT PROGRAM: A CASE OF UASIN GISHU COUNTY, KENYA.

BY

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DECLARATION

This project report is my original work and has not been submitted for award of any degree in university or college for examination or academic purposes.

Sign…….. Date……..……

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This work has been submitted for examination with my approval as the University supervisor.

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DEDICATION

I dedicate this project to my parents, my supervisor Jacob Kinjanjui and my family, Gladys Jepkoech and Gerald Kigen for their unwavering support throughout my academic pursuits.

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ABBREVIATIONS AND ACRONYMS

EIA :	Environmental Impact Assessment
EMCA:	Environmental Management and Coordination Act
GHG :	Green House Gas
MDGs:	Millennium Development Goals
MSW:	Municipal Solid Waste
NGOs:	Non-governmental organizations
SPSS:	Statistical Package for Social Science
SSWMS:	Sustainable solid waste management system
SWM:	Solid waste management
VOCs:	Volatile organic compounds
WTE:	Waste to Energy
3R:	Reduce, Reuse, and Recycle

ABSTRACT

The purpose of this study was to assess existing solid waste management practices in Uasin Gishu County with the aim of examining the main factors influencing sustainability of solid waste management program in the county. The study adopted a descriptive survey research design. The target population was one hundred and thirty (130) respondents. To get the sample, the researcher used the Krejcie and Morgan sample size table to select ninety seven (97) respondents. The research instrument for collecting data was a structured questionnaire. Data in this study was analyzed descriptively using arithmetic mean and standard deviation with the help of Statistical Package for Social Science (SPSS) and Excel. Data was displayed in table format. The findings indicated that what influenced how the nature of solid waste treatment influences waste management programs majorly was the availability of treatment with an average mean of (3.1829) which influenced revenue generated from the waste and availability of treatment influences the frequency of collecting waste. Findings also indicated that what influenced how Form of waste disposal used by the county government had on waste management majorly was that Land filling of waste disposed at an average mean of (4.5122) which influenced cost of receiving waste and revenue generated from waste. Capacity of infrastructure influenced solid waste management program majorly through the availability of infrastructure with an average mean of (3.7764) which influenced frequency of collecting waste and revenue generated from waste. The findings also indicated that what influenced the way planning process influences solid waste management program majorly was the existence of plans with an average mean of (4.252) which influenced revenue generated from solid waste and existence of plans also influenced frequency of collecting solid waste. It was recommended that counties should invest in infrastructural capacity, diversify form of waste disposal and invest in nature of treatment for solid waste management and enhance planning in waste management program.

CHAPTER ONE

INTRODUCTION

1.1Introduction

Chapter one of this study introduces the background of the study, the problem statement, purpose of the study, research objectives and research questions and finally significance of the study is discussed.

1.2 Background to the Study

The state of solid waste management in cities of developing countries is fast assuming the scale of a major social/environmental challenge. Sustainable solid waste management (SSWM) is a purposeful activity with the goal to maintain and improve the state of an environmental resource affected by human activities. It is not, as the phrase suggests, the management of the environment as such, but rather the management of the interaction and impact of human societies on the environment. The term 'waste management' incorporates collection, transportation, processing and disposal of the waste. It also includes strategies for reducing the amount of waste to be disposed of (Shekdar, 2009).

Sustainable solid waste management enhances maintenance of a healthy, aesthetic, and ecologically sound environment. Waste management involves waste collection, sorting, storage, recycling and disposal. Disposal can be done in a landfill or an open dumping site. For years, solid waste has been burned, re-used, or dumped with a qualitative level of processing which depends on the economic, cultural, social and political developments of communities in their particular situations (Carlson, 2006).

Globally, there is a drive towards SWM sustainability. 3R initiatives have been introduced accordingly to reduce, reuse, and recycle waste materials with the end view of reducing the final volume of waste that enters landfills (Lohani, B.N 2004). In most countries, the government has laid down the procedures and guidelines for collection, segregation, storage, transportation, processing, and disposal of solid waste. For instance,

the developed economies of Japan, South Korea, Taiwan, and Singapore aim for the elimination of landfills from their systems (Shekdar 2009).

In these countries, SWM systems have stabilized through a variety of legal measures supported by national funding (Shekdar 2009). Moreover, one of the most important environmental problems in cities of Beijing, China, is the production management and containment of urban solid waste. Global generation of municipal solid waste in 1997 was 0.49 billion tones with an estimated annual growth rate of 3.2% –4.5% in developed nations and 2% –3% in developing nations (Suocheng et al. 2001).Inappropriate management of urban solid waste not only increases the pollution to the environment, but also threatens human health through its collection, transfer and disposal processes. In Asian countries, their citizens are highly aware of their responsibilities making SWM a common practice (Zurbrugg, 2002).

However, in Africa, difficulties of solid waste management extend from the state to the local municipalities, refuse of all shapes and sizes are a common site in both urban and rural areas. These difficulties are concentrated and complicated by population pressures in the few heavily populated cities. For instance, in Accra, garbage collection and disposal is in the hands of one company, City & Country Waste Limited (CCWL). The main drivers of the waste problem in Nigeria, for instance, are poverty, high population and urbanization growth rates, compounded by a weak and underfunded infrastructure. The gravity of this problem is perhaps best reflected in the level of attention given to it in the United Nations Millennium Declaration in September, 2000. Three of the eight Millennium Development Goals (MDGs) in the Declaration have waste or resource efficiency implications. In response to the waste challenge many developed countries have embarked upon ambitious environmental reforms, recording remarkable advances in best practices and sustainable management of their Municipal Solid Waste (MSW) (Chianand DeWalle, 2006).

In Kenya, unsatisfactory SWM and illegal dumping sites exacerbate pollution of surface and ground water is prevalent. The inadequate Solid Waste Management strategies pose serious environmental and public health risks with associated significant environmental,

social and health costs (Mwangi, 2010).Open dumping of garbage facilitates breeding of disease vectors such as flies, mosquitoes, cockroaches, rats, and other pests (Otiso, 2003). Rapid urban population increase in developing countries has resulted in large unplanned settlements and excessive amount of solid waste. For instance, Nairobi presently has about 3.2 million inhabitants with daily solid waste generation ranging between 1,900 and 2,400 metric tons (UNEP, 2010). The main factors influencing waste management include inadequate financing, poor infrastructure and poor technology, lack of public awareness on good sanitary practices, inadequate legal and regulatory framework (Ngugi and Makokha, 2006).

In Uasin Gishu County the situation is not different from the global and National patterns, despite all the efforts being made by County department to decrease the number of solid waste affecting the environment. Solid waste is a challenge in Uasin Gishu County, it is very expensive and no good result seems to be recorded in the County despite spending a huge percentage of the towns' revenue they remain dirty (Otieno, 2010). In Uasin Gishu County, especially, Eldoret town, the Department of Environment was established with the mandate of taking care of environment and more specifically solid waste and pollution. The town of Eldoret is making money from waste instead of spending money to manage waste. This is through revenue generated and cost reduction in waste management (Mwangi, 2010). It was against this background that the study investigated the factors influencing solid waste management program in Uasin Gishu County.

1.3Statement of the Problem

Solid waste management is an issue in developing economies; most countries find themselves having to choose between budgeting for health, infrastructure or social services such as solid waste management. As a result of these pressing needs most developing economies are unable to provide regular service to urban residents often resulting to accumulation of solid waste in many areas. In Kenya, the main drivers of waste problem for instance, are poverty, high population and urbanization growth rates, compounded by a weak and underfunded infrastructure. Despite promulgation of the constitution that brought decentralized governance (devolution), the county governments

still give low priority to solid waste management making it underfunded and inadequate in terms of human resources and facilities. In Uasin Gishu County, most people either dump waste in open spaces or burn it, creating water and air pollution. (Makokha, E 2006)Locating new sites for disposal has also become increasingly difficult due to public opposition, rising cost of land, and lack of appropriate land area. Perhaps the most important factor for poor performance relates with societal and management apathy. Literature suggests that the operational efficiency of SWM depends on the active participation of the local government and of the citizens, but since the social status of SWM in low-income areas is low, there is lack of interest towards it.(Naliaka 2013)

There have been few studies that have been conducted to establish sustainable solid waste management and while a majority of these studies have been majorly conducted in other nations there appears to be an information gap in the local scenario. The studies reviewed addressed other issues other than the factors affecting sustainable solid waste management such as Devkottta, & Watanabe, (2006) who looked at need of community based sustainable approach for solid waste management in Kathmandu; Ngugi, Ikiara and Makokha (2006). Who looked at Waste Management the city: A Case Study Of Public Technical Training Institutions; Hope et al. (1999) who looked at Urbanization and the environment in southern Africa and Ozelir et al (2006) who looked at the Life cycle assessment of municipal solid waste management methods: Ankara case Study Environment International. None of these studies looked at factors affecting sustainability of solid waste management and there is therefore need to carry out a study that will fill this gap and provide answers to this issue.

The problem of sustainable solid waste management is a major problem in the country and one that continually plagues different county governments. It is therefore needed to come up with solutions that address this issue once and for all. This study, therefore, seeks to assess the factors influencing sustainability of solid waste management program localizing the study to Uasin Gishu County.

1.4 Purpose of the Study

The purpose of this study was to examine the factors influencing sustainability of solid waste management program in Uasin Gishu County.

1.5 Research Objectives

The study was guided by the following research objectives:

1. To examine how nature of solid waste treatment influence sustainability of solid waste management program in Uasin Gishu County.
2. To examine how form of solid waste disposal influences sustainability of solid waste management program in Uasin Gishu County.
3. To establish how capacity of infrastructure influences sustainability of solid waste management program in Uasin Gishu County.
4. To assess how planning process influences sustainability of solid waste management program in Uasin Gishu County.

1.6 Research Questions

1. How does the nature of solid waste treatment influence sustainability of solid waste management program in Uasin Gishu County?
2. How does the form of solid waste disposal influence sustainability of solid waste management program in Uasin Gishu County?
3. How does capacity of infrastructure influence sustainability of solid waste management program in Uasin Gishu County?
4. How does Planning process influence sustainability of solid waste management program in Uasin Gishu County?

1.7 Significance of the Study

The study is significant to various stakeholders who include county governments and private companies. Other counties and towns in the country might find the study and more so its findings important not only in solid waste management success but also for managing the environment through community participation and implementing laws.

The study provided information to the community members in Uasin Gishu County on the factors influencing solid waste management program and it also provided information

on the possible ways in which solid waste can be effectively managed to improve air and water quality, soil pollution and most importantly the environment.

The information might be helpful to County government, NGOs and other private organizations dealing with solid waste management in carrying out reforms and procedures that can ensure proper use of solid waste.

The study is also significant in that it forms a useful foundation against which future studies can be undertaken by other researchers taking into account the suggestions for further studies. Findings of the study also provided useful literature for other scholars who may wish to explore the area of solid waste management and the factors influencing it further.

1.8Delimitations of the Study

The study was delimited to factors influencing solid waste management program in Uasin Gishu County, Kenya. It specifically looked at four factors influencing solid waste management program in the County. These were nature of treatment, Form of waste disposal, capacity of infrastructure and planning process. The study delimited itself to a period between 2013 and 2015.

In order to utilize scarce resources, the research delimited to sample respondents within Uasin Gishu County who are responsible for collecting garbage including contracted companies in the county.

1.9 Limitations of the Study

The study could have been limited by lack of reception in the area of study in order to counter this the researcher visited the area of study before hand and sought consent from the relevant authorities and was given a go ahead to conduct the study.

The research questions could also have been misinterpreted and fail to yield the information that the study required. In order to safeguard against this the researcher conducted a test-retest which helped determine the suitability of the research instruments and revised them to ensure that they were suitable for carrying out the study.

1.10 Assumptions of the Study

In order to conduct the study, the following assumptions were made:

1. It was assumed that Solid waste management practices already exist in Uasin Gishu County.
2. It was also assumed that the respondents of the study would respond to the questionnaires genuinely and without bias.

1.11 Definitions of Significant Terms

The study encompasses the following terms:

Infrastructure: is physical and organizational structures needed for improving solid waste management in the county.

Planning Process: is termed as development of goals, strategies, task lists and schedules required to achieve the objectives of achieving sustainability of solid waste management program in Uasin Gishu County.

Sustainability: ability of solid waste management to last or continue for a long time at an affordable cost while generating revenue to pay for its own operations.

Sustainable solid waste management: enhancement and maintenance of a healthy ecologically sound environment that is cost effective. It involves maintaining or improving environmental standards through generations.

Waste Disposal: is the process of collecting and removing solid waste and relocating it to a place where it will be managed effectively.

Waste management: incorporates collection, transportation, processing and disposal of waste. It involves sorting, storage, recycling and disposal. It also includes strategies for reducing the amount of waste to be disposed of in Uasin Gishu County.

CHAPTER TWO
LITERATURE REVIEW

2.1 Introduction

This chapter focuses on literature related to the study. It contains the concept of sustainability of solid waste management, the theoretical framework, empirical review, conceptual framework of the study and finally summary of literature review.

2.2 Concept of Sustainability of Solid Waste Management

Globally, nations are doing all they can to solve the problem of waste management disposal and come with a sustainable way of addressing the problem. Multiple plans of action, developed at all levels of government, are being conducted to match the growing burden. The development of city wide initiatives for waste disposal is limited by the rapid pace of urban growth itself and the limited amount of financial resources available to the municipality for waste management. Filling the void, local initiatives to create urban solid waste management are playing a key role in building better solid waste management systems (Baud, Stelios, Michaela and Johan 2001). For example German development cooperation projects now implement the outcomes of analyses and resulting recommendations for action in their day-to-day operations. In so doing, they benefit from the sectorial and cross-sectorial approach of the advisory project.

In Kosovo, the urban development project Modernization of Municipal Services is using previously drafted guidelines on operator models for structuring the local waste management industry. In collaboration with the advisory project, a training module was developed in Kosovo to provide further training for employees in local authorities and waste disposal companies. Similar measures are being planned for other countries (Brook and Davila, 2000)

In Europe, waste is increasingly being used to produce both materials and energy, and recycling now saves more greenhouses gases than it generates. Campaigns that waste must no longer be deposited in residential areas and uncontrolled landfills or end up on illegal rubbish tips and in waterways continue to be carried out. Waste accumulates in the

world's oceans as marine litter, and is blown across continents and pulverized by the action of the wind, sun and waves. Plastic waste in particular does considerable damage to flora and fauna and finds its way into the human food chain in the form of micro-particles. Since eighty percent (80%) of the waste that ends up in the ocean originates from land-based sources, uncontrolled waste deposits in waterways and oceans are largely the consequence of non-existent or inadequate waste management and developed nations continually campaign for a green environment.

In Africa; many developing and emerging countries are faced with the major challenge of improving their inadequate and unsustainable waste management systems, in the last 20 years, a number of solid waste management projects have been carried out in collaboration with external support agencies. For example in Ghana, Some projects were successful in producing lasting impacts on the improvement of solid waste management in the country (Awortwi, 2004). However, many projects could not support themselves or expand further when the external agencies discontinued their support. A number of technical, financial, institutional, economic, and social factors contribute to the failure to sustain the projects, and they vary from project to project (Bartone, 1995). For example in Nigeria Like in most other developing countries and major cities, sustainable solid waste management in Lagos remains a herculean task, especially with its ever increasing population. While it may be said that LAWMA have been making efforts to improve waste management in the state, there are still a lot of untapped opportunities for sustainable waste management (Adeyinka, Bankole, and Olaye, 2005).

In Kenya, solid waste collection systems are inefficient, and disposal systems are not environmentally friendly; a solid waste study done in Nairobi shows that "about 30 to 40 per cent of all solid waste generated in urban areas is uncollected and less than 50 per cent of the population is served" (Naliaka, 2013). The problem of solid waste management continues to plague the country leading to a lot of hazards and creating unsightly environments. Overburdened and ineffective solid waste management systems in congruence with rapidly changing consumption patterns plague the city and major towns within the country. The resulting discrepancy between the current solid waste

management systems and the growing need for expanded collection and disposal facilities has left an accumulating amount of solid waste within the urban environment producing unaesthetic and unsanitary conditions. There is need to come up with measures that will address this problem within the country ones that are sustainable and able to provide a lasting solution for the problem once and for all. For example the current total recycling capacity in Nairobi is very low comparative to total waste being generated. Middle- to high-income areas have better waste collection, largely by private institutions, due to their greater ability to pay for the services. However, low-income areas like Kibera lack the capacity and are therefore largely susceptible to waste management problems which create health, safety and environmental concerns (Naliaka, 2013).

2.3 Theories on Solid Waste Management program

There are several theories that apply in solid waste management which include: Critical Theory, Network Theory and Social Cognitive Theory.

2.3.1 Critical Theory by Horkheimer (1937)

Horkheimer (1937) proposed the Critical Theory. Critical Theory has been defined as theory which can provide the analytical and ethical foundation needed to uncover the structure of underlying social practices and to reveal the possible distortion of social life embodied in them. As a body of theory, it is complex and multidisciplinary, seeking to explain the whole phenomenon of consciousness and to undermine the ways in which existing consciousness perpetuates existing societies. It is particularly associated with the 'Frankfurt School', founded in 1923. The most influential theorists of the first generation were Adorno and Max Horkheimer (1895-1973), though Marcuse, who stayed in the United States when the Frankfurt School returned from exile in 1950, found a larger audience (Horkheimer (1937).

Adorno and Horkheimer (1973) agreed that in essence, Critical Theory starts with Marx, but quickly abandons the philosophical materialism, the theory of historical development, and the crucial role of the proletariat, which are key features of most Marxism. What is retained is the sort of explanations of false consciousness and of alienation which are to

be found in Marx's earlier writings. It then draws on a variety of insights into the formation and structure of consciousness (more specifically, ‘modern’ consciousness), including Jean Piaget's accounts of how children learn language and thought, Ludwig Wittgenstein's philosophy of language, and Heidegger's hermeneutics. But, in each case, it goes beyond these forms of inquiry into a broader, Marx-like account of the political and economic processes upon which the workings of consciousness are said to depend.
Raymond (1981) states that Critical Theory is thus able to develop a sharp, subtle, and derogatory account of modern consciousness which undermines much what we believe by showing us the influences which have molded our beliefs. These influences are contrasted with rationality and with the conditions for rational argument that would allow what Habermas calls the ‘ideal speech act. Critical Theory has, therefore, had a considerable influence, often indirect, on such ‘counter-culture’ movements as feminism and the green movement because it allows them to point to the structure and irrational origins of our ‘patriarchal’ or industrial thought.

Blackwell, (1995) proposed that Critical Theory is relevant to solid waste and sustainable management as it focus mainly on green movement which emphasize on the need to conserve the environment in relation to prevention of solid waste dumping. Critical Theory also focuses on ethical foundation needed to uncover the structure of underlying social practices, for example individuals in a particular area may mainly believe that collection of solid waste is only responsible for poor people who have no other work to do, but in reality to manage collection of solid waste, it requires critical management skills and such skills are poised by the structure of the underlying community.

Moreover, Willard (1996) asserts that Critical Theory also examines the revelation of distortion of social life, social life here describes the way the individuals managed the solid waste collection process, but with much exposure to real world practices in similar process, individuals are able to apply the same ideas in local management of solid waste materials, this in long run brings about a better way of sustainable management.

2.3.2 Network Theory by Alders (1993)

Alders (1993) cited in Zerihun(1996) a network is defined as any group of individuals and/or organizations who, on voluntary basis, exchange information or goods or implement joint activities and who get organized for that purpose in such a way that individual autonomy remains intact. Based on this definition individuals´ motivation to join the network, based on self interest and conducting activities of common interest, are considered as the major characteristics of a network.

Wasserman & Faust (1999) views these joint activities within the social environment as a pattern or regularities in relationships within the interacting units resulting in structures. The relationship among the interacting units can be measured using structural variables and the relationship can be of different aspects including economic, political and interactional among others. According to Boissevain & Mitchel (1973) the set of transactions that relate the individuals has its own implication on the people involved in the transaction.

Nnunduma (2003) argues that Network Theory has resulted from the conceptualization of a social group within an interacting community. Boissevin & Mitchel (1973) described man is a social animal with the need to establish relation with others of his kind. Nnunduma describes networks within social groups by comparing it to living organisms as ´Networks are useful socio-economic systems with specific historical and cultural dimensions that emerge to meet the particular needs of people at a particular place Nnunduma(2003).

Mark (1998) classified networks in the context of trade and market in to two common models and ideal types of organization which are hierarchies and market. Networks exist in the middle of markets and coexist within hierarchies. He further noted that anything can be a network based on the definition of network given by Baber (1992) as network is a set of relationships within a defined population; the population can be a people or other relational nodes. However, these networks should have resources, skills, legitimacy and means of coordination.

Nnunduma (2003) argues that individuals engaged in to the activities of a network establish common aims and interests that are expected to result in the development of rules, values and norms. These in turn are expected to create roles, obligations and expectation of reciprocity. Wasserman & Faust (1999), cited in Nnunduma (2003) argues the strength of relational ties among members of a network has an overall implication on the potential of the members of the network to execute collective actions and this in turn has effect on how the network behaves. Actors and relations among actors are two major concepts in the study of a network theory. The concept of network has been introduced to the concept of the informal sector by the study of Lomnitz (1988) study titled Informal Exchange Networks in Formal Systems: A Theoretical Model.

The study argues that Networks of reciprocity and patron-client relations has been playing an important role in the informal sector. The actors in the informal sector who are involved within the informal activities have been described by Lomnitz as ´´disadvantaged´´ in comparison to the members within other sectors in the formal system. According to the study such a network and relation is important for the members of the informal sector in order to articulate or integrate into the formal market system and create informal social security system to survive (Lomintz, 1988).

Network Theory is relevant to solid waste and sustainable management in that for any waste to accumulate in a particular place there must be existence of people who form a network through a common interest. The relationship among the interacting units in a network can be judged using different aspects including economic, political and interactional among others such that through economic people gathered at a particular place to conduct business hence forming a network, through political people are controlled by hierarchies organizations formed within a network.

Nnunduma (2003) proposed that within the network there is release of solid waste materials by individuals hence there was no control of such solid waste collection and in long run it resulted in uncontrolled accumulation of waste, Network Theory here describes itself as having resources, skills legitimacy and means of coordination hence the resources here could be manpower that empowered others to realize the importance of

solid waste collection, the skills in a network was applied in the management of the solid waste management for proper disposal collection and treatment of such waste. The law passed out in a network of how to individually managed solid waste was critically accepted by all the people in a network and in long run the effectiveness of Network Theory in management of solid waste is realized. This is the theory this research is pegged on.

2.3.3 Social Cognitive Theory by Miller and Dollard (1941)

Miller and Dollard (1941) proposed the theory of social learning. Bandura and Walters (1963) broadened the Social Learning Theory with the principles of observational learning and vicarious reinforcement. Bandura (1963) provided his concept of self-efficacy in 1977, while he refuted the traditional learning theory for understanding learning.

Bandura (1963)the Social Cognitive Theory (SCT) is relevant to health communication and may be applied to solid waste and sustainable management. First, the theory deals with cognitive, emotional aspects and aspects of behavior for understanding behavioral change. Second, the concepts of the SCT provide ways for new behavioral research in health education.

Miller and Dollard (1941) further agreed that Social Cognitive Theory posits that an individual's behavior is primarily learned through his or her observation of others as well as through interaction with his or her environment. Through observing the behavior of others, one is able to construct models of appropriate behavior in one's mind and to form expectations and judgments about the likely outcomes of reproducing that behavior oneself. This means that behavior is largely learned and that one has the ability to reflect upon the behavior of oneself and others to determine appropriate behavior. It also means that if one's behavior is antisocial, one has the ability to reflect upon one's own behavior and to take a stand on that behavior, thus changing one's self-perception and altering one's own behavior.

Pajares (2009) asserts that Social Cognitive Theory is therefore relevant to solid waste and sustainable management in that the theory deals with cognitive, emotional aspects and aspects of behavior for understanding behavioral change, such that in a place where people were throwing solid waste in a particular place without caring, new individual in such place did exactly the same or if an individual used to throw solid waste carelessly in a particular place and shift to a another place he/she had to adapt to that areas ways of throwing solid waste.

Also the concepts of the Social Cognitive Theory provide ways for new behavioral research in health education, in that trough research in health matters people realized the harmful effects of living around uncontrolled solid waste disposal, and therefore individuals knew the importance of managing the solid waste materials in a more reasonable manner. Individuals learnt that solid waste management is a primary health benefit it is the control of vermin that spread disease. By consolidating residential and some types of commercial wastes, then using appropriate disposal technology habitat is reduced, or nearly eliminated, for rodents and insects that otherwise pose a public health risk.

Bandura (1976) agreed that the ideas for other theoretical areas such as psychology are welcome to provide new insights and understanding such that Social Cognitive Theory posits that an individual's behavior is primarily learned through his or her observation of others as well as through interaction with his or her environment. It explains that when the majority of individuals in a particular place decide to accumulate solid waste in a central location, you will probably do the same as your insights will tell you that such a procedure is a relevant idea. The study therefore concluded that Social Cognitive Theory plays a role in the field of solid waste management as it directly interacts with the environment.

2.4 Empirical Review

The following review of the literature focuses on empirical findings from quantitative and qualitative studies in solid waste management. Literature was found through a series of comprehensive searches on academic research texts and documents.

2.4.1Influence of Nature of Treatment on Solid Waste Management program

Zurbrugg(2002) affirms that one problem in most of the low-income country collection systems is that these are relatively inefficient since the collection vehicles are not technologically fitted to collect majority of developing countries' high density organic waste. Integrated waste management options are now being applied in most of the developed countries with resource recycle, recovery and energy generation facilities from the solid waste. Waste-to-energy (WTE) conversion is now considered as one of the optimal methods to solve the waste management problem in a sustainable way. Different mechanical, biological and thermo-chemical, waste-to-energy technologies are now applied for managing waste. Technological advancements, environmental regulations, and emphasis on resource conservation and recovery have greatly reduced the environmental impacts of solid waste (SW) management, including emissions of greenhouse gases (GHGs).

Boateng (2007) postulates that solid waste management deals with the way resources are used as well as with end-of-life deposition of materials in the waste stream. Often complex decisions are made regarding ways to collect, recycle, transport, and dispose of solid waste (SW) that affect cost and environmental releases. Prior to 1970, sanitary landfills were very rare. Wastes were "dumped" and organic materials in the dumps were burned to reduce volume. Waste incinerators with no pollution controls were common.

Devkota, and Watanabe(2006) conducted a study on Need of community based sustainable approach for solid waste management in Kathmandu and found out that today; solid waste management involves technologies that are more energy efficient and protective of human health and the environment. These technological changes and improvements are the result of decisions made by local communities and can impact residents directly. Selection of collection, transportation, recycling, treatment, and disposal systems can determine the number of recycling bins needed.

The development of new and emerging technologies has been driven by the need to find alternatives to land filling and mass-burn incineration. The City of most developed countries is evaluating the potential to apply new and emerging technologies to manage

up to 40% of the City's solid waste stream that cannot be diverted through other means. This remaining 40% of the solid waste stream is referred to as residual waste (Beierle and Cayford, 2002).

In low- and middle-income countries, municipal managers still face many common solid waste management problems. Although in some cities, successful innovative ideas and approaches have been implemented on different levels of the solid waste management system (from household storage to disposal), the know-how and experience is seldom communicated and transferred to others with similar responsibilities. Rather many municipal officers go through the same trial and error phases repeating mistakes made elsewhere before. Research institutions, NGOs, and International agencies are seen as very important actors for enhancing and supporting the dissemination of "best practices". It must be recognized, however, that there is not a "package solution" for solving the solid waste problem (Goodstein, 2003). Although the fundamental aspects of the waste management hierarchy remain valid, large flexibility to use different approaches for different local situations and actively involving residents at an early stage in planning and implementation are elements which have shown to be most promising (Garande and Dagg, 2005).

Effective and efficient recycling is possible by applying technology developed for increasing consumer participation, maximizing the value of collected materials and minimizing the costs of operating the system. Government and industry are best served by thinking long-term with respect to recycling systems. Experience has shown that short term strategies which focus on minimal upfront investment usually lead to higher recovery costs in the long run (Mongkolnchaiarunya, 2005).

Waste type is an important determinant of the technology chosen for waste management. For example, some wastes are technically incompatible with a specific technology because they would damage equipment. For wastes characterized as hazardous because of their reactivity, corrosiveness, and ignitability, there are well-established chemical and physical treatments available. However, for a waste in which toxicity is the major

hazardous characteristic, the choices are not clear. Toxic constituents may be organic, inorganic, or metallic, and many technologies could be used (Ozelir and Demirer, 2006). The major issue is whether to use a treatment or containment approach. For the most toxic waste, the preferred choice is treatment when it is technically feasible. In general, the kinds of waste most suitable for land-based containment are residuals from treatment operations, pretreated (or stabilized) waste, untreatable waste, and relatively low-hazard (and often high-volume) waste. However, some untreatable wastes are significantly toxic that land disposal should not be used, and waste elimination is the only acceptable alternative (Hagerty, 2003).

Many waste treatment technologies can provide permanent, immediate and significant degree of hazard reduction. In contrast, the long-term effectiveness of land-based disposal technologies relies on continued maintenance and integrity of engineered structures and proper operation. For wastes which are toxic, mobile, persistent, and bio-accumulative, and which are amenable to treatment, hazard reduction by treatment is generally preferable to land disposal.

In general, however, costs for land disposal are comparable to, or lower than, unit costs for thermal or chemical treatment (Ragle, 2005).For waste disposal, advanced landfill designs, surface impoundments, and injection wells are likely to perform better than their earlier counterparts. However, there is insufficient experience with these more advanced designs to predict their performance. Site and waste-specific factors and continued maintenance of final covers and well plugs was important (Barton and Patel, 2006). The ability to evaluate the effectiveness of these disposal technologies could be improved through better instrumentation of these facilities. Currently, their performance evaluation relies heavily on monitoring the indirect effects of their failure by, for example, detecting aquifer contamination (Sener, 2006).

2.4.2Influenceof Form of Waste Disposal on Solid Waste Management program

Solid waste is the unwanted or useless solid materials generated from combined residential, industrial and commercial activities in a given area. It may be categorized according to its origin (domestic, industrial, commercial, construction or institutional);

according to its contents (organic material, glass, metal, plastic paper etc); or according to hazard potential (toxic, non-toxin, flammable, radioactive, infectious etc). The methods of waste disposal and management of solid waste reduces or eliminates adverse impacts on the environment and human health and supports economic development and improved quality of life. A number of processes are involved in effectively disposing and managing waste for a municipality. These include monitoring, collection, transport, processing, recycling and disposal. Methods of waste reduction, waste reuse and recycling are the preferred options when managing waste (Kahn, 2000).

According to Boateng(2007), there are many environmental benefits that can be derived from the use of these methods. They reduce or prevent green house gas emissions, reduce the release of pollutants, conserve resources, save energy and reduce the demand for waste treatment technology and landfill space. Therefore, it is advisable that these methods be adopted and incorporated as part of the waste management plan. Waste reduction and reuse of products are both methods of waste prevention. They eliminate the production of waste at the source of usual generation and reduce the demands for large scale treatment and disposal facilities (Hagerty, 2003).

Lohani (2004) states that the methods of waste reduction include manufacturing products with less packaging, encouraging customers to bring their own reusable bags for packaging, encouraging the public to choose reusable products such as cloth napkins and reusable plastic and glass containers, backyard composting and sharing and donating any unwanted items rather than discarding them. All of the methods of waste prevention mentioned require public participation. In order to get the public onboard, training and educational program need to be undertaken to educate the public about their role in the process. Also the government may need to regulate the types and amount of packaging used by manufacturers and make the reuse of shopping bags mandatory.

Ngugi(2006) agrees that waste disposal methods seek to transform the waste into a form that is more manageable, reduce the volume or reduce the toxicity of the waste thus making the waste easier to dispose off. Treatment methods are selected based on the composition, quantity, and form of the waste material. Some waste treatment methods

being used today include subjecting the waste to extremely high temperatures, dumping on land or land filling and use of biological processes to treat the waste. It should be noted that treatment and disposal options are chosen as a last resort to the previously mentioned management strategies reducing, reusing and recycling of waste (Lohani, 2004).Recycling refers to the removal of items from the waste stream to be used as raw materials in the manufacture of new products.

A Wasserman (1999) state that thus from this definition recycling occurs in three phases: first the waste is sorted and recyclables collected, the recyclables are used to create raw materials. These raw materials are then used in the production of new products. Waste from our homes is generally collected by our local authorities through regular waste collection, or by special collections for recycling. Within hot climates such as that of the Caribbean the waste should be collected at least twice a week to control fly breeding, and the harboring of other pests in the community. Other factors to consider when deciding on frequency of collection are the odors caused by decomposition and the accumulated quantities (Schertenleib, 1992).

Sanitary Landfills are designed to greatly reduce or eliminate the risks that waste disposal may pose to the public health and environmental quality. They are usually placed in areas where land features act as natural buffers between the landfill and the environment. For example the area may be comprised of clay soil which is fairly impermeable due to its tightly packed particles, or the area may be characterized by a low water table and an absence of surface water bodies thus preventing the threat of water contamination.

In addition to the strategic placement of the landfill other protective measures are incorporated into its design. The bottom and sides of landfills are lined with layers of clay or plastic to keep the liquid waste, known as leachate, from escaping into the soil. Leachate is collected and pumped to the surface for treatment. Boreholes or monitoring wells are dug in the vicinity of the landfill to monitor groundwater quality. A landfill is divided into a series of individual cells and only a few cells of the site are filled with trash at any one time. This minimizes exposure to wind and rain. The daily waste is spread and compacted to reduce the volume, a cover is then applied to reduce odors and keep out

pests. When the landfill has reached its capacity it is capped with an impermeable seal which is typically composed of clay soil (Siddiqui, 2006).

Open waste piles are a common site in Uasin Gishu and the work of County is often limited to sweeping the streets and dumping the waste in the nearest river or vacant land. Modern waste management techniques, such as source separated door-to-door collection systems, material recovery and recycling facilities, sanitary land filling, and private sector participation have not yet been introduced in most municipalities (Kahn, 2000).

However, in spite of the many challenges faced by municipalities, in some urban areas, municipalities have joined hands with local communities and the private sector to introduce innovative approaches for waste management that are cost effective and efficient. These include door-to-door collection system in some areas and several in the municipalities, plastic collection and recycling systems with community and private sector participation, composting, medical waste management and land filling (Hope, 1999).

2.4.3Influence of Capacity of Infrastructure on Solid Waste Management program

Major problems that come with urbanization in developing countries include: inadequate physical infrastructure, crowding with high levels of waste, unsustainable resource consumption, and the settlement of environmentally vulnerable lands (Hope, 1999). Governmental resources to maintain and expand infrastructure in growing urban areas cannot keep pace with the rate at which urban settlements have been growing. High levels of growth not only demand a greater level of services, but also work to depreciate infrastructure already in place (Lohani, 2004).

Traffic congestion and transportation infrastructure are two major issues that urbanization in Africa has brought about. Maintaining and expanding urban roads to accommodate rapidly growing urban population has presented a major challenge for municipalities while maintaining sustainable solid waste management (Huri bin, 2003). Almost all African urban areas have abandoned money losing public transportation systems in favor of private transportation. Instead of easing the burden, this shift has overwhelmed public roads. Growing numbers of cars on the road has led to higher levels of energy

consumption and increased air pollution problems. In Lesotho and Mauritius the number of cars on the road have more than doubled from 1980-96 (Hope, 1999).

Developing countries that have benefited from the exploitation of precious natural resources, such as diamonds, have seen a jump in numbers of individuals that can afford cars, which has contributed to increased traffic levels and further road degradation (Hope, 1999). In addition to higher pollution levels and infrastructural stress, injury rates resulting from vehicle related accidents have risen. Part of the problem in maintaining road infrastructure comes from the division of responsibilities between national and local governments (Hoornweg, 2009). While federal governments are generally responsible for the primary street structure, housing and businesses are developed on locally managed roads, which do not receive as much attention as they should. Without proper access to these areas economic growth can be limited (Hope, 1999).

The accumulation of solid waste presents one of the most visible infrastructural problems in Africa especially in South Africa. It has been shown that wear on infrastructure has rapidly depreciated capital, which has limited the ability that municipalities have to collect waste and properly dispose of it. For example, in Dares Salaam, Tanzania, 30 garbage disposal trucks were bought in 1987, but due to heavy use only 3 were still operable in 1992 (Hope, 1999).

In Southern Africa, adequate waste management services can consume up to 2% of the GDP, which in some cases accounts for up to 50% of public operating budgets (Hope, 1999). Due to the demanding nature of waste management, Southern African countries tend to collect only between 50-80% of all solid waste (Hope, 1999). In 1994 Gaborone had 180,000 residents that together generated only 30-40 tons of waste each day. Just five years back, the reported level of waste generated was 90 tons per day (Hope, 1999). With this kind of growth, waste management facilities, such as dumps and landfills cannot be built quickly enough. With nowhere to go, waste is accumulating in poor neighborhoods where the proper services are not available (Haan, 2008). Initiatives to recycle raw materials and employ waste pickers have eased the burden that solid waste accumulation has had on urban areas and surrounding ecosystems. As a result of this, 50-65% of small-

scale industries in Dares Salaam, Tanzania receive the majority of their raw materials from waste pickers (Hope, 1999).

Urbanization in both developing and developed countries has put stress on environmental resources, which has lead to varying levels of environmental degradation; however, institutional responses to implement new technologies may restore sustainability in the long run. The primary problem with urbanization in developing countries is the stress that it puts on old infrastructures operating over their designed capacities. This leads to issues with the provision of potable water, proper sanitation services, underdeveloped roadways, and the accumulation of solid waste. These stresses put pressure on environmental conditions in urban areas, which can have significant negative impacts on fragile ecosystems (Hoornweg, 2009).

In developed countries, established urban centers have started to expand with the development of sprawling suburbs. Increased consumption of land and energy are the two primary issues associated with suburbanization (Barton, 2006). Frequent motor vehicle use, coupled with large homes that draw a lot of energy can cause environmental degradation in the form of elevated greenhouse gas emissions, which affect the environment on both a local and global scale. Although urbanization presents many challenges for both developing and developed countries, continued innovation, along with strategic government policies and investment can restore sustainability (Akolkar, 2001).

2.4.4 Influence of Planning Process on Solid Waste Management program

Tashakkori and Teddlie (1998) affirm that in most of the countries, waste collection systems are not properly planned to effectively utilize available resources. As waste is generated by the people, planning is essential to ensure a well-managed system. One pillar of sustainable solid waste management is strategic planning, and links to guidance are provided. Another pillar is cost analysis of solid waste options, and links to useful analytical tools are also provided. For financing, private sector involvement is a growing trend in solid waste management.

Ragle et al (2005) state that the overall goal of urban solid waste management is to collect, treat and dispose of solid wastes generated by all urban population groups in an environmentally and socially satisfactory manner using the most economical means available. Local governments are usually authorized to have responsibility for providing solid waste management services, and most local government laws give them exclusive ownership over waste once it has been placed outside a home or establishment for collection. As cities grow economically, business activity and consumption patterns drive up solid waste quantities. At the same time, increased traffic congestion adversely affects the productivity of the solid waste fleet. Productivity loss is exacerbated by longer hauls required of the fleet, as open lands for disposal are further and further away from urban centers (Siddiqui, 2006).

The challenge is to rationalize worker and vehicle performance, while expanding services to a growing urban population (Hoornweg, 2009).The management of solid waste subscribes to a notion of sustainability, which effectively aims to decouple the generation of waste from economic growth. This orientation emphasizes an 'integrated approach' (mix of options) to waste management, which is based on the 'waste hierarchy' (prevention, minimization, re-use, recycling, energy recovery and the environmentally sustainable disposal of residual waste) (Ragle, 2005).

The approach attempts to place responsibility for waste with both industry and consumers alike. For example, national policy argues that 'a high priority must be placed on the integration of waste management issues into the production/consumption cycle, so that waste spike increases are stabilized and current trends in waste production reversed' (Ozelir, 2006).While national waste policy and planning adheres to a notion of sustainable waste management, it is not altogether clear if sustainability is being achieved in practice. Accordingly, criteria for assessing sustainability must be set out and used to measure the management performance of Municipal Solid Waste (MSW). Increasingly, international trends suggest that the setting of sustainability objectives and the measurement of progress towards them might be determined through the use of indicators (Mongkolnchaiarunya, 2005).

2.5 Conceptual Framework

A conceptual framework is a model presentation where a researcher conceptualizes or represents the relationship between variables in the study diagrammatically (Orodho, 2004). The factors that are assumed to affect solid waste management program in Uasin Gishu County in this study are diagrammatically illustrated in Figure 1.

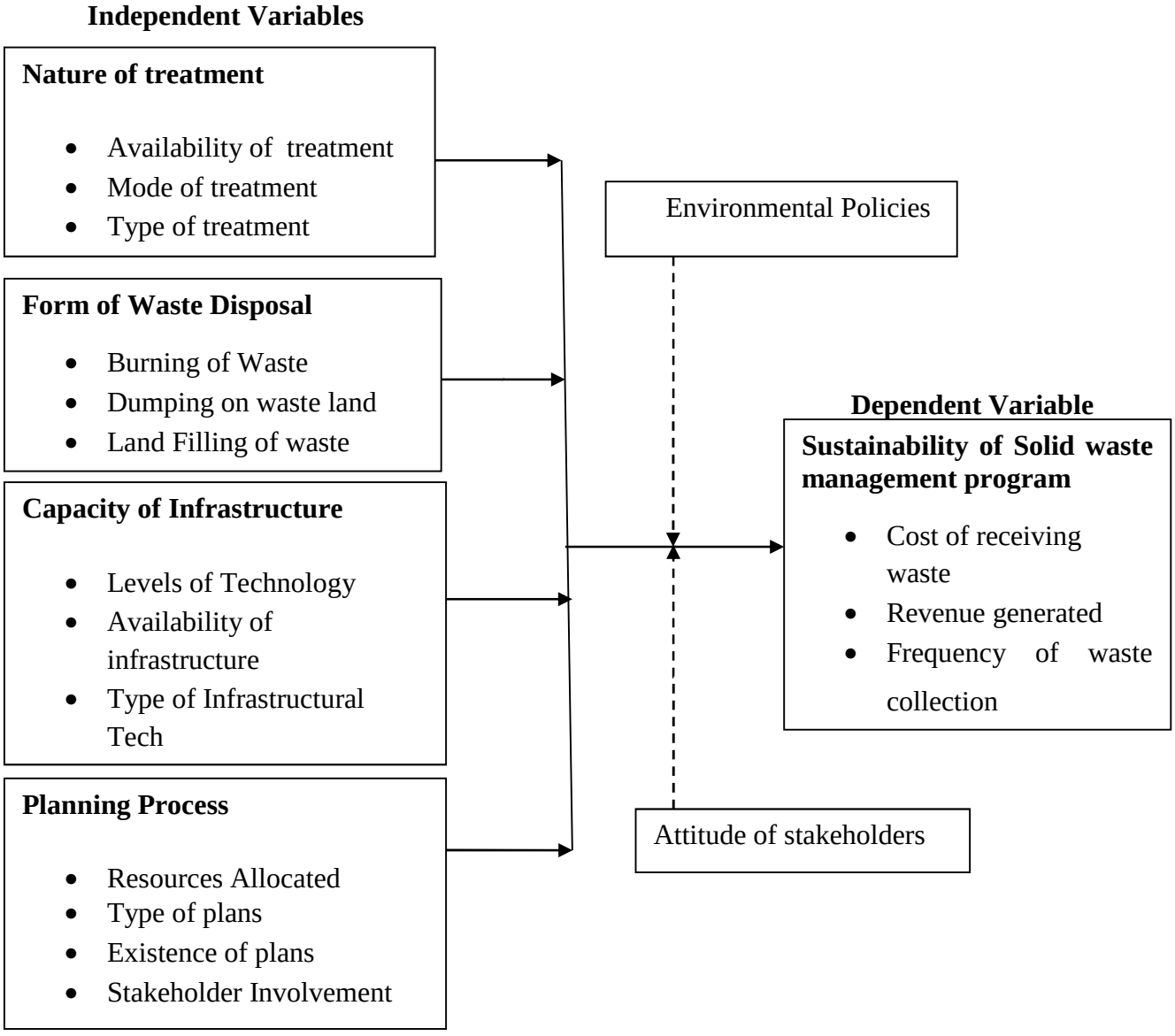

Figure 1: Conceptual Framework

The independent variables in this study were; nature of treatment, form of waste disposal, capacity of infrastructure and planning process. The indicators to be measured under

nature of treatment are availability of treatment, type of treatment and Mode of treatment .Form of waste disposal was another independent variable that is measured by determining method used in waste disposal such as burning of waste, dumping of wasteland and land filling of waste. Level of technology, availability of infrastructure and the type of infrastructure were the indicators to me measured so as to identify capacity of infrastructure. Planning process was another independent variable to be investigated by studying indicators such as existence of plans, resource allocation, and type of plans and stakeholder involvement.

2.5 Summary of Literature Review

Literature reviewed in this study was majorly drawn from other nations such Devkottta, & Watanabe (2006) who conducted their study Kathmandu, Hope et al. (1999) conducted his study in South Africa while Ozelir et al (2006)carried out the study in Ankara. There is therefore need to carry out a study within the local setting in order to come up with local solution to the problem of sustainable solid waste management.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter focused on the research methodology used in this study. The components of the chapter include research design, study site, the target population, sampling procedures and sample size, research instruments, reliability of research instruments, validity of the research, data collecting procedure, and data analysis techniques.

3.2 Research Design

The study employed a descriptive survey research design. A descriptive survey is a design used to assess thoughts, opinions, and feelings. Survey research can be specific and limited, or it can have more global, widespread goals. It describes or defines, often by creating a profile of a group of problems, people or events, through the collection of data (Cooper and Schindler, 2003). Descriptive Survey design was chosen because it enables the researcher to generalize the findings to a large population

3.3Target Population

Study population is a study of a group of individuals taken from the general population who share a common characteristic, such as age, and sex,. According to Mugenda and Mugenda (2003), target population about which information is desired for the study is derived from the population. The population that is actually surveyed is the study population. Target population is that population which is used by a research to generalize the results of the study. The target population of this study was one hundred and thirty (130) respondents from Uasin Gishu County who are responsible for collecting garbage in the county.

3.4 Sample Size and Sampling procedure

A sample is a small part of a larger population which is thought to be representative of the larger population while sampling procedures is the process of selecting a sub-set of

cases in order to draw conclusion about the entire set (Orodho, 2005). The sample size of this study was ninety seven (97) respondents.

The sample size employed for the identification of target population was scientifically computed as recommended by fitcher as follows:

$$nf = \frac{n}{\left(1+\frac{n}{N}\right)}$$

Where;

nf = Sample size (when the population is less than 10,000);384

n = Sample size (when the population is more than 10,000).

N = Estimate of the population size; 130

Therefore the sample size of the study for the teachers was calculated as follows

$$nf = \frac{384}{\left(1+\frac{384}{130}\right)}$$

Desired Sample Size for the respondents was therefore was 97 respondents

Table 3.1 Sampling Frame

Target population	**Target population**	**Sampling procedure**	**Sample size**
Contracted companies managers	8	8/130 *97	6
Employees	122	122/130 * 97	91
Total	**130**		**97**

Sample size was verified using Krejcie and Morgan sample size table. From the ratio sampling, six (6) contractors and ninety one (91) employees were selected to participate in the study to give a sample size of ninety seven (97) respondents.

3.5 Data Collection Instruments

The study used both primary and secondary data. Primary data was collected by use of questionnaires in the field while secondary data was collected from available data management system within the county government and Contract companies.

The instrument for collecting data was a questionnaire with closed ended questions; questionnaire was suitable for collecting data for research because it was appropriate for collecting a lot of information over a short period of time. They were administered to the refuse collection employees and the contractors. The questionnaire was filled by respondents and later collected by the researcher. Questionnaire was designed based on Likert scale. Oppenheim AN (1992), states that Linkert scale is composed of a series of four or more Likert-type items that are combined into a single composite score/variable during the data analysis process.

3.5.1ValidityofResearch Instruments

In order to ascertain content and face validity, the questionnaire was validated through expert opinion method where the questionnaires were presented to the supervisor at the University for Scrutiny and advice. The contents of the instruments were improved based on the supervisor’s advice and comments. The questionnaire items were then constructed in a way that they relate to each research question. That ensured that all research questions were catered for.

3.5.2 Reliability of Research Instruments

Oso and Onen (2009), state that reliability is a measure of the degree of which a research instrument yields consistent results after repeated trials. The researcher used the test-retest method to determine the accuracy of the data collected. The same test was given to the same people after a period of two weeks. Cronbach's alpha was used for calculating reliability coefficient which provided an acceptable value of 0.7 (Creswell, 2006).

3.6 Data Collection Procedure

The researcher obtained a letter of introduction from University of Nairobi. Once the research proposal was approved, the researcher arranged to visit Uasin Gishu County for familiarization purposes and to seek permission from the County government leadership concerning the intended date of data collection.

Once the permission was granted, the researcher arranged to visit the respondents within the county for familiarization purposes and to seek permission from the management concerning the intended date of data collection within their organization. After their participation was confirmed, a date was set and appointment booked with the organization authorities as well as the participants in the study. The participants were given time to respond to all the items in the questionnaires. Then the questionnaires were collected for data analysis.

3.7 Methods of Data Analysis

Data analysis is the process of creating order, structure and meaning to the mass of information collected (Mugenda, 2003). The data collected was analyzed using descriptive statistics. Descriptive statistics is the discipline of quantitatively describing the main features of a collection of data which provides simple summaries about the sample and about the observations that have been made (Dodge, 2003) the descriptive statistics that were used included frequencies tables and percentages.

Obure (2002) alludes that analysis of data varies with the purpose of the research, the complexity of the research design and the extent to which conclusion can be reached easily. The data analysis tools that were used in this study were computer program, Statistical Package for Social Science (SPSS) and excel.

3.8 Ethical Issues

In order to ensure that the study adheres to the ethical standards that are required to conduct a study the researcher sought consent from the relevant authorities. The researcher then introduced themselves to the prospective respondents and sought their consent to conduct the study. The researcher informed the respondents of their rights to

choose whether to participate in the study or not. The researcher observed confidentiality and anonymity in order to protect the sources of his information.

3.9 Operationalization of variables

The study variables were operationalized as follows;

Table 3.2 Operationalization Table of variables

Objective	Variables	Indicators	Measurement scale	Method of analysis
To examine how nature of solid waste treatment influences solid waste management program in Uasin Gishu County	Nature of treatment	Availability of treatment	Nominal	Mean and Standard Deviation
		Mode of treatment	Nominal	
		Type of treatment	Ordinal	
To examine how methods of solid waste disposal influences solid waste management program in Uasin Gishu County.	Form of waste disposal	Burning of waste	Nominal	Mean and Standard Deviation
		Dumping on waste land	Nominal	
		Land filling of waste	Nominal	
To establish how capacity of infrastructure influences solid waste management program in Uasin Gishu County.	Capacity of infrastructure	Level of technology	Interval	Mean and Standard Deviation
		Availability of infrastructure	Nominal	
		Type of infrastructure technology	Nominal	
To assess how planning process influences solid waste management program in Uasin Gishu County.	Planning process	Resources allocated	Ordinal	Mean and Standard Deviation
		Types of plans	Nominal	
		Existence of plans	Nominal	

CHAPTER FOUR

DATA ANALYSIS,PRESENTATION, DISCUSSION ANDINTERPRETATION

4.1 Introduction

This chapter aimed to analyze the factors influencing sustainability of solid waste management program in Uasin Gishu County. The information collected was presented in tabular formats. Discussions of the findings were also given and the information analyzed was interpreted in relation to the research objectives to ensure that it is provides answers to the research questions.

4.2 Response Rate

The study sought to establish data from 97 respondents as a representative sample. Eighty two (82) questioners were duly completed and returned out of ninety seven (97) that were administered to the respondents. This presents eighty four percent (84%) response rate, which was considered valid for the purpose of research. Keeter et al, (2006) states that any survey with a response rate of above 70% gives out a more reliable and accurate information as it manifests significant feedbacks. The cross sectional nature of the sample was intended to collect views regarding the subject from several perspectives.

4.3Demographic Information of the Respondents

The study sought to determine the demographic information of the respondents. The study therefore tried to establish the gender, age, education level, working experience, and position of the respondents. The researcher found it necessary to analyze the general characteristics of the respondents as the characteristics of the respondents could have had an influence on the responses elicited from the respondents. The findings are presented as follows;

4.3.1 Distribution of Respondents by Gender

During Data collection the respondents were requested to indicate their gender.

Table 4.1 Gender of the Respondents

Gender	Frequency	Percentage Frequency
Male	40	48.8
Female	42	51.2
Total	**82**	**100**

The findings on the gender of the respondents indicate that (51.2%) were females while (48.8%) of the respondents were male. This is an indication of a well-balanced workforce in terms of gender orientation. This could perhaps be an indication of the organizations embracing the equal employment opportunity. This is good for this study since the opinion of both genders is equally presented.

4.3.2 Distribution of Respondents by Age.

During data collection, the respondents were asked to indicate their Age.

Table 4.2 Ages of the Respondents

Age of Respondents	Frequency	Percentage Frequency
21-30 years	24	29.3
31-40 years	31	37.8
41-50 years	17	20.7
Above 50 years	10	12.2
Total	**82**	**100**

The findings on the ages of the respondents indicate that (37.8%) of the respondents were aged between 31-40 years,(29.3%) were between 21-30 years, (20.7%) were in aged41-50 years while (12.2%) were above 50 years of age. The findings indicate that the researcher was able to collect data from individuals drawn from different age brackets therefore there those that view the process with fresh eyes and those who have been in the industry for long and therefore knows all the tricks in the industry. This was good for the

study since it would offer great information for the study and from informed points of view.

4.3.3 Distribution of Respondents by Level of Education

Respondents were also requested to indicate their highest level of education attained.

Table 4.3 Education of the Respondents

Level of Education	Frequency	Percentage Frequency
Certificate	23	28.3
Diploma	26	31.6
Bachelors' Degree	28	34.1
Masters' Degree	5	6.0
Total	**82**	**100**

From the results, educational levels of the respondents indicate that28.0% of the respondents were certificate holders whereas a significant number (31.7%) of the respondents attained the diploma level of education. The respondents who attained the bachelor's degree accounted for 34.1% of the population while the remaining partly (6.1%) were master's degree holders. These findings indicate that the respondents were well learned and therefore were in a good position to understand the study and provide the researcher with the information sought. The population was in a better position to answer questions and give a technical opinion on the subject of the study.

4.3.4 Distribution of Respondents by Level of experience achieved.

The respondents were also requested to indicate their level of Experience in respect to the solid waste management department.

Table 4.4 Experience of the Respondents

Years of Experience	**Frequency**	**Percentage Frequency**
Less than 5 years	25	30.5
5-10 years	9	11
10-15 years	34	41.5
15-20 years	9	11
Above 21 years	5	6.1
Total	**82**	**100**

The findings on the working experience of the respondents indicate that(41.5%) of the respondents had a working experience of 10-15 years, 30.5% had worked for less than 5 years,11.0% of the respondents had a working experience of 5-10 years, 11.0%for 15-20 years while the remaining 6.1% of the respondents had a working experience of above 21 years. The findings indicated that varied responses could be collected from the respondents considering that those who had little experience and those who had a lot of experience participated in the study. These findings also indicate that a good number had worked for considerably longer period of time and therefore were in a position to provide well informed responses for the study.

4.3.5 Distribution of Respondents by Position

Respondents were also requested to indicate their position in the department of solid waste management.

Table 4.5 Position of the Respondents

Position of Respondents	**Frequency**	**Percentage Frequency**
Top management	17	20.7
Middle Level Management	22	26.8
Supervisory Level	43	52.4
Total	**82**	**100**

Findings on the job position held by the respondents indicate that (52.4%) of the respondents worked at the supervisory level,26.8% were in the middle level management while20.7% of the respondents were at the top level management. The findings indicated that varied responses could be collected from the respondents considering that those who worked as supervisory, top and middle level management participated in the study.

4.4Nature of Treatment and Sustainability of Solid Waste Management program

The study sought to determine how the nature of solid waste treatment influences waste management program. The findings are presented in Table 4.6.

Table 4.6 Nature of Treatment and Sustainability of Solid Waste Management program

Statements		Mean	Std. Deviation
5A	Availability of treatment influence frequency of collecting waste	3.34	1.70127
5B	Availability of treatment influence cost of receiving waste	2.52	0.99661
5C	Availability of treatment influence revenue generated from the waste	3.68	1.49797
5D	Mode of treatment of waste influence frequency of waste collection	3.16	1.57503
5E	Mode of treatment of waste influence cost of receiving waste	2.72	1.27922
5F	Mode of treatment of waste influence revenue generated from waste	3.02	1.50698
5G	Type of treatment influences frequency of collecting waste	2.79	1.48022
5H	Type of treatment influences cost of receiving waste	2.54	1.12431
5I	Type of treatment influences revenue generated from waste	3.01	1.30046

N=82

The study findings on the how the nature of solid waste treatment influences waste management program indicate that a majority of the respondents that is mean of 3.68were of the opinion that availability of treatment influence revenue generated from the waste,

with a mean of 3.34 respondents said that availability of treatment influence frequency of collecting waste, respondents with a mean of 3.16 said that mode of treatment of waste influence frequency of waste collection, mean of 3.02 said mode of treatment of waste influence revenue generated from waste,3.01 mean said type of treatment influences revenue generated from waste, 2.79 mean said type of treatment influences frequency of collecting waste, 2.72 mean of respondents said mode of treatment of waste influence cost of receiving waste, 2.54 mean of respondents said type of treatment influences cost of receiving waste while 2.52 mean of respondents said availability of treatment influence cost of receiving waste.

These findings therefore imply that what affected how the nature of solid waste treatment influences waste management program majorly was the availability of treatment with an average mean of (3.1829) which influenced revenue generated from the waste and availability of treatment influences the frequency of collecting waste. This therefore implies that how well-endowed the county is in treatment and how readily they can access it will determine the revenue they will generate and their capability to frequently conduct the waste management. This therefore implies that availability of treatment that the county requires to conduct solid waste management is what mostly affects the waste management program more greatly. This is because the availability will determine the frequency with which they can conduct disposal and what revenue they can derive from it since waste can be turned into different useful products through treatment and therefore their ability to treat in ways such as recycling and processing of the waste will determine their ability to generate more revenue. One can therefore conclude that the county government has limited types of treatments that they use to address the problem of solid waste management and they therefore cannot be able to adequately address the problem of solid waste management since different types of waste produced require availability of different types of treatment.

These findings are supported by Zurbrugg (2002) who said that due to the fact that the municipalities have inadequate types of treatment, their availability and the modes they use waste management program are affected since different kinds of waste that are generated require to be treated in different ways. Many waste treatment technologies can

provide permanent, immediate, and very high degrees of hazard reduction Zurbrugg (2002) also points inefficiency in most of the low-income country collection systems since the collection vehicles are not technologically fitted to collect majority of developing countries' high density organic waste hence treatment is not readily available affects their ability to generate revenue through the offering of these services of garbage collection.

According to Shekdar(2009) integrated waste management options are now being applied in most of the developed countries with resource recycle, recovery and energy generation facilities from the solid waste. Waste-to-energy (WTE) conversion is now considered as one of the optimal methods to solve the waste management problem in a sustainable way. Different mechanical, biological and thermo-chemical, waste-to-energy technologies are now applied for managing waste. Technological advancements, environmental regulations, and emphasis on resource conservation and recovery have greatly reduced the environmental impacts of solid waste (SW) management, including emissions of greenhouse gases (GHGs). This illustrates why the nature of treatment affects the solid waste management program since different types of wastes require different types and mode of treatment and the availability of these treatment is crucial.

4.5Form of Waste Disposal and Sustainability of Solid Waste Management program

The study sought to determine the influence that form of waste disposal used by the county government had on waste management program. The findings are presented the Table 4.7.

Table 4.7:Form of Waste Disposal and Sustainability of Solid Waste Management program

	Statement	Mean	Std. Deviation
6A	Burning of waste influences frequency of collecting waste	4.29	0.63805
6B	Burning of waste influences cost of receiving waste	4.22	0.54488
6C	Burning of waste influences revenue generated from waste	4.48	0.52647
6D	Dumping waste on land influences frequency of collecting waste	4.29	0.57709
6E	Dumping waste on land influences cost of receiving waste	4.01	0.63817
6F	Dumping waste on land influences revenue generated from waste	4.13	0.76598
6G	Land filling of waste disposed influence frequency of collecting waste	4.45	0.52476
6H	Land filling of waste disposed influence cost of receiving waste	4.59	0.54322
6I	Land filling of waste disposed influences revenue generated from waste	4.5	0.59317

N=82

The findings on the influence that form of waste disposal used by the county government had on waste management program indicate that a majority of the respondents that is 4.59 were of the opinion that Burning of waste disposed influenced cost of receiving waste, 4.5 said Dumping waste on land influences revenue generated from waste, 4.48 said Land filling of waste disposed influences revenue generated from waste, 4.45 said Burning of waste disposed influence frequency of collecting waste, 4.29 said Dumping waste on land influences frequency of collecting waste and Land filling of waste disposed influences frequency of collecting waste, 4.22 said Burning of waste disposed influences cost of receiving waste, 4.13 said Dumping waste on land influences revenue generated from waste while 4.01 said Land filling of waste disposed influences cost of receiving waste.

These findings therefore, imply that what affected how form of waste disposal used by the county government had on waste management majorly was that the burning of waste disposed at an average mean of (4.5122) which influenced cost of receiving waste and

type of waste disposed influences revenue generated from waste. This therefore implies that burning of waste was what the county was supposed to address because it was the one that greatly influenced the form of waste disposal to be used by the county. This could be attributed to the fact that different waste produced required different forms of waste disposal. Different waste required different forms of disposing them and therefore incurred different costs while at the same time generated different amounts of revenue since in the process of disposal some could be recycled and therefore generate revenue for the county. One can therefore conclude that the county government therefore has a number of methods that it uses in waste disposal this is the reason why the methods that used affect solid waste management program most significantly compared to other factors of sustainable solid waste management.

These findings are supported by Ozelir and Demirer (2006) who said that the form of waste disposal is an important determinant of the technology chosen for waste management. For example, some wastes are technically incompatible with a specific technology because they would damage equipment. For wastes characterized as hazardous because of their reactivity, corrosiveness, and ignitability, there are well-established chemical and physical treatments available. However, for a waste in which toxicity is the major hazardous characteristic, the choices are not clear. Toxic constituents may be organic, inorganic, or metallic, and many technologies could be used. This therefore indicates that the methods that will be used for the purpose of solid waste management will be determined by the type of waste produced, quantity and the nature of the waste. This is why the methods that the county government used in waste management influenced solid waste management program the most.

According to Kahn(2000) the methods of waste disposal and management of solid waste reduces or eliminates adverse impacts on the environment and human health and supports economic development and improved quality of life. A number of processes are involved in effectively disposing and managing waste for a municipality. These include monitoring, collection, transport, processing, recycling and disposal. Methods of waste reduction, waste reuse and recycling are the preferred options when managing waste; the method used will be determined by the nature type and quantity of waste.

Ngugi (2006) further states that waste disposal methods seek to transform the waste into a form that is more manageable, reduce the volume or reduce the toxicity of the waste thus making the waste easier to dispose off. Treatment methods are selected based on the composition, quantity, and form of the waste material. Some waste treatment methods being used today include subjecting the waste to extremely high temperatures, dumping on land or land filling and use of biological processes to treat the waste.

Therefore different types of waste that are generated in a county require different forms of disposal to address the problem of waste disposal. The more options in form of waste disposal a county has the more they are able to address different types of wastes generated.

4.6Capacity of Infrastructure and Solid Waste Management Program

The study sought to determine the influence that capacity of infrastructure has on solid management waste program. The findings are represented in table 4.8

Table 4.8 Capacity of Infrastructure and Sustainability of Solid Waste Management Program

	Statement	Mean	Std. Deviation
7A	Levels of infrastructural technology influences frequency of collecting waste	3.61	1.51337
7B	Levels of infrastructural technology influences cost of receiving waste	2.9	1.04951
7C	Levels of infrastructural technology influences revenue generated from waste	3.79	1.3309
7D	Availability of infrastructure influences frequency of collecting waste	3.93	0.93993
7E	Availability of infrastructure influences cost of receiving waste	3.59	1.01776
7F	Availability of infrastructure influences revenue generated from waste	3.82	1.04383
7G	Type of infrastructural technology influences frequency of collecting waste	3.28	1.25977
7H	Type of infrastructural technology influences cost of receiving waste	3.02	1.07698
7I	Type of infrastructural technology influences revenue generated from waste	3.51	1.00914

N=82

The findings on the influence that capacity of infrastructure has on solid management waste program indicates that a majority of the respondents that is 3.93 were of the opinion that availability of, infrastructure influences frequency of collecting waste 73.82 said availability of infrastructure influences revenue generated from waste, 3.61 said levels of infrastructural technology influences frequency of collecting waste, 3.59 said Availability of infrastructure influences cost of receiving waste, 3.28 said type of infrastructural technology influences frequency of collecting waste, 3.51 said type of infrastructural technology influences revenue generated from waste, 3.02 said type of infrastructural technology influences cost of receiving waste while 2.9 said levels of infrastructural technology influences cost of receiving waste.

These findings therefore indicate that what affected the way that capacity of infrastructure influences solid management waste program majorly was availability of infrastructure with an average mean of (3.7764) which influenced the frequency of collecting waste and availability of infrastructure influences revenue generated from

waste. These findings therefore imply that the availability of the capacity of infrastructure was the major way that influenced the solid waste management program. This could be attributed to the fact a county government has to have an infrastructure in order to be able to carry out waste disposal program. Without it the nothing can be accomplished and that is why the availability of this infrastructure affects the ability of the county to collect waste and to generate revenue.

From the findings one can therefore conclude that the county government has a moderately developed infrastructure to conduct solid waste management and that is why it can only carryout the waste management process to some extent and within specified zoned areas. It is yet to develop its infrastructure fully to cater for the needs of the county as far as solid waste management is concerned which could be attributed to high population growth.

These findings concur with Lohani (2004) who said that the major problems that come with urbanization in developing countries include: inadequate physical infrastructure, crowding with high levels of waste, unsustainable resource consumption, and the settlement of environmentally vulnerable lands. Governmental resources to maintain and expand infrastructure in growing urban areas cannot keep pace with the rate at which urban settlements have been growing. High levels of growth not only demand a greater level of services, but also work to depreciate infrastructure already in place. Since the level of growth is higher than the rate of infrastructural growth, local authorities are unable to fully meet the needs of its citizenry such as solid waste management.

Hope, (1999) further supports these findings by stating that the accumulation of solid waste presents one of the most visible infrastructural problems in Africa especially in South Africa. It has been shown that wear on infrastructure has rapidly depreciated capital, which has limited the ability that municipalities have to collect waste and properly dispose of it. Due to the demanding nature of waste management, Southern African countries tend to collect only between 50-80% of all solid waste. With growth in waste generation, waste management facilities, such as dumps and landfills cannot be

built quickly enough. With nowhere to go, waste is accumulating in poor neighborhoods where the proper services are not available.

The infrastructural capacity affects waste management program; there is therefore need for county governments to develop their infrastructure in order to be able to cater for the waste management needs of their residents fully. The capacity of infrastructure that a county has therefore affects the solid management program.

4.7Planning Process and Sustainability of Solid Waste Management program

The study sought to determine the effect of planning process and solid waste management process. The findings are presented in Table 4.9

Table 4.9 Planning Process and Sustainability of Solid Waste Management program

	Statement	Mean	Std. Deviation
8A	Existence of plans influences frequency of collecting solid waste	4.3	0.53723
8B	Existence of plans influences cost of receiving solid waste	4.09	0.81953
8C	Existence of plans influences revenue generated from solid waste	4.37	0.65757
8D	Resources allocated influences frequency of collecting solid waste	4.09	0.72352
8E	Resources allocated influences cost of receiving solid waste	4.04	0.76085
8F	Resources allocated influences revenue generated from solid waste	3.99	0.89572
8G	Type of plans influences frequency of collecting solid waste	3.82	0.84806
8H	Type of plans influences cost of receiving solid waste	3.6	0.92776
8I	Type of plans influences revenue generated from solid waste	3.67	0.90342
8J	Stakeholder involvement influences frequency of collecting solid waste	4.01	0.76164
8K	Stakeholder involvement influences cost of receiving solid waste	3.95	0.71841
8L	Stakeholder involvement influences revenue generated from solid waste	3.74	0.84343

N=82

The findings on the effect of planning process has on solid waste management process indicate that a majority of the respondents that is 4.37 were of the opinion that existence of plans influences revenue generated from solid waste, 4.3 said existence of plans influences frequency of collecting solid waste, 4.09 said Existence of plans influences cost of receiving solid waste and resources allocated influences frequency of collecting solid waste, 4.04 said resources allocated influences cost of receiving solid waste, 4.01 said stakeholder involvement influences frequency of collecting solid waste. 3.99 said resources allocated influences revenue generated from solid waste, 3.95 said stakeholder involvement influences cost of receiving solid waste, 3.82 said type of plans influences frequency of collecting solid waste, 3.74 said stakeholder involvement influences revenue generated from solid waste, 3.67 said type of plans influences revenue generated from solid waste while 3.6 said type of plans influences cost of receiving solid waste.

These findings therefore, indicate that what affected the way planning process influences solid waste management process majorly was the existence of plans with an average mean of (4.252) which influenced the revenue generated from solid waste and existence of plans influences frequency of collecting solid waste. These findings therefore imply that the existence of planning affected the planning process in solid waste management. This could be attributed to the fact that when plans are in existence in the county government they can be able to carry out the waste management program since they have a plan of action and know what they are expected to every step of the way. This comes in handy in enabling them to generate revenue and collect waste since they have a plan of action to undertake these tasks.

Form the findings one can therefore conclude that the county government is involved with some level of planning in regards to solid waste management and that is the reason why they have been able to substantially affect solid waste management in the county. They have been involved in resource allocation towards the solid waste management program, made some plans with this regard which enables them to deliver some considerably good results in the management of solid waste.

These findings are affirmed by Tashakkori and Teddlie (1998) who said that in most of the countries, waste collection systems are not properly planned to effectively utilize available resources. As waste is generated by the people, planning is essential to ensure a well-managed system. One pillar of sustainable solid waste management is strategic planning, and links to guidance are provided. Another pillar is cost analysis of solid waste options, and links to useful analytical tools are also provided. For financing, private sector involvement is a growing trend in solid waste management. Therefore the engagement of the county government in planning is a plus towards the management of solid waste.

According to Ragle et al (2005), the overall goal of urban solid waste management is to collect, treat and dispose of solid wastes generated by all urban population groups in an environmentally and socially satisfactory manner using the most economical means available(Jegasothy, 1999). The challenge is to rationalize worker and vehicle performance, while expanding services to a growing urban population (Hoornweg, 2009). It takes proper planning process to ensure that all these are a success.

4.8Sustainability of Solid waste management program

The study sought to determine the measures of Sustainability of solid waste management in Uasin Gishu County. The findings are presented in Table 4.10

Table 4.10Sustainability of Solid Waste Management Program

	Statement	Mean	Std. Deviation
9A	The number of times solid waste management is collected is predestined per region	4.2881	0.6173
9B	Solid waste is collected when stake holders find it necessary	3.6829	1.49797
9C	There funds set aside for collecting solid waste	3.6707	0.90342
9D	Cost of collecting solid waste is excessive	4.4857	0.53141
9E	Revenue generated from solid waste management is recycled	3.6707	0.90342
9F	Revenue generated from solid waste management is enough	3.9878	0.89572

N=82

The findings indicate that a majority of the respondents that is 4.4857 were of the opinion that cost of collecting solid waste is excessive,4.2881 said that the number of times solid waste management id collected is predestined per region, 3.9878 said revenue generated from solid waste management is channeled to, 3.6829 said solid waste is collected when stake holders find it necessary while 3.6707 said revenue generated from solid waste management is recycled and there funds set aside for collecting solid waste.

These findings therefore imply that cost of collecting solid waste is excessive and therefore the process of Sustainable solid waste management required a lot of funds. The county therefore is faced with a tough challenge of ensuring that they have enough funds to carryout to undertake sustainable solid waste management.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSIONS ANDRECOMMENDATIONS

5.1Introduction

This chapter aims to present a summary of the findings and discussions of the study, conclusions of the study, recommendations of the study and suggestions for further studies. It will therefore highlight the findings that the study made, draw conclusions from the study and make recommendations and suggestions for future studies.

5.2Summary of findings

This section examines summary of research findings as per the objectives of the study.

5.2.1 Nature of Treatment and Solid Waste Management Program

The study findings on how nature of solid waste treatment influences waste management program indicate that a majority of the respondents that is 3.68 were of the opinion that availability of treatment influence revenue generated from the waste, 3.34 said availability of treatment influence frequency of collecting waste, 3.16 said mode of treatment of waste influence frequency of waste collection, 3.02 said mode of treatment of waste influence revenue generated from waste,3.01 said type of treatment influences revenue generated from waste, 55.8% said type of treatment influences frequency of collecting waste, 2.72 said mode of treatment of waste influence cost of receiving waste, 2.54 said type of treatment influences cost of receiving waste while 2.52 said availability of treatment influence cost of receiving waste.

These findings therefore, imply that what affected how the nature of solid waste treatment influences waste management program majorly was the availability of treatment with an average mean of (3.1829) which influenced revenue generated from the waste and availability of treatment influences the frequency of collecting waste. This therefore implies that how well-endowed the county is in treatment and how readily they can access it will determine the revenue they will generate and their capability to frequently conduct the waste management. This therefore implies that availability of

treatment that the county requires to conduct solid waste management is what mostly affects the waste management program more greatly. This is because the availability will determine the frequency with which they can conduct disposal and what revenue they can derive from it since waste can be turned into different useful products through treatment and therefore their ability to treat in ways such as recycling and processing of the waste will determine their ability to generate more revenue. One can therefore conclude that the county government has limited types of treatments that they use to address the problem of solid waste management and they therefore cannot be able to adequately address the problem of solid waste management since different types of waste produced require availability of different types of treatment

These findings are supported by Zurbrugg (2002) who said that due to the fact that the municipalities have inadequate types of treatment, their availability and the modes they use waste management program are affected since different kinds of waste that are generated require to be treated in different ways. Many waste treatment technologies can provide permanent, immediate, and very high degrees of hazard reduction Zurbrugg (2002) also points inefficiency in most of the low-income country collection systems since the collection vehicles are not technologically fitted to collect majority of developing countries' high density organic waste hence treatment is not readily available affects their ability to generate revenue through the offering of these services of garbage collection.

According to Shekdar (2009) integrated waste management options are now being applied in most of the developed countries with resource recycle, recovery and energy generation facilities from the solid waste. Waste-to-energy (WTE) conversion is now considered as one of the optimal methods to solve the waste management problem in a sustainable way. Different mechanical, biological and thermo-chemical, waste-to-energy technologies are now applied for managing waste. Technological advancements, environmental regulations, and emphasis on resource conservation and recovery have greatly reduced the environmental impacts of solid waste (SW) management, including emissions of greenhouse gases (GHGs). This illustrates why the nature of treatment

affects the solid waste management program since different types of wastes require different types and mode of treatment and the availability of these treatment is crucial.

5.2.2Form of Waste Disposal and Solid Waste Management Program

The findings on the influence that form of waste disposal used by the county government had on waste management program indicate that a majority of the respondents that is 4.59 were of the opinion that Land filling of waste disposed influenced cost of receiving waste, 4.50 said Land filling of waste disposed influences revenue generated from waste, 4.48 said Burning of waste disposed influences revenue generated from waste, 4.45 said Land filling of waste disposed influence frequency of collecting waste, 4.29 said Dumping on waste land influences frequency of collecting waste and Burning of waste disposed influences frequency of collecting waste, 4.22 said Burning of waste disposed influences cost of receiving waste, 4.13 said Dumping on waste land influences revenue generated from waste while 4.01 said Dumping on waste land influences cost of receiving waste.

These findings therefore imply that what affected how the forms of waste disposal used by the county government had on waste management majorly was that the Land filling of waste disposed at an average mean of (4.5122) which influenced cost of receiving waste and Land filling of waste disposed influences revenue generated from waste. This therefore implies that Land filling of waste disposed is what the county was supposed to address since it was the one that greatly influenced the form to be used. This could be attributed to the fact that different waste produced required different forms of waste disposal. Different waste required different forms of disposing them and therefore incurred different costs while at the same time generated different amounts of revenue since in the process of disposal some could be recycled and therefore generate revenue for the county. One can therefore conclude that the county government therefore has a number of forms of waste disposal that it uses in waste disposal this is the reason why the form that is used affect solid waste management program most significantly compared to other factors of sustainable solid waste management.

These findings are supported by Ozelir and Demirer (2006) who said that the waste type is an important determinant of the technology chosen for waste management. For example, some wastes are technically incompatible with a specific technology because they would damage equipment. For wastes characterized as hazardous because of their reactivity, corrosiveness, and ignitability, there are well-established chemical and physical treatments available. However, for a waste in which toxicity is the major hazardous characteristic, the choices are not clear. Toxic constituents may be organic, inorganic, or metallic, and many technologies could be used. This therefore indicates that the methods that will be used for the purpose of solid waste management will be determined by the type of waste produced, quantity and the nature of the waste. This is why the methods that the county government used in waste management influenced solid waste management program the most.

According to Kahn (2000) the methods of waste disposal and management of solid waste reduces or eliminates adverse impacts on the environment and human health and supports economic development and improved quality of life. A number of processes are involved in effectively disposing and managing waste for a municipality. These include monitoring, collection, transport, processing, recycling and disposal. Methods of waste reduction, waste reuse and recycling are the preferred options when managing waste; the method used will be determined by the nature type and quantity of waste.

Ngugi (2006) further states that waste disposal methods seek to transform the waste into a form that is more manageable, reduce the volume or reduce the toxicity of the waste thus making the waste easier to dispose off. Treatment methods are selected based on the composition, quantity, and form of the waste material. Some waste treatment methods being used today include subjecting the waste to extremely high temperatures, dumping on land or land filling and use of biological processes to treat the waste.

Therefore different types of waste that are generated in a county require different forms of waste disposal to address the problem of waste management. The more options in form a county has the more they are able to address different types of wastes generated.

5.2.3Capacity of Infrastructure and Solid Waste Management Program

The findings on the influence that capacity of infrastructure has on solid management waste program indicates that a majority of the respondents that is 3.93 were of the opinion that availability of, infrastructure influences frequency of collecting waste 3.82 said availability of infrastructure influences revenue generated from waste, 3.61 said levels of infrastructural technology influences frequency of collecting waste, 3.59 said Availability of infrastructure influences cost of receiving waste, 3.28 said type of infrastructural technology influences frequency of collecting waste, 3.51 said type of infrastructural technology influences revenue generated from waste, 3.02 said type of infrastructural technology influences cost of receiving waste while 58% said levels of infrastructural technology influences cost of receiving waste.

These findings therefore indicate that what affected the way that capacity of infrastructure influences solid management waste program majorly was availability of infrastructure with an average mean of (3.7764) which influenced the frequency of collecting waste and availability of infrastructure influences revenue generated from waste. These findings therefore imply that the availability of the capacity of infrastructure was the major way that influenced the solid waste management program. This could be attributed to the fact a county government has to have an infrastructure in order to be able to carry out waste disposal program. Without it the nothing can be accomplished and that is why the availability of this infrastructure affects the ability of the county to collect waste and to generate revenue.

From the findings one can therefore conclude that the county government has a moderately developed infrastructure to conduct solid waste management and that is why it can only carryout the waste management process to some extent and within specified zoned areas. It is yet to develop its infrastructure fully to cater for the needs of the county as far as solid waste management is concerned which could be attributed to high population growth.

These findings concur with Lohani (2004) who said that the major problems that come with urbanization in developing countries include: inadequate physical infrastructure, crowding with high levels of waste, unsustainable resource consumption, and the settlement of environmentally vulnerable lands. Governmental resources to maintain and expand infrastructure in growing urban areas cannot keep pace with the rate at which urban settlements have been growing. High levels of growth not only demand a greater level of services, but also work to depreciate infrastructure already in place. Since the level of growth is higher than the rate of infrastructural growth, local authorities are unable to fully meet the needs of its citizenry such as solid waste management.

Hope, (1999) further supports these findings by stating that the accumulation of solid waste presents one of the most visible infrastructural problems in Africa especially in South Africa. It has been shown that wear on infrastructure has rapidly depreciated capital, which has limited the ability that municipalities have to collect waste and properly dispose of it. Due to the demanding nature of waste management, Southern African countries tend to collect only between 50-80% of all solid waste. With growth in waste generation, waste management facilities, such as dumps and landfills cannot be built quickly enough. With nowhere to go, waste is accumulating in poor neighborhoods where the proper services are not available.

The infrastructural capacity affects waste management program; there is therefore need for county governments to develop their infrastructure in order to be able to cater for the waste management needs of their residents fully. The capacity of infrastructure that a county has therefore affects the solid management program.

5.2.4Planning Process and Solid Waste Management Program

The findings on the effect of planning process has on solid waste management process indicate that a majority of the respondents that is 4.37 were of the opinion that existence of plans influences revenue generated from solid waste, 4.30 said existence of plans influences frequency of collecting solid waste, 4.09 said Existence of plans influences cost of receiving solid waste and resources allocated influences frequency of collecting solid waste, 4.04 said resources allocated influences cost of receiving solid waste, 4.01 said stakeholder involvement influences frequency of collecting solid waste. 3.99 said

resources allocated influences revenue generated from solid waste, 3.95 said stakeholder involvement influences cost of receiving solid waste, 3.82 said type of plans influences frequency of collecting solid waste, 3.74 said stakeholder involvement influences revenue generated from solid waste, 3.67 said type of plans influences revenue generated from solid waste while 3.60 said type of plans influences cost of receiving solid waste.

These findings therefore indicate that what affected the way planning process influences solid waste management process majorly was the existence of plans with an average mean of (4.252) which influenced the revenue generated from solid waste and existence of plans influences frequency of collecting solid waste. These findings therefore imply that the existence of planning affected the planning process in solid waste management. This could be attributed to the fact that when plans are in existence in the county government they can be able to carry out the waste management program since they have a plan of action and know what they are expected to every step of the way. This comes in handy in enabling them to generate revenue and collect waste since they have a plan of action to undertake these tasks.

Form the findings one can therefore conclude that the county government is involved with some level of planning in regards to solid waste management and that is the reason why they have been able to substantially affect solid waste management in the county. They have been involved in resource allocation towards the solid waste management program, made some plans with this regard which enables them to deliver some considerably good results in the management of solid waste.

These findings are affirmed by Tashakkori and Teddlie (1998) who said that in most of the countries, waste collection systems are not properly planned to effectively utilize available resources. As waste is generated by the people, planning is essential to ensure a well-managed system. One pillar of sustainable solid waste management is strategic planning, and links to guidance are provided. Another pillar is cost analysis of solid waste options, and links to useful analytical tools are also provided. For financing, private sector involvement is a growing trend in solid waste management. Therefore the

engagement of the county government in planning is a plus towards the management of solid waste.

According to Ragle et al (2005), the overall goal of urban solid waste management is to collect, treat and dispose of solid wastes generated by all urban population groups in an environmentally and socially satisfactory manner using the most economical means available (Jegasothy, 1999). The challenge is to rationalize worker and vehicle performance, while expanding services to a growing urban population (Hoornweg, 2009). It takes proper planning process to ensure that all these are a success.

5.2. 5 Sustainability of Solid Waste Management Program

The findings indicate that a majority of the respondents that is 4.4857 were of the opinion that cost of collecting solid waste is excessive, 4.2881 said that the number of times solid waste management is collected is predestined per region, 3.6829 said revenue generated from solid waste management is channeled back to solid waste management infrastructure, 3.6707 said solid waste is collected when stake holders find it necessary while 3.660 said revenue generated from solid waste management is recycled and there funds set aside for collecting solid waste.

These findings, therefore, imply that cost of collecting solid waste is excessive and therefore the process of Sustainability of solid waste management required a lot of funds. The county therefore is faced with a tough challenge of ensuring that they have enough funds to carry out and undertake sustainable solid waste management.

5.3 Conclusions

It was concluded that, what affected how the nature of solid waste treatment influences waste management program majorly was the availability of treatment. This is because the availability influenced revenue generation from the waste and the frequency of collecting waste. How well-endowed the county is in treatment and how readily they can access it will determine the revenue they will generate and their capability to frequently conduct efficient and sustainable waste management. The availability of treatment that the county requires to conduct solid waste management is what mostly affects the waste management program more greatly. The county government has limited types of

treatments that they use to address the problem of solid waste management and they therefore cannot be able to adequately address the problem of solid waste management since different types of waste produced require availability of different types of treatment; there should therefore endeavor to invest in more types of treatment in order to address the problem of solid waste management.

It was also concluded that what affected the form of waste disposal used by the county government had on waste management was majorly land filling of waste. This is because they influenced the cost of receiving waste and revenue generated from waste. Different types of waste required different forms of disposing them and therefore incurred different costs while at the same time generated different amounts of revenue since in the process of disposal some could be recycled and therefore generate revenue for the county. The county government therefore has a number of forms that it uses in waste disposal this is the reason why the form that used affect solid waste management program most significantly compared to other factors of sustainable solid waste management.

On what affected the way that capacity of infrastructure influences solid management waste program majorly it was concluded that it is the availability of infrastructure. This because is it influences the frequency of collecting waste and the revenue generated from waste. The county government had to have an infrastructure in order to be able to carry out waste disposal program. Without it the nothing could be accomplished and that is why the availability of this infrastructure affected the ability of the county to collect waste and to generate revenue. The county government had a moderately developed infrastructure to conduct solid waste management and that is why it could only carryout the waste management process to some extent and within specified zoned areas. It was yet to develop its infrastructure fully to cater for the needs of the county as far as solid waste management is concerned which could be attributed to high population growth.

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The study concluded that what affected the way planning process influenced solid waste management process majorly was the existence of plans influences. This is due to the fact that when plans are in existence in the county government they can be able to carry out the waste management program since they have a plan of action and know what they

are expected to every step of the way. This comes in handy in enabling them to generate revenue and collect waste since they have a plan of action to undertake these tasks. The county government is involved with some level of planning in regards to solid waste management and that is the reason why they have been able to substantially affect solid waste management in the county. They have been involved in resource allocation towards the solid waste management program, made some plans with this regard which enables them to deliver some considerably good results in the management of solid waste.

5.4 Recommendations of the Study

The following recommendations were made:

1. The county should invest in more types of treatment for solid waste management. This will enable them to be able to carry-out the different kinds of treatments that are required for different types of wastes produced and ensure that they reduce volume of waste and its hazardous effect.
2. The county should diversify the form of waste disposal used. This will enable them to address the different nature of waste produced in the county. Different types of waste that are generated in a county require different methods to address the problem of waste disposal the more options the county has in methods of disposal the more they are able to address different types of wastes generated.
3. The county government should invest in infrastructure capacity to enable them address the issue of waste disposal. The rate at which the population density is growing requires more effort from the county in terms of investing in infrastructural development to enable them meet the needs of their residents as far as waste disposal is concerned.
4. The county should go on to implement the plans they make as far as the waste management is concerned. This will ensure that every strategy that is made is implemented and utilized. The county should also involve its citizenry and other stakeholders in the waste management planning and carrying out which will go a long way in ensuring the success of the projects.

5.5 Suggestions for Further Studies

Further studies should be carried out in the following areas;

1. The impact of devolution on solid waste management in Uasin Gishu County.
2. The impact urbanization and slum growth on solid waste management program.

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APPENDICES

APPENDIX I: INFORMED CONSENT LETTER

Dear Respondents,

RE: PARTICIPATION IN MY STUDY.

I am a student of Nairobi University pursuing masters of Arts degree in Project planning and management. I am currently conducting research for my study on the **FACTORS INFLUENCING SUSTAINABILITY OF SOLID WASTE MANAGEMENT PROGRAM: A CASE OF UASIN GISHU COUNTY, KENYA.**

I kindly request you to participate in my study and your responses to the items in the questionnaire will be treated with utmost confidentiality, and will not be used for any other purposes except for this study. You are free to withdraw from this study at any time you deem fit. You may also request the researcher to inform you about the findings of this study.

Sign:

Name: Walter Otieno Ogola

Registration #: L50/68794/2011

APPENDIX II: QUESTIONNAIRE

The purpose of this questioner is to collect information on the existing solid waste management in Uasin Gishu County. Theinformation collected will not be used for any other purposes except for this study

INSTRUCTIONS

Kindly tick (√) where appropriate OR write your response in the spaces provided.

Section A: Demographic Information

1. Gender?

Male { }

Female { }

2. Age?

21-30 years { }

31-40 years { }

41-50 years { }

Above 50 years { }

3. Highest level of Education?

Certificate { }

Diploma { }

Bachelors Degree { }

Master's Degree { }

4. Working experience?

Less than 5 years { }

5-10 years { }

10-15 years { }

15-20 years { }

Above 20 years { }

5. What is your job level/position in the organization?

Top Management () Middle level management () Supervisory Level () other (specify).....

Section B: Specific Information

Key: Strongly Agree (SA) =5, Agree (A) =4, Neutral (N) =3, Disagree (D) =2, Strongly Disagree (SD) =1

5. Kindly rate the following statements as to the extent to which you agree with them on the influence of type of treatment on sustainability of solid waste managementprogram

Influence of nature of treatment on sustainability of solid waste managementprogram		**5**	**4**	**3**	**2**	**1**
5A	Availability of treatment influence frequency of collecting waste					
5B	Availability of treatment influence cost of receiving waste					
5C	Availability of treatment influence revenue generated from the waste					
5D	Mode of treatment of waste influence frequency of waste collection					
5E	Mode of treatment of waste influence cost of receiving waste					
5F	Mode of treatment of waste influence revenue generated from waste					
5G	Type of treatment influences frequency of collecting waste					
5H	Type of treatment influences cost of receiving waste					
5I	Type of treatment influences revenue generated from waste					

6. Kindly rate the following statements as to the extent to which you agree with them on the influence ofform of waste disposal on sustainability of solid waste managementprogram.

Influence of Form of waste disposal on sustainability of solid waste managementprogram		**5**	**4**	**3**	**2**	**1**
6A	Burning of waste influences frequency of collecting waste					
6B	Burning of waste influences cost of receiving waste					
6C	Burning of waste influences revenue generated from waste					
6D	Dumping waste on land influences frequency of collecting waste					
6E	Dumping waste on landinfluences cost of receiving waste					
6F	Dumping waste on landinfluences revenue generated from waste					
6G	Land filling of waste disposed influence frequency of collecting waste					
6H	Land filling of waste disposed influence cost of receiving waste					
6I	Land filling of waste disposed influences revenue generated from waste					

7. Kindly rate the following statements as to the extent to which you agree with them on the influence of infrastructure on sustainability of solid waste managementprogram

Influence of capacity of infrastructure on sustainability of solid waste managementprogram		**5**	**4**	**3**	**2**	**1**
7A	Levels of infrastructural technology influences frequency of collecting waste					
7B	Levels of infrastructural technology influences cost of receiving waste					
7C	Levels of infrastructural technology influences revenue generated from waste					
7D	Availability of infrastructure influences frequency of collecting waste					
7E	Availability of infrastructure influences cost of receiving waste					
7F	Availability of infrastructure influences revenue generated from waste					

7G	Type of infrastructural technology influences frequency of collecting waste					
7H	Type of infrastructural technology influences cost of receiving waste					
7I	Type of infrastructural technology influences revenue generated from waste					

8. Kindly rate the following statements as to the extent to which you agree with them on the influence of planning process on sustainability of solid waste managementprogram

Influence of planning process on sustainability of solid waste managementprogram		**5**	**4**	**3**	**2**	**1**
8A	Existence of plans influences frequency of collecting solid waste					
8B	Existence of plans influences cost of receiving solid waste					
8C	Existence of plans influences revenue generated from solid waste					
8D	Resources allocated influences frequency of collecting solid waste					
8E	Resources allocated influences cost of receiving solid waste					
8F	Resources allocated influences revenue generated from solid waste					
8G	Type of plans influences frequency of collecting solid waste					
8H	Type of plans influences cost of receiving solid waste					
8I	Type of plans influences revenue generated from solid waste					
8J	Stakeholder involvement influences frequency of collecting solid waste					
8K	Stakeholder involvement influences cost of receiving solid waste					
8L	Stakeholder involvement influences revenue generated from solid waste					

9. Kindly rate the following statements as to the extent to which you agree with them on the sustainability ofsolid waste managementprogram

Solid waste management program		**5**	**4**	**3**	**2**	**1**
9A	The number of trips of solid waste collected is predestined per region					
9B	Solid waste is collected when stake holders find it necessary					
9C	There funds set aside for collecting solid waste					
9D	Cost of collecting solid waste is excessive					
9E	Revenue generated from solid waste management is recycled					
9F	Revenue generated from solid waste management is enough					

APPENDIX III: KREJCIE, R.V& MORGAN, D.W, SAMPLE SIZE TABLE

Table for Determining Sample Size from a Given Population

N	*S*	*N*	*S*	*N*	*S*
10	10	220	140	1200	291
15	14	230	144	1300	297
20	19	240	148	1400	302
25	24	250	152	1500	306
30	28	260	155	1600	310
35	32	270	159	1700	313
40	36	280	162	1800	317
45	40	290	165	1900	320
50	44	300	169	2000	322
55	48	320	175	2200	327
60	52	340	181	2400	331
65	56	360	186	2600	335
70	59	380	191	2800	338
75	63	400	196	3000	341
80	66	420	201	3500	346
85	70	440	205	4000	351
90	73	460	210	4500	354
95	76	480	214	5000	357
100	80	500	217	6000	361
110	86	550	226	7000	364
120	92	600	234	8000	367
130	97	650	242	9000	368
140	103	700	248	10000	370
150	108	750	254	15000	375
160	113	800	260	20000	377
170	118	850	265	30000	379
180	123	900	269	40000	380
190	127	950	274	50000	381
200	132	1000	278	75000	382
210	136	1100	285	1000000	384

Note.—*N* is population size. *S* is sample size.

Source: Krejcie & Morgan, 1970