DETERMINANTS INFLUENCING WASTE MANAGEMENT IN KENYA: A CASE OF WHITEHOUSE RESIDENTIAL AREA IN MAVOKO SUB-COUNTY

BY

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2016
DECLARATION

I declare that this research project report is my original work and has not been presented at any other institution for award as a degree.

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L50/71288/2011

I confirm that this research project report has been submitted for examination with my approval as the university supervisor.

Signed………………………………… Date……………………………..

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DEDICATION

This project is dedicated to my parents Ndewiga Gatumu and Harriet Ndewiga, for their unwavering support for my education and the impetus to enroll and complete this programme. My sincere gratitude to my husband John Ngirachu and my siblings Muriithi Ndewiga and Mugendi Ndewiga for their prayers and immense support in the course of this study project.
ACKNOWLEDGEMENT

I would like to thank my Supervisor Dr. Evans Vidija Sagwa, for his continuous support, patience, encouragement, systematic guidance and his kind heart to share his immense knowledge and experience as he supervised my project.

Further, I thank Dr. John Mbugua, Resident Lecturer for his continued support as well as my lecturers who made my classes fascinating and educative. I would also like to acknowledge lecturers in the Department of Extra-Mural Studies, University of Nairobi, who unlocked the concepts explored herein.

Finally I would like to acknowledge my Project Planning classmates and colleagues who enriched the discussion groups. Special thanks to Stephen Mbunga, Jacqueline Ochieng and Martin Ng’ang’a.
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<tr>
<td>CBOs</td>
<td>Community-Based Organizations</td>
</tr>
<tr>
<td>JICA</td>
<td>Japan International Cooperation Agency</td>
</tr>
<tr>
<td>NCC</td>
<td>Nairobi City Council</td>
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<td>UNEP</td>
<td>United Nations Environmental Programme</td>
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ABSTRACT

Population in urban centres in Kenya has been on an upward trend and this has come with poor handling of waste in most of the cities. This study proposed to study determinants of waste management in Kenya; A case of Whitehouse residential area in Mavoko sub-county. It had four objectives: To determine the effect of household income on waste management at Whitehouse residential area in Mavoko sub-county, to determine how houses location influence waste management at Whitehouse residential area in Mavoko sub-county, to determine the effect of infrastructure on waste management at Whitehouse residential area in Mavoko sub-county and how types of waste influence waste management at Whitehouse residential area in Mavoko sub-county. The research design that was used in this research was descriptive research design. The target population of this study was the 104 residents of Whitehouse residential area in Mavoko sub-county. This number was as per the Syokimau Residents Association (SRA). The data collection instruments for the research were use of questionnaires. The study determined the validity through a careful definition of the topic of concern, the themes and the scales to be used, ensuring that the instruments contained a representative sample of the population on the subject matter of interest. The researcher employed the test-retest method to establish reliability. The researcher used both qualitative and quantitative methods to analyze data. The quantitative method to be employed was use of tables and percentages. The data was analyzed using descriptive and inferential statistics techniques. A relationship between them was established. The researcher used Statistical Packages for Social Science (SPSS). The findings of this research are that household income, location and infrastructure determined waste management in Whitehouse residential area. The findings of this research indicated that household income level affected waste management. This was supported by the fact that households with more cash support proper disposal of waste. The research found out that location of households influences the efficiency of waste management due to well-developed roads. The research found out that a significant relationship existed between the infrastructures designed for managing waste as adequate attention was not put to the existing infrastructures.
CHAPTER ONE
INTRODUCTION

1.1 Background of the Study
Larger organizations often require services from an external waste service provider. These companies are required to ensure that any bins they provide customers meet local area requirements. When contacting a commercial waste service provider, they will be able to provide customers with a range of potential options to suit their needs. Hiring a waste service provider will typically require forming a contract. There are some elements which need to be known in advance to ensure that an effective contract for both the waste service provider and the firm or organization requiring the services (Kuniyal et al. 1998; Zerboc, 2003.). There are many different factors which can be negotiated in a contract including the frequency of collection, the equipment being used, the fees, volumes collected, and rates for different streams. It can be useful to conduct a waste characterization study before approaching external waste service providers to ensure that contract provisions will allow for implementation of the waste management strategy in a cost effective manner (CCME, 1996).

In a developing country, the problems associated with waste management are more acute than in a developed country (Zerboc, 2003). The presence of inadequate financial resources and infrastructure to deal with waste creates a vicious cycle; resources not being enough leads to low quality of service provision which leads to fewer people willing to pay for said services, which in turn further erodes the resource base and so on (Kuniyal et al. 1998; Zerboc, 2003). The problem is further complicated by rapid growth in population and urbanization, which adds greatly to the volume of waste being generated and to the demand for waste retrieval service in municipal areas. However, more often than not, an increase in population is not matched with an equal increase in revenue for the local municipalities for waste management (Zerboc 2003). Besides this, rapid urbanization means rapid growth of shanty dwelling units that are largely unplanned for, and add to the waste, health, and hygiene problems.

Another significant factor that contributes to the problem of solid wastes in a developing
country scenario is the inefficiencies in proper collection and transportation facilities. Improper planning coupled with rapid growth of population and urbanization serves to add congestion in streets, and as a result the waste collection vehicles cannot reach such places, thus allowing filth to build up over time. The dearth of monetary resources, at times, results in improper or no transportation vehicles for waste disposal adding another dimension to the ever-rising cycle of problems (Jain, 1994; Zerboc, 2003). In any developing country, the threats posed by improper handling and disposal of solid wastes (though often ignored) contribute to the high level of mortality and morbidity (Medina, 2002). Human and ecosystem health is also threatened due to improper handling of solid wastes.

In addition to all the problems mentioned above, mountainous regions in developing countries face additional challenges in solid waste management, in terms of their highly fragile environment and difficult terrain. The problems associated with solid waste in the mountainous region have serious cascading effects on the lower valley. Often solid waste is the number one threat to the fragile ecology of the mountainous environment (Jain, 1994). Besides this, seasonal tourist inflow adds significantly to the demands on resource base and contributes considerably to the amount of wastes generated. The absence of proper regulations fails to encapsulate the waste generated by the tourists and fees to be paid there of (Jain 1994; Kuniyal et al. 1998; Cole and Sinclair 2002).

According to Agunwamba (2000), waste disposal is the management of waste to prevent harm to the environment, injury or long term progressive damage to health. Disposal of waste is where the intention is to permanently-store the waste for the duration of its biological and chemical activity, such that it is rendered harmless. Waste Management refers to the collection, processing, recycling, transport, and monitoring of waste products. The waste products means the various materials produced by human activity and is undertaken for reducing their effect on health, environment or aesthetics. Another application of the waste management is to recover the various resources from it. It involves the management of solid, liquid, and gaseous wastes.
Each type of waste requires a different methods and fields of expertise. The practices of waste management differ from developed and developing nations. In fact, there is difference in methods used in the urban and rural areas, and for industrial or residential producers. It is the responsibility of local government authorities to manage non-hazardous residential and institutional waste in metro areas. On other hand, the generator (Gwebu, 2003) does the management for non-hazardous commercial and industrial waste.

The Nairobi City Council (NCC) and private commercial companies are the principal providers of Waste Management in Nairobi. Kenya’s and in particular Nairobi’s solid waste management has deteriorated over the years. As opposed to the 1970s and 1980s where the government in conjunction with the NCC were collecting the bulk of the city’s waste, the 21st century has seen waste collection being left to the private companies. According to a UNEP study in 1998, it showed that the NCC collected 90 per cent of the waste and as mid 1980s approached; the NCC performance dwindled and attracted private sector providers. This, according to JICA (1998) attracted the existence of at least 60 private solid waste collection services in the city. Mismanagement of the waste has seen an increase in pollution of the city, resulting to a public health hazard.

Private companies together with a small fraction of the NCC serviced high-income and some middle-income residential areas as well as commercial centres. The core low-income areas (slums and other unplanned settlements) where 55-60 per cent of Nairobi residents live, however, receives no waste collection service save for localized interventions by community-based organizations (CBOs) (Gwebu, 2003). Despite this, people in the low-income areas are still willing to pay for improved services for their waste collection. Therefore, no matter a person’s financial status, it is quite evident that majority of city residents are willing to have an agreed, consistent plan and order for their garbage collection. This trend has seen success of effective garbage collection by private enterprises in residential areas in Nairobi areas and its environs like in Mavoko Sub-county.

Before the genesis of private garbage collection in this area, majority of the residents were used to burning part of their garbage, or staying with garbage in their compounds until when they would work out a plan with other neighbours. They would source for a place they could
dispose their refuse or pay a garbage collector to dispose it for them. With the NCC not being effective much, the new trend of use of plastic bags for trash was adopted from the developed countries. Though not yet fully explored in Nairobi and the country at large, other countries where private garbage enterprises are thriving, they not only make money from collecting the garbage but further recycling it as well. Despite making money from garbage collection, most of individuals who thrive on private garbage collection make even more money through recycling the garbage collected; this is where the real money is found. According to the Ministry of State for Environmental Affairs, Egypt is reported to generate 75 million tonnes of solid waste every year. The country then recycles 150,000 tonnes of the 650,000 tonnes of recyclable waste generated every year. If this waste is not recycled, then the country loses out an average of $500 million annually. Hence, the industry has been significantly transformed from mere garbage collection to thriving enterprises (Gwebu, 2003).

1.2 Statement of the Problem

During the time of study, there existed a limited empirical literature on the Kenyan waste management. The available literature dwelled largely on performance description and its causes, household waste generation behaviour, and waste characteristics. Ikiara et al. (2004) found that while poor management of solid waste is a general problem in Kenya, there are no controlled landfills in Machakos County and complete reliance was placed on open uncontrolled burning. Many scavengers existed and tannery sludge, hospital wastes including used syringes and other industrial wastes. The problem that faced Mavoko Sub-county was lack of effective waste management systems for the disposal of garbage generated in households’ houses.

It was observed that no specific legislation on waste management existed in Kenya as it currently relies on the Public Health Act (Cap 242) and the Local Government Act. Local authorities normally set effluent discharge guidelines. An Environmental Management and Co-ordination Bill received its first reading in Parliament in 1996, but progress has been slow. In the major cities, Nairobi and Mombasa- paper, cans, glass and plastic bottles are collected for recycling by private businesses or individuals. There is no such service in the smaller towns like Machakos. Individual household waste containers are only present at higher and middle-income households. Low-income households make use of communal containers or
dumping stations - where waste is hand loaded into vehicles. Some dumping stations are constructed of concrete but others are just informal piles, which are sometimes burnt.

In 1996, 50% of the Nairobi City Council refuse collection vehicles were non-operational at any one time. This is according to a study by Njuguna on Garbage Collection (2007). It showed that some 6,000 tonnes of waste oils are recycled in Kenya, out of 27,000 tonnes. Waste oils are also used as fuel and for wood preservation. The recycling process, however, produces acid tars. The World Bank funded the preparation of the National Environmental Action Plan, which contains some aspects on waste management. There is no formal waste management strategy. The Ministry of Environment expressed the view that engineered landfill was extremely expensive.

1.3 Purpose of the Study
This study sought to establish the determinants of waste management systems on garbage handling in Kenya, with specific regard to Whitehouse residential area in Mavoko Sub-county.

1.4. Objectives of the Study
The study was guided by the following specific objectives:

i. To determine the effect of income of households on waste management at Whitehouse residential area in Mavoko Sub-county.

ii. To determine how houses location influence on waste management at Whitehouse residential area in Mavoko Sub-county.

iii. To determine the effect of infrastructure on waste management at Whitehouse residential area in Mavoko Sub-county.

iv. To determine types of waste at Whitehouse residential area in Mavoko Sub-county.

1.5 Research Questions
This study sought to answer the following questions:

i. What is the effect of household income on waste management at Whitehouse residential area in Mavoko Sub-county?

ii. How does the houses location affect waste management at Whitehouse residential area in Mavoko Sub-county?
iii. What is the effect of infrastructure on waste management at Whitehouse residential area in Mavoko Sub-county?

iv. What are the types of waste at Whitehouse residential area in Mavoko Sub-county?

1.6 Significance of the Study
The research may provide information about effective waste management both for companies that wish to adopt and implement waste management processes. The research may help universities and other learning institutions that offer environmental and waste management related courses to design appropriate curriculum tailor-made for project managers working in project planning and management. This may enable them to link theoretical concepts to actual practice in the field and make necessary adjustments to suit the market.

To academicians and researchers the study may provide a base for further studies and give a point of reference to broaden their views of waste management and its contribution to the development of effective systems for managing garbage.

The study may help the Government formulate policies and regulations specifically on waste management that can enable both private and public firms improve their performance through effective waste management processes.

1.7 Delimitations of the Study
This study was confined to the determinants influencing waste management in Kenya at Whitehouse residential area in Mavoko Sub-county. The respondents were residents of Whitehouse residential area.

1.8 Limitations of the Study
The study was likely to face a number of limitations. The study could not have controlled the respondents’ attitude which could affect the quality of information given. Also, some matters concerning governments and waste management are more often regarded as confidential hence there were some respondents who did not provide full information for fear of being reprimanded. However, the researcher assured the respondents of the confidentiality of the information that they provided.
1.9 Assumptions of the Study
This study was based on the assumption that:

i. The respondents were in a position to understand and answer all the questions and cooperate with the researcher in giving honest and reliable information.

ii. All the selected persons had adequate and relevant information on the subject under the study and were willing to participate in the study.

1.10 Definition of Significant Terms
Generation is the production of something; the inception or the origin of something.

Income is the money received, especially on a regular basis, for work or through investments.

Infrastructure refers to the basic physical and organizational structures and facilities (e.g., buildings, roads, and power supplies) needed for the operation of a society or enterprise.

Location refers to a particular place or position. It’s the action or process of placing someone or something in a particular position.

Private enterprises refer to those businesses or companies that are owned solely by individuals or groups of people with no association whatsoever to any government or public backup.

Waste is any material that is not wanted; the unusable remains or byproducts of something.

Waste disposal refers to the management of waste to prevent harm to the environment, injury or long term progressive damage to health. Disposal of waste is where the intention is to
permanently store the waste for the duration of its biological and chemical activity, such that it is rendered harmless

Waste management refers to the collection, processing, recycling, transport, and monitoring of waste products. The waste products means the various materials produced by human activity and is undertaken for reducing their effect on health, environment or aesthetics.

1.1 Organization of the Study
This study is organized into five chapters. Chapter one covers the background to the study followed by the statement of the problem. It delves shortly into the purpose of the study and the four objectives that were the focus of the study. Afterwards the research questions are elaborated followed by the significance of the study. The delimitations, limitations, assumptions and definitions of significant terms are handled next, in that order. Chapter two highlights the literature review of previous studies in the same area and the conceptual framework. Chapter 3 reveals the research methodology and it contains information on the research design, sampling procedures, data collection among others. Chapter 4 will cover data analysis, presentation, interpretation and discussion. Finally, chapter five will summarize the findings, conclusions and recommendations of the study.
CHAPTER TWO
LITERATURE REVIEW

2.1 Introduction
The purpose of this literature review is to gain an understanding of waste management planning concepts, frameworks, strategies, and components that are current and emerging in the field. In this chapter, literature review, which was related to and consistent with the objectives of the study, was reviewed. Important theoretical and practical problems were analyzed; relevant literature on the aspects pertaining to waste management systems in Mavoko Sub-county were discussed.

2.2 Waste Management
Waste is the by-product of human activity which contains the same material that is found in the useful products but it differs from useful products because it lacks in value. Wastes can be categorized depending on their attributes such as their physical state, original use, material type, physical properties, origin and safety level (McDougall, 2008). The source of the waste will put it under either municipal and non-municipal waste. The sources for the municipal wastes as described by (Zhu, 2007) are public places, offices, shops, hospitals, households and streets. The government is left to handle the municipal waste. In most cases, waste from industries is not classified within the municipal waste. However, the waste gets mixed into the solid waste stream.

The strategies of waste management can be classified depending on their ability to minimize waste as reduce, reuse and recycling (3Rs). This concept promotes the relationship between waste generators, collectors, processors and manufacturers, and decreases the amount of waste that is disposed of. Further, the amount of environmental deterioration will be decreased, emissions from landfills will be minimized, and natural resources and energy will be saved (Zhu et al., 2007).

Throughout the years the primary concern of waste management has been changing. Health and safety were primary concerns; therefore, waste management has been prioritizing and minimizing health risks (UNEP, 2002). Today, sustainability has become the primary concern of waste management in addition to health and related issues. Consequently, sustainable waste
management incorporates the three broad pillars of sustainable development which are environmental, economic, social. Therefore, sustainable waste management should be economically viable, socially acceptable and environmentally efficient (McDougall, 2008).

As a result, waste management systems are providing consideration to environmental issues over economic costs in the decision-making process. The two major concerns of waste management about the environment are the conservation of resources and pollution and deterioration of renewable. The preservation of resources is more or less the old concern of waste management about the environment. However, contamination of the environment is the recent concerns of waste management about the environment (McDougall, 2008).

In a nutshell, sustainable waste management has three objectives these are: reducing the amount of waste generated, managing sustainably through minimization of the environmental burden, minimizing the economic cost and maximizing the social acceptability, and the last objective is considering waste as a resource (UNEP, 2002). The first concept of integrated waste management is based on development assessment of a product from its production and consumption point of view. The drop in consumption and consumption of thrown away produce within the production system as a replacement for new resources can lead to reduced end-of-cycle waste generation; thus, fewer efforts and resources would be necessary for the final disposal of the waste.

The second concept of integrated waste management is based on its generation from different sources including domestic, commercial, industrial and agriculture. While the third concept of integrated waste management that relies on its management that includes regulations and laws, institutions, financial mechanisms, technology and infrastructure, and the role of various stakeholders in the solid waste management chain (UNEP, 2009).

Waste management from municipals is an issue of global significance. The management decisions made by mayors, county executives, and city and county councils and boards can impact the release of greenhouse gas (GHG) emissions that add to global climate change. GHG emissions can trap heat in the atmosphere and direct to warming the planet and changing its weather. According to the latest U.S. Environmental Protection Agency (EPA)
inventory of GHG emissions, the waste management sector represents ~4% of total U.S. anthropogenic GHG emissions (i.e., 260 out of 6750 teragrams of CO₂ equivalents). Landfills are the largest anthropogenic source of CH₄ in the United States and represented ~90% of GHGs from the waste sector in 1999 (U.S. Environmental Protection Agency, 2001). Emissions of CH₄ result from the decomposition of biodegradable components in the waste stream such as paper, food scraps, and yard trimmings. The potential for global climate change caused by the release of GHGs is being debated both nationally and internationally. Options for reducing GHG emissions are being evaluated. Management of waste presents potential options for GHG reductions and has links to other sectors (e.g., energy, industrial processes, forestry, and transportation) with further GHG reduction opportunities.

The Minnesota Waste Management Act in 1980 was passed. Since then, considerable changes have occurred throughout the United States. In Minnesota, system components include collection and transport of curb side/alley residential and commercial waste, recyclables, yard waste collection services, drop-off sites, and transfer stations. There is also a mass-burn combustion facility (with energy recovery), three refuse-derived fuel (RDF) waste processing facilities, and a private processing facility for recyclables. Of the waste being processed, 15% is recycled, and 11% (i.e., yard waste) is composted. Regional and out-of-state landfills are used for the disposal of residues, non-recyclable waste, and ash (National Renewable Energy Laboratory (1995).

The practices at municipal dumpsites are not useful. Dumping is unlimited and industrial, agricultural, domestic, and medical wastes end up in one site. Dump sites are not always fenced off as in some cases the perimeter fence has been stolen or vandalized. This allows easy admission to the location at any time of the day. Mangizvo (2008) observed that the perimeter fence at Mucheke Municipal dump site had been removed, and the place was not guarded, enabling the dumping of restricted materials, such as car batteries and metals. Scavengers had free right of entry to the dump, and they mixed up the waste as they dug into it to recover any valuable material. As a result of poor control, medical and hazardous wastes end up at municipal dumpsites even though they have their special dumping areas.
In Dar es Salaam City, Tanzania industrialists, and hospital owners take their waste to the Vingunguti dumpsite (Mato & Kaseva, 1999). In Ibadan, Nigeria, pathological wastes, and sharps from the city’s hospitals are dumped in an unregulated and haphazard manner in open dumpsites at Aba-Eku, Aperin-Oniyere, and Ajakanga. Maintenance of the free dumps is also an issue; there is no compaction and covering of waste (Agunwamba, 1998). As a result, waste is easily blown away by the wind, making it an eyesore as plastics litter the area around the dump. Most local authorities resort to burning the waste to curb the nuisance produced by flying litter. Scavengers and workers at the dump run the risk of contracting respiratory diseases as they inhale the smoke. The lack of soil cover enables rainwater to infiltrate refuse and produce leachate that contaminates ground water reserves.

2.3 Income of Households and Waste Management

Population in cities are every day growing at an alarming rate, what with everyday migration from rural to the urban areas. This includes in municipals where growth of waste generation has been rapid, while the ability to collect and safely dispose of the material has been on a general decline (Rotich et al., 2005). The ability to provide disposal services by Nairobi city declined due to their inability to keep all waste collection trucks at full operational capacity. Most of the trucks were old bearing in mind that they had been in use for more than ten years. The likes of Kisumu and Mombasa, a punctured tire of the trucks was sufficient to take a collection truck out of service for weeks pending funds for a replacement to be processed, while drivers earned their average pay. Uncollected waste at the upper and middle-income zones tends to increase during the rainy seasons when road conditions are worsened by rains. The situation in the low-income suburban areas is worse because of inappropriate disposal of waste. Local authorities tend to concentrate their limited services mainly in the central business districts (CBDs) and the more affluent communities, which have better access (Rotich, 2005).

It was observed by Afroz, (2010) that high-income households generate more waste that can be attributed to high consumption rates among the high-income areas than low-income areas. Waste production is a big problem, more so in the developing countries. Family size and income is the primary factor that determines the amount of urban waste produced because
municipal waste is necessary in any economy. As economic conditions, especially in developing countries, improve and keep on improving, so is the amount of waste being produced in these areas. Therefore, waste generated is highly influenced by the level of incomes of urban households. The government and the private sector are accountable for the minimization of waste by reducing the amount of inputs or resources used for production and consumption, and recycling (Baud et al., 2004).

2.4 Location of Household and Waste Management
The problem of waste in Mavoko sub-county emanates from high waste generation, lack of disposal sites, small waste collection by local authorities, and household/individual poor disposal habits (Banga et al., 2011). Uncontained generation of waste and elimination, coupled with poor collection services, poses a significant threat to the environmental quality and human health (Jin et al., 2006; Afroz et al., 2009).

Waste management is a public good that cannot be optimally provided under the present market conditions since the commodity is considered by not competing for consumption and non-excludability. Waste collection and disposal services necessitate a different market situation from the conventional market pricing mechanism to achieve most favourable resource allocation. This is because the environmental services are often under-priced or non-priced (Anaman & Jair, 2000; Jin, 2006) and hence to make the most of social welfare levels resources must be allocated in a way to bring about most beneficial changes. It is, therefore, important to come up with a technique that can evaluate the environmental magnitude relevant for use in decision-making. Stated preference methods are the primary means of valuing non-market benefits (Jin, 2006) and the commonly used non-market valuation technique is the contingent valuation method (Carson, 2001; Jin, 2006). The uncontrolled manner in which waste is disposed of at most open dumpsites creates serious health problems to humans, animals, and environmental degradation. This inadequate waste disposal translates into economic and other welfare losses (Zurbrugg, 2002). The environment is degraded in some ways. The soil is contaminated by being in contact with waste and leachate. A study on a dumpsite in Kariba in Zimbabwe, trace metal concentrations were determined in soil samples collected from the area during 1996 and 1997. Accumulation of copper (Cu), lead
(Pb), iron (Fe), and zinc (Zn) were found within the disposal site (Chifamba, 2007). The concentration of Zn, Pb, and Cu were in surface soil samples up to 75 meters away from the disposal site. Leachates collected from Ibadan and Lagos dumpsites had detectable levels of dissolved solids, chloride, ammonia, chemical oxygen demand (COD), lead, iron, copper, and manganese. This was most likely a result of the rampant dumping of lead acid car batteries and metal scraps (Ikem, Osibanjo, Sridhar, &Sobande, 2002).

In a study carried out at Dandora dumpsite, 42% of soil samples had ten times higher lead levels than normal (Oyaro, 2003). Leachates also contaminate both ground and surface water. During floods, water mixed with leachate may flow out of the dumpsites and get into nearby ponds, streams, and rivers. The Nairobi River, for example, passes through the Dandora Municipal Dumping site, and some of the waste from the site finds its way into the river (Environmental News Service, 2007). This is a health risk to the communities near the dump and those downstream who may be using the water for various purposes. In Eldoret town, the operation of an open dumpsite near the Mwenderi River has significantly polluted the Sosiani River as shown in figure 2.2, because the dumpsite, formerly a sand quarry, has small streams draining into the Sosiani River (Rotich, 2006).

The study at Kariba showed that water samples taken from the surrounding area of the dumpsite had a high level of concentration of mercury (Hg) and Pb (Chifamba, 2007). Okonkwo and Mothiba (2004) found a high degree of lead in the Madanzhe and Mvudi Rivers in Thohoyandou, South Africa, which was attributed to the effluent from a nearby sewage treatment plant and a waste dumping site, which leachate had contaminated with lead flowing into the rivers. The Golden Quarry landfill in Harare pollutes ground water in the area close to it. Levels of coliforms, cadmium, iron, lead and nitrates were above the water quality guidelines throughout the nearby suburb of Westlea (Love, Zingoni, Ravengai, & Owen, 2006). Water in the suburb is not suitable for domestic use. Mangizvo (2008) identified in a study of the Mucheke Municipal Dumpsite in Masvingo, Zimbabwe, that trace metals of lead, iron, copper, zinc, and phosphorus had contaminated soils within a 50-meter radius.
2.5 Infrastructure and Waste Management

Rapid urbanization has seen existing dumping sites initially located at a safe distance outside the municipal boundaries are now being more and more encircled by settlements and housing estates (Schertenleib & Meyer, 1992). This has caused the public to oppose their existence as they cause odour, dust, and other nuisances. People living close to dump sites are in danger of contracting diseases associated with landfills. Oyaro (2003) notes that tests conducted on 328 children living near the Dandora dumpsite found that half of them had excess concentrations of lead in their blood. Anaemia, skin infections, asthma, and other respiratory diseases also disproportionately affected them. These conditions are associated with high levels of toxins at the dumpsite, which receives plastics, rubber, wood, metals, chemicals, and hospital waste (Environmental News Services, 2007; Oyaro, 2003).

Thousands of poverty-stricken Africans make a living through salvaging recoverable materials from waste sites. Daily, women, the elderly, and children spend long hours at the open waste dumpsites sifting through the rubbish for valuable items. Wilson, Velis, and Cheeseman (2005) say these people use their bare hands without any protective clothing.

Waste hierarchy as explained by (Baud, 2004) is the basis for waste minimization strategies and refers to the 3Rs which is reduced, reuse and recycle. The application of the 3R concept into the waste management minimizes the amount of waste that goes into dumpsites or landfills. First, the reduction is aimed at reducing the amount of waste formed by adopting or optimizing the production process of manufacturers and industries. As a result, natural resources will be saved. Reuse occurs when one material served its original purpose and used again for another purpose rather than being thrown away.

Recycling is all about transforming or reprocessing of materials that served the original function into new products. Otherwise, those products that served the original function will be considered as waste (Zhu, 2007). Recycling is common among materials such as glass, plastic, metals and electronic waste.
Babalola, (2010) in Nigeria opines that the rise in the population levels also brought about with it rapid economic growth and consequently the increase in the living standards of the people. Wastes and other contaminants from residential and other land use land use in Damaturu town are highly visible. Currently, domestic waste management in Damaturu has severe problems, involving low collection rate, unscientific disposal method (open dumping), lack of separation and treatment mechanism in place, and burning of waste dumps without air pollution measures in place.

For the better understanding of the present waste management scenario in the study area, the study is structured as follows: Waste collection bins are placed at strategic locations identified by the agency and termed as colossal waste generating points with wheeled plastic garbage bins, metal trash bins, and constructed waste bunkers. The contents of these containers are finally disposed at a location 6 kilometres away from the generating points (YOSEPA, 2009). This method adopted shows that the waste collections are source specified approach in which the individual components of the waste stream are sampled, sorted and weighed. This method is useful for defining a local waste stream. The system adopted by the agency is the public bin collection system. This comprises of the collection from different sources like residential and commercial areas and deposited in the open bins located strategically along street corners of the town. Wastes are not treated before disposal at the final dumping sites (Babalola et al., 2010).

Waste minimization and recycling have not gone beyond the practice of picking and sorting through heaps of refuse or garbage. Waste management in Nigeria is under the responsibility of the Local Environmental Protection Agency as stipulated by the 1988 decree which established the Federal Environmental Protection Agency (FEPA). The Yobe State Environmental Protection Agency, (YOSEPA) Sanitary Board and Metropolitan Council carry out the collection of waste in Damaturu. However, these local authorities have been plagued by the increasing rate of waste generation, collection and transportation problems due in large part to overstretched facilities, shortages of manpower and lean budget.
In Uganda, Urban local government authorities in Uganda are responsible for waste management services. However, they lack adequate infrastructure, operate in an incompetent institutional set-up, and have limited financial and technical resources. This has led to an insufficient level of provision of services. The rate of waste generation is increasing each day. According to the mayor of Kampala, about 1,580 tons of waste are generated per day. Only 40% of it is collected. A significant amount of solid waste either is burnt on the streets or ends up in drainage channels, marshy areas and empty plots (Banga, 2011).

2.6 Types of waste and Waste Management

The types of waste that are being generated in these areas are reliant on a number of factors. One of the factors is population, going by the number of people generating the waste in the area in question. If the numbers of people generating the waste are high, then waste in that area will be at a high rate. However, waste generation rates are dependent on other factors. Ngoc and Schnitzer (2009) argue that waste generation rates are affected by socioeconomic development, the degree of industrialization and climate. The known or traditional means of waste disposal or management are; refuse composting, incineration and sanitary landfill/dumpsites. Refuse to compost requires the relatively high temperature for mechanical composting on one hand, and the most important process in rural and urban areas involves dug pits, wherein the collected refuse are disposed off to rot or ferment. This results to what is known as “compost” and used as natural manure in farms. A variant of composting is compacting or wastes reduction through the mechanical process of ‘squeezing’ to ensure smaller sizes and packages which enhance disposal/management time and space. The other method is incineration. This process involves burning of collected solid wastes from households, offices and markets (Napoleon et al., 2011).

The only slight drawback of waste incineration is the stench or odour emanating from there. Waste incineration is a much easier process because of dryness and more combustion that is natural. The third variety in waste management is the sanitary landfill. This is a process of collecting wastes and conveying them by using vehicle, heavy-duty dumpsters, lorries, and tippers to designated dumpsites. The accumulating wastes are carefully and concisely laid or layered into specified depression or valleys or dug borough pits (as sites) with the intent to fill and reclaim these exact locations for future uses (Adegboye, 2006).
In our environment, we easily claim the use of land landscape ravaged by gulley erosion. The main impetus of this kind of variation is cost consideration and opportunity for another pit to cover an old hole. Nevertheless, by the use of hollow channels, so much capital and power are saved in the process. The only participation is the damming of both ends of the desired portions to be used in the dumping operation. Reducing the nuisance and hazards of indisposed wastes (by clearing or removing them) to remote sanitary landfill sites, is one less expensive way to save the government and public from the additional strictures of environmental degradation (Adegboye, 2006). The increasing occurrence of waste build up in several urban centres in Kenya is not peculiar to Kenyan cities alone.

Waste management practices differ for developed and developing nations, for urban and rural areas, and for residential and industrial producers. It states clearly that management for non-hazardous residential and institutional waste in cities is usually the responsibility of local government authorities, while management for non-hazardous commercial and industrial waste is usually the job of the generator. Waste management methods cannot be uniform across regions and sectors because individual waste management methods cannot deal with all potential waste materials in a sustainable manner (Adegboye, 2006). Conditions vary; therefore, procedures must also vary accordingly to ensure that these conditions can be successfully met. Waste management systems must remain flexible in light of changing economic, environmental and social conditions (Napoleon et al., 2011). In most cases, a number of processes, many of which are closely interrelated, holds out waste management; therefore it is logical to design holistic waste management systems, rather than alternative and competing options.

Emerging cities in developing economies like Kenya display features of unplanned growth, population explosion, and casual settlement. As a result, the irregular build-up of waste that needs to be cleared on a timely basis or disposal and treatment to lessen their hazardous effect on residents and enhance rather demean the quality of our environment needs to be tackled frontally, systematically, in an all-embracing manner (Napoleon et al., 2011).
Past independent, individual, commercial and industrial responses to how waste is generated and controlled have not bore positive results. A more integrated approach needs to be integrated which would combine a life cycle analysis with modern method or waste disposal through composting, incineration and recycling for energy, chemical, and other active uses. A life cycle analysis (LCA) just indicate that waste administration needs to follow a path of source separation, collection, reuse, recycling of the non-organic waste and energy and compost fertilizer production of the inorganic waste via anaerobic digestion (Wikipedia 2009).

In many Kenyan cities, scavenging, which is the business of picking scraps from refuse dumps for sale is thriving. Ordinarily, considered a nasty and demeaning job because of the dirty nature of the dumpsite, coupled with the offensive stench and gaseous emissions they produce while valuable scraps are being sorted, scavenging is regarded as a business of last resort for those engaged in it. Nonetheless, as dirty as is the business, those involved in it are surprisingly making fortunes and smiling to the banks. The large number involved in it undermines the fact that the business is lucrative for the operators, especially since there is a ready market for scrap items.

They buyers, in turn, sell to companies, which recycle them as raw materials for the production of new products (Adegboye, 2006).

2.7 Theoretical Framework

Theories and models provide frameworks to guide research design and interpret research results. Eisenhardt (1989) identifies three distinct uses of theory: As an initial guide to research design and data collection; as part of an iterative process of data collection and studies found that subjective norm influences not only the behavioural intention (Venkatesh & Davis, 2000), but also other constructs including satisfaction and perceived usefulness.

2.7.1 Ecological Modernization Theory

Managing waste can be challenging for industrial, commercial and institutional (ICI) sectors. Organizations must deal with a wide variety of materials, large volumes of waste, and behaviours of many customers, visitors, and/or students from within and outside of the
province. However, a strategic solid waste resource management planning approach will help to define solid solutions. Integrated waste resource management planning enables organizations to create a comprehensive strategy that can remain flexible in light of changing economic, social, material (products and packaging) and environmental conditions.

Ecological Modernization (EM) refers to a series of institutional, operational, economic, governance, social and political shifts that are set in motion by environmental drivers. These drivers push new social arrangements, new discourses, new scientific and technical developments, and a change in responsibilities and interests between public and private sectors, between governments and their citizens, between civil society and other economic actors, and between the formal and informal sectors and arrangements within a wide range of disciplines. Although political institutions have contributed to poor environmental outcomes in the past, Ecological Modernization Theory (EMT) argue that they can be readily reformed to address ecological issues (Mol&Sonnenfeld, 2009) better. Proponents hope that through marginal shifts in focus, political actors could be responsible for building new and different coalitions to make environmental protection politically feasible. Thus, EM research has examined the institutional changes that accompany a shift from government to environment governance. For example, EM argues for a more substantial transformation towards decentralized, consensual forms of governance, and a focus on new ways of political intervention. Advocates consider the role of the nation-state to be central to achieving more sustainable societies. There is an emphasis on “open, democratic decision-making, maximizing participatory opportunities for broader social interests” (Berger, 2001). These opportunities will only occur alongside increasing activism by nongovernmental organizations, economic agents and changes to the institutional structure of society.

Ecological Modernization has a good chance of influencing decision makers since it frames the debate in non-threatening terms by supporting industrial development, the market, and liberal democracy. EM argues that economic growth can be decoupled from environmental harm through institutional transformations. In essence, EM supports the existing institutional of power and modest initial reforms and also prepares the groundwork for substantial transformations.
Ecological Modernization advocates technological innovation that decouples economic growth and industrial development from environmental damage to a cleaner industrial revolution. The theory aims to encourage industry to research, develop and deploy the more eco-efficient technology. This new technology should reduce raw material and energy use, cut emissions, eliminate the use of hazardous material, wean production off the depletion of non-renewable resources, sustainability of harvest renewable resources conserve biodiversity and protect essential environmental materials, energy use and waste disposal (Cohen, 2006).

Ultimately Ecological Modernization treats all environmental issues, solid waste included, as a challenge to eliminate inefficiency via better design. It promotes the use of more eco-efficient technology as well as the redesign of economic and political institutions to create incentives that will effectively decouple economic growth from raw material use, waste and environmental damage (Dryzek & Howes, 2012). Waste is seen as an indicator of inefficiency.

Ecological Modernization is a theory of environmental sociology, which provides a sociological interpretation of environmental reforms. The theory suggests that the need for a national policy of solid waste management (SWM) and capable system for sustainability of SWM. However, national system of SWM seems to be not working efficiently to deliver sustainability due to lack of responsiveness of governmental officials, policy and institutional gaps, privatization process failures and managerial aspect problems.

2.7.2 The Theory of Planned Behaviour

Waste management is largely regulated by legislation and policy implemented at the municipal level, but there are significant provincial regulations that may come into play. In some instances federal regulations may also be relevant, particularly if dealing with hazardous substances or shipping waste across provincial boundaries. Operational logistics play an important role in designing a waste management plan. The equipment, human resources, and budgetary requirements of the plan must all be considered in the design process as well as how the plan will be implemented, monitored and reviewed. Most organizations will require some services provided by commercial waste/recycling/composting service providers. With proper research, the contractual relationship with waste service providers can be negotiated to ensure that the contract provisions will allow for the successful implementation of the waste management strategy.
Integrated Waste Management (IWM) has emerged as a holistic approach to managing waste by combining and applying a range of suitable techniques, technologies and management programs to achieve specific objectives and goals (McDougall et al., 2001). The concept of IWM arose out of recognition that waste management systems are comprised of several interconnected systems and functions, and has come to be known as “a framework of reference for designing and implementing new waste management systems and for analysing and optimising existing systems” (UNEP, 2009). Municipal solid waste management has become a challenging environmental issue. Many cities in both urban and rural areas have encountered problems with disposal and treatment facilities that are inadequate to deal with the significant volume of solid waste. In Thailand, it is estimated that around 24.73 million tons of municipal solid waste were generated in the year 2012. Only 15.90 m tons (64.29%) was disposed of in prepared waste bins, and 11.90 m tons was collected. Therefore, more than half of the waste (13.62 m tons or 55.08%) was untreated or incorrectly treated. It is very expensive to improve disposal and treatment facilities. Thus, the budgets for municipal solid waste management are insufficient to provide disposal facilities. Many cities confront objections from the community due to concerns about environmental conservation. Thus, new treatment plants, both sanitary landfills, and incineration, have been banned in many municipalities.

Recycling is considered an effective measure to reduce the cost of collection, transportation, and treatment of waste. It also extends the life of sanitary landfills or incinerators for solid waste disposal and creates income for those who recycle. Recycling behavior is defined as separating waste in specific waste bins or collecting behavior waste materials for selling to recycling shops. These recyclable materials will then be collected for processing into new products. This solid waste includes paper, glasses, plastics, and metals, that is, iron, copper, aluminium, and lead.

2.8 Conceptual Framework
Mugenda and Mugenda (2003) refers conceptual framework as a hypothesized model identifying the model under study and the relationship between the dependent and independent variables.
The independent variables involves the four determinants of household waste management reflected through income of the household, infrastructural facilities available within the household area, location of the household and types of generation of waste. The dependent variable for the study involves management of waste in Mavoko Sub-county. The moderating variables involves the government policy at national and county level while the intervening variables are local politics that influence award of tender on waste management and environmental agents.

However, in as much as it may be a thriving business in Kenya and maybe other African nations, it can be argued that it is a collapsing enterprise in the European nations, what with a better sustainable environment being advocated for and use of plastic bags being banned. In Zurich, Switzerland, residents are now being forced to reduce on their garage or pay more for it to be collected. In the New York Times of April 23 2005, reported that Zurich, in contrast,
had made throwing things away nearly impossible - and also costly. The trash bag, depending on the size, had to be purchased from the government at about 5 Swiss Francs or $4.25 apiece. The drastic measures were taken by government after it was established that household waste was increasing by 10 per cent after every five years despite measures to reduce waste. This strategy may have worked since household trash in the town eventually started reducing significantly as residents were forced to recycle and only dispose of waste when it was absolutely necessary (Grange, 1999). It also created a revolution in the way residents shopped and stores did business. Since the residents had a hard time of disposing what they had shopped and also the packing materials, they avoided buying products that came in packages of cardboard, plastic and Styrofoam as it would result to more spending when disposing them off.

Solid wastes in Nairobi are a by-product of a broad spectrum of industrial, service and manufacturing processes. Primary high-volume generators of industrial solid wastes include the chemical, petroleum, metals, wood, paper, leather, textile and transportation industries. Secondary smaller generators include auto and equipment repair shops, electroplaters, construction firms, dry cleaners and pesticide applicators (Grange, 1999).

Mismanagement of these wastes typically results in pollution of the natural environment and may pose substantial danger to public health and welfare. There are various methods of waste disposal including integrated waste management, Plasma gasification, Landfill, Supercritical water decomposition and Incineration. There are lots of concepts about waste management which differ in their usage as per the varying regions or countries. Some of the widely used concepts include Waste hierarchy, extended producer responsibility and Polluter pays principle. The waste hierarchy points to the “reduce, reuse and recycle” that classify waste management strategies as per their effectiveness in regards to waste minimization. The waste hierarchy is the cornerstone of majority of waste minimization strategies. It focuses on taking out the maximum practical advantages from products and generating least amount of waste (Agunwamba, 2000).
2.9 Knowledge Gap

One of the knowledge gaps identified in the literature review was that there is all manner of solutions or ways as to how waste should be handled, depending on the type of waste. Many people have different answers on managing waste, whether it should be treated by the municipal or by private garbage collectors. The methods employed in the developed countries may not necessarily be integrated or adopted in the Kenyan market due to various factors, like our economy and our government has not scrapped off the use of polyethylene paper, which is most relied on in Kenya. Thus the methods of handling waste in Whitehouse residential area will have to be constrained to the country’s capabilities.

2.10 Summary of the Reviewed Literature

This chapter examined the various factors that limit the disposal and treatment of waste due to inefficient facilities that are inadequate to deal with the significant volume of solid waste. Some of the salient themes that occurred were the theories emphasizing the need for a national policy of waste management and efficient system for sustainability. The theory of planned behaviour reveals that mismanagement of these wastes typically results in pollution of the natural environment and may pose the substantial danger to public health and welfare. It discusses the various methods of waste disposal including integrated waste management, Plasma gasification, Landfill, Supercritical water decomposition and Incineration.
CHAPTER THREE
RESEARCH METHODOLOGY

3.1 Introduction
This chapter outlines in details how the research was conducted, from the philosophical stand to the practical methods adopted. It reviewed the research design, the population of interest, the sampling techniques and details of the variables that were used. An outline of method that was used to ensure validity and reliability of the instrument was also presented. Data collection instruments, data collection approaches and data analysis procedures were also presented.

3.2 Research Design
According to McMillan and Schumaker (2001); a research design is a plan for selecting respondents, research sites and data collection procedures to answer the research questions. A research design is a framework or plan underpinning a study’s concept and research questions. It is the stage at which to formulate conceptual models, to determine the research problems and hypotheses, to establish research instruments, technique, measurements and scales for collecting data and testing the research questions (Lee & Ling, 2008). The study adopted descriptive research design. Descriptive research enabled investigation to the research to describe terms or relationships concerning the study problem. The descriptive method was preferred since it ensures complete description of the situation, making sure that there was minimum bias in the collection of data (Cooper and Schindler, 2003).

3.3 Target Population
A population is a well-defined or set of people, services, elements, and events, group of things or households that are being investigated. This definition ensures that population of interest is homogeneous. And by population the researcher means complete census of the sampling frames. A population is defined as the units to be studied in terms of time as well as the boundaries of territory (Yang & Miller, 2008). According to Mugenda and Mugenda (2003), a target population is a complete set of individual’s area or objects with some common characteristics to which the researcher wants to generalize the results of the study. The target population of this study constituted the 104 residents (source, Syokimau Residents
Association- SRA) of Whitehouse residential area in Mavoko Sub-county. Mugenda and Mugenda, (1999), describes the target population in a way that it should contain some observable characteristics, to which the researcher intends to generalize the results of the study.

3.4 Sampling Procedure
According to Bartlett, Kotrlik and Higgins (2001) the size of the sample depended on the precision the researcher desired in estimating the population parameter at a particular confidence level hence there was no single rule that could be used to determine sample size. According to Troendle and Kai (2003) size of a sample should be determined by adequacy and resource consideration. This means that the sample should be large enough to enable reasonable estimates of variables to be obtained, capture variability of responses and facilitate comparative analysis. A research sample is defined as the people who actually participate in a study. A census was applied on the 104 residents of Whitehouse residential area. A census is a study of every unit, everyone or everything, in a population. It is known as a complete enumeration, which means a complete count. Conducting a census often results in enough respondents to have a high degree of statistical confidence in the survey results. If you have a population of less than 1,000 individuals, you may often need to survey everyone to achieve statistical confidence.

3.4.1 Sample Size
A total of 104 households were enumerated to represent the total population of Whitehouse residential area.

3.5 Methods of Data Collection
The researcher developed the instruments to aid in data collection and was obliged to commute daily to Whitehouse residential to administer the questionnaires during the defined research period. Questionnaires were the main data collection tools for this study. The questionnaires contained both the closed-ended parts and a few open-ended ones. Open ended sections allowed the sampled households to answer the required questions at their own discretion whereas the closed ended ones provided a number of alternative answers from which the respondent were required to choose from. The questionnaires were self-administered to the selected households using drop and pick method.
3.6 Validity of research Instrument

Validity refers to how well a test measures what it is purported to measure (Phelan & Wren 2006). For this to exist, the techniques to be used are meant to yield information that is not only relevant to the study hypothesis but also in terms of “relevance” and “corrections”. Creswell and Miller (2000) noted that an instrument that yields valid data will necessarily yield reliable data but an instrument that yields reliable data will necessarily yield valid information. The survey instrument was pilot tested using a sample of residents at Whitehouse residential area. These residents were not involved in the final survey. Dempsey (2003) contended that content validity is judgmental. In this respect, the study determined the validity through a careful definition of the topic of concern, the themes and the scales to be used, ensuring that the instruments contained a representative sample of the population on the subject matter of interest. In established criterion related validity, efforts were made to ensure that the criterion was relevant, free from bias, reliable and the information specified by the criterion is available.

3.7 Reliability of Research Instruments

Reliability is the degree to which an assessment tool produces stable and consistent results (Phelan & Wren, 2006). The researcher employed the test-retest method to establish reliability. This involved administering the same instruments twice to the same group of subjects. A time lapse of two weeks was given between the first and second test in establishing reliability of the research. The scores from Time 1 and Time 2 were then correlated in order to evaluate the test for stability over time. The scores in time 1 and time 2 in this research were similar.

3.8 Methods of Data Analysis

Data analysis was categorized in different stages. The collected extracted data from the filled questionnaires were coded and later analysed after cleaning of data. The descriptive and inferential statistics was used to analyze the data collected. Normally, descriptive statistics constitutes measures of central tendency and dispersion. Inferential statistics utilized include correlation and regression analysis.
The analysed data was presented in tabular formats and later interpreted for successful reporting.

3.9 Operational Definition of Variables
The operational definition of the variables is captured on Table 3.1

Table 3.1: Operationalization table

<table>
<thead>
<tr>
<th>Type of variable</th>
<th>Measurement of Indicator</th>
<th>Measurement Scale</th>
<th>Type of data analysis methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Independent Income</td>
<td>-Household Income level</td>
<td>Ordinal</td>
<td>• Descriptive statistics,</td>
</tr>
<tr>
<td></td>
<td>-Payment of garbage services</td>
<td></td>
<td>• Frequency distribution,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Percentages</td>
</tr>
<tr>
<td>Independent Location</td>
<td>-Household site</td>
<td>Ordinal</td>
<td>• Descriptive statistics,</td>
</tr>
<tr>
<td></td>
<td>-Waste collection bodies</td>
<td></td>
<td>• Frequency distribution,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Percentages</td>
</tr>
<tr>
<td>Independent Infrastructure</td>
<td>-Availability of sewerage facility</td>
<td>Ordinal</td>
<td>• Descriptive statistics,</td>
</tr>
<tr>
<td></td>
<td>-Household waste facilities</td>
<td></td>
<td>• Frequency distribution,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Percentages</td>
</tr>
<tr>
<td>Independent Types of waste</td>
<td>Observable types of wastes generated e.g. food, paper, plastic, clothes</td>
<td>Nominal</td>
<td>• Descriptive statistics,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Frequency distribution,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Percentages</td>
</tr>
<tr>
<td>Dependent Waste Management</td>
<td>-Waste reduction</td>
<td>Ordinal</td>
<td>• Descriptive statistics,</td>
</tr>
<tr>
<td></td>
<td>-Hazardous waste correctly disposed</td>
<td></td>
<td>• Frequency distribution,</td>
</tr>
<tr>
<td></td>
<td>-Waste recycling</td>
<td></td>
<td>• Percentages</td>
</tr>
<tr>
<td></td>
<td>-Expenditure reduction for the Mavoko Subcounty</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
3.10 Ethical Considerations
The study valued the respondents’ way of life and thus it was carried out with utmost integrity to enhance a good relationship with the respondents. Most importantly, the respondents were allowed to participate in the exercise at their own consent with those unwilling to participate being allowed to leave. The researcher maintained objectivity in all phases of the study in order to get accurate and reliable data. Data was handled with utmost confidentiality from collection, data analysis and to making honest and original presentation of research methodology and results.
CHAPTER FOUR
DATA ANALYSIS, PRESENTATION AND INTERPRETATION

4.1 Introduction
The study was conducted to examine the determinants influencing waste management in Kenya in Whitehouse residential area in Mavoko Sub-county. It establishes the relationship between the frequency of garbage collection in the area (waste management) in relation to the physical location of individual houses in the area, income status of individuals in the areas, the garbage collection charges and the reliability of garbage collectors.

The results that are used in this chapter were obtained when the gathered data was subjected to statistical analysis abetted by the Statistical Package for Social Sciences (SPSS) to generate the measures of central tendency (frequencies, percentages, mean an mode). The data is presented in form of figures and tables.

4.2 Questionnaire Return Rate
In the exercise, 104 questionnaires were issued out for this exercise and 96 responses were received. This represented a high response rate of 92 % that was achieved through constant, friendly follow up of the sampled respondents and frequent visits to Mavoko residential area.

4.3 Demographic Characteristics of the Respondents
The main respondents of the survey originated from the estates in the area and were guided in registering their responses with the use of the structured questionnaires.

4.3.1 Gender of respondents
There was a good representation of both genders of the respondents who were selected for the exercise. However it is more male households who participated in the exercise (54 individuals) as opposed to the female-households (42 persons).

Table 4.1: Gender of the Respondents

<table>
<thead>
<tr>
<th>Gender</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
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<tbody>
<tr>
<td>Male</td>
<td>54</td>
<td>56</td>
</tr>
<tr>
<td>Female</td>
<td>42</td>
<td>44</td>
</tr>
<tr>
<td>Total</td>
<td>96</td>
<td>100</td>
</tr>
</tbody>
</table>
4.3.2 Age Distribution of the Respondents

Table 4.2: Age distribution of the Respondents

<table>
<thead>
<tr>
<th>Age Distribution of the Respondents</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 20 years</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>21-30 years</td>
<td>30</td>
<td>31</td>
</tr>
<tr>
<td>31-40 years</td>
<td>35</td>
<td>37</td>
</tr>
<tr>
<td>41-50 years</td>
<td>19</td>
<td>20</td>
</tr>
<tr>
<td>&gt; 50 years</td>
<td>6</td>
<td>6</td>
</tr>
</tbody>
</table>

Majority of the respondents who agreed to participate in the exercise were in the 31 to 40 years group that formed 37% of sampled group followed by the 21 to 30 years group that accounted for 31% of sample. Equally, the respondents who were in the group of less than 20 years and below and those above 50 years formed the least proportion of the sampled population i.e. 6% each.

4.3.3 Years Lived In White House Residential Area

The exercise also sought to establish the number of years that various respondents had lived in the Whitehouse region.

Most of the respondents acknowledge living in the area for more a period not less 4 years but not exceeding 8 years, rated at 43%. The next group of the respondents (33%) reiterated living in the area for a period of 9 to 12 years followed by those who had lived in the area for not more than 3 years. However, the group that acknowledged living in the area for more than 16 years formed the least proportion of the sampled population.

Table 4.3: Years Lived In White House Residential Area

<table>
<thead>
<tr>
<th>Years lived at White house</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 3 years</td>
<td>20</td>
<td>21</td>
</tr>
<tr>
<td>4-8 years</td>
<td>41</td>
<td>43</td>
</tr>
<tr>
<td>9-12 years</td>
<td>32</td>
<td>33</td>
</tr>
<tr>
<td>&gt; 16 years</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>
4.3.4 Highest Level of Education of the Respondents

Majority of the respondents from the area stated university education level as their highest level of education at 38% followed by those who had tertiary level of education at 32%, then secondary education at 17%. The respondents who had primary level of education were the least represented in the survey i.e. at 5%.

Table 4.4: Highest Level of Education of the Respondents

<table>
<thead>
<tr>
<th>Highest level of Education</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Secondary</td>
<td>16</td>
<td>17</td>
</tr>
<tr>
<td>Tertiary college</td>
<td>36</td>
<td>32</td>
</tr>
<tr>
<td>University</td>
<td>31</td>
<td>38</td>
</tr>
<tr>
<td>Postgraduate</td>
<td>8</td>
<td>8</td>
</tr>
</tbody>
</table>

4.4 Household Income Status

4.4.1 Total Household Range (Kes)

The highest number of the respondents fall under the group with an aggregate household monthly income of Kenya shillings 10,000 to 50,000, representing 43% of the sampled population followed by those who had an aggregate monthly income between Kenya Shillings 50,001 and 100,000. The respondents with a total income between Kenya Shillings to 10,000 formed the least population of the whole group.

Table 4.5: Total Household Range (Kes)

<table>
<thead>
<tr>
<th>Total household range (KES)</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-10,000</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>10,001-50,000</td>
<td>40</td>
<td>43</td>
</tr>
<tr>
<td>50,001-100,000</td>
<td>34</td>
<td>36</td>
</tr>
<tr>
<td>100,001-200,000</td>
<td>14</td>
<td>15</td>
</tr>
<tr>
<td>Above 200,000</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Missing System</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>
4.4.2 Disposable Income

This study examined the relation between the aggregate monthly income and disposable level of income of the respondents.

**Table 4.6: Disposable Income vs. Respondents’ Total Monthly Income**

<table>
<thead>
<tr>
<th>Disposable income (in Kes)</th>
<th>0-10,000</th>
<th>10,001-50,000</th>
<th>50,001-100,000</th>
<th>100,001-200,000</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-10,000</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>10,001-50,000</td>
<td>8</td>
<td>32</td>
<td>0</td>
<td>0</td>
<td>40</td>
</tr>
<tr>
<td><strong>Total household range (Kes)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50,001-100,000</td>
<td>0</td>
<td>24</td>
<td>10</td>
<td>0</td>
<td>34</td>
</tr>
<tr>
<td>100,001-200,000</td>
<td>0</td>
<td>8</td>
<td>2</td>
<td>4</td>
<td>14</td>
</tr>
<tr>
<td>Above 200,000</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>12</td>
<td>64</td>
<td>12</td>
<td>6</td>
<td>94</td>
</tr>
</tbody>
</table>

As displayed in the above table, the respondents who earn large amounts of money have huge amounts at their disposal.

Majority of the respondents who can be termed as low-income earners relies on the services of the municipal council in discarding their garbage. Evidently, out of 12 respondents who have Kenya Shillings 0 to 10,000 at their disposal, 7 of them relies on the municipal council of the areas to collect their garbage in comparison to the 5 respondents who rely on private providers of garbage collection services. For, the respondents who have between Kenya Shillings 10,001 to 50,000 at their disposal, 37 of them are consumers of the municipal services of garbage collection while the rest 27 respondents relies on services of the private garbage collectors. In the next category, the respondents with between Kenya Shillings 50,001 and 100,000, 8 relied on the services of private providers while only 4 respondents consumed
the services of the local authority in the area. Lastly and notably, all the respondents with a disposable income that ranged between Kenya Shillings 100, 001 and 200,000 consumed the services of the private providers for garbage collection.

Table 4.7: Disposable Income as a Determinant for the Service Providers

<table>
<thead>
<tr>
<th>Disposable income (in Kes)</th>
<th>Municipal council</th>
<th>Private garbage collection enterprises</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-10,000</td>
<td>7</td>
<td>5</td>
<td>12</td>
</tr>
<tr>
<td>10,001-50,000</td>
<td>27</td>
<td>37</td>
<td>64</td>
</tr>
<tr>
<td>50,001-100,000</td>
<td>4</td>
<td>8</td>
<td>12</td>
</tr>
<tr>
<td>100,001-200,000</td>
<td>0</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Total</td>
<td>38</td>
<td>56</td>
<td>94</td>
</tr>
</tbody>
</table>

Clearly from the above tabular representations, households with large amount of money at their disposal relies on the services of the private providers for garbage collection. In other words, there is a significant relationship between the service provider chosen by individuals for garbage collection and the disposable income (Persons’ r = 0.71).

4.4.3 Frequency of garbage collection

The largest proportion i.e 47 out of 96 respondents claimed that garbage is collected from their individual houses once a week while 34 other respondents stated that it is collected twice in a week. However, only 15 respondents reiterated that the garbage is collected after two weeks from their households.

Table 4.8: Disposable Income as a Determinant for the Frequency of Garbage Collection

<table>
<thead>
<tr>
<th>Disposable income (in Kes)</th>
<th>Once a week</th>
<th>Twice a week</th>
<th>After 2 weeks</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-10,000</td>
<td>6</td>
<td>0</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>10,001-50,000</td>
<td>37</td>
<td>18</td>
<td>9</td>
<td>64</td>
</tr>
<tr>
<td>50,001-100,000</td>
<td>4</td>
<td>10</td>
<td>0</td>
<td>14</td>
</tr>
<tr>
<td>100,001-200,000</td>
<td>0</td>
<td>6</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>Total</td>
<td>47</td>
<td>34</td>
<td>15</td>
<td>96</td>
</tr>
</tbody>
</table>
Notably and from the above table, the individuals whose disposable income fall under the range of Kenya Shilling 0 to 50,000 have their garbage collected by the either the Municipal council of the area or the private services provider either once a week (43 respondents asserts) or twice after two weeks (15 individuals contend). However, it is only 18 individuals in this group who had their garbage collected twice in a week.

For the individuals who have more than Kenya Shillings 50,000 at their disposal, the majority of them (16) have garbage collected from their houses at least twice in a week while only 4 of them who have the garbage collected once in a week. Thus, the amount of disposable income at an individual’s hands is a determinant of the frequency of garbage collection from households at White House residential area.

4.5 Impact of Houses Location on Waste Management

4.5.1 Distance of Household's House from the collection Point

The majority of the respondents (82 individuals) stated that their houses are located approximately between 200 meters and 1 kilometer away from the site of collection of garbage in the area constituting 96% of the sampled population. Only 14 households reiterated living more than a kilometer from the designated point of garbage collection in the area.

<table>
<thead>
<tr>
<th>Distance away from the garbage collection point</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>like 200-499 metre away</td>
<td>41</td>
<td>43</td>
</tr>
<tr>
<td>500-999 metres away</td>
<td>41</td>
<td>43</td>
</tr>
<tr>
<td>&gt; 1 KM</td>
<td>14</td>
<td>15</td>
</tr>
<tr>
<td>Total</td>
<td>96</td>
<td>100</td>
</tr>
</tbody>
</table>

A table showing individual household’s houses location away from the garbage collection point.

4.5.2 Household Location as a Determinant of Garbage Collection Exercise

Apparently, distance of households houses play less significant roles in influencing the cost, frequency and the reliability of the garbage collectors. This could be explained by the fact that
the area has well developed road networks enabling garbage collection exercise. Additionally, being a general public want, the local authority of the White House residential could be obliged to charge standard amount to all the consumers of its products. However, there could be a slightly difference for the private providers of the same services at the area for a need to recover their operations cost.

Table 4.10: Household location as a determinant of garbage collection exercise

<table>
<thead>
<tr>
<th>Distance household's house from the garbage collection point</th>
<th>Pearson Correlations Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Confidence level</td>
<td>90%</td>
</tr>
<tr>
<td>N</td>
<td>96</td>
</tr>
<tr>
<td>House location affects frequency of garbage collection</td>
<td>-0.023</td>
</tr>
<tr>
<td>House location is a determinant of cost of garbage collection</td>
<td>-0.148</td>
</tr>
<tr>
<td>House location determines reliability of garbage collectors</td>
<td>-0.002</td>
</tr>
<tr>
<td>Houses nearer the main road are able to access better quality garbage collection services</td>
<td>0.012</td>
</tr>
<tr>
<td>Efficient garbage collection system regardless of the location of neighbourhood houses</td>
<td>0.68</td>
</tr>
</tbody>
</table>

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

4.6 Infrastructure as a Determinant of Waste Management

4.6.1 Households Supporting Garbage Collection Exercise

A significant number of the interviewed households (72 persons) asserted about supporting garbage collection exercises carried out either by the municipal council or the private service providers in the White House residential area. Concurrently, 22 of the remaining sampled households reiterated about not supporting the exercise.
Table 4.11: Households Supporting Garbage Collection Exercise

<table>
<thead>
<tr>
<th>Support garbage collection exercise</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>72</td>
<td>77</td>
</tr>
<tr>
<td>No</td>
<td>22</td>
<td>23</td>
</tr>
</tbody>
</table>

For those who never supported the garbage collection assignments, they listed inefficiencies in the collection of garbage and management of the dumpsites, significant and unnecessary garbage collection delays that causes inconveniences and lack of all services providers to adhere to the stipulated environmental measures to curb pollution.

4.6.2 Infrastructures Available for Waste Management

Out of the 93 respondents who answered this query, 43 confirmed that there exists sewage pits in the area, 28 stated of availability of public garbage collection trucks, 16 reiterated of present private providers trucks while the rest 6 households claimed of existence of dump sites that are in good proximity for usage in the area. Meanwhile, 3 households never answered this question.

Table 4.12: Infrastructures Available for Waste Management

<table>
<thead>
<tr>
<th>Available infrastructures for waste management</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sewage pits</td>
<td>43</td>
<td>46</td>
</tr>
<tr>
<td>Public (counties) garbage collection trucks</td>
<td>28</td>
<td>30</td>
</tr>
<tr>
<td>Private service providers trucks</td>
<td>16</td>
<td>17</td>
</tr>
<tr>
<td>Dump sites away but in good proximity for usage from the residential area</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>Missing System</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>96</td>
<td></td>
</tr>
</tbody>
</table>

4.6.3 Infrastructure as a Determinant for Waste Management

Some of the defined aspects showed aptly that infrastructure is a significant determinant of waste management in the area. For instance, the households who participated in garbage collection exercises emphasized that in most cases, the local authorities or private service
providers running the garbage collection task fails to pay adequate attention to the existing infrastructures (p= -0.538) and reiterated also that both local authority and service providers in the area do not have good maintenance schedule for their systems (r= -0.646). Remarkably, the sampled households reiterated that existing garbage collection systems do not totally mitigate any health and environmental disasters attributable with the neglect of waste dumps.

Table 4.13: Infrastructure as a determinant for waste management

<table>
<thead>
<tr>
<th>Available infrastructures for waste management</th>
<th>Correlations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Most local authorities/ services providers pay adequate attention to the dump sites/infrastructures.</td>
<td>-0.538*</td>
</tr>
<tr>
<td>Local authorities/garbage service providers have good maintenance schedules for their systems.</td>
<td>-0.646*</td>
</tr>
<tr>
<td>The garbage collection systems mitigate any health and environmental disasters that may result from the neglect of waste dumps.</td>
<td>-0.3*</td>
</tr>
<tr>
<td>Good management of waste in general in Machakos county.</td>
<td>-0.107</td>
</tr>
<tr>
<td>There is specific legislation on waste management and on the environment.</td>
<td>-0.042</td>
</tr>
<tr>
<td>Available controlled manner in which waste is disposed off at most open dumpsites without creating serious problems to human, animals, and environmental degradation.</td>
<td>0.059</td>
</tr>
<tr>
<td>Adequate waste disposal that does not translate into economic and other welfare losses</td>
<td>0.103</td>
</tr>
<tr>
<td>Rapid urbanization has not affected the waste disposal system in the area</td>
<td>0.131</td>
</tr>
<tr>
<td>Available formal consultation about the location and operation of dump sites. They are selected by the municipal authorities.</td>
<td>-0.132</td>
</tr>
<tr>
<td>Private garbage collection entrepreneurs deliver better services than the city council.</td>
<td>-0.175</td>
</tr>
</tbody>
</table>

Sig. (2-tailed); N=96

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

Clearly and from the above table, there the rest aspects of infrastructure significant effects on waste management in White House residential area.
4.7 Types of Waste as a Determinant of Waste Management

4.7.1: Types of Waste as a Determinant of Waste Management

In most homes of the interviewed households, food waste is the key form of waste that is generated with 47 persons affirming this, followed by metallic waste then plastic and clothes waste. Meanwhile, paper waste accounts for the least percentage (4%) of the household generated waste in White House residential area.

Table 4.14: Types of Waste as a Determinant of Waste Management

<table>
<thead>
<tr>
<th>Type of waste generated in households</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food waste</td>
<td>47</td>
<td>50</td>
</tr>
<tr>
<td>Paper wastes both degradable e.g. newspapers and non-degradable e.g. nylon</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Plastics</td>
<td>12</td>
<td>13</td>
</tr>
<tr>
<td>Clothes</td>
<td>12</td>
<td>13</td>
</tr>
<tr>
<td>Metallic objects</td>
<td>19</td>
<td>20</td>
</tr>
</tbody>
</table>

Clearly, food waste is the leading type of waste that is generated in individual houses.

The households confirmed that they rarely recycle the waste that are generated in their residences ($r = -0.6$).

Table 4.15: Households’ Recycling Habits on waste

<table>
<thead>
<tr>
<th>Recycling habits on waste</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>We always recycle before finally disposing</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>We sometimes recycle before disposing</td>
<td>10</td>
<td>7</td>
</tr>
<tr>
<td>We never recycle</td>
<td>80</td>
<td>83</td>
</tr>
</tbody>
</table>

From the table above, the largest part of the sampled household asserted of not recycling the generated waste in their houses at any one moment.
CHAPTER FIVE
SUMMARY OF FINDINGS, DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction
This chapter summarizes the findings of the study, conclusions and recommendations.

5.2 Summaries of Finding
From the data and other information obtained and analyzed to answer the research questions of the study, a number of research findings were presented in chapter four. The findings are summarized in this section

5.2.1 Household’s Views on the Income and Waste management
The research found out that income level affected household waste management; this was supported by the fact that most of the household respondents believed that level of income of household affected waste management. This was further supported by the fact that individuals’ households with more cash at their disposal greatly support waste management assignments (higher income earners have garbage collected twice a week while people on the lower end prefer a weekly collection or after two weeks). Clearly, the individuals who have more than Kenya Shillings 50,000 at their disposal, the majority of them (16) have garbage collected from their houses at least twice in a week while only 4 of them who have the garbage collected once in a week. This could be because at least more than a half of low-income household respondents believed that household solid waste management was expensive.

5.2.2 Household Location as a Determinant of Garbage Collection Exercise
The research found out that location of households (distance from town center) that individual households’ house location point less considerably influences the efficiency of waste management. The fact is explainable based penetrability of the area due to well-developed roads. This could be because the municipal authorities are less strict to households which reside near town centers than those further away from the town centers.
5.2.3 Infrastructure as a Determinant of Waste Management
The research found that a significant relationship existed between the infrastructures designed for handling garbage on waste management system at Whitehouse residential area. Undoubtedly, the households raise concerns about local authorities and private service providers of garbage collection services failing to pay adequate attention to the existing infrastructures. This was explainable due to the fact that the local authorities or private service providers running the garbage collection task failed to pay adequate attention to the existing infrastructures (p= -0.538) and do not have good maintenance schedule for their systems (r= -0.646).

5.2.4 Types of Waste as a Determinant of Waste Management
The revealed that food waste was the key form of waste that is generated by the households in White House residential area with 47 persons affirming this, followed by metallic waste then plastic and clothes waste. Meanwhile, paper waste accounts for the least percentage (4%) of the household generated waste in White House residential area. Concurrently, the research further revealed that recycling habits of waste remained a new element in the Mavoko community at White House residential area with 83 individuals of the sampled population affirming this. This could be because both the Municipal and Private providers of garbage services do have failed to create awareness to individuals on the best strategies to recycle the produced waste.

5.3 Discussion
The study aimed at establishing a set of distinct objectives. Foremost, the research wanted to study disposable income as a determinant of waste management on different households in Mavoko sub-county Whitehouse residential area. Waste management combines and applies a range of suitable techniques, technologies and management programs to achieve specific objectives and goals (McDougall et al., 2001; The concept of IWM arose out of recognition that waste management systems are comprised of several interconnected systems and functions, and has come to be known as “a framework of reference for designing and implementing new waste management systems and for analysing and optimising existing systems” (UNEP, 2009). Municipal solid waste management has become a challenging
environmental issue. Many cities in both urban and rural areas have encountered problems with disposal and treatment facilities that are inadequate to deal with the significant volume of solid waste. Apparently, disposable income emerged as a key determinant of waste management exercises with the households with less amounts of money at their disposal going for the municipal services as opposed to the wealthy who prefer for private services probably because they are efficient and causes less delays. For instance, all the households with a disposable income that ranged from Kenya Shillings 100,001 to 200,000 consumed the services of the private providers while only 5 persons, whose disposable income ranged from Kenya Shillings 0 to 10,000 who relied on the services of private providers. Alternatively, 7 of the 12 households, with disposable income ranging from Kenya Shillings 0 to 10,000, relied on municipal council services for garbage collection.

Furthermore, the amount of disposable income that is held by households at different categories significantly influences the frequency of garbage collection. Evidently, 58 out of the 76 households with a disposable income ranging from Kenya Shillings 0 to 50,000 have their garbage collected either after or two weeks. Only 18 persons in the group who have their garbage collected twice on a weekly basis. Contrary, out of 20 households whose disposable income fall under the range of Kenya shillings and above, only 4 of them have garbage collected once in a week. The rest have their generated garbage collected twice in a week. All these findings are supported by the work of Zerboc (2003) who postulates that insufficient financial leads to low quality of service provision as fewer people become less willing to pay for high quality services creating a hurdle on waste management.

Another separate objective of the study was to determine how houses location impact on waste management system. In regards to this objective, the research revealed that individual households’ locations away from the garbage collection point less significantly influence the efficiency of waste management. This could be explained by the fact the area is not hilly and the roads are penetrable facilitating its easier access and transportation of gathered garbage. Consequently, this oblige the local authority of the area to standardize charges on consumers of such public services. However, there could be a slightly difference of charges by the private providers on the same services to cover up on their operations cost. This discovery
contradicts Jain (1994) argument that reiterates that inadequate monetary resources, at times, results in improper or no transportation vehicles for waste disposal adding another dimension to the ever rising cycle of problems.

On third objective, there is a significant relationship between the infrastructures designed for handling garbage on waste management system at Whitehouse residential area. The households raise concerns about local authorities and private service providers of garbage collection services failing to pay adequate attention to the existing infrastructures. Additionally, they claimed that these bodies good maintenance schedule for their systems that do not totally mitigate health and environmental disasters. The findings are consistent with Agunwamba (2000) work which states that poor waste management systems usually fails in preventing harm to the environment, injuries or long term progressive damages to health of households and the environment they live in.

The last objective revealed that despite all the sampled households generating of daily basis different waste: food waste, paper wastes both degradable, plastics, clothes and metallic objects, less efforts is usually shown in waste management. Normally, majority of the households (83) conformed that they do not recycling exercises at all. Only 16 households of the sampled 96 households asserted practicing recycling of waste before disposal and in particular 6 of them doing frequent recycling of waste. The findings is in tandem with the Gwebu (2003) which reveals that practices of waste management differ from developed and developing nations. Explicitly, there is difference in methods used in the urban and rural areas, and also for industrial or residential producers. It is the responsibility of local government authorities to manage non-hazardous residential and institutional waste in metro areas.

5.4 Conclusions
From the research, it is concluded that the above-discussed factors significantly influence waste management in Kenya. It is further established that the availability and adequacy of resources meant for the disposal of garbage substantially hinder the waste management systems. Apparently, the physical geographical structure of an area could deter the garbage collection exercises by making the area impassable thus limiting transportation activities.
Additionally, the wellbeing of different households, which can be reflected by the amount of money, that is available for disposal. As household economic conditions improve, so is the amount of solid waste produced. Therefore, solid waste produced is highly influenced by the level of incomes of urban households.

Finally, the efforts made by individual households and service providers and in this case, both the local authority and private service providers of garbage collection services. For households, it was established irrespective of generating huge volumes of food waste compared to other wastes such as papers, plastics, metallic objects etc., they do never show interest of recycling the produced waste. Remarkably, some waste are degradable and thus poses less environmental hazards to the environment and also the lives of households. However, some waste such as plastic bags, metallic objects waste among others is not degradable. Consequently, when they are not well disposed, they are capable of culminating hazardous effects to the environment. For the local authorities and the providers of garbage services, there is a laud call by the households to make sure that they adhere to effective management schedules of existing and new waste management infrastructure and systems. This will not only promote a cleaner environment but also ensure that there are no inconveniences and delays when it comes into waste management by the households.

5.5 Recommendations

From the research, the following recommendations are made.

i. Garbage should be collected at least twice a week from every individual household irrespective of the income status. Both the local and national government of Kenya should enhance the collection policies such that the both private and public services providers can efficiently manage their systems.

ii. Stringent measures should be imposed and implemented by the relevant laws to prevent the leakage of solid waste and the odor that emanates from such garbage.

iii. Initiatives to treat, recycle, reuse and dispose of wastes at the source of generation and regulatory procedures should be set and implemented thoroughly.

iv. There need to be well laid and developed prevention and minimization mechanisms that ensures environmentally sound management of hazardous wastes.
5.6 Suggestions for Further Studies

1) The study revealed that disposable income of different households significantly influences the frequency of garbage collection in their home areas. Further studies should be made in this area.

2) From the findings of this research, further research on determinants of waste management in Kenya should be conducted in other towns as well. This will show if this research has universal application.
REFERENCES


Division of Technology, Industry and Economics International Environmental Technology Centre Osaka/Shiga, Japan.


APPENDICES
APPENDIX 1: Letter of Transmittal

Murugi Ndwiga

P O Box 11200-00400,

Nairobi.

Dear Respondent,

RE: LETTER OF TRANSMITTAL

I am a Masters of Arts student at the University of Nairobi, School of Continuing and Distance Education. I am pursuing a Master of Arts degree in Project Planning and Management. I am researching on the determinants of waste management systems on garbage handling in Kenya: A case study of Whitehouse residential area in Mavoko Sub-county. Kindly answer all the questions as accurately and as fully as possible. The responses received shall be treated with utmost confidentiality and professionalism. Do not write your name on any part of this document.

You may respond by either writing a statement or a tick □ where required.

.......................................

Murugi Ndwiga

L50/71288/2011
APPENDIX 2: Questionnaire for Residents of Whitehouse Residential Area

The purpose of this questionnaire is to collect data on determinants influencing waste management in Kenya: A case of Whitehouse residential area in Mavoko Sub-county. The researcher assures you that the information gathered will be treated with utmost confidentiality and for academic purposes only.

Please tick (√) where appropriate or fill in the required information.

(To be filled by Residents of Whitehouse residential area)

QUESTIONNAIRE – WHITEHOUSE RESIDENTS

SECTION A: SOCIAL DEMOGRAPHIC INFORMATION

1. Sex
   Male  ( )
   Female  ( )

2. Age bracket
   < 20 years  ( )
   21-30 years  ( )
   31-40 years  ( )
   41-50 years  ( )
   >50 years  ( )

3. Highest level of education?
   Primary  ( )
   Secondary  ( )
   Tertiary College  ( )
   University  ( )
   Post Graduate  ( )

4. How many years have you lived at Whitehouse residential area?
   <3 years  ( )
   4-8 years  ( )
   9-12 years  ( )
   13-15 years  ( )
   >16 years  ( )
SECTION B: HOUSEHOLD INCOME

1. What is your total household range (in Kes.)?
   (i) 0-10,000 ( )
   (ii) 10,001-50,000 ( )
   (iii) 50,000-100,000 ( )
   (iv) 100,001-200,000 ( )
   (v) Above 200,000 ( )

2. What’s your disposable income (in Kes.)?
   (i) 0-10,000 ( )
   (ii) 10,001-50,000 ( )
   (iii) 50,000-100,000 ( )
   (iv) 100,001-200,000 ( )
   (v) Above 200,000 ( )

3. Who collects garbage from your house?
   Municipal council ( )
   Private garbage collection enterprises ( )

4. How often is garbage collected from your house?
   Once a week ( )
   Twice a week ( )
   After two weeks ( )
5. Approximately how far apart is your house from the garbage collection point?

- 200-500 metres away  (  )
- 500-1000 metres away  (  )
- Over 1 KM away  (  )

6. To what extent do you agree with the following statements regarding how location of your house influences garbage collection exercise?

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Neither agree nor disagree</th>
<th>Disagree</th>
<th>Strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location of my house affects frequency of garbage collection</td>
<td></td>
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</tr>
<tr>
<td>Cost of garbage collection is determined by location of my house</td>
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<tr>
<td>Location of my house determines reliability of the garbage collectors</td>
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<tr>
<td>The nearer the house is to the main road the more they are able to access better quality service providers of garbage collection</td>
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<tr>
<td>The garbage collection system is efficient regardless of the location of the houses in the neighbourhood</td>
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</table>
SECTION D: IMPACT OF INFRASTRUCTURE ON WASTE MANAGEMENT

7. Do you support, the work carried out by the garbage dumpsite cartels?
   Yes ( )
   No ( )

8. If no, kindly explain
   ……………………………………………………………………………………………..
   ……………………………………………………………………………………………..

9. What are the infrastructures available in this neighbourhood for waste management?
   a) Sewage pits
   b) Public (Counties) garbage collection trucks
   c) Private services providers trucks
   d) Dump sites that away but in good proximity for usage from the residential area

10. {Tick (✓) the appropriate column} (1) Strongly disagree (2) Disagree (3) Moderately agree (4) Agree (5) Strongly agree

<table>
<thead>
<tr>
<th>WASTE DISPOSAL MANAGEMENT</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Most local authorities / service providers pay adequate attention to the dumps</td>
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<td>Local authorities / garbage service providers have good maintenance schedules for their systems</td>
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<tr>
<td>The garbage collection systems mitigate any health and environmental disasters that may result from the neglect of waste dumps</td>
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<tr>
<td>There is good management of waste in general in Machakos county.</td>
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<tr>
<td>There is a specific legislation on waste management and on the environment.</td>
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</tbody>
</table>
There is a controlled manner in which waste is disposed off at most open dumpsites without creating serious health problems to humans, animals, and environmental degradation.

There is adequate waste disposal that does not translate into economic and other welfare losses

Rapid urbanization has not affected the waste disposal system in this area

There is formal consultation about the location and operation of dump sites. They are selected by the municipal authorities.

Private garbage collection entrepreneurs deliver better services than the city council

**SECTION E: TYPES OF WASTE**

11. Which of the below types of waste are generated from your household on a regular basis?

   a) Food Waste
   b) Paper Wastes e.g. polythene papers, newspapers etc.
   c) Plastic Waste
   d) Clothes
   e) Metallic Waste

12. How would you describe recycling habits of your household on the waste items mentioned above?

   a) We always recycle before finally disposing
   b) We sometimes recycle before disposing
   c) We never recycle