EFFECTIVENESS OF WASTE MANAGEMENT STRATEGIES ON ENVIRONMENTAL HEALTH, THE CASE OF MERU MUNICIPALITY

BY

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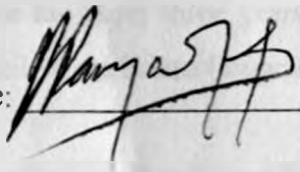
DECLARATION

This research project is my original work and has not been presented to any other institution of higher learning, for the award of certificate, diploma or degree.

Signature: 

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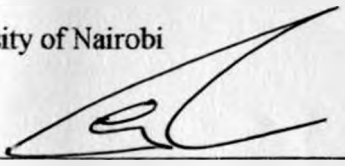
Signature: 

Date: 15/8/2011

DEDICATION

This project is dedicated to my late father, Jeremiah Kanyamu; the fountain of inspiration, for the thirty three years dedicated services to Local Authorities; Meru County Council, Meru Urban Council and the Municipal Council of Meru.

To my wife Lydiah Mwiti and sons Kevin and Victor, thank you for cheering me on.

May the Almighty God bless you all.

ACKNOWLEDGEMENT

I owe special gratitude to all who have in any way contributed to the successful completion of this project.

I am greatly indebted to my supervisor Dr. Christopher Gakuu for his guidance and support in making this project a reality. My gratitude also goes Mr. John Rugendo Chandi my lecturer for his support in this work.

To my wife and sons for their continued patience and moral support.

May the almighty God bless you all.

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ABBREVIATION AND ACRONYMS

EMCA	-	Environmental Management and Co-ordination Act
GOK	-	Government of Kenya
LA	-	Local Authorities
MCM	-	Municipal Council of Meru
MDG's	-	Millenium Development Goals
NEMA	-	National Environmental Management Authority
SPSS	-	Statistical Packages of Social Science
UNCHS	-	United Nations Centre for Human Settlement
UNEP	-	United Nations Environmental Program
UNESCO	-	United Nations Education Scientific and Cultural Organisation
WHO	-	World Health Organisation

ABSTRACT

Waste management constitutes a major problem in many third world cities. Most cities do not collect the totality of wastes generated, and of the wastes collected only a fraction receive proper disposal. This represent a source of water, land and air pollution and poise risk to the environmental health. This trend is expected to persist in the developing world thereby considerably deteriorating the situation. Cities on the other hand spend resources to improve their waste management. However the strategies employed at times are not effective hence impact negatively to environmental health. The research project aimed at assessing the effectiveness of waste management strategies on environmental health, the case of Meru Municipality. It is a study that involved major categories of various economic activities in the Meru Municipality. Assessing the effectiveness of present waste management strategies on the environment health implies that urgent steps may be required to upgrade or improve the strategies if they are found not to be effective and further measures for sustainability if they are found to be effective and impacting positively to environmental health. This research project therefore focused on the current state of affairs. The research analyzed the waste management strategies, and their effectiveness and impact on environmental health. Descriptive research design, and more specifically a survey design was employed. This in a nutshell involved in depth analysis of the effectiveness of the waste management strategies and their ultimate impact on environmental health. Data was analyzed using statistical package for social sciences (SPSS). The findings and recommendations of this study may significantly contribute to enhancement and fostering of the environmental health. Fundamentally, the research findings availed key information towards implementing Kenya's Economic Blue Print Vision 2030 and accomplishment of the Global Millenium Development Goals by 2015. More than half of the solid waste generated in Meru consists of organic matter. It was established that waste collection services were provided only sporadically to low-income areas because of poor accessibility and very high waste generation which cannot be handled with available vehicles and equipment. Similarly, the Municipal Council of Meru experienced inadequate financing, lacked a policy on waste reduction and on involving community groups in waste management. In conclusion, municipal solid waste issues represent major problems to the governments of developing nations. As poorer nations grow and develop, improvements in infrastructure and technology should help to overcome barriers to the safe disposal of urban waste. Environmental regulations, intelligently designed to protect the health and integrity of ecosystems and human populations, should be created and enforced now in order to prevent the need for costly remediation measures in the future. The study recommends increasing the number of employees, facilities and equipments and maintaining the drainage/sewer system, educating the public on waste management to create awareness in the community to advocate and encourage the use of proper waste disposal and handling and strict enforcement of the rules and regulation guarding waste management.

CHAPTER ONE

INTRODUCTION

1.1 Background to the study

Waste management strategies are a core function of any urban authority. All over the world this responsibility is entrusted to municipal councils/corporations; No urban authority has a choice of whether or not to manage it's waste, the only choice is that of the strategy to employ. Waste management has emerged as a crucial concern of environmental health. The World Health Organisation – (WHO, 1995) defines environmental health as those aspects of human health and diseases that are determined by factors in the environment that can cause disease or death. According to United Nations International Children Emergency Fund – (UNICEF, 2008) majority of the population in third world countries live on one dollar a day. In the struggle to survive and meet their basic needs they engage in destructive practices that impact negatively to the environment.

Most third world countries did not have environmental policies until recently for example in Kenya the Environmental Management and Co-ordination Act – (EMCA) was enacted in 1999, 36 years after independence. To date the authority lacks enough staff and funding to handle environmental health concerns. This has resulted to inability to police and prevent environmental violations, being more reactive than pro-active, waste of economic resources in the process of taking corrective actions, lack of waste management in urban areas, poor foresight by planners, inability to adopt appropriate practices to manage waste disposal, poor protection of wetland and water catchment areas from both residential and industrial wastes, and laxity in endorsing existing laws pertaining to environmental protection (GOK, 2005). As Mostafa K. Tolba, former Executive Director of the United Nations Environment Programme – UNEP said *"the problems that overwhelm us today are precisely those we failed to solve decades ago"*, (World Resources Institute 2003) is therefore applicable to many third world countries Kenya included.

The world commission on environment and development chaired by Norwegian Prime Minister Gro Harlem Brundtland (and consequently called the Brundtland commission 1987 is now a common feature of any development effort. In reference to Brundtland report 1987 therefore waste management strategies should encompass

sustainable development to be effective with sustainable development being defined as *"development that meets the needs of the present without compromising the ability of future generations to meet their own needs"*. In a nutshell it is a pattern of resource use that aims to meet human needs while preserving the environments so that these needs can be met not only in the present but also for future generations.

In Kenya municipal councils, local water and sewerage companies, National Environment Management Authority (NEMA) are entrusted with sustainable waste management programmes in urban areas to ensure sustainable development. There is therefore the need of following a systematized procedure in environmental health issues. Environment components tend to assume some hierarchical organization such that what happens at each level influences what occurs and/or goes on at adjacent levels re-affirming the need to respect the common good because all things are interconnected in some way (Mugendi, 2006).

Effective waste management from one part will benefit the other part and the vice – versa is true. Sound waste management policies can protect the productive capacity of both the natural and Human resources. "Environmental Health is therefore a central concern of any long-term development strategy - the achievement of the millennium development goals 2012 and Kenya's Economic Blue Print Vision 2030. The ministry of Environment and Natural Resources in Kenya has been charged with the mandate to implement millennium development goal 7 target 9. One of the components of target 9 is integrating the principles at sustainable development into county policies and programmes (GOK, 2006).

The National Environment Management Authority (NEMA) has a critical role to play in the attainment of vision 2030 under the environment sector. As the principle agency of government charged with the implementation of all environmental polices, the Authority is expected to develop environmental standards, regulations and guidelines to spearhead environmental management so far NEMA has developed 7 regulations since inception with the *waste management regulation 2006* being among them (NEMA 2010-2013).

Waste management strategies include methods of waste handling methods, waste disposal, awareness on waste management, government policy on waste management and the more recently privatization of wastage management. Considering the current situation that environment forms the back bone of the productive sector and is key to poverty reduction and socio-economic development; and that local authorities, whose main responsibility is management of waste, and their most pressing problems being poor service delivery, loss of public goodwill, financial crisis, limited flexibility due to legal and institutional framework and lack of leakages with communities and community participation (Mbogua and Chana, 1999) the lack of proper enforcement the Environmental Act (GOK, 2004) there is urgent need for assessment of the effectiveness of waste management strategies on environmental health. Environmental health is therefore dependant on well designed and implemented waste management strategies.

1.2. Statement of the problem

Waste management is a major problem world-over. The social economic development has caused an increased pressure to the environment. There is need for reduction in environmentally damaging activities – waste management being one of them (Rosenbaum, 2002).

The production of consumables all over the world and their disposal has negatively impacted upon the environment. The more the production the more the waste, the more there is to dispose. Waste management is therefore a crucial component in the global environment concern, (Kevin & Lewis, 1994).

The Stockholm conference of 1972 addressed such concerns. The developing mega cities have enormous waste management problems. Mexico one of the largest cities in the developing world generates some 10,000 tons of garbage each day, manilla in the Philippines generates excess of 10,000 tons of waste daily, (World Bank, 2006). Nairobi city generates over 1,000 tons of refuse daily (GOK, 2005).

In Africa, for many people the way to dispose waste is simply to drop it in some place, open unregulated dumps are the predominant methods of waste disposal in Kenya, and many African countries. There are challenges associated with open

dumping; animal scavengers, becomes habitat for rats, flies, mosquitoes, scavenging birds, produces leachates, may be a security risk of human scavengers and health risk due to rabid dogs and mosquitoes (Lohani and Baldisimo 1990).

In Kenya waste management offers general challenges from clogged drainage, and sewers, water borne diseases like typhoid, cholera and diarrhoea among others increased upper respiratory diseases from open burning of garbage to malaria (GOK, 2006).

The collection and disposal waste in Kenya is one of the major services entrusted to the local authorities. The councils establish a refuse collection services and charges for this service are levied. However, in most towns of Kenya unsightly piles of refuse can be seen (GOK, 2005).

The Meru Municipal council is entrusted with waste management within the municipality. Meru town is within Imenti North District, and within the jurisdiction of Meru County. It is the Meru County Headquarters. It covers a total area of $62km^2$ with $42km^2$ under Imenti forest leaving about $20km^2$ for human settlement. The outlook of waste management in Meru Municipality is devastating. There is low capacity to handle waste; there is no dumping site and no by-laws pertaining to waste management. In addition the municipal has inadequate resources and mechanisms of solid waste management; the sewerage system is poorly located and has inadequate treatment works. Meru Municipality is inadequately sewered with only a 6km sewerage system in Meru Town CBD with Makutano, Gitimbine and Gitoro areas not sewered (MCM, 2007-2012).

Environmental degradation is therefore rampant, waste is disposed in the Imenti Forest, the new dump site is next to Lake Nkunga a world heritage site, there are intermittent fire out-breaks in the forests, garbage in the forest produce leachates that infiltrate underground water, there in turn has increased vulnerability to sanitation related epidemics. The lack of proper enforcement of the environment act has greatly contributed to this state of affairs (GOK, 2002 – 2008). This study therefore sought to investigate the effectiveness of waste management strategies on environmental health in the Meru Municipality.

1.3. Purpose of the study

The main purpose of the study was to assess the effectiveness of waste management strategies on environmental health.

1.4 Objectives of the study

The study was guided by the following objectives:

1. To establish the influence of waste handling methods on environmental health.
2. To establish the influence of waste disposal methods on environmental health.
3. To establish the influence of waste management awareness on Environmental health.
4. To assess the influence of government waste management policy on environmental health
5. To assess influence of privatization of waste management on environmental health.

1.5. Research questions

The study sought to answer the following research questions

1. How do waste handling methods influence environmental health?
2. How do waste disposal methods influence environmental health?
3. How does waste management awareness affect environmental health?
4. To what extent does government policy on waste management affect environmental health?
5. To what extent does privatization of waste management affect environmental health?

1.6. Significance of the study

The results of this study may be useful to the following areas; local authorities in Kenya and specifically Meru Municipal Council may understand the dynamics of waste management. Further vital information may be provided to policy makers towards improvement of waste management strategies. Fundamentally, organizations may gain from findings as this study may aid them in identification of constrains facing environmental health.

It is significant to note that academicians shall benefit from additional information in this key area of waste management. This study may also from foundations for further research, since there exist a vicious cycle between waste management and poverty. In conclusion the community may understand it's role and input in waste management.

1.7 Delimitations/scope of the study

The research was carried out in Meru Municipality and focused on households, commercial activities, education institutions and health institutions within the municipality. It can therefore not be generalized to other municipalities or region. Questionnaires were used and where need be personal interviews were carried to triangulate the data.

1.8 Limitation of the study

Since the study focused on the effectiveness of waste management strategies on environmental health, the case of Meru Municipality. The extent to which the study results may be generalized to the large population may not be a representative. Further the effectiveness of waste management strategies on environmental health were affected by a multiplicity of factors. Alienating the influence of the factors was difficult. The potent effect of non-response error might have affected study results. The researcher followed up and engaged assistance.

1.9 Assumptions of the study

The study assumed that waste management strategies had an influence on environmental health and further assumed that the following strategies were the only ones that affected environmental health; methods of waste handling, methods of waste disposal, awareness of waste management, government policy on waste management, privatization of waste management and that people would be available and gave honest and correct information.

1.10 Definitions of significant terms

Assessment -According to the Oxford Advanced Learners Dictionary (2002, assessment is the calculation of deciding the value or amount.

Disease -According to the World Health Organization (WHO 1995), Disease is a state of abnormal change in body, conditions that impair important physical or physiological functions.

Ecosystem -According to the National Environmental Management Authority (2010), Ecosystem means a dynamic complex of plants, animals, micro-organism communities and their non-living environment interacting as a functional unit.

Effectiveness -According to the Longman Dictionary of Contemporary English (1990) effectiveness is producing a desired result or condition

Environment -According to the Environment Management and Co-ordination Act (1999) Environment includes the physical factors of the surroundings of human beings including, land, water, atmosphere, sound, oduor, taste, the biological factors of animals and plants and the social factors of aesthetic and includes both the natural and the built environment.

Environmental Health – The World Health Organisation (1990) defines Environmental Health as those aspects of human health and disease that are determined by factors in the environment that can cause disease or death.

Environmental Management – The Environmental Management and Co-ordination Act (1999) defines Environmental Management as the protection, conservation and sustainable use of the various elements or components of the environment.

Health -According to the World Health Organisation (1995), health is a state of complete mental, physical and social well being and not merely absence of disease.

Management -According to the Oxford Advanced Learners Dictionary (2002), Management is the art or practice of controlling and dealing with people, situations or decision making.

Strategies -The Longman Dictionary of Contemporary English (1990) defines strategy or strategies as the act of planning in advance any movement.

Waste -According to the Environmental Management and Co-ordination Act, 1999 waste includes any matter which is discharged, emitted or deposited in the environment in such volume, composition or manner likely to cause an alteration of the environment.

Waste Management – According to Furedy (1990) waste management entails the collection, transport, processing, recycling and disposal of waste to reduce effect on the environment. It also includes the recovery of resources from the environment.

1.11 Summary

This study sought to assess the effectiveness of waste management strategies on environmental health in Meru Municipality, in the Meru County. Some of the issues highlighted include, the background of the study that tries to justify the study. The statement of the problem explains there exist a gap between the actual and ideal state. The objectives of the study are then followed by the research questions, limitations and delimitations of the study. Finally the assumptions of the study are then mentioned followed by the definitions of significant terms.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter provides the literature review on waste management strategies and their impact to environmental health. This section therefore provides literature pertaining waste management in developing countries which forms the basis of this study. The study reviews literature on waste management in third world cities, the generation of wastes and their impact on environmental health, the conventional waste management systems and their short comings and the need for an integrated waste management approach model. The chapter also reviews the waste management strategies such as waste handling, methods of waste disposal, incineration, landfill, recycling, open dumps, awareness, government policy and privatization. Finally there is a summary of the literature review.

2.2 Waste Management in Third World Cities

Waste management in developing countries has received less attention from policy makers and academics than that paid to other urban environmental problems, such as air pollution. It however contributes to high morbidity and mortality rates in many third world cities. The collection, transport, processing, recycling and disposal of waste material has effect on the environment. Therefore there is need to effectively manage wastes for sustainable environmental health.

According to Cointreau and Kaadt (1991) waste management is the systematic process carried out to reduce the material effect on the environment and to recover resources from them and should entail the collection transport, processing, recycling and disposal of wastes, to reduce effect on the environment. He maintains that waste management today cannot be limited to collection, transport, processing and disposal. Wells (1995) adds waste management awareness and government policy on waste management as integral components of sustainable waste management. This he envisages will eventually seek to reduce the amount of waste that individuals, businesses and other organizations generate.

The bottom purpose of effective waste management is the improvement of the environmental health. Further it has become clear that effective waste management

strategies are not merely nice things to provide, but strategic measures for sustainable environmental management and overall social-economic development.

Wastes are materials discarded in both the urban and rural areas which municipalities or communities are usually held responsible for collection transport and final disposal. They include household refuse, institutional wastes, street sweeping, commercial wastes, construction and demolition debris. In developing countries urban wastes contain varying amounts of industrial wastes from small industries as well as dead animals and fecal matter. The collection, transport and disposing of wastes in third world cities represent a larger expenditure.

According to Meyer (1987) waste management usually accounts for 30-50 percent of municipal operational budgets. And despite these high expenses, cities collect only 50-80 percent of the refuse generated. In India, for instance about 50 percent of refuse generated is collected, 33 percent in Karachi, 40 percent in Yangoon, and 50 percent in Cairo. However disposal in all these cities receives less attention; as much as 90 percent of wastes collected end up in open dumps.

Waste disposal in third world cities receives less attention points out to the fact that areas that lack refuse collection are usually the low income communities. Residents tend to either dump their garbage at the nearest vacant plot, public space, creek, river or simply burn it in their backyards. Uncollected waste may accumulate on the streets and clog drainage when it rains, which may cause flooding. Wastes can also be carried away by run-off water to rivers, lakes and seas affecting those ecosystems. Alternatively wastes may end up in open dumps legal and illegal, the most common disposal method in third world cities and countries. The open dumping of wastes generates various environmental and health hazards. The decomposition of organic material produces methane, which can cause fire and explosions, and contribute to global warming. Further the biological and chemical processes that occur in open dumps produce strong leachates, which pollute surface and ground water. Periodically fires break out in the open dumps generating smoke and contributing to air pollution and affecting these ecosystems (Meyer, 1987).

According to Phatak (1993) in the Mexican City of Tampico, on the Gulf of Mexico Coast, a fire burned for over six months at the open dump. Fires at open dumps he explains, often start spontaneously by the Methane and heat generated by biological decomposition, or by dump managers who deliberately set periodic fires to reduce the volume of the wastes to allow more wastes to be disposed, thus extending the life of the dumps. Human scavengers cause intentional fires at dumpsites since metals are easier to spot and recover among the ashes after the fires than among piles of mixed wastes. He further points out animal feeding at dumpsite usually transmit diseases to humans living in the vicinity. Wastes generally attract birds, rats, flies and other animals to the dumps.

2.2.1 Generation of wastes and their impact on environmental health

There exist a positive correlation between a community's income and the amount of wastes generated. Wealthier individuals consume more than lower-income ones, which results in a higher waste generation rate for the former. The processes of accelerated population growth and urbanization translate into a greater volume of wastes generated. Higher incomes and economic growth also tend to have an impact on the composition of wastes. Wealthier individuals consume more packaged products, which results in a higher percentage of inorganic materials-metals, plastics, glass, textiles among others in the waste stream. Higher volumes of wastes and a changing composition have a profound impact on waste management practices. More wastes being generated and with a higher content of inorganic materials could have a significant impact on environmental health.

According to the World health Organisation (1990) environmental health are those aspects of human health and diseases that are determined by factors in the environment that can cause disease or death. Environmental health concerns include;

Climate change and effect on health, food safety, noise pollution and control, toxic waste management and disposal, occupational health and industrial hygiene, air quality (indoor and ambient), vector borne disease and control, and radiological health. If wastes resulting from population and economic growth are not collected, treated and disposed of properly, environmental health in third world cities will further deteriorate.

2.3 Conventional waste management systems and their short comings

Waste management is the collection, transport, processing, recycling and disposal of waste to reduce effect on the environment. It is also carried out to recover resources within environments', and differ for developed and developing nations, urban and rural areas, residential and industrial areas or commercial areas. Management of non-hazardous residential and institutional wastes in metropolitan areas is usually the responsibility of the local government (Furedy 1991).

In order to extend refuse collection, upgrade disposal facilities, and diminish the risk to human health and the environment associated with inadequate waste management, various measures have been implemented. The solutions that are commonly proposed to problems in waste management in third world cities have the following features: Centralized and undiversified solutions that do not distinguish the different needs and heterogeneity of neighbourhoods within each city and between cities. Secondly bureaucratic top down solutions, usually reached without or with little community participation, and finally capital intensive approaches that involve advanced technology and equipment, frequently imported from industrialized countries. It is important to note that the formal conventional solutions only consider the formal sector, neglecting the existence and possible contributions of the informal sector that has developed around waste collection and recycling in many Third World Cities (Medina 1997).

2.3.1 The need for an Integrated Waste Management Approach Model

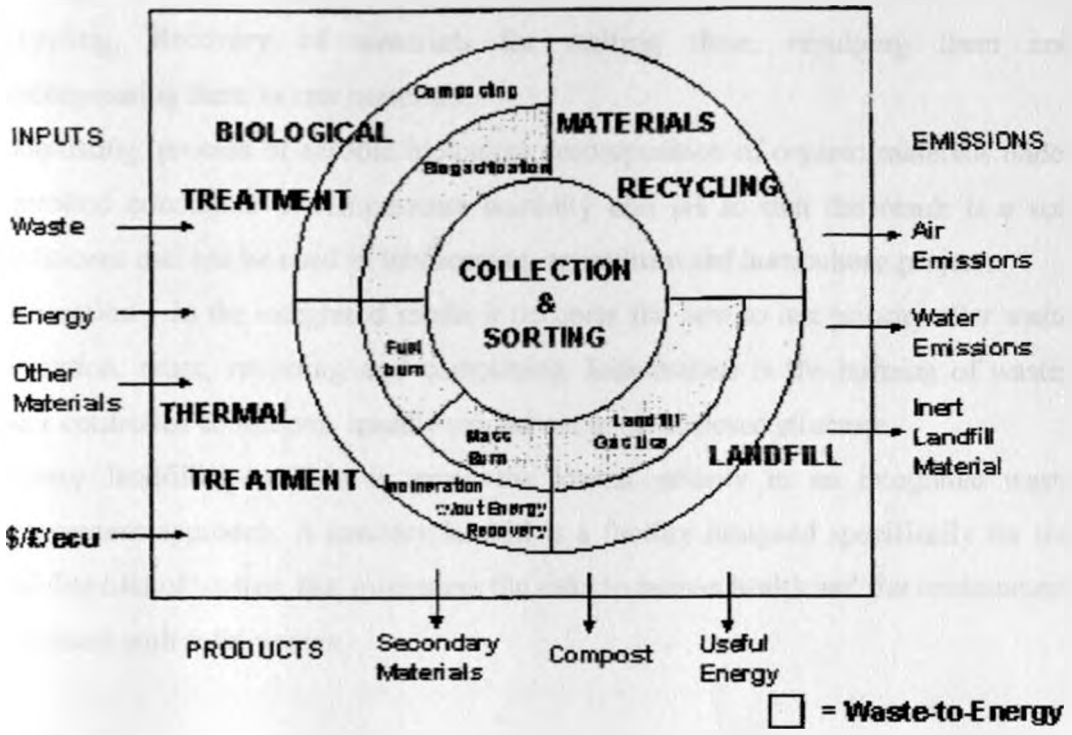


Figure 2.1: The Effect of Income on Municipal Solid Waste Generation Rates for Countries of Varying Levels of Economic Development. A model Journal of Solid Waste Technology and Management.

Source: Medina. (1997).

This model delivers a range of social benefits, health clean environment, social conscience, self respect, security, quality life, community spirit and cohesion. In the developed world the approach to waste management regarded as the most compatible with an environmentally sustainable development is called 'integrated waste management model for municipalities. This approach consists of a hierarchial and co-ordinated set of actions that reduces pollution, seeks to maximize recovery of reusable and recyclable materials and protects human health and the environment. The integrated waste management approach however should be adopted in the Third world cities. According to Medina (1997) integrated waste management has the following structures, in order of priority:

Waste preventing:- A preventive action that seeks to reduce the amount of waste that individuals, businesses and other organization generate.

Reuse; consisting of recovery of items to be used again, perhaps after some cleaning and refurbishing.

Recycling; Recovery of materials for melting them, repulping them and reincorporating them as raw materials.

Composting; process of aerobic biological decomposition of organic materials under controlled conditions of temperature humidity and pH so that the result is a soil conditioner that can be used in landscaping, agriculture and horticulture projects.

Incineration – In the integrated model it occupies the next to last priority after waste prevention, reuse, recycling and composting. Incineration is the burning of wastes under controlled conditions, usually carried out in an enclosed structure.

Sanitary landfilling – This is given the lowest priority in an integrated waste management approach. A sanitary landfill is a facility designed specifically for the final disposal of wastes, that minimizes the risks to human health and the environment associated with solid wastes.

2.4 Waste handling

Waste collection methods vary widely among different countries and regions. Domestic waste collection services are often provided by local government authorities, or by private companies in the industry. Some areas especially those in less developed countries, do not have a formal waste-collection system. Methods of waste handling and transport include the following; sewerage and drainage system, dustbins and garbage trucks.

In Australia for instance curb side collection is the method of disposal of waste. Every urban domestic household is provided with three dustbins; one for recyclables, another for general waste and another for garden material. To encourage recycling, municipalities provide larger recycle bins, which are larger than general waste bins. General waste and garden waste is dumped at landfills while some is recycled and recyclables are recycled. In Europe few communities use a proprietary collection system known as Envac, which conveys refuse via under ground conduits using a vacuum system. Other vacuum based solutions include the Metro Taitan Single-line

and ring-ling systems. In Canada rural waste is often disposed by hauling it to a transfer station. Waste is then collected and transported to a landfill (Cointreau 1982).

In Taipei City the city government charges its household and industries for the volume of rubbish they produce. Waste will be only collected by the city council if waste is disposed in government issued rubbish bags. This policy has successfully reduced the amount of waste the city produces and increased the recycling rate. In Israel, the Arrow Ecology Company has developed the ArrowBio system, which takes trash directly from collection trucks and separates organic and inorganic materials through gravitational settling, screening and hydro-mechanical shredding. The system is capable of sorting huge volumes of waste; salvaging recyclables, and turning the rest into biogas and rich agricultural compost. The system is used in California, Australia, Greece, Mexico and the United Kingdom (PCL 2008).

Traditionally waste collection has been the use of garbage trucks. These trucks move within cities and fill the trucks with waste collected from dustbins. However new technologies such as radio frequency, identification tags, GPs and integrated soft wane package enable better quality data to be collected without the use of estimation or manual data entry is yet to catch up with the traditional methods.

According to the Pacific Consultants International (2008) radio frequency identification tags are now being used to collect data on presentation rates for curb-side pick-ups which is useful when examining the usage of recycling bins or similar benefits of GPs tracking is particularly evident when considering the efficiency of ad hoc pick-ups where collection is done on a consumer request basis. Integrated soft ware packages are useful in aggregating this data for use in optimization of operations for waste collection operations. Further vision camera's and video recording devices are becoming more widely used particularly concerning residential services and contamination of the waste stream.

Appropriate technology for waste handling refers to the use of compactor trucks. These refuse collection vehicles are equipped with a compactor mechanism to increase the density of the waste, and thus minimize the number of collection trips. These trucks are commonly used in industrialized countries given the low density of

the waste generated but cannot be justified in the Third World's low income communities, since their waste is very dense and does not need to be compacted.

In cities of most developing countries there have been several problems associated with the use of these trucks; breakdowns and require considerable investment.
Despite the mostly negative experience with the use of compactor trucks in Third World cities over 60 percent of loans made by the World Bank between 1985 and 1996 were used to purchase compactor trucks. In some cases compactor trucks have displaced the informal refuse collectors, eliminating their livelihood. The use of compactor trucks in low income – areas is technically inappropriate, economically unsustainable and socially undesirable, whereas other methods of waste handling and transport are (World Bank 2006).

2.5 Methods of waste disposal

Modern waste management system recommends an integrated waste management approach that combines the following; incineration, landfill, recycling and open dumps

2.5.1. Incineration

Incineration is a modern method of disposing solid waste. It involves combustion of waste material. Incineration and other high temperature systems are sometimes described as "Thermal treatment" Thermal treatment is a term given to any waste treatment technology that involves high temperatures in the processing of the waste feed stock. In this technique municipal solid waste is fed into a furnace and burned at a temperature of up to $1{,}130^{0}C$. A lot of heat is generated which can heat water and possibly drive turbines to generate electricity.

According to Wells (1995) incineration is carried out both on a small scale by individual and on a large scale by industry. It is viable in disposing solid, liquid and gaseous waste. It is a practical method of disposing certain hazardous waste and medical waste. However it is a controversial method of waste disposal due to issues such as emission of gaseous pollutants, such as certain metals, acid gases and classes of chemical known as dioxins and furans which have been implicated in both defects and several types of cancer. They are very expensive to construct.

2.5.2 Landfill

Disposing of waste in a landfill involves burying the waste and this remains common practice in most countries. Landfills were often established in abandoned or unused quarries. It has been the primary method of solid waste disposal because; it is the cheapest and most convenient method. It has however been contaminating the ground water systems.

Modern landfill is referred to as a sanitary landfill. It is clay lined at the bottom, each day's deposit of fresh garbage is covered with a layer of soil. In the selecting of a modern landfill site, ground water, geology, soil type and sensitivity to local citizens concerns must be well understood to avoid environmental hazard and conflict. Landfills produce water leaks through buried trash and methane gas. These secondary waste products must be monitored. Methane however can be used to generate electricity.

According to Pacific Consultants International (2008) a properly designed and well-managed landfill can be a hygienic and relatively inexpensive method of disposing of waste materials. Older poorly designed or poorly managed landfills can create a number of adverse environmental impacts such as wind-blown litter, attraction of vermin, production of carbon dioxide when organic wastes breaks down anaerobically – This gas can create odour problems, kill surface vegetation and is a greenhouse gas and contributes to the greenhouse effect. Many landfills also have landfill gas extraction system installed to extract the land fill gas (PCL, 2008)

2.5.3 Recycling

The popular meaning of recycling in most developed countries refers to the widespread collection and reuse of everyday waste materials such as empty beverage containers. These are collected and sorted into common types so that the raw materials from which the items are made can be reprocessed into new products. Material for recycling may be collected separately from general waste using dedicated bins and collection vehicles or sorted directly from mixed waste streams. Recycling therefore has two meanings; reusing something such as refillable beverage container (soft drink and bottles are examples) or in terms of solid waste management recycling is the reprocessing of discarded materials into new useful products.

The most common consumer products recycled include aluminium beverage cans, steel, glass bottles, paperboard, cartons, newspapers, magazines, corrugated and fiberboard boxes.

According to Medina (1998) recycling has the following benefits; better alternative to either dumping or burning waste, saves money, saves energy, saves raw materials as it could be the raw material for another product. Saves land spaces while reducing pollution and reduces waste volumes drastically. Biological reprocessing is also a recycling process. Waste materials that are organic in nature, such as plant material, food scraps and paper products can be recycled using biological composting and digestion processes to decompose the organic matter. The resulting organic material is then recycled as mulch. The energy content of waste products can be harvested directly by using them as a direct combustion fuel or indirectly by processing them into another type of fuel. Recycling through thermal treatment ranges from using wastes as a fuel source for cooking or heating, to anaerobic digestion and the use of the gas fuel, to fuel boilers to generate steam and electricity in a turbine.

2.5.4 Open dumps

Open unregulated dumps are the predominant method of waste disposal in developing countries. For many people in Third World cities their ways of disposing waste is simply dropping it someplace. For instance, Mexico one of the largest cities in the world generates some 10,000 tons of garbage each day, there are enormous garbage problems with some ending in open dumps (Kirov, 1982).

The following are challenges associated with open dumping;

Becomes habitant for rats, flies, mosquitoes, human scavengers, dogs among others. Open dumps therefore become health hazards, animal and human scavengers hence becoming a security and health risk.

Open dumps are biological and physical hazards. For instance, mosquitoes cause malaria, whereas frequent fire breakups cause enormous environmental degradation, with devastating impacts on agriculture production.

Open dumps ultimately contaminate the environment, causing water and air borne diseases. They are however inexpensive method of disposal of waste material.

2.6. Awareness

Awareness can greatly prevent, minimize and avoid the generation of wastes. It was at the United Nations conference on human environment held Stockholm in 1972 that the world governments of the United Nations called for global strategy for combating environmental degradation through the use of a wide variety of approaches within the formal and non-formal education processes. The strategy was to involve in-school and out-of-school populations. The three major outcomes of the Stockholm conference that have significantly contributed to awareness of environmental issues are:-

Establishment of the United Nations Environmental Programme (UNEP to coordinate all environmental matters in United Nations (U.N) agencies, the world environmental day observed in June 5th every year with annual theme depending with the country – for example Environmental health; among others and finally international Environment Education Program (IEEP) was formed and its theme formulated. UNEP was urged to work closely with the United Nations Education Scientific and Cultural Organisation (UNESCO). Since the Stockholm conference many meetings, workshops, symposia, pilot projects and other action programmes have been conducted at all levels- global, regional, community and institutional.

The Belgrade workshop (1975) however explicitly aimed at international collaborative education program by fostering clear awareness of the concerns about economic, social, political and ecological inter-dependence in urban and rural areas, and provide each person with opportunity to acquire knowledge, skills, attitudes and commitment to protect and improve environment. Further create patterns of behaviour of individuals and the society as a whole towards environment.

Waste prevention is given the highest priority awareness programmes. It seeks to reduce the amount of waste that individual, businesses and other organizations generate. By not creating waste, fewer collection vehicles and a fewer number of refuse collectors would be needed; fewer and smaller waste handling facilities would be required, and it would extend the life of the landfills. Society as a whole would be benefited.

According to Kresse and Ringeltaube (1982) awareness can reduce wastes, through waste reduction measures of; carrying jute bag when going shopping, saying no to

plastic bags and get easily degradable alternatives, re-use and recycle waste as much as possible, digging compost pit at your garden for all biodegradable and public campaigns to create awareness on waste reductions measures.

2.7. Government Policy

The government policy on waste management is the key to reduction and better management of wastes. The government policy outlines key issues and considerations that must be addressed pertaining waste management. The policy must be grounded on internationally recognized hierarchy of options, namely prevention, minimization, reuse/recycling and the environmentally sustainable disposal of waste which cannot be prevented or recovered.

According to Nema (2010 – 2013) the government policy should address the following; a diversion of a significant percentage of household waste away from landfill, reduction in biodegradable municipal waste consigned to landfill, recovery of construction and demolition waste within a progressive period and rationalization of municipal waste landfills, with progressive and sustained reductions in number, leading to an integrated network, incorporating energy recovery and high standards of environmental protection.

Kresse and Ringeltaube (1982) concur that government policy should focus on waste prevention and waste reduction strategies. Any government policy should consider the following strategies; enacting policies that discourage the production, sale and consumption of products containing unnecessary packaging material, enacting policies that discourage the production, sale and consumption of disposable products, enacting policies that encourage the production, sale and consumption of reusable or recyclable products, enactment of policies that encourage production, sale and consumption of long-lasting products, enactment of a policy that promotes the consumption of large-size products. The amount of packaging material-plastics, glass or metal-needed to contain a kilogram or liter of a product decreases as the size of a product increases, enactment of policies that encourage the production, sale and consumption of repairable products (that do not have to be discarded when they malfunction), and finally encourage enactment of policies that stipulate production,

sale and consumption of light-weight products (which when discarded, would result in a reduction of the weight of the waste to be collected, transported and disposed off.

2.8. Privatization

Waste management is a growing environmental and financial problem in developing countries. Despite significant efforts in the last decades, the majority of municipalities in the developing countries cannot manage the growing volume of waste produced in their cities. This inability to manage urban solid waste consists of failures in the following areas; inadequate services, inadequate financing, inadequate environmental control, poor institutional structure, inadequate understanding of complex systems and inadequate sanitation. There is therefore need and urgency to involve the private sector in the waste management sector.

According to Cointreau and Kaadt (1991) the private stakeholders in waste collection include the following;

2.8.1 Formal Private Sector

The formal private sector' is here understood to refer to private sector corporations, institutions, firms and individuals, operating registered and/or incorporated businesses with official business licences, an organized labour force governed by labour laws, some degree of capital investment, and generally modern technology.

2.8.2 The informal private sector

The term 'informal private sector' refers to unregistered, unregulated or casual activities carried out by individuals and/or family or community enterprises, that engage in value-adding activities on a small-scale with minimal capital, using local materials and labour-intensive techniques.

According to Chapin (1995) informal activities in contrast and recycling, are often driven by poverty, and are initiated personally and spontaneously (and sometimes haphazardly) in the struggle for survival. Consequently the choice of material to collect is in the first place determined by the value of the waste materials, and in the second place, by their ease of extraction, handling and transport.

2.8.3 Community Based Organisation (CBO's)

The community and its representatives have direct interests in waste management, as residents service users and tax payers. Communities in the low-income areas generally receive marginal or no services in terms of public transport, electricity, drinking water, sanitation, drainage and also waste removal. These communities will sometime take the initiative to organize themselves into Community Based Organisations (CBO's) with the direct goal of self-help and improving their living conditions. Such CBO's may receive external assistance in the form of technical and/or financial and from different agencies.

2.8.4 Non-Governmental Organisations (NGO's)

The term NGO can refer to such diverse organizations as churches, universities, labour organizations, environmental organizations and lobbies. Generally non-governmental organizations (NGO's) are intermediate organizations which are put directly and continuously involved in community projects. NGO's not only advocate, they can also be involved in awareness-raising, advocacy and decision-making. NGO's can act as intermediaries between grassroots initiatives (CBO's) and municipal governments, or serve the ideological, political or altruistic interests of international organizations. They can advocate interest on a larger scale than the single community and provide support and advice to CBO's, but also to marginal groups in the society, such as waster pickers at dump sites and street children.

2.8.5 Rationale and Justification for private sector in waste management

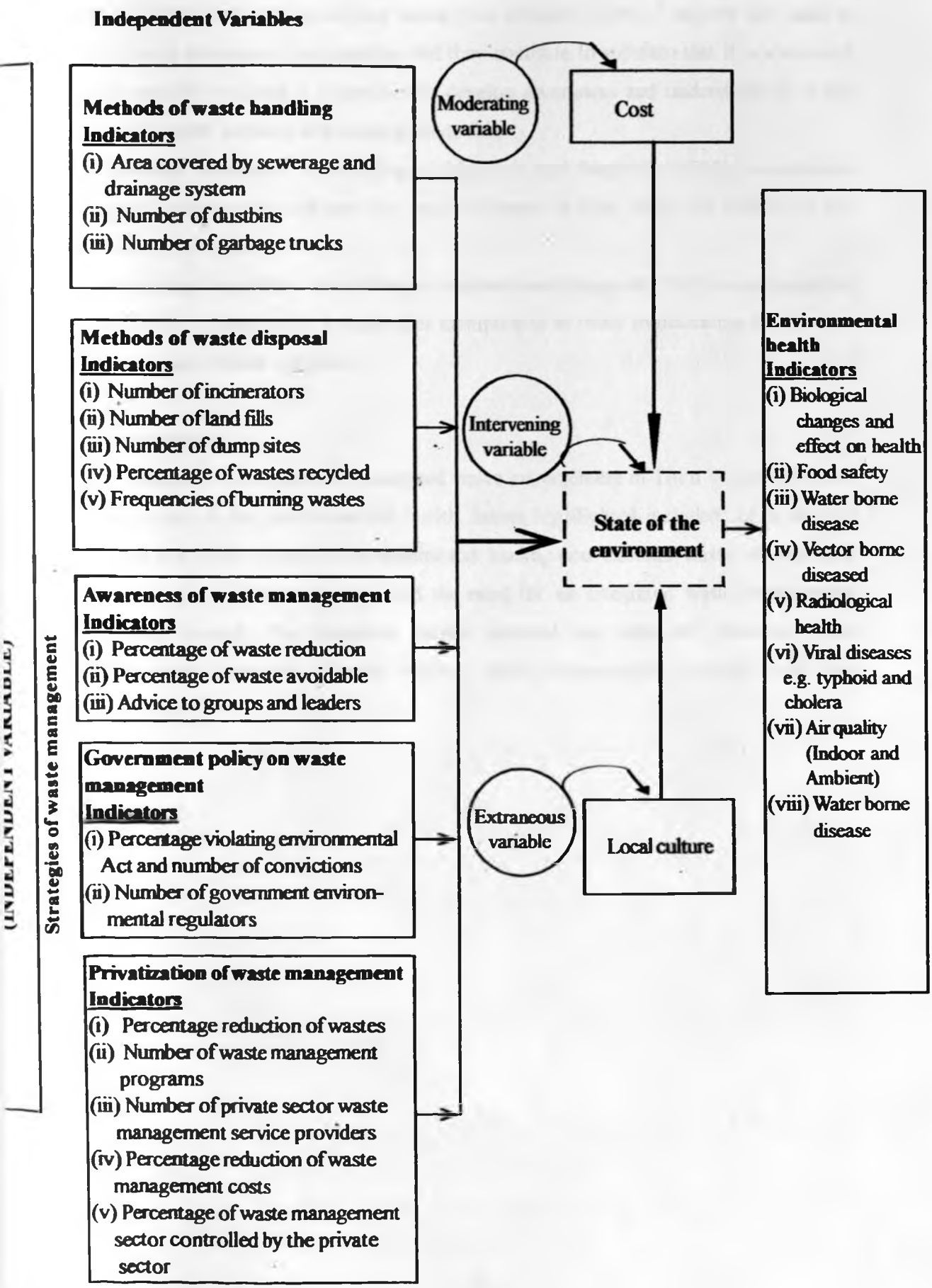
Private sector participation in waste management is not, in itself, a prior goal of waste policy. It is rather a means to achieve the general improvement of waste management systems operating or being planned in developing countries. Private sector participation in waste management system should occur when it can contribute to making those systems more responsive, more efficient, more economical, more equiTable, or more environmentally responsible.

According to Furedy (1991) gains of including the formal private sector in waste management systems include the following;

Greater efficiency and enhanced performance, better management and accountability due in part to the fact that the private business functions as a contractor, and could lose the contract, faster response associated with partly with ability to raise capital,

higher service ethics, associated with the business's image and their ability to attract new clients, greater flexibility in terms of purchase of land and sitting of facilities, greater access to experience and technology due to the potential to create partnerships with experienced private businesses in other countries and regions finally there is risk reduction, by transferring unpredicTable costs or unreliable revenues onto the private operator.

Further outlines potential benefits of including the informal private sector in waste management include; the successful recovery and return to productive use of materials that would otherwise end-up in the waste stream, the handling of large volumes of materials at no or marginal costs to the municipal government, reduction of the amount of waste materials requiring collection and transport, risk reduction, by transferring marginal activities, unpredicTable costs or unreliable revenues to the private operator, extension of the lifetime of capital investments such as environmentally appropriate sanitary landfills or composting facilities, through reduction of through-put, provision of waste removal and sanitary services to otherwise unserved sectors of the city and the provision of services at no-cost to the municipality.



ure 2.1: Conceptual Framework

According to Kombo and Tromp (2006) a conceptual framework can be defined as a set of broad ideas and principles taken from relevant fields of enquiry and used to structure a subsequent presentation and they continue to stipulate that it is a research tool intended to assist a researcher to develop awareness and understanding of the situation under scrutiny and to comminute this.

Dependent variables – According to Mugenda and Mugenda (1999), a dependent variable attempts to indicate the total influence arising from the effects of the independent variable.

Independent variable – According to Mugenda and Mugenda (1999) an independent variable is a variable that a researcher manipulates in order to determine its effect or influence on another variable.

2.10 Summary

The literature review basically analysed waste management in Third World cities and their impact to the environmental health. Issues highlighted included; generation of wastes and their impact to environmental health, conventional waste management system and their short comings and the need for an integrated waste management approach model. The literature further showed the need of effective waste management strategies. Finally various waste management strategies are then mentioned.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

The chapter presents a description of the methods the researcher employed to enable investigation of the problem of study. It discusses the research design, target population, data collection instruments, data collection sources, data analysis techniques and presentation whenever necessary discussion in each section is backed by justification based on the experts opinion of other scholars.

3.2 Research Design

The study was a descriptive survey design. According to Kothari (2005), descriptive research is a study concerning specific predictions, with narrations of facts and characteristics concerning individual, group or situation. A survey type research usually has larger samples because the percentage of responses generally happens to be low, as low as 20 to 30%. It was concerned with describing, recording, analyzing and interpreting conditions that either exist or existed. A survey is very appropriate in case of social and behavioural sciences and the research design must be rigid, must make enough provision for protection against bias and must maximize reliability as the aim happens to be to obtain complete and accurate information. Mugenda and Mugenda (1999) concurs, the major purpose of descriptive research is the description of the state of affairs and reporting the way things are. Kerlinger (1973) asserts that descriptive studies are not only restricted to fact finding but may often result in formulation of important principles of knowledge and solution to significant problems. Kothari (2005) adds that most social research is descriptive in nature, and is a comparative design and can be appropriately referred to as a survey design. For example Owino (2006) of the University of Nairobi in her study titled "A survey of training and development practices applied by International NGOs operating in Nairobi" adapted descriptive survey where she ranked variables of interest on a likert scale.

3.3. Target population

The target population of the study comprised residents of Meru Municipality. The population was obtained from the 2009 census report which reported a population of 53,786 in the Meru Municipality, residing in 16,451 households; There also existed

108 institutions (schools and polytechnics) with a total number of 36,638 students and 1410 – commercial activities (491 Hotels and Lodgings, 827 shops, and 88-Bars, 3 industries, one depot or large warehouses. There also exist 8 health institutions (1 General Hospital, 2 Private Hospitals and 5 Health Centres). The target group therefore was 384 residents whom the study took as a representative sample.

3.4. Sample Size

According to Mugenda and Mugenda (1999) "where time and resources allow a researcher should take as big sample as possible" However generally, the sample size depends on factors such as the number of variables in the study, type of design, method of data analysis and the size of the accessible population. Orodho (2003) says that a sample design is a definite plan determined before any data is actually collected for obtaining a sample from a given population. Kothari (2005) asserts that if the sample size is too small, it may not serve to achieve the objectives and if it is too large, it may incur huge costs and waste resources. He maintains that the sample must be of an optimum size- not excessively large nor too small. Sampling technique therefore is the procedure a researcher uses to gather people, places or things to study, it involves the process of selecting a number of individuals or objects from a population such that the selected group contains elements representative of the characteristics found in the entire group (Kombo and Tromp, 2006).

According to Mugenda and Mugenda (1999) new researchers often have problems determining the sample size. The rule of the thumb should be to obtain a big sample as possible. However, resources and time tend to be a major constraint in deciding on the sample size to use. In social science research the following formulae can be used to determine the sample size;

$$n = \frac{Z^2 pq}{d^2}$$

Where n = the desired sample size (if the target population is greater than 10,000)

Z = the standard normal deviate at the required confidence level

P = The proportion in the target population estimated to have characteristic being measured.

Q = 1 - p

d = The level of statistical significance set

According to Mugenda and Mugenda (1999) *Fisher et-al* recommends if there is no estimate available of the proportion in the target population assumed to have the characteristic of interest 50% should be used.

Therefore;

$$n = \frac{(1.96)^2 (.50)(.50)}{(.050)^2}$$

$$n = 384$$

In order to increase statistical efficiency of the sample, stratified random sampling was employed to pick subjects of the study. The target population was divided into four broad categories; namely, Households (Residence), Institutions (Educational Institutions), Commercial Activities and Health Institutions

There exist 16,451 households in the municipality, 108 Institutions (schools and polytechnics) with a total number of 36,638 students and 1410 commercial activities, (491 hotels and lodgings, 827 shops and 88 bars, 3 industries, 1 deport or large warehouses) and 8 health institutions, (1 General Hospital, 2 Private hospitals and 5 Health centres).

According to Mugenda and Mugenda (1999) the goal of stratified random sampling is to achieve desired representation from various categories in the population. This method of sampling influenced statistical efficiency and provided data to represent and analyze.

Table 3.1: Sample size for municipality categories

No.	Category	Number	Percentage %	Sample No.
1	Households	16,451	91.5%	351
2	Education Institutions	108	0.6%	2
3	Commercial Activities	1,410	7.84%	30
4	Health Institutions	8	0.044%	1
	Total	**17,977**	**100%**	**384**

Source: Kenya Populations census 2009

Table 3.2: Sample size for various households per location in Meru municipality

No.	Locations	Household	Percentage %	No. of size
1	Township	1,043	6.34%	22
2	Kaaga	3,462	21%	74
3	Upper Igoki	2,687	16.3%	57
4	Tuntu	1,153	7%	25
5	Gakoromone	3,654	22.2%	78
6	Magundu	2,969	18%	63
7	Mpuri	1,483	9%	32
	Total	**16,451**	**100%**	**351**

Source: Kenya population census 2009

Table 3.3: Sample size for various commercial activities in Meru Municipality

No.	Commercial activities	Number	Percentage %	Sample Number
1	Lodgings & Hotels	491	34.8%	10
2	Shops	827	58.6%	18
3	Bars	88	6.2%	2
4	Deports/Warehouse	1	0.07%	0
5	Industries	3	0.21%	0
	Total	**1,410**	**100%**	**30**

Source: Kenya Populations census 2009

3.5 Data Collection Instruments

The researcher used a questionnaire with checklist questions. Each item on the questionnaire was developed to address a specific objective of the study. The items in the questionnaire were structured and unstructured. The structured questions were used to measure subjective responses. The questionnaires were self administered. The researcher was however present to clarify on any questions that were not clear to the respondents. Where it proved difficult for respondents to complete the questionnaires immediately, the researcher left them with the respondents and picked them at a later agreeable time. Further the researcher interviewed the waste management service providers and managers by administering a interview schedule.

3.6 Validity and Reliability

Reliability refers to the degree to which instruments yields consistent data or results after repeated trials (Mugenda and Mugenda 1999). To increase the reliability of the data the researcher employed test-retest technique in which instruments were be administered twice to the same subjects. To reduce the short comings and ensure effectiveness of the questionnaire a pre-test was conducted on a different sample of similar characteristics to the actual sample. This enhanced reliability of the data collection instrument.

Validity refers to degree of accuracy and meaningfulness of inferences based on research results. Validation of the data was done using content validity. This measures the degree to which data collected using a particular instrument represents a specific domain of indicators or content of a particular concept (Mugenda and Mugenda 1999). The indicators of variables were clearly defined as scrutinized and instruments developed to match them.

3.7. Operationalization of Variables

Table 3.4: Operationalization of Variables

Research question	Variables	Indicator	Measurement	Level of scale	Data collection	Approach of analysis	Type of analysis	Level of analysis
How do waste handling methods influence environmental health?	**Independent** Waste handling methods	▪ Different methods used in waste handling	▪ Percentage of area sewered ▪ Percentage area with drainage system ▪ Number of dustbins ▪ Number of garbage trucks	▪ Nominal ▪ Interval scale	▪ Secondary data sources ▪ Interview/questionnaire	▪ Qualitative ▪ Quantitative	Non-parametric	Descriptive
	Dependent Environmental health	▪ Sanitation and safety of the environment	▪ Level of vector borne diseases ▪ Level of viral diseases ▪ Level of water borne diseases ▪ Level of changes on health ▪ Level of change in air quality	▪ Interval scale ▪ Nominal	▪ Secondary data sources ▪ Interviews/questionnaires	▪ Quantitative ▪ Qualitative	Non-parametric	Descriptive
How do waste disposal methods influence environmental health?	**Independent** Waste disposal methods	▪ Different methods of disposing waste	▪ Number of incinerators ▪ Number of landfills ▪ Number of dumpsite ▪ State of dumpsites ▪ Number of pits ▪ Frequencies of burning wastes	▪ Nominal ▪ Scale	▪ Secondary data sources ▪ Interview/ questionnaire	▪ Qualitative ▪ Quantitative	Non-parametric	Descriptive

Research question	Variables	Indicator	Measurement	Level of scale	Data collection	Approach of analysis	Type of analysis	Level of analysis
How does waste management awareness affect environmental health?	**Independent** Waste management awareness	▪ Knowledge of strategies used in waste management	▪ Percentage of wastes reduction ▪ Number an percentage of waste avoidance measures ▪ Advice given to groups and leaders	▪ Nominal ▪ Interval scale	▪ Secondary data sources ▪ Interview/questionnaires	▪ Qualitative ▪ Quantitative	Non-parametric	Descriptive
To what extent does government policy on waste management affect environmental health?	**Independent** Government policy on waste management	▪ Existing government policies on waste management	▪ Percentage of violating environmental act. ▪ Number of convictions ▪ Number fined by violating environmental act	▪ Nominal ▪ Scale	▪ Secondary data sources ▪ Interview/questionnaires	▪ Qualitative ▪ Quantitative	Non-parametric	Descriptive
To what extent does privatization of waste management affect environmental health?	**Independent** Privatization of waste management	▪ Private initiatives in waste management	▪)Percentage reduction of wastes ▪ Number of waste management programs ▪ Percentage reduction of waste management costs	▪ Nominal ▪ Scale	▪ Secondary data sources ▪ Interview/questionnaires	▪ Qualitative ▪ Quantitative	Non-parametric	Descriptive

3.8. Data Analysis and Presentation

After collecting the completed questionnaires they were edited and coded to facilitate statistical analysis. The aim was to eliminate unusable data, interpret ambiguous answers and contradictory data from related questions. The coding scheme facilitated the development of an appropriate data structure to enable entry into the computer. Data entry and storage was done using the statistical package of social science (SPSS) Orodho and Kombo (2002) points out that qualitative data is not always compuTable by arithmetic relation. The responses were categorized into various classes called categorical variables. Since the purpose of this study was to describe the situation as it is, a simple descriptive analysis was done. The categorized data was arranged to determine how the independent and dependent variables relate. This was achieved by the use of the statistical packages for social science (SPSS). This was so since SPSS is designed for analysis of social science data and contains most of the routine social scientist employ. This study employed descriptive statistics. The data was presented using frequency Tables, followed by interpretation.

3.9. Summary

This chapter discusses the research methodology applied in the study. Various items are explained as per this application. The explanation follows a sequence; research design, target population, sampling procedure, methods of data collection, reliability, validity and methods of data analysis to be used.

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION AND INTERPRETATION

4.1 Introduction

This chapter presents analysis, presentation and interpretation of the findings of the study. Findings are mainly presented in form of frequency Tables. The chapter is divided into subsections where general characteristics of the respondents such as age, gender, marital status and educational background. The data is also analyzed around key variables like waste handling methods, waste disposal methods, waste management awareness, government waste management policy and privatization of waste management.

4.2 Return rate

Out of 384 questionnaires distributed for the study; 380 respondents filled and returned them representing a return rate of 98.96% which is statistically accepTable representation of the target population.

4.3 General information

This section gives findings around general socio-demographic characteristics of the respondents such as age, gender, marital status, educational background among others.

4.3.1 Gender of the respondent

The respondents were requested to indicate their gender. Their responses are presented on Table 4.1.

Table 4.1: Gender of the respondent

Gender	Frequency	Percentage
Male	145	38.2
Female	235	61.8
Total	**380**	**100.0**

According to Table 4.1, majority (61.8%) of the respondents were female with male being the minority (38.2%). This indicates that waste management activities fit within

the gender-assigned roles and responsibilities of women, including household maintenance and community management.

4.3.2 Age of the respondent

The respondents were required to indicate their age and this was recorded on Table 4.2 below.

Table 4.2 Age of the respondent

Age	Frequency	Percent
Below 25 years	181	47.6
26- 35 years	116	30.5
36- 45 years	42	11.1
above 45 years	41	10.8
Total	**380**	**100.0**

Table 4.2 illustrates that majority of the respondents were below 25 years (47.6%) of age followed by those between 26-35 years (30.5%) then 36- 45 years (11.1%) and lastly those above 45years (10.8%). According to the Table the interview was done among the youth showing that the older generation was not well represented leading to lack of information about the Municipality from those who have been in it longer.

4.3.3 Marital status of the respondent

Marital status was required and Table 4.3 shows how the respondents responded.

Table 4.3: Marital status of the respondent

Marital status	Frequency	Percent
Married	140	36.8
Separated	13	3.4
Single	227	59.7
Total	**380**	**100.0**

Table 4.3 indicates that majority of the respondents were single (59.7%) followed by those who were married (36.8%) and finally those who are separated (3.4%).

4.3.4 Level of education of the respondent

The respondents were requested to indicate their level of education. Table 4.4 shows their responses.

Table 4.4: Level of education of the respondent

Education	Frequency	Percent
Primary	27	7.1
Secondary	154	40.5
College/ University	199	52.4
Total	**380**	**100.0**

Table 4.4 shows that majority of the respondents have attended up to collage/university level. This is a demonstration that majority of the respondents have had quality education to understand waste management. 40.5% have attended up to secondary level and 7.1% up to primary level indicating that all the respondents have had basic education.

4.3.5 Activity the respondent is engaged in

The respondents were required to indicate the various activities they were engaged in and this was recorded on Table 4.5 below.

Table 4.5: Activity the respondent is engaged in

Response	Frequency	Percent
Residential/ Household activity	131	34.5
Commercial activity	45	11.8
Educational institution activity	99	26.1
Health institution activity	48	12.6
Total	**323**	**85.0**

According to Table 4.5, majority (34.5%) of the respondents are involved in residential/ household activities. 26.1% were involved in educational activities, 12.6% in health activities and 11.8% in commercial activities. This is an indication that majority of the respondents were well aware of waste management activities. The

Table also has a percentage missing indicating that other respondents were not involved in the given activities. Their responses were indicated in Table 4.6.

Table 4.6: Other activity the respondent was engaged in

	Frequency	Percent
Banking	4	1.1
Business	33	8.7
Farming	4	1.1
ICT	8	2.1
Technical support	4	1.1
Wage earner	4	1.1
Total	**57**	**15.2**

Table 4.6 shows that the respondents were also engaged in business (8.7%), banking (1.1%), farming (1.1%), ICT (2.1%), technical support (1.1%) and wage earning (1.1%)

4.3.6 Amount of waste produced by the respondent's household/category

The respondents were required to indicate an estimate of the daily waste they produce at their homes. The results were indicated on Table 4.7

Table 4.7: Amount of waste produced by the respondent's household/ category

Amount	Frequency	Percent
5-10 Kg	285	75.0
10-15 Kg	54	14.2
15-20 Kg	20	5.3
More than 20 Kg	21	5.5
Total	**380**	**100.0**

Table 4.7 illustrates that majority of the respondents produce 5- 10 kg (75%) of waste, followed by 10-15 kg (14.2%), then more than 20 kg 15-20 kg (5.5%) and lastly those who produce 15-20 kg (5.3%) of waste.

4.3.7 Composition of waste generated from households.

The respondents were requested to indicate the amount of waste they generally dispose of in different categories and this was shown on Table 4.8 below.

Table 4.8: Composition of waste generated

Waste	Papers		Disposals		Food items		Garden waste		Plastics		Metals		Glasses	
	F	%	F	%	F	%	F	%	F	%	F	%	F	%
100%	48	12.6	21	5.5	38	10	16	4.2	28	7.4	8	2.1	4	1.1
75%	33	8.7	19	5.0	47	12.4	26	6.8	31	8.2	-	-	8	2.1
50%	55	14.5	33	8.7	73	19.2	31	8.2	25	6.6	4	1.1	4	1.1
25%	44	11.6	74	19.5	103	27.1	49	12.9	43	11.3	13	3.4	18	4.7
Below 25%	200	52.6	233	61.3	119	31.3	258	67.9	253	66.6	355	93.4	346	91.1

Table 4.8 indicates that waste generated by the households consist of less than 25% of all the categories given as in the Table. Out of the waste generated by the house holds metal was the least produced with majority (93.4%) producing less than 25%. Other least produce are glasses (91.1%), plastics (66.6%) and garden waste (67.9%). Disposals were at 61.3%, papers 52.6% and food items at 31.3%. The most produced waste was food items with the majority (68.7%) producing more than 25%. These results are an indication that majority of the households' production of solid waste is less than 25%.

4.4 Methods of handling waste in Meru Municipality

4.4.1 Opinion on solid waste management by the Municipal

The Meru municipality residents were asked of their opinion on the solid waste management system of the council and their response was recorded on Table 4.9 below.

Table 4.9: Opinion on solid waste management system by the Municipal Council

Response	Frequency	Percent
Satisfactory	65	17.1
Non- satisfactory	315	82.9
Total	**380**	**100.0**

According to Table 4.9, majority (82.9%) of the residents are not satisfied with solid waste management system of the Meru Municipal Council. This is an indication that the council method of handling solid waste is not functioning in the manner suitable to the residents. Therefore the council's waste management strategies are not effective.

4.4.2 Reusing waste

The residents were requested to indicate whether they reuse the waste items produced in their households and the results were presented in Table 4.10 below.

Table 4.10: Reusing waste

Response	Frequency	Percent
Yes	97	25.5
No	283	74.5
Total	**380**	**100.0**

Table 4.10 shows that majority (74.5%) of the residents did not reuse waste produced by their households and the minority (25.5%) does reuse the waste. This is an indication that majority of the residents do not recycle their waste which leads to more pollution especially if the waste is not well handled.

4.4.3 Street cleaners

The residents were requested to indicate their knowledge of who cleans the streets and their answers were recorded on Table 4.11 below.

Table 4.11: Street cleaners

Response	Frequency	Percent
Sweeper from Municipal	287	75.5
They are never swept	89	23.4
Other (Landlord)	4	1.1
Total	**380**	**100.0**

Table 4.11 indicates that the streets were cleaned by sweepers from the Municipal

(75.5%). The other percentage says that the streets were never swept (23.4%) and/ or that they were cleaned by other means/ landlords (1.1%).

4.4.4 Street cleanliness

The residents were asked whether they encountered uncleanness on the streets and Table 4.12 indicates their responses.

Table 4.12: Street cleanliness

Response	Frequency	Percent
Yes	289	76.1
No	91	23.9
Total	**380**	**100.0**

Table 4.12 illustrates that majority (76.1%) of the residents saw uncleanness on the streets. This is an indication that though the Municipal workers sweep the streets they were not effective or that the methods they used were not satisfactory. This shows that the Municipal is not effective on handling waste thus the appearance of solid waste all over the municipality.

4.4.5 Cases of illegal dumping within the Municipality

The respondents were requested to indicate whether there are problems with illegal dumping and in what areas within the municipality and their responses were recorded on Table 4.13 below.

Table 4.13: Cases of illegal dumping within the municipality

Response	Illegal dumping		What areas		
	Frequency	Percent		Frequency	Percent
Yes	6	100	All around	1	16.7
No	-	-	Kairanya place, Nchege plaza	2	33.3
			Behind Cooperative bank	2	33.3
			Nevada place, Makutano BP	1	16.7

Table 4.13 indicates that all (100%) the respondents have noticed illegal dumping all around the town (16.7%), behind Kairanya place, Nchege plaza (33.3%), Cooperative bank (33.3%), Nevada place and Makutano BP (16.7%). This is an indication that the council is not doing enough to inform its residents on proper waste disposal methods which has led to illegal dumping that affects environmental health .This indicates that the current strategies are not effective.

4.4.6 Availability of waste segregation/sorting facility within the Municipal.

The residents were required to indicate whether the Municipal had a waste segregation/sorting facility and their responses were indicated in Table 18 below.

Table 4.14: Availability of waste segregation/sorting facility within the Municipal

Response	Frequency	Percent
Yes	196	51.6
No	184	48.4
Total	**380**	**100.0**

According to Table 4.14 the residents were split at almost 50% on their knowledge of availability of a sorting facility in the Municipal with the majority (51.6%) of residents confirming knowledge of a sorting facility and the minority (48.4%) having no idea. This is an indication that the Municipality has not made known to the residents of their services when it comes to waste management. This shows that their effectiveness in waste management is questionable.

4.4.7 Availability of waste management facilities

The respondents were asked to discuss examples of waste collection practices, segregation and waste treatment facilities. Their responses are presented in Table 4.15.

Table 4.15: Availability of waste management facilities

Response	Segregation		Collection practices		Treatment facilities	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Any	0	0	0	0	0	0
None	6	100	6	100	6	100

Table 4.15 illustrates that the Municipal Council (100%) do not have any facilities that offers any of the listed waste management strategies indicating that the Municipal Council is ill equipped to manage waste thus affecting environmental health.

4.4.8 Handling individual waste in residential premises

The residents were required to indicate how they handled their individual waste using individual containers. Table 4.16 shows the results.

Table 4.16: Handling individual waste in residential premises

Response	Metal bin		Plastic bin		Plastic bag		Oil drum		Others	
	F	%	F	%	F	%	F	%	F	%
Almost exclusively	24	6.3	104	27.4	111	29.2	26	6.8	21	5.5
Frequently	13	3.4	125	32.9	90	23.7	8	2.1	2	0.5
Sometimes	47	12.4	28	7.4	24	6.3	31	8.2	30	7.9
Never	296	77.9	123	32.4	155	40.8	315	82.9	327	86.9
Total	**380**	**100**	**380**	**100**	**380**	**100**	**380**	**100**	**380**	**100**

According to Table 4.16, majority of the residents used plastic bins (67.6%) with majority of them using them frequently (32.9%) and plastic bags (59.2%) with majority using them almost exclusively (29.2%). The Table also indicates that metal bins (77.9%), oil drums (82.9%) and other methods (86.9%) are never used by majority of the resident.

4.4.9 Handling individual waste in commercial premises.

The residents were required to indicate how they handle their individual waste using individual containers. Table 4.17 shows the results.

Table 4.17: Handling individual waste in commercial premises

Response	Metal bin		Plastic bin		Plastic bag		Oil drum		Others	
	F	%	F	%	F	%	F	%	F	%
Almost exclusively	57	15	32	8.4	12	3.2	4	1.1	4	1.1
Frequently	20	5.3	81	21.3	35	9.2	8	2.1	4	1.1
Sometimes	15	3.9	44	11.6	11	2.9	28	7.4	8	2.1
Never	288	75.8	223	58.7	322	84.7	340	89.5	364	95.8
Total	**380**	**100**	**380**	**100**	**380**	**100**	**380**	**100**	**380**	**100**

Table 4.17 indicates that majority of the households do not use any of the provided options to dispose off waste but those who do use the methods prefer plastic bins (41.3%). Majority of the residents indicates that metal bins (75.8%), plastic bags (84.7%), and oil drums (89.5%) are rarely used and other methods (95.8%) too indicating that the residents do not handle all their waste appropriately. This also shows that the residents are not aware of waste management strategies thus affecting the environmental health.

4.4.10 Handling waste using communal containers

The respondents were required to indicate how they handle waste using communal containers in residential premises within the community. The results are shown in Table 4.19.

Table 4.19: Handling waste using communal containers

Response	Metal bin		Plastic bin		Oil drum		Concrete bin		Others	
	F	%	F	%	F	%	F	%	F	%
Almost exclusively	55	14.5	58	15.3	22	5.8	12	3.2	53	13.9
Frequently	8	2.1	71	18.7	10	2.6	6	1.6	2	0.5
Sometimes	30	7.9	39	10.3	34	8.9	20	5.3	24	6.3
Never	287	75.5	212	55.8	314	82.6	342	90.0	301	79.2
Total	**380**	**100**	**380**	**100**	**380**	**100**	**380**	**100**	**380**	**100**

According to Table 4.19, majority of the residents rarely use metal bins (75.5%),

plastic bags (82.6%), oil drums (90.0%) or other methods (79.2%) though a percentage of them use plastic bins (44.2%) in the community which indicates that they are limited .Availability of these methods within the community and that the residents are not sensitized on the effective methods of disposing waste so they use what they are familiar with.

4.4.11 Handling waste using communal containers in commercial premises

The residents were to illustrate methods they use to dispose off their waste in commercial premises and this was presented in Table 4.20.

Table 4.20: Handling waste using communal containers in commercial premises

Response	Metal bin		Plastic bin		Oil drum		Concrete bin		Others	
	F	%	F	%	F	%	F	%	F	%
Almost exclusively	43	11.3	15	3.9	-	-	-	-	-	-
Frequently	22	5.8	46	12.1	14	3.7	12	3.2	4	1.1
Sometimes	27	7.1	30	7.9	15	3.9	2	0.5	7	1.8
Never	288	75.8	289	76.1	351	92.4	366	96.3	369	97.1
Total	**380**	**100**	**380**	**100**	**380**	**100**	**380**	**100**	**380**	**100**

Table 4.20, shows that majority the residents rarely use any of the given option in commercial premises (metal bin 75.8%, plastic bins 76.1%, oil drum 92.4%, concrete bin 96.3%, other- 97.1%). This is an indication that at the commercial premises the given options are not present and that the residents use other s which indicates that the waste management strategies are not strictly adhered to nor are they strictly being enforced in the Municipality thus affecting its effectiveness.

4.4.12 Residents rating of waste handling methods in the Municipality

The residents were requested to rate the waste handling methods in the Municipality and the results are indicated on Table 4.21.

Table 4.21: Residents rating of the waste handling methods in the Municipality

Response	Frequency	Percent
Poor	157	41.3
Fair	162	42.6
Good	42	11.1
Excellent	19	5.0
Total	**380**	**100.0**

According to Table 4.21, majority of the residents rate waste handling methods as fair (42.6%) followed by those who rate is as poor (41.3%), good (11.1%) and then excellent (5.0%). This puts further emphasis on the residents' dissatisfaction with the waste management system of the Municipality as shown in Table 4.9 demonstrating that waste management strategies were not effective and impacting negatively to the environment.

4.5 Influence of waste methods on Environmental Health

4.5.1 Methods used to dispose waste within the Municipality

Residents were required to indicate various ways they use to dispose off their waste and this was presented in Table 4.22 below.

Table 4.22: Methods used to dispose off waste within the Municipality

Response	Frequency	Percent
Burning	110	28.9
Using self dug compost pit	106	27.9
Using estate provided bins	31	8.2
Collection by the Municipal Council	30	7.9
Throwing in the bush	19	5.0
By recycling	4	1.1
Private waste collectors	3	0.8

Table 4.22 shows that residents dispose off their waste by contracting private collectors (0.8%), recycling (1.1%) and illegally dumping in the nearby bush (5.0%). Others contract the Municipal council (7.9%) and use bins provided by various estates

(8.2%) with the majority digging their own compost pit (27.9%) and /or burning (28.9%) their waste. The methods used by the majority residents in disposing waste aid in destroying the environment. This is an indication that the majority of the residents are ignorant of the waste management strategies and are not provided with the right quantity and quality equipment by the Municipal council to help improve environment health thus affecting the effectiveness of the waste management strategies.

4.5.2 Waste disposal within the Municipality

The respondents were requested to indicate ways in which they dispose off several items. Their responses are presented in Table 4.23 below.

Table 4.23: Waste disposal within the Municipality

Methods	Hazardous waste		Yard waste		Electronics	
	F	%	F	%	F	%
Composting	-	-	5	83.3	6	100
Burying/burning	1	16.7	1	16.7	-	-
Disposal by producers	5	83.3	-	-	-	-

According to Table 4.23, the Municipality composts and/or buries yard waste (83.3%) and electronics (83.3%) at the selected dumping site while hazardous wastes are left to their producers to dispose off (83.3%).

4.5.3 Availability of waste collection mechanism in the Municipal Council.

The respondents were requested to indicate whether they were aware of availability of waste collection mechanism in the Municipality and whether the Municipality provide waste segregation bins. Their responses are shown in Table 4.24.

Table 4.24: Availability of waste collection mechanism in the Municipal Council

Response	Availability of waste collection		Provision of segregation bins	
	Frequency	Percent	Frequency	Percent
Yes	222	58.4	64	16.8
No	158	41.6	316	83.2
Total	**380**	**100**	**380**	**100**

Table 4.24 demonstrates the majority of the residents were aware of the availability of waste collection mechanism by the council (58.4%). This shows that majority are knowledgeable of the Municipality's responsibility on controlling and maintaining waste disposal. Majority of the residents however indicate that they are not provided with segregation bins for waste collection (83.2%) by the Municipal council. This is an illustration that the Municipal council strategies on waste management were not effective and thus affecting environmental health.

4.5.4 Curbside waste collection.

The municipal council employees were requested to indicate whether they have a curbside waste collection and recycling programs that is provided to the residents by the municipal Council or private companies. Table 4.25 shows their responses.

Table 4.25: Curbside waste collection

Response	Municipal Collection		Private collection		Recycling	
	F	%	F	%	F	%
Yes	2	33.3	0	0	0	0
No	3	50	6	100	6	100
Not sure	1	16.7	0	0	0	0
Total	**6**	**100**	**6**	**100**	**6**	**100**

According to Table 4.25, majority (50%) indicate that there is no curbside collection nor is there a recycling program (100%) provided by the Municipal council. All (100%) of them agree that there is none available from a private company. This further reiterates the residents' opinions as shown in Table 4.25 above indicating that the Municipality did not have a waste collection mechanism providing services to them.

4.5.5 Availability of a home facility to compost waste

The residents were asked whether they have compost facilities within their homes. Table 4.26 shows the results.

Table 4.26: Availability of a home facility to compost waste

Response	Frequency	Percent
Yes	240	63.2
No	140	36.8
Total	**380**	**100.0**

Table 4.26 shows that majority (63.2%) of the residents have compost facility in their homes/ facilities where they dispose off their waste. This is an indication that the residents are doing their part in trying to control solid waste from spilling over all around the municipality thus influencing the environmental health positively.

4.5.6 How municipal disposes of waste

The respondents were required to indicate the manner in which the municipal council disposed waste and this is presented in Table 4.27.

Table 4.27: How municipal disposes waste

Response	Frequency	Percent
Compost pit	2	33.3
Dumping grounds	3	50
Dust bin	1	16.7
Total	**6**	**100.0**

Majority of the respondents (50%) stated that the Municipal Council waste was disposed in a dumping ground indicating that the Municipal Council should have a segregated area where waste is disposed in order to control waste from spilling over all over town. This would help improve environmental health in the Municipality.

4.5.7 Solid waste disposal and treatment.

The residents were asked for their opinion on solid waste disposal and treatment within the Municipality. Table 4.28 shows the results.

Table 4.28: Solid waste disposal and treatment

Response	Solid waste disposal		Solid waste treatment	
	Frequency	Percent	Frequency	Percent
Satisfactory	67	17.6	51	13.4
Non- satisfactory	313	82.4	329	86.6
Total	**380**	**100**	**380**	**100**

According to Table 4.28 majority of the residents are dissatisfied with the Municipal Council disposal (82.4%) and treatment (86.6%) of solid waste. This shows that the Municipal Council waste management strategies were not effective and negatively impacted on the environment.

4.5.8 Measures taken by the Municipal to reduce solid waste

The respondents were required to indicate the measures taken by the municipal council to reduce the amount of waste produced by the households in the Municipality. Their responses are indicated in Table 4.29.

Table 4.29: Measures taken by the Municipal to reduce solid waste

Response	Frequency	Percent
Every household is advised to dig compost pits.	5	83.3
Every household with a dust bin	1	16.7
Total	**6**	**100.0**

Table 4.29 indicates that majority (83.3%) of the respondents indicate that the Municipal had advised its residents to dig compost pits in their homes to help curb illegal dumping around the city. This aids effective waste management thus improving the environmental health.

4.5.9 Best methods of disposing waste.

Residents were requested to indicate some of the methods they think are the best of disposing waste. Table 4.30 indicates their responses.

Table 4.30: Best methods of disposing waste

Response	Frequency	Percent
Recycling	114	30
Contracting the Municipal/ Private collectors	91	23.9
Building incinerators	76	20
Digging compost pits around the Municipality	38	10
Improving the disposal/ drainage system	20	5.3
Salting	5	1.3

The methods the residents are proposing include salting (1.3%), improving the disposal/drainage systems (5.3%) and digging compost pits (10%). Others are incinerating the solid waste (20%), contracting collectors from the Municipal council/ private collectors (23.9%) with the majority proposing recycling (30%) according to Table 4.30. This is an indication that the residents are conscious of the harm solid waste cause to the environment and consequently waste management should be improved.

4.5.10 Expanded solid waste services

The respondents were requested to indicate a new and expanded solid waste service that the Municipal would like have made available to its clients. Table 4.31 shows the results.

Table 4.31: Expanded solid waste services

Response	Frequency	Percent
Curbside	1	16.7
Incineration plant	1	16.7
Recycling and incineration plant	2	33.3
Recycling plant	2	33.3
Total	**6**	**100.0**

According to Table 4.31, the Municipal Council would like to have recycling (50%) and incineration plant (33.3%) and curbside collection (16.7%) provided to its residents which will help in improving the environmental health.

4.5.11 Purchasing recyclable products

The residents were requested to indicate whether they would pay extra money for recyclable products and their responses are shown in Table 4.32.

Table 4.32: Purchasing recyclable products

Response	Frequency	Percent
Yes	259	68.2
No	121	31.8
Total	**380**	**100.0**

Table 4.32 indicates that majority (68.2%) of the residents would pay extra for recyclable products. It is known that a man's trash is another's gold meaning that not all that is thrown away has no value. This makes recyclable products worth buying while helping to improve environmental health as majority of the residents indicated. Their acceptance of recyclable products also help improve the effectiveness of the waste management, as this would reduce the amount of solid waste disposed.

4.6 Influence of waste management awareness on environmental health

4.6.1 Meaning of solid waste management

It was imperative to know if the residents had any idea what solid waste management was and their results are shown in Table 4.33

Table 4.34: Have an idea of what solid waste management is

Response	Frequency	Percent
Yes	261	68.7
No	119	31.3
Total	**380**	**100.0**

Table 4.34 indicates that majority (68.7%) of the residents knew what solid waste management was. This would influence the effectiveness of waste management strategies on environmental health due to the fact that they are conscious about solid waste and its effects.

4.6.2 Availability of the information resource about Environment sector

Information resource about environment sector are available to the Municipal residents to aid their participation in planning and decision making which is why the respondents were requested to indicate whether they knew about it and this was presented on Table 4.35

Table 4.35: Availability of the information resource about Environment sector

Response	Frequency	Percent
Extensive information resource are readily available	10	2.6
Limited official information supplements to environment sector	33	8.7
Limited information is available for the environment sector	185	48.7
No information is available	152	40.0
Total	**380**	**100.0**

Table 4.35 illustrates that majority of the residents were aware of the information resource (60%) and that there is limited information available (57.4%). This indicates the Government is not doing enough in informing the people regarding the environment. Awareness on waste management is therefore not effective thereby implying that it's not an effective strategy in waste management in the municipality. Environmental Health is therefore at risk.

4.6.3 Provision of information about waste and related matters

The respondents were required to describe the provision of information to the Municipal waste practitioners and other stakeholders about the Municipal waste and related matters. Their responses are presented in Table 4.36.

Table 4.36: Provision of information about waste

Response	Frequency	Percent
Health education sessions	2	33.3
Public health and NEMA	4	66.7
Total	**6**	**100.0**

According to Table 4.36, majority of the respondents stated that information is provided from the Public Health Ministry and NEMA (66.7%). Others indicate that the information is provided during the health education sessions (33.3%). This shows that information resource is available though limited just as indicated by the residents in Table 4.35.

4.6.4 Training and residents' participation in awareness initiatives

The residents were asked if the national/local authorities conducted training for the Municipal waste management with the local communities/citizens and if the residents had ever participated in awareness initiative on waste management in the last 12 months. Table 4.36 shows their responses.

Table 4.36: Training and residents' participation in awareness initiatives

Response	Training		Participation	
	Frequency	Percent	Frequency	Percent
Yes	34	8.9	35	9.2
No	169	44.5	345	90.8
Not sure	177	46.6	-	-
Total	**380**	**100**	**380**	**100**

Table 4.36 shows that majority (91.1%) of the residents had no idea of any training offered by the local/ national authority. This is an indication that majority of the residents are not well informed of the availability of the training. Majority of the residents also indicated that they had not attended any awareness initiative in the last 12 months (90.8%) indicating that they are not informed on when the trainings would take place or the importance of the trainings. This influences waste management strategies negatively as the residents do not have knowledge of them or their

importance. This implies that awareness as a waste management strategy is not effective thereby negatively impacting on Environmental Health.

4.7 Extent to which government policy on waste management has affected environmental health

4.7.1 Municipal Waste regulation/law

The residents were required to indicate their knowledge of the existence of Municipal Waste regulation and equivalent policy instrument and the legislation that would ban the disposal of various materials and products in landfills. Table 4.37 indicates the results.

Table 4.37: Municipal Waste regulation/ law

Response	Existence of law			Recent legislation	
	Frequency	Percent		Frequency	Percent
Exists fully	26	6.8	Yes	31	8.2
Exists partially	71	18.7	No	349	91.8
Exists but ineffective	200	52.6		-	-
None	83	21.8		-	-
Total	**380**	**100**			

According to Table 4.37 majority (78.2%) of the residents are aware of the existence of the Municipal Waste regulation and equivalent policy with the majority stating that it is ineffective (52.6%). This is an indication that the residents are knowledgeable of the waste management strategies but the Municipal Council is not doing much to enforce them. This affects the environment health due to the fact that the main enforcers of the bylaws are not effective. The Table also shows that majority (91.8%) of the respondents are in the dark regarding recent legislation in the Meru Municipality that ban various materials and products from being disposed of in the landfills. This shows that the Municipal council is not doing much to sensitize its residents about new laws that they introduce to the community. This in turn negatively influences environmental health.

4.7.2 Available Policies/laws on waste management

The respondents were required to list the available policies and this was recorded on Table 4.38.

Table 4.38: Available Policies/laws on waste management

Response	Frequency	Percentage
EMCA – Public health act- 2010	3	50
Reform/Disposal of waste law- 2010	3	50

Table 4.38 demonstrates that some of the laws available include EMCA – public health act of 2010 (50%) and Reform/ Disposal of waste law of 2010 (50%).

4.7.3 Violation of environmental laws/ by- laws.

The residents were asked to indicate whether they had ever violated any environmental laws/by- laws and if the effective enforcement of these laws would help improve the waste management strategies. Table 4.39 shows their responses.

Table 4.39: Violation of environmental laws/ by- laws

Response	Law violation		Effective enforcement	
	Frequency	Percent	Frequency	Percent
Yes	99	26.1	340	89.5
No	281	73.9	40	10.5
Total	**380**	**100**	**380**	**100**

Table 4.39 illustrates that majority of the respondents have not violated any environmental laws/ by- laws (73.9%) and that effectively enforcing the laws/ by-laws (89.5%) would help improve the environmental health. This further puts emphasis on the residents' knowledge of the laws as indicated on Table 4.39 and encourages the Municipal Council to put more effort in enforcing the laws which would in turn help improve the strategies and the environment health.

4.8 Extent to which privatization of waste management affect environmental health

4.8.1 Administration of partnership related to Municipal waste management

The residents were asked if they were aware of the partnership related to Municipal waste management and if they were effectively administered.

Table 4.40: Administration of partnership related to Municipal waste management

Response	Frequency	Percent
Exists fully	21	5.5
Exists partially	69	18.2
Exists but ineffective	164	43.2
None	126	33.2

Table 4.40 indicates that majority (66.8%) of the residents were aware that the partnership existed with majority of them indicating that it is ineffective (43.2%). This shows that the Municipal had no institutional and community support in dealing with increased waste within the town. This negatively impacts on the effectiveness of waste management and consequently on environmental health.

4.8.2 Joint projects with partnerships undertaken by the Municipal

The respondents were requested to list joint projects with partnerships within the Municipality. Table 4.41 shows the results.

Table 45: Joint projects

Response	Frequency	Percent
None	6	100.0

The Table illustrates that the Municipality has had no (100%) joint projects with any partnership. This indicates that the Municipality has not given other stakeholders the opportunity to be involved in improving environmental health by being involved in the waste management strategies.

4.9 Municipal Waste Management problems.

The residents were required to indicate the extent to which the problems they were faced with affected the effectiveness of waste management strategies. Their responses are shown in Table 4.42 below.

Table 4.42: Municipal Waste Management problems

Problems	Strongly agree		Agree		Not sure		Disagree		Strongly disagree	
	F	%	F	%	F	%	F	%	F	%
Illegal dumping	221	58.2	107	28.2	36	9.5	8	2.1	8	2.1
Limited knowledge	145	38.2	121	31.8	87	22.9	12	3.2	15	3.9
Limited resources	141	37.1	139	36.6	61	16.1	23	6.1	16	4.2
Lack of coordination	183	48.2	67	17.6	101	26.6	18	4.7	11	2.9
Too little revenue	108	28.4	81	21.3	125	32.9	34	8.9	32	8.4
Lack of experience	132	34.7	90	23.7	68	17.9	58	15.3	32	8.4

Table 4.42 indicates that majority of the residents believe that illegal dumping (86.4%) affects the effectiveness of waste management strategies. This shows that the municipal is not helping in the proper disposal of waste thus the illegal dumping. The Table also illustrates that majority of the residents blame the ineffectiveness of waste management strategies on limited knowledge on technological solutions as well as process (70%), limited resources (73.7%), lack of coordination between authorities in formulation of policy measures (65.8%) and too little revenue from waste collection fees (49.7%). Lack of experience and knowledge of waste management workers (58.4%) is also a problem affecting the effectiveness of waste management strategies, according to Table 4.42. This shows that the effectiveness of waste management is truly wounded and that there is need for educating both the public and the Municipal Council employees in order to help improve the effectiveness of waste management strategies.

4.9.1 Effectiveness of waste management strategies.

Residents' opinion on the effectiveness of waste management strategies was required and their responses were recorded on Table 4.43 below.

Table 4.43: Effectiveness of waste management strategies

Response	Frequency	Percent
Yes	91	23.9
No	289	76.1
Total	**380**	**100.0**

As shown in Table 4.43, majority (76.1%) of the residents the strategies indicated that the strategies used in waste management were not effective. This further emphasizes on the fact that the residents were dissatisfied with the way the Municipal Council has been managing

4.9.2 Comments and concerns regarding solid waste management in the municipality

The respondents were requested to indicate their concerns regarding solid waste in Meru Municipality and their results are shown in Table 4.44.

Table 4.44: Concerns regarding solid waste management in the municipality

Concerns	Frequency	Percent
Inadequate waste management equipments	4	66.7
Lack of awareness of the waste management strategies	3	50
Lack of experience and skilled employees	1	16.7
Lack of coordination between waste management partners	4	66.7
Improper disposal methods	2	33.3

Table 4.44 shows that the respondents states that lack of waste management strategies (50%), improper disposal methods (33.3%) and lack of skilled/ experienced employees (16.7%) as some of their major concerns with the majority indicating that lack of coordination (66.7%) and inadequate waste management (66.7%) as major concerns.

4.9.3 Ways of improving waste management

The residents were required to suggest ways that would help improve waste management within the Municipality. Their opinions are shown in Table 4.45.

Table 4.45: Ways of improving waste management

Response	Frequency	Percent
Improving the currents means of collection/ strategies	237	62.4
Employing/ training more employees	69	18.4
Educating the public/ employees on waste management	74	19.5
Strictly enforcing the currents strategies	68	17.9
Involving the public/ other sectors in planning/decision making	36	9.5
Partnering with private sector on waste collection/management	44	11.6

According to Table 4.45, majority (62.4%) of the residents indicate that the current strategies should be improved to blend in with the current society technologies and the ever growing population. This shows that the current strategies are not effective. The Table also shows that the residents recommend employing and training more personnel (18.4%), educating the public on waste management (19.5%) and strictly enforcing the current strategies (17.9%). The residents also recommend that the Municipal council should partner with the private sector to help with the waste collection and waste management (11.6%).

4.10 Environmental health

4.10.1 Effect of Effective waste management strategies on environmental health

The residents were required to indicate whether effective waste management strategies would improve the environmental health and their responses are shown in Table 4.46.

Table 4.46: Effect of effective waste management strategies on environmental health

Response	Effective strategies	
	Frequency	Percent
Yes	359	94.5
No	21	5.5
Don't know	-	-
Total	**380**	**100.0**

Table 4.46 illustrates that effective strategies (94.5%) would help improve the environmental health. Effective enforcement of these strategies would significantly improve the environmental health.

4.10.2 Effect of effective waste management strategies on parameters of environmental health

The residents were asked whether effective waste management strategies would affect environmental health and the results were presented in Table 51.

Table 4.47: Effect of effective waste management strategies on parameters of environmental health

Response	Yes		No		Don't know	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Air quality	296	77.9	42	11.1	42	11.1
Water quality	294	77.4	49	12.9	37	9.7
Bio- diversity	233	61.3	69	18.2	78	20.5
Climate change	242	63.7	69	18.2	69	18.2
Land degradation	235	61.8	82	21.6	63	16.6

Table 4.47 indicates that effective waste management strategies would affect air quality (77.9%), water quality (77.4%), bio- diversity (61.3%), and climate change (63.7%) and land degradation (61.8%). This is an illustration that the residents did understand the effects of ineffective waste management strategies making them willing to learn, understand and maintain these strategies. This implies that effective waste management strategies will ultimately improve environmental health and the vice versa is true since the bottom purpose of any waste management strategy should be the improvement of the environment.

4.10.3 Influences of current waste management strategies on environmental health

The respondents were requested to indicate ways in which effective waste management influences the environmental heath. Table 4.48 indicates the results.

Table 4.48: Influences of current waste management strategies on environmental health

Response	Frequency	Percent
It helps in the production of manure	2	33.3
It reduces breeding grounds of several diseases	1	16.7

Table 4.48 indicates that the respondents state that effective waste management strategies influence the environmental health because it helps in the production of manure (33.3%) which are good for planting of crops/ trees and it also reduces the breeding grounds of different diseases (16.7%) which can affect human beings. The respondents agreed that effective waste management improved environmental health hence enhancing the productive capacity of both the flora and fauna.

4.10.4 Ways/ strategies to improve environmental health.

The residents were requested to indicate ways that would help improve the environmental health within the Municipality. Table 3.4 shows their comments.

Table 4.49: Ways/ strategies to improve environmental health

Response	Frequency	Percent
Advocating proper waste handling/ disposal methods.	245	64.5
Increasing waste handling employees and equipments/facilities	75	19.7
Maintaining the drainage / sewage system	41	10.8
Educating the public on waste management	64	16.8
Strictly enforcing waste management laws/ strategies	58	15.3
Planting trees/ flower beds.	31	8.2

Table 4.49 shows that the residents recommend increasing the number of employees, facilities and equipments (19.7%), maintaining the drainage/sewer system (10.8%) and educating the public on waste management (16.8%) to create awareness in the community. They also recommend strict enforcement of the rules and regulation guarding waste management (15.3%) and planting of trees and flower beds (8.2%) with majority (64.5%) recommending advocating and encouraging the use of proper waste disposal and handling. This is a demonstration that the current waste

management strategies would function effectively if not for the lack of enough personnel, equipments and facilities and also the lack of awareness among the residents.

4.11 Challenges encountered in fostering environmental health.

The respondents were asked to list some of the challenges encountered in fostering the environmental health and their responses were recorded in Table 54 below.

Table 4.50: Challenges encountered in fostering environmental health

Response	Frequency	Percent
Lack of awareness by the public	5	83.3
Lack of funds	4	66.7
Lack of experience and skilled employees	4	66.7
Improper disposal methods	2	33.3
Inadequate equipments	2	33.3
Lack of enforcement of environmental laws	2	33.3

According to Table 4.50, the respondents indicate that lack of funds (66.7%), experienced and skilled employees (66.7%) and improper disposal methods (33.3%) and inadequate equipments (33.3%0 are some of the challenges they face. Majority of the respondents do state that the lack of awareness within the public (83.3%) is a major challenge. Lack of enforcement of environmental laws is another challenge (33.3%) demonstrating that the Municipality needs to enforce the environmental laws and the waste management strategies to help improve environmental health. They also need to educate the public on environmental health and manage their budget effectively to be able to purchase more equipment and employ and train more workers.

4.12 Chapter summary

This chapter detailed the data analysis, gave the interpretation of the findings and presented the findings in frequency Tables. The purpose of this chapter was to present the result of the procedures described in the methods and present evidence in form of Tables, text and figures. The data analysis was done on the basis of the study objectives. Moreover, the analysis was done by handling each question in the data collection tool. Descriptive statistics were widely used in the analysis of the data.

CHAPTER FIVE

SUMMARY OF FINDINGS, DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter presents a summary of findings, conclusion drawn from the analysis and the recommendations by the researcher. The main objective of this study was to assess the effectiveness of waste management strategies on environmental health taking a case of Meru Municipality. The specific objectives of the study were to establish the influence of waste handling methods on environmental health, establish the influence of waste disposal methods on environmental health, establish the influence of waste management awareness on Environmental health, assess the influence of government waste management policy on environmental health and assess influence of privatization of waste management on environmental health.

5.2 Summary of findings

Objective	Summary of findings
To establish the influence of waste handling methods on environmental health.	• 82.9% of the residents were not satisfied with solid waste management system of the Council • 74.5% of the residents do not reuse waste produced • 76.1% of the residents indicated that the streets were littered • 100% of the respondents noticed illegal dumping all around the town • Metal bins (77.9%), oil drums (82.9%) were never used by majority of the resident • Majority of the residents rate waste handling methods as fair (42.6%) followed by those who rate is as poor (41.3%), good (11.1%) and then excellent (5.0%)
To establish the influence of waste disposal methods on environmental health	• Majority of the residents were not provided with segregation bins for waste collection (83.2%) by the Municipal • 50% indicated that there was no curbside collection • There was no recycling program (100%) provided by the Municipal council • Residents were dissatisfied with the Municipal Council disposal (82.4%) and treatment (86.6%) of solid waste • 83.3% of the respondents indicated that the Municipal had advised its residents to dig compost pits in their homes to help curb illegal dumping around the city

Objective	Summary of findings
	• 63.2% of the residents had compost facility in their homes
To establish the influence of waste management awareness on Environmental health.	• Residents were aware of the information resource (60%) • There was limited information available (57.4%) • Information was provided from the Public Health Ministry and NEMA (66.7%). • 91.1% of the residents had no idea of any training offered by the local/ national authority
To assess the influence of government waste management policy on environmental health	• 78.2% of the residents were aware of the existence of the Municipal Waste regulation and equivalent policy • 52.6% of the residents stated that the law was ineffective • 91.8% of the respondents were in the dark about the recent legislation in the Meru Municipality that ban various materials and products from being disposed of in the landfills.
To assess influence of privatization of waste management on environmental health	• 66.8% of the residents were aware that partnership existed • The partnerships were ineffective (43.2%) • The Municipality had no (100%) joint projects with any partnership.

5.3 Discussions

Solid wastes in Meru are a by-product of a broad spectrum of industrial, household and service processes. Food waste was the main form of waste from homes. Secondary smaller generators of waste included auto and equipment repair shops, construction firms, dry cleaners and pesticide applicators. Mismanagement of these wastes typically results in pollution of the natural environment and may pose substantial danger to public and environmental health. According to Kresse and Ringeltaube (1982) awareness of waste management strategies in a population can reduce wastes, through waste reduction measures of; carrying jute bag when going shopping, saying no to plastic bags and get easily degradable alternatives, re-use and recycle waste as much as possible, digging compost pit at your garden for all biodegradable and public campaigns to create awareness on waste reductions measures. This study established that information provided by the Public Health Ministry and NEMA was limited and that very few respondents were aware of existence of any other information resource (60%)

The study found out that the available bylaws regarding waste management were ineffective. In addition, 91.8% of the respondents were in the dark about the recent

legislation in the Meru Municipality that ban various materials and products from being disposed of in the landfills. According to Kresse and Ringeltaube (1982) concur that government policy should focus on waste prevention and waste reduction strategies. Lack of strong laws and their enforcement could result into poor management of waste hence becoming a health hazard to the environment.

Partnerships between local authorities and other agents (the private sector, NGOs and communities), to facilitate sharing of Solid Waste Management (SWM) responsibilities and financial burden, are yet to emerge in Meru. There are hardly any deliberate and active processes of collaborative action between stakeholders and relationships are largely informal. Effective coordination among the numerous actors in the town's SWM sector was absent. Private garbage collection firms were non-existent and if present operated in with little or no cooperation from the municipal authority. Due to limited public awareness and negative perception of informal actors, there is in fact little public support for source separation of waste, and waste recycling, re-use, and minimization.

5.3 Conclusions

Responsibility for the provision of most urban services is allocated to the level of local government as a result of the British colonial heritage of the country. Uncollected solid waste is one of Meru's most visible environmental problems: The municipal service which seems to fail most strikingly is garbage collection and disposal because it causes littering and untidiness which has an immediate adverse environmental health impact. The lack of adequate garbage disposal in an area often results to a general deterioration of community health and community development. More than half of the solid waste generated in Meru consists of organic matter. It was established that waste collection services were provided only sporadically to low-income areas because of poor accessibility and very high waste generation which cannot be handled with available vehicles and equipment. Other problems encountered by the Municipal Council of Meru include inadequate financing, lack of a policy on waste reduction and on involving community groups in waste management (though it does participate in several noTable efforts). In conclusion, municipal solid waste issues represent major problems to the governments of developing nations. As poorer nations grow and develop, improvements in infrastructure and technology should help to overcome barriers to the safe disposal of

urban waste. Environmental regulations, intelligently designed to protect the health and integrity of ecosystems and human populations, should be created and enforced now in order to prevent the need for costly remediation measures in the future.

5.4 Recommendations

The following recommendations are hereby proffered:

i). The study recommends that the Municipal Council of Meru should increase the number of employees, facilities and equipments and maintaining the drainage/sewer system

ii). The study recommends that the government and local authorities should invest in educating the public on waste management to create awareness in the community to advocate and encourage the use of proper waste disposal and handling.

iii). The Municipal Council should endeavor to instituting strict enforcement of the rules and regulation guarding waste management

iv). Local authorities should encourage and promote private sector involvement and participation in waste management programs

5.5 Areas of further research

Further research is need with other Municipalities across the country. This will yield relevant information that could be used for policy design to promote clean environment and improve environmental heath

5.6 Summary of chapter five

This chapter presented a summary of main findings, gave a discussion of the findings and drew conclusions from the analyzed data. Recommendations by the researcher were made and areas of further research proposed. The main objective of this study was to assess the effectiveness of waste management strategies on environmental health taking a case of Meru Municipality.

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APPENDICES

Appendix 1 Letter of transmittal of data collection instruments

KANYAMU DOUGLAS MWITI
P.O. BOX 45 – 60200
MERU.

LETTER OF INTRODUCTION

TO WHOM IT MAY CONCERN

RE: ASSESSMENT OF THE EFFECTIVENESS OF WASTE MANAGEMENT STRATEGIES ON ENVIRONMENTAL HEALTH, THE CASE OF MERU MUNICIPALITY

I am a post graduate student at the University of Nairobi pursuing a Master of Arts Degree in Project Planning and Management. I am currently undertaking a research proposal, "An assessment of the effectiveness of waste management strategies on environmental health, the case study of Meru municipality".

Further I feel your institution has the information that will help me in this study. I humbly request you to allow me to carry out this research in your organization.

The information being sought is meant purely for writing a M.A. project, in Project Planning and Management and also to enhance management efficiency of waste management in the municipality. The information got will not be used against you whatsoever.

Yours faithfully,

Kanyamu Douglas Mwiti

Appendix 2: Questionnaire

This questionnaire attempts to gather information to assess the effectiveness of waste management strategies on environmental health using the case of Meru municipality. The information will be treated with total confidentiality and used for research purposes only. Please complete every item as honestly as possible and make comments where necessary. You may not write your name in the questionnaire for confidentiality purposes.

Tick in the box next to the right response and fill in the black spaces accordingly.

Section A: General information

1. Please indicate your gender

   Male ☐

   Female ☐

2. Please indicate your age bracket

   a) Below 25 years ☐ b) 26-35 ☐ c) 36- 45 ☐

   d) Above 45 ☐

3. Marital status

   a) Married ☐ b) Separated ☐ c) Widow ☐

   d) Single ☐

4. Level of Education

   Up to primary level ☐

   Secondary level ☐

   College/university level ☐

   Others (specify) _____

5. Please indicate the activity you are engaged in

   a) Residential/household activity ☐

   b) Commercial activity e.g lodging, hotels etc ☐

   c) Educational Institution Activity ☐

   d) Health institution activity ☐

   e) Others specify _____

6. What is the estimated amount of waste produced by your home/category daily?

i). 5-10 Kg ☐

ii). 10-15 Kg ☐

iii). 15-20 kg ☐

iv). More than 20 Kg ☐

7. Waste generated by your home consists of

Type of waste	Waste composition				
	100%	75%	50%	25%	Less than 25%
Papers					
Disposables					
Food items					
Garden waste					
Plastic					
Metal					
Glass					

Section B: Methods of handling waste

8. What is your opinion about the solid waste management system of the Meru Municipal Council?

Satisfactory ☐

Non-satisfactory ☐

9. Do you reuse waste items?

Yes ☐

No ☐

10. Who cleans the streets, garbage drums and drains?

Sweeper from Municipal ☐

They are never cleaned ☐

Others (Specify) _____

11 Do you see dirtiness in the streets due to solid waste?

Yes ☐

No ☐

12 Does the municipality have waste segregation/sorting facilities for Municipal waste?

Yes ☐

No ☐

13. How do you handle waste?

Type of containers		Residential premises				Commercial premises			
		A	F	S	N	A	F	S	N
Individual Containers	Metal bin								
	Plastic bin								
	Plastic bag								
	Oil drum								
	Others								
Communal containers	Metal bin								
	Plastic bin								
	Oil drum								
	Concrete bin								
	Others								

KEY:

A= Almost exclusively used

F= Frequently used

S= Sometimes used

N= Never used

14. How would you rate the waste handling methods in your category?

Poor ☐

Fair ☐

Good ☐

Excellent ☐

Section C: Methods of waste disposal

15. What methods do you use to dispose off garbage currently?

_____

_____

_____

16. Is there any waste collection mechanism provided by the Government or Municipal Council?

Yes ☐

No ☐

17. If yes, do they provide any waste segregating bins to homes or all the waste is collected in one bin.

Provided ☐

Not provided ☐

18. Do you have any facility to compost waste like kitchen items and garden waste in your home/facility?

Yes ☐

No ☐

19. What is your opinion about solid waste disposal within the Municipality?

Satisfactory ☐

Non-satisfactory ☐

20. What is your opinion about solid waste treatment within the Municipality?

Satisfactory ☐

Non-satisfactory ☐

21. In your opinion what is the best method to dispose of waste.

_____

_____

_____

22. Will you be ready to pay extra money to purchase recyclable products?

Yes ☐

No ☐

Section D: Awareness

23. Do you have an idea of what solid waste management is?

Yes ☐

No ☐

24. Information resources about Environment sector are available to the Municipal residents to aid their participation in planning, decision making

Extensive information resources are readily available. ☐

Limited official information supplements to Environment sector ☐

Limited information is available via the Environment sector ☐

No information is available ☐

25. Does your national authority/local authority conduct training for Municipal waste management with local communities and citizens?

Yes ☐

No ☐

Not Sure ☐

26. Have you participated in any awareness initiatives on waste management in the last 12 months organised by the Municipal or any other organisation?

Yes ☐

No ☐

Section E: Government waste management policy

27. A national Municipal Waste regulation/law or equivalent policy instrument exist and is effectively administered.

Exists fully ☐

Exists partially ☐

Exists but ineffective ☐

None ☐

28. Are you aware of recent legislation in Meru Municipality that will ban various materials and products from disposal in landfills over the next few years?

Yes ☐

No ☐

29. Have you ever violated any environmental law or by-laws in the last three months

Yes ☐

No ☐

30. In your own opinion do you think effective enforcement of environmental laws and by-laws would improve waste management strategies.

Yes ☐

No ☐

Section F: Privatization of waste management

31. A partnership related to Municipal waste management exists and is effectively administered.

Exists fully ☐

Exists partially ☐

Exists but ineffective ☐

None ☐

Section G: Municipal Waste Management Problems

32. The following waste management problems can affect the effectiveness of waste management strategies. Using the scale given, indicate the extent to which they have affected the effectiveness of waste management.

Waste management problem	Strongly agree	Agree	Not Sure	Disagree	Strongly Disagree
Illegal dumping					
Limited knowledge on technological solutions as well as processes					
Limited resources including technologies (e.g. recycling facilities, no landfill plan and lack of landfill area),					
Lack of coordination between national authorities, local authorities and other sectors in the formulation of policy measures					
Too little revenue from waste collection fees					
Lack of knowledge and experience of waste management workers					

33. In your own opinion, are the waste management strategies currently in place effective in management of solid waste within Meru Municipality?

Yes ☐

No ☐

34. Suggest some ways/strategies to be put in place to improve waste management within the Meru Municipality.

_____

_____

_____

_____

_____

Section H: Environmental Health

35. In your opinion would effective waste management strategies significantly improve the environmental health.

Yes ☐

No ☐

36. Would effective waste management strategies affect any of the listed items?

1.	Air quality	Yes	☐	No	☐	Don't know	☐
2.	Water quality	Yes	☐	No	☐	Don't know	☐
3.	Bio-diversity	Yes	☐	No	☐	Don't know	☐
4.	Climate change	Yes	☐	No	☐	Don't know	☐
5.	Land degradation	Yes	☐	No	☐	Don't know	☐

37. In your opinion are the waste management strategies currently in place improving the environmental health?

Yes ☐

No ☐

38. Suggest some ways/strategies to improve the environmental health within the municipality?

_____

_____

_____

_____

_____

Appendix 3: Interview schedule

This interview schedule attempts to gather information to assess the effectiveness of waste management strategies on environmental health using the case of Meru municipality. The information will be treated with total confidentiality and used for research purposes only. Please complete every item as honestly as possible and make comments where necessary.

1. Do you have curbside trash and recycling collection that is provided by your department or municipal council?

   _____

   _____

2. Do you have curbside recycling collection that is provided by a private company with which you contract for service?

   _____

   _____

3. If you have no curbside collection service, how do you dispose of your trash and recycling?

   _____

   _____

   _____

   _____

4. What measures, if any, do you take to reduce the amount of solid waste the households within the municipality produces?

   _____

   _____

   _____

   _____

5. What new or expanded solid waste services would you like to have made available to your clients in future?

   _____

   _____

   _____

   _____

6. Do you notice problems with illegal dumping within the Municipality? If so, please identify these specific locations.

   _____

   _____

   _____

   _____

7. Please briefly discuss examples/cases of segregation/sorting facilities practice (e.g. name of company(ies)/organization(s) in the municipality, location(s), number of facilities, etc.)

8. Please briefly discuss examples/cases of waste collection practice (e.g. name of company (ies)/organization(s), location(s), etc.)

9. Please briefly discuss examples/cases of Municipal waste treatment facilities practice (e.g. name of company(ies)/organization(s), location(s), number of facilities, type of facilities, etc.)

10. Please briefly list and describe the policies or law (s), regulation(s), explicit and implicit, national/local, enactment/ date/responsible agency, related to Municipal Waste Management

11. Do you participate in recycling programs within the Municipality?

12. How do you dispose of hazardous materials (batteries, paint, solvents, home and garden chemicals, fluorescent tubes and bulbs) within the municipality?

13. How do you dispose of yard waste (grass clippings, shrubbery and tree trimmings)?

14. How do you dispose of electronics within the Municipality (computers, TVs, cell phones)?

15. Please briefly list and describe joint projects with partnerships between Municipalities and other stakeholders including national government related to Municipal waste management in your Municipality, and including key players involve.

16. Please describe the provision of information to Municipal waste practitioner and other relevant stakeholders about Municipal waste related matters, particularly in decision making and Municipal waste management.

17. Please share any additional comments, concerns or suggestions you may have regarding solid waste in Meru Municipality

18. Please describe how waste management strategies influence environmental health.

19. What are the major challenges encountered in fostering the environmental health?