INFLUENCE OF WASTE MANAGEMENT PRACTICES ON NATURAL ENVIRONMENT CONSERVATION IN KENYA: A CASE OF SLAUGHTERHOUSES IN KIRINYAGA COUNTY

BY

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DECLARATION

I declare that this research project report is my original work and has not been presented for an award in any other university.

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This research project report has been submitted for examination with my approval as the University Supervisor.

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DEDICATION

This research project is dedicated to my late mother Elizabeth Wangeci who always insisted on cleanliness as a preventive measure against contagious diseases and bad odour around our residential area.To my sister Wanjiku Kago who has taken academic advancement as a way of life and my brother Muchiri Kago who is very keen on environmental impact assessment in all his business establishments. ToConsolata Missionaries Religious congregation who have opened me up to the world by giving me the opportunity to meet many people in the world and to love knowledge with the aim of serving God and humanity in the best way.

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LIST OF ACRONYMS AND ABBREVIATIONS

BODBiochemical Oxygen Demand

CODChemical Oxygen Demand

CRSP Cultural Resources Survey Programme

DO Dissolved Oxygen

DTIEDivision of Technology, Industry and Economics

EMCA Environmental Management and Co-ordination Act,

EPA Environmental Protection Agency

EPAEnvironmental Protection Authority

GWPGlobal Warming Potential

IDCPInternational Declaration on Cleaner Production

IPCC Inter-Governmental Panel on Climate Change

IPPF International Professional Practices Framework

ISWM Integrated Sustainable Waste Management

MLR Multiple Linear Regression

NEMANational Environment Management Authority

RCRAResource Conservation and Recovery Act

SEM Strategic Environmental Management

SPSS Statistical Package for Social Science

TSSTotal Suspended Solids

UNCEDUnited Nations Conference on Environment and Development

UNECA United Nations Economic Commission for Africa

UNEPUnited Nations Environmental Programme

UNFCCCUnited Nations Framework Convention on Climate Change

WHOWorld Health Organization

ABSTRACT

The title of the study is the influence of waste management practices on natural environment conservation in the slaughterhouses in Kirinyaga County.The objectives of the study were: To identify the influence of waste source reduction management practices on natural environment conservation in the slaughterhouses in Kirinyaga County. To explore the influence of waste recycling management practices on natural environment conservation in slaughterhouses in Kirinyaga County. To determine the influence of waste energy recovery management practices on natural environment in slaughterhouses in Kirinyaga County. To examine the influence of waste disposal management practices on natural environment conservation in slaughterhouses in Kirinyaga County. The design of the study was descriptive research. The target population was 204 staff members from 51 slaughterhouses in Kirinyaga County. The sample size was 75 subjects determined byKrejcie& Morgantablebut a total of 65 subjects were interviewed. The data collection instrument was a questionnaire. The data collected was analysed using descriptive statistics and inferential statistics. The results were presented through frequencies and percentages. The information was displayed by use of tables. The study findings indicated that waste management practices influence the natural environment conservation in slaughterhouses in Kirinyaga County. The study recommends that waste source reduction practices,though already implemented in many slaughterhouses, need to be revamped by new technology, better management plans and well trained staff. The study recommends that variety of waste recycling practices need to be introduced. The study also recommends that the staff and the owners of slaughterhouses should be provided with the necessary information on waste energy recovery practices. On waste disposal practices the study recommends that technology and funds are very necessary in order to encourage modern waste disposal practices like landfills and combustion.Although a high number of slaughterhouses are in private hands, the County Governments and NEMA need to take more responsibility in orienting owners and staff of slaughterhouses in the relevant waste management practices.More studies can be carried out in the following areas: The dynamics surrounding waste management practices need to be fully established so that they can be implemented in the best way. This study was done in Kirinyaga County. A similar study may be replicated in all Counties in Kenya so as to reach to a clearer picture of waste management practices in the slaughterhouses and promote natural environment conservation. Similar study needs to be conducted in other industries and urban centres in Kenya. A study to investigate why majority of slaughterhouses are turning to private partnerships.

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CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

This study focussed on the influence of waste management practices on natural environment conservation in Kenya taking a case of slaughterhouses in Kirinyaga County. The issue of waste management is of urgent interest in all countries of the world, African countries and in Kenyan society.At a global level, waste generationis closely linked to population growth, mushrooming urban centresand affluence as indicated byBogner, et al, (2012). Another view by Top (2014) insists that waste generationglobally is closely related to mushrooming small scale business within most national economies in the world.According to Bogner, et al, (2012) establishment of affordable, effective and truly sustainable waste management practices is a challenge to many countriesin the world in spite of the fact that this is a necessity and a cornerstone to sustainable development.

The need for waste management practices in African continent is even more urgent since most developing countries are found in this place. According to United Nations Economic Commission for Africa, UNECA (2015) the typology of wastes generated in Africa encompass industrial, agricultural, sewage, domestic, municipal and other wastes including wastes from the medical, nuclear, electrical and electronic industry.UNECA (2015) further notes that waste management problems in Africa are varied and complex with infrastructure, political, technical, social, economic, organisational, management, regulatory and legal issues and challenges to be addressed. Generally in most African countries, waste is typically disposed off without consideration for environmental and human health impacts, leading to its accumulation in cities, towns and uncontrolled dumpsites (UNECA, 2015).

The need for efficient waste management practices is even more urgent in the Kenyan society. According to NEMA (2015), in Kenya waste generated emanates from both industrial waste and residential areas with industrial waste adding up to 21%, residential waste 61% of the generated wastes and40% of waste generated in the urban centres is collected and disposed off at designated disposal sites. The rest of waste containing heavy metal salts detergents and medical waste is dumped in unsuitable areas or disposed off in

rivers that transverse.NEMA oversees the implementation of the Waste Management Regulations 2006. The Regulations prescribe the standards in waste management operations from generation, handling, storage, collection, transport, treatment and final disposal. NEMA insists that full compliance to these regulations will yield a clean and healthy environment for all.

This study focusses on the waste generated from slaughterhouses in Kirinyaga County. Slaughterhouses are studied here due to the fact that they are industries and they generate waste. Slaughterhouses in Kenya fall in the category of small scale industries although a few are expanding to become big industries.The waste which these slaughterhousesgenerateneed to be managed in order to promote the conservation of the natural environment. According to Business dictionary (2014) waste management encompass management of all processes and resources for proper handling of waste materials.

Slaughterhouses in Kenya do not seem to call for a serious waste management practices because few people visit them. However many small scale slaughterhouses found in Kenya are sure to have an influence on natural environment conservation. Kirinyaga County alone has a total of 51 small scale slaughterhouses and all apart from two of them are privately owned.

This study therefore focussed onthe state of four categories of waste management practices in slaughterhouses in Kirinyaga County. These practices are waste source reduction practices, waste recycling practices, waste energy recovery practices and waste disposal practices. Waste source reduction can be defined as a way of minimising waste at the source (EPA, 2014). The most common sources of waste in slaughterhouses are animal holding areas, animal slaughtering areas, unwanted carcasses and carcasses parts, waste burning and employeeôs errors among others (New South Wales Legislation (NSW), 2012). Waste reduction methods in this situation may include: Designing animal holding areas to allow easy collection of waste and cleaning, ensuring there is a good supply of water in the animal slaughtering areas, avoiding slaughtering sick animals and training employees in waste management methods among others.

The second is waste recycling practice which includes a series of activities like the collection of used, reused, or unused items that would otherwise be considered waste; sorting and

processing the recyclable products into raw materials; and remanufacturing the recycled raw materials into new products (APA, 2013). All horns, hair, skins, bones, teeth generated from the slaughterhouses have the potentiality to be recycled to new materials which can create finances and employment.

Waste energy recovery practices should be taken very seriously because potentially it has a promising future in employment and economic development. Energy recovery from waste is the conversion of non-recyclable waste materials into useable heat, gas, electricity, or fuel (EPA, 2014). Converting non-recyclable waste materials into electricity and heat generates a renewable energy source and reduces carbon emissions (UNEP, 2014). In Kenya some slaughterhouses, daily farmers, cities and towns are already utilising waste energy recovery to produce gas and electricity.

Waste disposal is a method to eliminate safely what cannot be recycled, transformed to manure, or used for energy recovery (EPA, 2014). One way to dispose off waste is to place it in properly designed, constructed, and managed landfills, where it is safely contained (Zafar, 2014). Another way to handle this waste is through combustion (Zafar, 2014). Combustion is the controlled burning of waste, which helps reduce its volume. This kind of waste from a slaughterhouse includes: Animal parts rejected by health officers and disease infected carcasses.

All these four categories of waste management practices calls for good planning, good flow of information, financial, technological and human resources. This study sought to establish the state of these categories of waste management practices in the slaughterhouses in Kirinyaga County. The study also sought to establish the factors influencing the implementation of these practices in the slaughterhouses and to knowthe stakeholders most interested in these waste management practices. These may be the farmers, families who need to put up biogas digesters, NEMA with the aim of environmental protection, the management of the slaughterhouses for waste energy recovery, the community because of their right to clean environment among others. It is also important to list most of the challenges facing the efficient waste management practices.

Adopting and implementing in the best way the four categories of waste management practices, knowing and dealing with the factors influencing the implementation of these practices together with working well with the stakeholders interested in these practices may improve a lot the conservation of the natural environment in Kenya. This may be one way of promoting the sustainable development in Kenya and beyond

1.2 Statement of the Problem

The problem of this study was the lack of efficient waste management practices in slaughterhouses in Kenya. This problem is confirmed by the fact that when efficient waste management practices are not properly implemented in slaughterhouses,the waste generated is typically disposed off without consideration of environmental and human health influence.This study therefore sought to investigate the state of waste management practices inslaughterhouses in Kenya taking the case of Kirinyaga County and propose the efficient practices which may be implemented to help in the conservation of the natural environment, indicate the stakeholders who may be interested in waste management practices in slaughterhouses, list challenges and possible solutionsin the implementation of waste management practices.

According to Morrissey & Brown (2004) there are four categories of waste management practices which efficiency depends on the way they are adopted and implemented. These are: Waste source reduction practices, waste recycling practices, waste energy recovery practices and waste disposal practices. This study adopted these four categories of waste management practices to analyse the situation of waste management practices in the slaughterhouses in Kirinyaga County. The studyassessed the presence and implementation of these practices in slaughterhouses in Kirinyaga County. It sought to identify the stakeholders interested and in favour of their implementation and the challenges facing their implementation in the slaughterhouses in Kirinyaga County. The study made some conclusions on the influence of these practices to the conservation of natural environment in slaughterhouses in Kirinyaga County.

In the literature reviewed, it was noticed that authors could concentrate on some of these practices but not all four at once. For example Guerreroet al. (2012) researching on solid

waste management challenges for cities in developing countries, focussed on waste recycling practices and waste disposal practices. Salem, Lettieri and Baeyens (2009) researching on recycling and recovery routes of plastic solid waste, focussed on recycling and energy recovery from solid plastic wastes. Top (2014) researching on waste generation and utilisation in micro-sized furniture-manufacturing enterprises in Turkey did not consider waste disposal management practice as necessary in the furniture manufacturing industry. These authors did not research on the presence of the four categories of waste management practices together in their cases of waste management as it has been done in this study. These authors also did not focus on the influence of waste management practices on the natural environment conservation as it has been done in this study.

Data collection was done in Kirinyaga County because of its high population density and high concentration of slaughter facilities. This County is situated in the central Kenya region which according to Population census (2009) has a total area of 1,205.4 km2 (465.4 sq. mi) and approximately 528,054 people. According to the County veterinary report found in appendix III, this County had 51 slaughter facilities. Most of these were small and they specialized in slaughtering cows, goats, sheep and pigs. Most of these slaughter facilities were privately owned due to the past failures of local authorityôs organs to manage them. However, even now all of them produce a certain quantity of waste at daily baseswhich combined have a significant capacity to pollute the natural environment.Despite of all these, no research had been carried out on the influence of waste management practices on the natural environment conservation in Kenya taking the case of Kirinyaga County.

1.3 Purpose of the Study

The purpose of this study was to investigate the influence of waste management practices to the natural environment conservation in Kirinyaga County.

1.4 TheObjectivesof the Study

The study was guided by the following objectives:

i. To identify the influence ofwaste source reductionmanagement practiceson natural environment conservation inthe slaughterhouses in Kirinyaga County.
ii. To explore the influence of waste recyclingmanagement practices on natural environment conservation in slaughterhouses in Kirinyaga County.
iii. To determine the influence of waste energy recovery management practices on natural environment in slaughterhouses in Kirinyaga County.
iv. To examine the influence of waste disposalmanagement practices on natural environment conservationin slaughterhouses in Kirinyaga County.

1.5 Research Questions

i. How do waste source reduction management practices influence natural environment conservation in slaughterhouses in Kirinyaga County?
ii. How do waste recycling management practices influence natural environment conservation in slaughterhouses in Kirinyaga County?
iii. How do waste energy recovery management practices influence the natural environment conservation in slaughterhouses in Kirinyaga County?
iv. How do waste disposal management practices influence natural environment conservation in slaughterhouses in Kirinyaga County?

1.6 Significance of the Study

The findings of the study may have both theoretical and practical implications for the future of waste management practices in the slaughterhouses in Kenya. Theoretically, the study was expected to contribute to the advancement of knowledge about waste management practices in slaughterhouses in Kenya. It also highlightedthe factors that influence the waste management practices, the stakeholders interested in these practices and the important role efficient waste management plays in the conservation of the natural environment.

The study had also practical significance because it may lead to the improvement of strategies for the waste management practices which may serve in managing waste in other entities like urban centres and different industries. The study may be of immediate benefit to the ministries of education and health in the formulation of the future educational waste management policies. The results of this study were expected to enlighten the stakeholders in this area on the achievement of the outlined goals for waste management practices. The study may help in appropriate development and implementation of guidelines for waste management in operating slaughterhousesin the country. The study was expected to form a base on which others can develop their studies.

1.7 Delimitation of the Study

The study focused on four categories of waste management practicesin slaughterhouses in Kirinyaga County which influence the natural environment conservation.These practices are: Waste reduction methods, waste recycling methods, waste energy recovery methods and waste disposal methods. The study did not include other practices like: Implementation of NEMA policies, professional staff in environment and health, slaughterhouse farms and specified sites for slaughterhouses among others. The study took place in Kirinyaga County situated in the Central Kenya region which according to Population census (2009) has a total area of 1,205.4 km2 (465.4 sq. m) and approximately 528,054 people. In this County there are 51 slaughterhouses with an average of 4 employees in each. A sample was obtained from these employees to collect more authentic primary data because these individuals were in daily contact with the operations of the slaughterhouses. The primary data collection took place within a scope of three weeks on January 2015. The other 47 Counties did not receive the same attention.

1.8 Limitations of the Study

The limitations in this study included: Transport challenges because some slaughterhouses were not situated in all-weather roads. This limitation was catered for by conducting the research during the dry season. The other limitation was that some slaughterhouses operated occasionally especially during market days. This was catered for by identifying the days when they had great demand. Language barrier was the other limitation because some staff

members could not understand English language. This was catered for by preparing a group which could speak the local language fluently.The other limitation was the cost of conducting the field research. This was catered for by convincing the sponsors to give more funds.

1.9Assumptions of the Study

Theassumptions of this study were: Slaughterhouses management would look positively at this study on waste management practices rather than look at it as trap to expose their misdeeds. The slaughterhouse staff would collaborate in providing the necessary information. Being a densely populated County in Kenya, Kirinyaga County would provide a credible target population for data collection.

1.10 Definitions of Significant Terms As Used in the Study

Natural Environment Conservation: Implementation of efficient waste management practices in the slaughterhouses in Kirinyaga Countyand all concerned institutions taking their roles promptly and responsibly.

Slaughterhouse Staff: All those directly involved in the activities of the slaughterhouse.

Slaughterhouses: It is an infrastructure to ensure that the process of killing animals and birds to provide meat and other products is done according to the policies and ethical establishment of the society.

Waste Source Reduction: Taking precautions so as to generate as little waste as possible.

Waste Disposal: To eliminate the waste that cannot be utilised in any way.

Waste Generated: Unwanted materials which result from the activities of slaughterhouses like dirty water, animal droppings, dust etc.

Waste Management Practices: These are planned processes to ensure that waste generated from slaughterhouses is either reduced, recycled, converted to energy or disposed completely to minimise its possibility of polluting the environment.

Waste Minimization: To bring down the quantity ofwaste generated by an industry, institution or any other entity.

Waste Recycling: To convert the generated waste to new materials for use.

Waste to Energy: Utilise the waste to produce energy like heat or biomass.

1.11 Organization of the Study

This study has five chapters. Chapter One is the Introduction which contains the following topics; the background of the study, the purpose of the study, the statement of the problem, the objectives of the study, the research questions, the significance of the study, the delimitation of the study, the limitations of the study, basic assumptions of the studythe definition of the significant terms and the organization of the study. Chapter Two is the literature review. It has the introduction, waste source reduction management practices and the natural environment conservation, waste recycling management practices and the natural environment conservation, waste energy recovery management practices and the natural environment conservation, waste disposal management practices and the natural environmental conservation,theoretical framework, and conceptual framework, Knowledge gaps and a summary. Chapter Three is the research methodology used in the study. It contains the introduction, research design, target population, sample size and sampling procedures, data collection instruments which contains pilot testing, validity and reliability of research instruments then data collections procedures, data analysis techniques, ethical issues and the operational definition of the variables. Chapter Four contains introduction, questionnaire response rate, demographic characteristics of the respondents, Waste source reduction management practices, Waste recycling management practices, waste energy recovery management practices, waste disposal management practices, most efficient waste management practices, and challenges facing the implementation of waste management practices. Chapter Fivecontainsintroduction, summary of the findings, discussions, conclusion, recommendations for policy actions, suggestions for further studies.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

The chapter presents literature review that outlines the waste source reduction management practices and natural environment conservation, waste recycling management practices and natural environment conservation, waste energy recovery management practices and natural environment conservation,waste disposal management practices and natural environment conservation, theoretical framework, and conceptual framework, knowledge gaps and a summary.

2.2Waste Source Reduction Management Practices and Natural Environment Conservation

According to EPA (2013) waste source reduction management practices, includes precautions taken by an organization tominimise the quantity of waste generated. This minimization may be realised by reusing or donating items, buying in bulk, reducing packaging, redesigning products, and reducing toxicity in some organization (EPA, 2013). According to UNEP (2014) waste source reduction practices involves protection of the quality and supply of fresh water resources, promoting sustainable human settlement development, protecting and promoting human health conditions and changing consumption patterns.

Various scholars have tried to identify the focus of waste source reduction management practices.According toLebersorger and Schneider (2014) the focusshould be on transfer of best practices, information, education of employees and customers. According to ISWM (2010) the focus should bematerial separation at the waste source and the main barriers to this goal are negative attitude, lack of awareness, vested interests and unaffordable technology. The focus of waste source reduction management also includes identification of the stakeholders according to WASTE (2004). These arepeople or organizations that may have an interest in adequate waste source reduction activities in every situation. According to Tai et al. (2011), the stakeholders are national and local government; municipal authorities; city corporations; non-governmental organizations; households; private contractors; Ministries of Health; Environment, Economy and Finance and recycling companies. The other focus according to Guerrero et al (2012) is the challenges that waste source reduction management face.

Waste source reduction practices face various challenges according to WASTE (2004).Such challenges according to Guerrero et al. (2014), emerge from the family size, their education level and the monthly income. They further argue that households attitudes related to separation of waste are affected by the active support and investment of a real estate company, community residential committeesô involvement for public participation and fee for collection service based on the waste volume or weight. Gender, peer influence, land size, location of household and membership of environmental organization explain household waste utilization and separation behaviour.

According to Hazra&Goel (2009) factors that influence waste source reduction practices arethe aspects that facilitate the performance of the system which are: technical, environmental, financial, socio-cultural, institutional and legal entities.Hazra&Goel, (2009) suggest that technical factors influencing the practice are related to lack of technical skills among personnel within municipalities and government authorityôs deficient infrastructure, poor roads and vehicles, insufficient technologies and reliable data.

According to Asase et al.(2009), the factors affecting waste management are the lack of environmental control systems and evaluation of the real impacts. Ekere, et al, (2009) propose that the involvement of the population in active waste management is necessary to have better practices. According to Chung & Lo (2008), lack of organizational capacities, professional knowledge and scanty information from the public domain affect the practices of waste management. Chung & Lo (2008) add that the extremely limited information is not complete or is scattered around various agencies concerned, therefore, it is extremely difficult to gain an insight into the complex problem of waste management practices.

According to Asase et al. (2009), an adequate legal framework contributes positively to the development of the integrated waste management system while the absence of satisfactory policies and weak regulations are detrimental to it. Some researchers indicate that waste management in different situations has failed due to financial factors. According to Guerrero et al. (2012), the huge expenditure needed to provide the service, the absence of financial support, limited resources, the unwillingness of the users to pay for the service and lack of proper use of economic instruments have hampered the delivery of proper waste management services. The involvement of the private sector is a factor that could improve the efficiency of the system (Guerrero et al., 2012).

According toGuerrero et al. (2012) it is generally regarded that waste management is the sole duty and responsibility of local authorities, and that the public is not expected to contribute. The operational efficiency of solid waste managementGuerrero et al. (2012) says depends upon the active participation of both the municipal agency and the citizens, therefore, socio cultural aspects mentioned by some scholars include people participating in decision making, community awareness and societal apathy for contributing in solutions. Guerrero et al. (2012) points out that waste worker are associated to low social status a situation that gives as a result low motivation among the solid waste employees. Politicians give low priority to solid waste compared to other municipal activities with the end result of limited trained and skilled personnel in the municipalities (Guerrero et al., 2012). Positive factors that improve the system are support from municipal authorities and strategic plans for waste management that allows monitoring and evaluating annually the system (Asase et al., 2009).

Waste source reduction thus involves minimization of the waste generated by a given entity. The focus of waste source management practices may involve among others transfer of best practices, information, education of employees and customers, identification of the stakeholders and the challenges faced in the management.

2.3 Waste Recycling Management Practices and Natural Environment Conservation

According to EPA (2013),waste recycling management practices is a series of activities that involves the collection of used, reused, or unused items that would otherwise be considered waste; sorting and processing the recyclable products into raw materials; and remanufacturing the recycled raw materials into new products. Recycling also include composting of food scraps, yard trimmings, and other organic materials (EPA, 2013).

Various organizations have identified some objectives of waste recycling management practices. According Toolbox (2014),the objectives of waste recycling practices is reduction of quantity of wastewater, reduction of bio-degradable value and recovery of solid waste. Toolbox (2014), recommends the techniques of improvement of waste recovery and recycling in slaughterhouses, from tanneries and in dairy plants. To cut the costs, Toolbox (2014) recommends the use of right technical package and disciplined qualified and trained personnel. The positive environmental impact of waste recycling practices according to

Toolbox (2014), is reduction of waste load, recovery of solid waste for recycling and composting and recovery of chromium.According to Abattoir Legislation (2012), the main objective of animalwastes recycling is to provide manure.

Researchers have contradicting views on waste recycling management practice influence to the environment. According to Top (2014), the number of small-scale businesses within most national economies is generally high, especially in developing countries. Often these businesses have a weak economic status and limited environmental awareness (Top, 2014). The type and amount of waste produced, and the recycling methods adopted by these businesses during their operation can have negative effects on the environment (Top, 2014). However, EPA (2014), insists that recycling is environmental friendly because it prevents the emission of many greenhouse gases and water pollutants, saves energy, supplies valuable raw materials to industry, creates jobs, stimulates the development of greener technologies, conserves resources for the future, and reduces the need for new landfills and combustors.

Various researchers identify some factors that influence waste recycling management practices in different parts. According to Top (2014), the factors that limit recycling practises include waste collection and transportation, the scale of the business, the industrial sector in which the company operates, the amount and type of waste produced, environmental regulations and the level of development within a particular country and environmental pollution. Work force that has received vocational training,influence the utilisation of waste materials in a variety of ways.

Other researchers likeGonzalez &Adenso-Diaz (2010) reported that social influences, altruistic and regulatory factors are some of the reasons why certain communities develop strong recycling habits. These authors also showed that people who frequently go to the bins to dispose off general refuse are more likely to recycle some product at home, and in most cases, as the distance to the recycling bins decreases, the number of fractions that citizens separate and collect at home increases. Factors that facilitate recycling rates according to Top (2014) are: Markets for recycled materials and increasing professionalism in recycling companies. Support for recycling projects and infrastructures, recycling companies in the country, drop-off and buy back centres, and organization of the informal sector. Lack of knowledge of treatment systems by authorities is reported as one factor affecting the treatment of waste (Chung & Lo, 2008).

Waste recycling thus involvescollection and processing of waste into raw materials and remanufacturing the recycled raw materials into new products. Recycling practices have an influence on environmental conservation. Recycling practices face challenges like social influences, altruistic and regulatory factors, the scale of the business, the industrial sector in which the company operates the amount and type of waste produced, environmental regulations and the level of development within a particular country among others.

2.4Waste Energy Recovery management Practices and Natural Environment Conservation

Waste energy recovery is the conversion of waste materials into heat, electricity, or fuel energy through a variety of processes like combustion, gasification, anaerobic digestion, and landfill gas (LFG) recovery (EPA, 2013). Wasteenergy recovery generates a renewable energy source and reduces carbon emissions by offsetting the need for energy from fossil sources and reduces methane generation from landfills(UNEP, 2012).

The natural gas energy production and biomass energy production are popular in Kenya. According to ISWM (2010), in Nairobi 51% of the waste is of an organic nature, allowing for energy recovery by anaerobic digestion to produce biogas and nutrient recovery by means of composting. According to Rotich et al. (2014), energy recovery from slaughterhouses waste in Kenya is referred to asCows to Kilowatts whichinvolves set-up of biogas digesters with the biogas being combusted and converted to electricity.

There are three main pathways for conversion of organic waste material to energy according to Zafar (2014). These are: Thermochemical conversion, characterized by higher temperature and conversion rates, is best suited for lower moisture feedstock and is generally less selective for products. Physico-chemical technology involves various processes to improve physical and chemical properties of solid waste. The bio-chemical conversion processes, which include anaerobic digestion and fermentation, are preferred for wastes having high percentage of organic biodegradable (putrescible) matter and high moisture content. Anaerobic digestion can be used to recover both nutrients and energy contained in organic wastes such as animal manure. The process generates gases with a high content of methane (55ï 70 %) as well as bio fertilizer. The most attractive method of converting animal waste

materials to useful form is according to Zafar (2014), anaerobic digestion which gives biogas that can be used as a fuel for internal combustion engines, to generate electricity from small gas turbines, burnt directly for cooking, or for space and water heating.

Waste-to-energy plants are of great value according to Zafar (2014). This is because among other things they recover the thermal energy contained in the trash in highly efficient boilers that generate steam that can then be sold directly to industrial customers, or used on-site to drive turbines for electricity production. WTE plants are highly efficient in harnessing the untapped energy potential of organic waste by converting the biodegradable fraction of the waste into high calorific value gases like methane. The digested portion of the waste is highly rich in nutrients and is widely used as bio fertilizer in many parts of the world (Zafar, 2014).

Waste energy recovery thus involves the conversion of waste into energy.The best practice of converting animal waste materials to useful form is anaerobic digestion which gives biogas that can be used as a fuel, to generate electricity, burnt directly for cooking, or for space and water heating.Waste energy recovery generates renewable energy, reduces carbon emissions and reduces methane generation from landfills.

2.5 Waste Disposal Management Practices and Natural Environment Conservation

Waste disposal management practices deals with the waste that cannot be prevented or recycled. According to (EPA, 2011), such waste is disposed through properly designed, constructed, and managed landfills, where it is safely contained and is also disposed through combustion which is the controlled burning of waste that helps reduce its volume. If the technology is available, properly designed, constructed, and managed landfills can be used to generate energy by recovering methane and similarly, combustion facilities produce steam and water as a by-product that can be used to generate energy (EPA, 2011).

Controlled burning of waste and landfills must be well designedto protect the environment from contaminants which may be present in the solid waste stream (EPA, 2014).According to EPA (2014), modern landfills are well-engineered facilities that are located, designed, operated, and monitored to ensure compliance with the law because thelandfills which are poorly planned can contaminate ground water and produce landfill gases.Landfills and combustions are rare waste disposal practices in Kenyan institutions. According to Gakungu

et al. (2013), waste collected from most institutions in Kenya is disposed of in the rubbish pits or collected by the municipality.

Researchers have identified some factors which influence waste disposal in various situations. One such factor is the problem of transfer and transport of waste to disposal points. Hazra&Goel (2009) notes that transfer and transport is influenced by improper bin collection systems, poor route planning, lack of information about collection schedule, insufficient infrastructure, poor roads and number of vehicles for waste collection. The other factor is lack of organization in the informal sector and poor promotion of micro-enterprises which affect extending affordable waste collection services (Hazra&Goel 2009).The other factor is poor management of household waste disposal. According to Ruijs&Hagos(2008),the supply of waste facilities significantly influence waste disposal choice together with inadequate supply of waste containers and longer distance to these containers increases the probability of waste dumping in open areas and roadsides relative to the use of communal containers. They also mention the insufficient financial resources limiting the safe disposal of waste in well-equipped and engineered landfills and absence of legislation are mentioned.

According to Hazra&Goel (2009),there are two efficient waste disposal management practices which are landfills and combustion. These have to be well designed to prevent environmental pollution. According to Gakungu et al. (2013) the factors which influence waste disposal practices include the problem of transfer and transport, lack of participation of informal sector, poor promotion of micro-enterprises, poor management of household waste disposal and insufficient financial resources.

2.6 Theoretical Framework

This study adoptedIntegrated Sustainable Waste Management (ISWM) Model as discussed byMorrissey & Brown (2004) to analyse and make recommendations on efficient waste management practices in slaughterhouses in Kirinyaga County in order to promote the conservation of natural environment. According to Guerrero&Hogland(2012) this model was developed by waste management advisers on urban environment and development and partners or organizations working in developing countries in the mid-1980s and further

developed by the Collaborative Working Group (CWG) on solid waste management in the mid-1990.

The model acknowledges the importance of three dimensions when analysing, developing or changing a waste management system. The dimensions are: the stakeholders that have an interest in solid waste management, the elements or stages of the movement or flow of materials from the generation points towards treatment and final disposal and the aspects or ñlensesò through which the system is analysed.

In the elaboration of the three dimensions, the (ISWM) model suggests four waste management practices which efficiency depends on the way they are adopted and implemented. These are: Waste source reduction practices, waste recycling practices, waste energy recovery practices and waste disposal practices. This study adopted these four categories of waste management practices to analyse the efficiency of waste management practices in the slaughterhouses in Kirinyaga County. As the model suggests, the study also focused on the factors influencing waste management in the slaughterhouses and the stakeholders interested in these practices.

2.7 Conceptual Framework

The conceptual framework of this study is found in figure 2.1 below. According to Mosby's Medical Dictionary (2009) conceptual framework is a group of concepts that are broadly defined and systematically organized to provide a focus, a rationale, and a tool for the integration and interpretation of information.

Independent Variables

M

Waste Reduction Management Practices:

- Number of waste source reduction practices
- Number of factors influencing waste reduction practices
- Number of stakeholders interested in

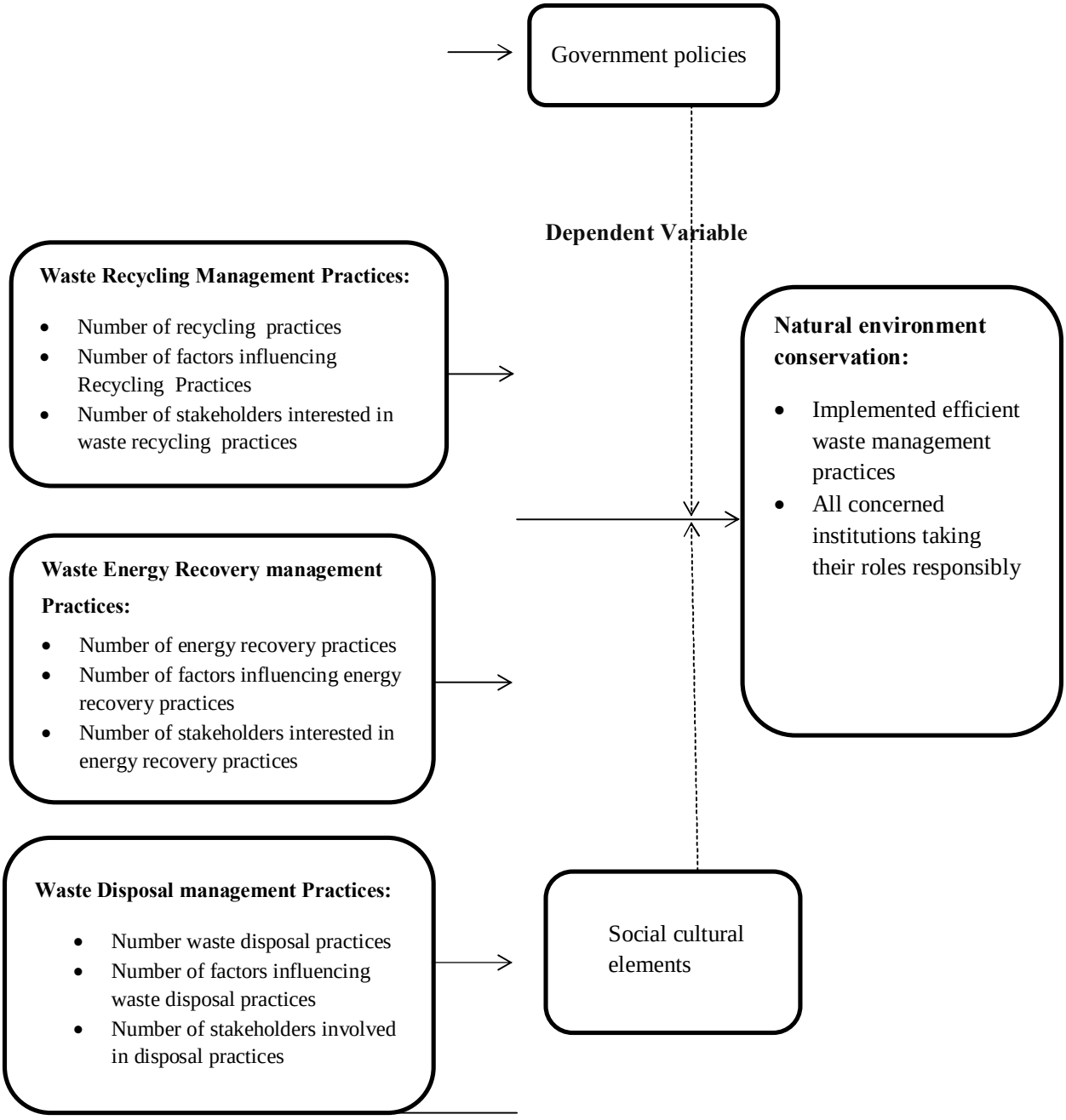

Figure 1. Conceptual Framework

This study used multiple linear regressions (MLR) which according to Punch (2009) is a design strategy to conceptualize and organize the research. The dependent variable was natural environment conservation and four independent variables which were: waste source

reduction practices measured by the number of waste reduction practices, the number of factors influencing waste source reduction practices and the number of stakeholders interested in waste source reduction practices. The second independent variable was waste recycling practices measured bythe number of recycling practices, number of factors influencing waste recycling practices and the number of stakeholders interested in waste recycling practices. The third independent variable was waste energy recovery practices measured bythe number of energy recovery practices, the number of factors influencing energy recovery practices and the number of stakeholders interested in energy recovery practices. The fourth independent variable was waste disposal management measured by the number of waste disposal practices, the number of factors influencing waste disposal practices and the number of stakeholders interested in waste disposal practices.The intervening variable of the study is social cultural elements involved in reducing, recycling, recovering energy and disposing waste. The moderating variable isGovernment policies which guide the reduction, recycling, energy recovery and disposal of waste.

2.8Knowledge Gaps

Knowledge gaps involve identifying the findings of an author or authors on a particular variable and detecting some elements in the same topic which needs more research. Table 2.1 gave a summary of the knowledge gap.

Table 2.1 Knowledge Gaps

Author/Title	Findings	Knowledge Gaps
Guerrero, Maas and Hogland (2012)	comprehensive analysis on stakeholders	This study focuses on two waste management

Solid waste management challenges for cities in developing countries	some key factors that affect the systemsofsolid waste management	systems which are recycling and disposal. It does not focus much on waste source reduction and waste energy recovery.
Salem, Lettieri and baeyens (2009) Recycling and recovery routes of plastic solid waste.	Four routes of plastic solid waste treatment are: primary (re-extrusion), secondary (mechanical), tertiary (chemical) and quaternary (energy recovery) Schemes and technologies of plastic solid management	The study does not focus on the influence the recycling and recovery routes of plastic solid waste have on natural environment conservation. The study also remains silent on plastic waste disposal
Top (2014) Waste generation and utilisation in micro-sized furniture-manufacturing enterprises in Turkey.	The type and amount of waste produced, and the recycling methods adopted by these businesses during their operation can have negative effects on the environment. This study investigated the types of waste generated and the recycling methods adopted in micro-sized enterprises engaged in the manufacture of furniture and also whether the characteristics of the enterprise had any effect on the waste recycling methods that were practised. There are infrastructural and technical capacity issues in management of those solid wastes. Solid waste management is important in terms of job creation. The percentage of the workforce that has received vocational training in furniture Manufacturing is low. The number of systems used to collect the wastes generated during conversion of materials is inadequate. The wastes generated in one process are not collected together, or separated according to their properties. Wastes generated at the sites investigated were not disposed in landfills or by incineration in open conditions. wastes are used to heat the workplace by burning them under conditions of incomplete combustion. Very few businesses choose to utilise their wastes other than using them for their own needs wood waste is primarily used for energy purposes Waste was burnt using inappropriate devices under inappropriate conditions total emissions generated by them as a whole has a significant negative impact on the environment. The energy generated from this resource is clean and renewable The by-laws related with waste management must be put into practice Studies which reveal the economic and environmental potential from recycling and aiming to remove existing barriers in waste recovery will help to develop proper policies	The study does not focus on the influence the waste generation and utilisation in micro-sized furniture-manufacturing enterprises in Turkey has on natural environmental conservation.

2.9 Summary

Chapter two starts with an introduction. This literature review identifies, defines and delves into four waste management practices which are: Waste source reduction management practices, waste recycling management practices, waste energy recovery management practices and waste disposal management practices. The theoretical framework of the study was analysed which was Integrated Sustainable Waste Management (ISWM) Model. To provide a focus, a rationale, and a tool for the integration and interpretation of information in this study, a conceptual framework was provided. In the section of the knowledge gaps, findings of an author or authors on a particular variable are shown and some elements in the same topic which needs more research detected.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter outlines the methods and procedures that were used to collect analyse and present data required in the study on the influence of waste management practices on natural environment conservation in Kirinyaga County. They included theresearch design, target population, the sample size and the sampling procedures, research instruments, pilot testing of the instruments,validity and reliability of research instruments, data collection procedures, data analysis techniques,ethical issuesin research and operational definition of variables.

3.2 Research Design

This study used a descriptive survey design to find out the influence of waste management practices in the slaughterhouses in Kirinyaga County.According to Mugenda&Mugenda (1999) descriptive survey design is a process of collecting data in order to answer questions about the current status of the subjects in the study. Hale (2011) says the participants answer questions administered through interviews or questionnaires and then the researchers describe the responses given. In this study participants were interviewed from researcher administered questionnaire. This is to help all the participants understand and answer questions correctly because some subjects did not have much school education.

3.3 Target Population

The population of this study were all the staff at the slaughterhouses and all the slaughterhouses in Kirinyaga County. According to Kombo & Tromp (2006) the population is an entire group of individuals, objects or items from which samples are taken for measurement. The target population for this study was 204 subjectsfrom 51 slaughterhousesas shown in appendix V.According to Mugenda&Mugenda (2003) the target population is that population to which a researcher wants to generalize the results of a study.

3.4 Sample Size and Sampling Procedures

The sample of this study was obtained through the use of Krejcie& Morgan (1970) table of required sample size in appendix VII. According to Mugenda&Mugenda (2003) sampling is the process of selecting a number of subjects for a study in such a way that the individuals selected represent the large group from which they were selected. The sample was selected from the target population of 204 staff members obtained from 51 slaughterhouses in Kirinyaga County. According to Mugenda&Mugenda, (2003) a sample is carefully selected so as to be representative of the whole population with the relevant characteristics. With the confidence level at 95.0% andthe degree of accuracy or margin of error at 0.09%, Krejcie& Morgan (1970) table gives a sample size of 75 subjects from the target population of 204 subjects. 75 subjects were selected by use ofconvenience sampling technique which involves selecting cases or units of observation as they become available to the researcher (Mugenda&Mugenda, 2003).To achieve the gender, stratified random sampling was used which according Mugenda and Mugenda has a goal to achieve desired representation from various subgroups in a population.

Table 3.1 Research Design and Sampling Procedures

Research Design	Population	Target Population	Sample Unit	Sample	Sampling technique	Gender
Descriptive Survey	All slaughterhouses staff and all slaughterhouses in Kirinyaga County	204 individuals from 51 slaughterhouse s in Kirinyaga County	An individual among the 204 subjects	75 subjects	Convenience sampling technique	Stratified random sampling

The research design of this study was descriptive survey. The population of the study were all the staff of the slaughterhouses and all slaughterhouses in Kirinyaga County. The target population were 204 individuals distributed in all 51 slaughterhouses in Kirinyaga County. The sample size was 75 subjects obtained through convenience sampling technique. Stratified random sampling was used to obtain the gender.

3.5 Data Collection Instruments

The survey questionnaire was used as the main data gathering instrument in this study.According to Paliparan (2011), research instruments or tools are ways of gathering data. This questionnaire had structured or closed ended and unstructured or open ended questions. It contained seven sections which included: section A demographic information; section B waste source reduction management practices; section C waste recycling management practices; section D waste energy recovery management practices; section E waste disposal management practices; section F efficient waste management practices; section F challenges and solutions. The survey was organized in the above themes. The questionnaire allowed the carrying out of the quantitative approach effectively with the use of statistics for data interpretation.

3.5.1 Pilot Testing of the Research Instrument

Piloting of the research instrument was done before the actual data collection exercise among 5 individuals not included in the sample but were staff of slaughterhouses. According toImpact (2011),piloting is done to test whether the questionnaire is clear to the respondents, precise and comprehensive enough to provide the anticipated type of data, and determine whether the research objectives will be fulfilled.The individuals were asked questions while the researcher observed to note the unclear questions and other elements to be corrected in the questionnaire. Respondents were also asked for suggestions or necessary corrections to ensure further improvement and accuracy of the instrument. The necessary corrections were done and the questionnaire was deemed ready for the field research.

3.5.2 Validity of Research Instruments

This study used, content validity, which Punch (2009), says focuses on whether the full content of conceptual definition is represented in the measure.To ensure that the inferences made by the study from the data obtained were as close to reality as it can be practically possible as advised by Punch (2009);The problem statement, objectives, research questions, conceptual framework, variables, indicators, methods and types of data analysis were taken into account when formulating the questionnaire.

3.5.2 Reliability of Research Instruments

Reliability is the degree to which a research instrument produces stable and consistent results (Phelan & Wren, 2006).This study used Test-retest method of assessing reliability of the research instrument. This method according to Punch (2009), involves administering the same instrument twice to the same group of subjects.A group of 5 individuals was selected for the Test - retest and the questionnaire was administered to them twice within one week. The 1st round and the 2nd round scores of the 5 were correlated from both testing periods.According to Mathbits (2014) the mathematical formula for computing correlation coefficient is:

$$r = \frac{n\sum xy - (\sum x)(\sum y)}{\sqrt{n(\sum x^2) \quad (\sum x)^2}\sqrt{n(\sum y^2) \quad (\sum y)^2}}$$

r = Correlation Coefficient

x = 1st round scores

y = 2nd round scores

n = number of individuals tested

A coefficient of 0.085 was obtained. This implied that the data of this instrument has high test-retest reliability.

3.6 Data Collections Procedures

Before the collection of primary data begun, introduction letter was obtained from the School of Continuing and Distance Education;The permit from the National Council for Science and Technology was applied for.Kirinyaga County veterinary officer was contacted for approval to visit slaughter facilities in the County for data collection. The interviewers involved as recommended by Mugenda&Mugenda (2003) familiarized themselves with the interview conditions, logistics, controls, safeguards and variables being studied. Pilot testing was done to ensure the questions are clear, receive comments and suggestions and note deficiencies of the questionnaire (Mugenda&Mugenda, 2003). Reliability Test-retest wasdone. Visits to the

sampled slaughterhouses were done.All the questionnaires were put together ready for data analysis and the group of interviewers met to give some feedbacks on the exercise. The secondary data needed was collectedby way of reading, analysing and recording data obtained from thebooks, journals, newspapers, daily, internet material, news, andgeneral knowledge.The tools used in collecting and recording data include field note books, pens, pencils rubbers, a camera and cell phone.

3.7 Data AnalysisTechniques

The data from the field was cleaned, coded, and key-punched into a computer then analysed as recommended byMugenda&Mugenda (2003).The data from the administered questionnaires was converted to numerical codes or categorised and tabulated using simple frequencies and percentages. The data collected was analysed using descriptive statistics andinferential statistics. The purpose of descriptive statistics is to enable describe the distribution of the scores or measurements (Mugenda&Mugenda, 2003).The type of descriptive statistic used in this study wasthe measure of central tendency andvariability ordispersion. The measure of the central tendency preferred is the mean which is calculated by adding up all the scores and dividing the sum by the total number of scores(Mugenda&Mugenda, 2003). Variability was measured through the calculation of standard deviation and the variance. Inferential statistics was also used to analyse the qualitative data. According to Mugenda&Mugenda (2003)inferential statistics deal with inferences about population based on results obtained from the sample.

3.8 Ethical Considerations

This study followed the three ethical principles as discussed by Gakuu&Kidombo (2010) which are beneficence, respect and justice: On beneficence, the study made all the efforts to follow scientific rules, promote environmental protection, having the necessary respect to the individual research participants and minimising or avoiding unnecessary risk, harm, or wrong to anything or anybody. The study treated people with respect and courtesy, including those who are not autonomous (e.g., small children, people who have mental retardation or senility). On justice this study ensured that those who bear the risk in the research are those

who benefit from it; ensuring that the procedures are reasonable, non-exploitative, carefully considered and fairly administered.

3.9 Operational Definition of Variables

Operational definition of variables is done by focusing on the objectives, variables, indicators, measurement scales, methods of data analysis and types of analysis as shown in table 3.2. There were four objectives and four independent variables. Each independent variable had three indicators. There was one dependent variable with one indicator. The variables were seen to be operationalized depending on whether they fall in the range of ordinal, intervals, nominal and ratios scales. Method of data analysis included measures of central tendency and dispersion, percentages and frequency distribution. There were two types of analysis, descriptive and inferential statistics.

Table 3.2 Operational Definitions of Variables

OBJECTIVES	VARIABLES	INDICATORS	MEASUREMENT SCALES	METHOD OF DATA ANALYSIS	TYPE OF ANALYSIS
To identify the influence of waste source reduction management practices on natural environment conservation in the slaughterhouses in Kirinyaga County.	**INDEPENDENT VARIABLES** Waste source reduction	Functional waste source reduction management practices Responsible concerned institutional support	Interval Ratio	Measures of central tendency and dispersionPercentages Frequency distribution	Descriptive statistics inferential statistics
To explore the influence of waste recycling management practices on natural environment conservation in slaughterhouses in Kirinyaga County.	Waste recycling	Functional waste recycling management practices Responsible concerned institutional support	Interval Ratio	Measure of central tendency anddispersion, Percentages Frequency distribution	Descriptive statistics inferential statistics
To determine the influence of waste energy recovery management practices on natural environment in slaughterhouses in Kirinyaga County.	Waste energy recovery	Functional waste energy recovery management practices Responsible concerned institutional support	Interval Ratio	Measure of central tendency and dispersion Percentages Frequency distribution	Descriptive statistics inferential statistics
To examine the influence of waste disposal management practices on natural environment conservation in slaughterhouses in Kirinyaga County.	Waste disposal	Functional waste management practices Responsible concerned institutional support	Interval Ratio	Measure of central tendency And dispersion,Percentages Frequency distribution	Descriptive statistics. inferential statistics
	DEPENDENT VARIABLE: Natural Environment conservation	Functional and efficient waste management practices Responsible concerned institutional support	Nominal Ordinal Interval Ratio	Measure of central tendency and dispersion, Percentages Frequency distribution.	Descriptive analysis, inferential statistics.

3.10 Summary

This study used descriptive survey method and the target population were 204 individuals from 51 slaughterhouses in Kirinyaga County. The sample size was 75 subjects. A questionnaire was the main data gathering instrument. Pilot testing was done to ensure the clarity of the questionnaire to the respondents. The study used content validity to ensure that the data obtained was as close to reality as it can be practically possible.The reliability of the research was assessed by the use of Test-retest method. The data was analysed by the use of descriptive and inferential statics. The study followed the three ethical principles of beneficence, respect and justice. A table of operational definition of variables was done.

CHAPTER FOUR

DATA ANALYSIS, PRESENTATIONS, AND INTERPRETATIONS

4.1 Introduction

This chapter is divided into two main sections. Section one presents demographic data for the subjects. The second section presents the analyses of data on the influence of waste management practices on natural environment conservation in slaughterhouses in Kirinyaga County. The study specifically investigated on the waste source reduction practices, waste recycling practices, waste energy recovery practices and waste disposal practices with the aim of discovering how the implementation or non-implementation of these practices influence the natural environment conservation in Kirinyaga County.

4.2 Response Rate

Questionnaire response rate refers to the number of subjects interviewed in the field. The sample size of this study was 75 subjects and 65 subjects were able torespond to the questionnaire. This was 86.7 % response rate which was used for data analysis.

4.3 Demographic Characteristics of Respondents

This section describes the demographic characteristics of respondents who participated in this study. The following demographic characteristics were focused: Gender, age, duration in slaughtering job and duration in current slaughterhouse.The findings are shown in Tables 4.1 to 4.4.

4.3.1 Gender of Respondents

The study sought to establish the gender of the respondents. The findings are as in Table 4.1.

Table 4.1 Gender of Respondents

Gender	Frequency	Percentage
Male	60	92.3%
Female	5	7.7%
Total	65	100%

Among the respondents, only 5 (7.7%) were female while 60 (92.3%) of slaughterhouses staff were male. This indicated that male gender dominates the slaughtering job in Kirinyaga County. A lot of energy is required to operate the system at the slaughterhouse.

4.3.2 Age Brackets of Respondents

The study sought to establish the age brackets of the respondents and the findings are presented in Table 4.2.

Table 4.2 Ages Brackets of Respondents

Age	Frequency	Percentage
18-23	4	5.5%
24-28	10	15.8%
29-33	13	20.5%
34-38	10	15.8%
39-43	4	5.5%
44-48	17	26.4%
Over 54	7	10.5%
Total	65	100%

The data shows that 17(26.4%) of respondents were aged between 44 and 48 years, while 13(20.5%) were aged between 29 and 33 years. Respondents between 34 and 38 years were 10(15.8%) while those between 24 and 28 years were 10(15.8%). The respondents aged

between 18 and 23 years were 4(5.5%) the same rate of respondents between 39 and 43 years 4(5.5%). Those respondents over 54 years were 7(10.5%). This data indicates that few young people are employed in the slaughterhouses in Kirinyaga County. The largest group are those between 44 and 48 years which may be indicative of the importance of patience and experience in slaughtering business. The other large group is between 29 and 33 which may also be indicative of the need of strength to work in slaughterhouses.

4.3.3 Duration of Respondents in Slaughtering Job

The study sought to establish the duration of the respondents in slaughtering job and the findings are presented in Table 4.3.

Table 4.3 Duration of Respondents in Slaughtering Job

Years	Frequency	Percentage
Less than one year	10	15.4%
1 to 5 years	40	61.5%
6 to 10 Years	5	7.7%
Over 10 Years	10	15.4%
Total	65	100%

This study indicated that 40 (61.5%) of the respondents have been in slaughtering employment between 1 and 5 years whereas 10 (15.4%) have been in the slaughter employment in less than one year the same rate as those who have been employed for more than 10 years. Those between 6 and 10 years are 5 (7.7%). This indicated that majority of slaughterhouse staff donôt exceed 5 years in slaughterhouse employment. This meant after gaining experience and income they decide to venture into other businesses or self-employment.

4.3.4 Duration of Respondents in Current Slaughterhouse

The study sought to establish the duration of the respondents in current slaughterhouse and the findings are presented in Table 4.4.

Table 4.4 Duration of Respondents in Current Slaughterhouse

Years	Frequency	Percentage
Less than one year	15	23.1%
1 to 5 years	35	53.8%
6 to 10 Years	5	7.7%
Over 10 Years	10	15.4%
Total	65	100%

The findings show that 35 (53.8%) of the respondents had worked in the current slaughterhouse between 1 and 5 years whereas those who had worked less than 1 year are 15 (23.1%). Those who had worked in the same slaughterhouse between 6 to 10 years are 5 (7.7) whereas those who exceed 10 years in the current slaughterhouse are 10 (15.4%). This indicates that slaughterhouse staff change job within 5 years and may seek employment in slaughterhouses where there is demand. The 15.4% of the staff who endure more than 10 years most likely are the owners of the slaughterhouses.

4.4 Waste Management Practices

The study sought to understand how waste management practices influence natural environment conservation in slaughterhouses in Kirinyaga County. The results of the opinions of the respondents are presented in Tables 4.5 to Table 4.15

4.4.1 Waste Source Reduction Management Practices

The study sought to find out; different types of waste source reduction practices; factors influencing waste reduction practices and the stakeholders interested in waste reduction practices in slaughterhouses in Kirinyaga County. The findings are shown in Tables 4.5 to Table 4.7.

Table 4.5 Waste Source Reduction Practices

Waste reduction practices	Frequency	Percentage
Animal holding areas	50	77%
Sufficient water	65	100%
No infected animals	65	100%
Trained employees	40	61.5%
Other	10	15.4%

The findings indicated that in all slaughterhouses, to reduce waste in their premises ensure that there is sufficient water represented by 65 (100%) and also they ensure that no infected animal is slaughtered indicated by 65 (100%). Most slaughterhouses also construct good and easy to clean animal holding areas indicated by 50(77%). The other waste source reduction practice is training of the employees in various processes of cleanliness in the slaughterhouses indicated by 40(61.5%). Other practices of waste reduction include mowing the compound and starting a garden in the compound of the slaughterhouse indicated by 10(15.4%). These findings suggest that management of slaughterhouses in Kirinyaga County is sensitive to natural environment conservation because several waste source reduction practices are in place.

Table 4.6 Factors influencing Waste Source Reduction Practices

Factors	Frequency	Percentage
Lack of funds	17	26.7%
Lack of trained personnel	13	20%
Lack of support from local authority	35	53%
Poor waste management plan	35	53%
Poor information flow from NEMA	26	40%
Location of the slaughterhouse	30	46.7%
Others	4	6.7%

The analysis indicated that 35(53%) respondents identified poor waste management plan of the slaughterhouses as the strongest factor influencing waste source reduction in slaughterhouses in Kirinyaga County. Lack of support from the local authority share the same rate of 35 (53%). This was followed by the location of the slaughterhouse with 30 (46.7%) and poor information flow from NEMA with 26 (40%). Lack of funds was mentioned by 17 (26.7%), lack of trained personnel 13 (20%) and other factors with 4 (6.7). The findings indicated that the factors influencing waste reduction practices are based on management, leadership and location of slaughterhouses in Kirinyaga County.

Table 4.7 Stakeholders Interested in Waste Source Reduction Practices

Stakeholder	Frequency	Percentage
County Government	26	40%
NEMA	52	80%
Recycling Companies	0	0%
Residents in the area	13	20%
Slaughterhouse management	56	86.7%
Education Institutions	43	66.7%
Others	17	26.7%

The findings show that the stakeholder most interested with waste source reduction practices is slaughterhouse management with 56 (86%) of the respondents mentioning it. NEMA was also seen as an important stakeholder with 52 (80%) of respondents followed by the education institution with 43 (66.7%) of the respondents. The rest are County government with 26 (40%) of respondents, others with 17 (26.7%), residents in the area with 13 (20%), and recycling companies with 0 (0%) of respondents. This data implies that the interest of the

stakeholders in waste reduction practices is influenced by the benefits in business environment, environmental watch services and educational research.

4.4.2 Waste Recycling Management Practices

The study sought to find out different types of waste recycling practices; factors influencing waste recycling practices and the stakeholders interested in waste recycling practices in slaughterhouses in Kirinyaga County. The findings are shown in Tables 4.8 to 4.10.

Table 4.8 Waste Recycling Management Practices

Recycling Practices	Frequency	Percentage
Collection in rows and vessels	39	60%
Sorting and processing raw materials	35	53%
Producing mature compost	65	100%
Others	4	6.7%

The findings show that all slaughterhouses in Kirinyaga County use waste in producing compost manure as indicated by 65 (100%) of the respondents. Sorting and processing raw materials practice was indicated by 35 (53%) of the respondents. Others waste recycling practices like pouring waste water on horticulture gardens was indicated by 4 (6.7%) of the respondents. No respondent indicated remanufacturing of raw materials. These findings indicate that recycling of waste in slaughterhouses focuses basically on producing manure, sorting and preparing skins to sell elsewhere.

Table 4.9 Factors Influencing Waste recycling Practices

Factors	Frequency	Percentage
Cost of the machinery	13	20%
Lack of trained personnel	9	13.3%
Lack of support from local authority	9	13.3%
Poor waste management plan	35	53.3%
Poor information flow from NEMA	13	20%
Location of the slaughterhouse	48	73.3%

The analysis show that 48 (73.3%) of the respondents indicated that location of the slaughterhouse has great influence on waste recycling practices. Poor waste management plan was cited by 35 (53.3%) while cost of machinery and poor information from NEMA was cited by 13 (20%) of the respondents each. The other factors cited were lack of trained personnel and lack of support from the local authority cited by 9 (13.3%) respondents each. No other factor was cited by the respondents. These findings indicated that waste recycling in slaughterhouses in Kirinyaga County is mostly influenced by the location of the slaughterhouse, waste management plan and relevant information flow from the relevant authorities.

Table 4.10 Stakeholders Interested in Waste Recycling Practices

Stakeholders	Frequency	Percentage
County Government	4	6.7%
NEMA	26	40%
Residents in the area	9	14%
Slaughterhouse management	65	100%
Education Institutions	26	40%
Others	8	12%

In responding to the stakeholders interested in waste recycling practices, 65 (100%) of respondents indicated slaughterhouse management as the stakeholder most interested in waste recycling. NEMA and educational institutions were indicated by 26 (40%) of respondents each. Residents of the area were indicated by 6 (14%) of the respondents while the County Government was indicated by 4 (6.7%) respondents. Other stakeholders like farmers were indicated by 8 (12%) of the respondents and no respondent indicated recycling companies.

These findings indicated that the stakeholder most interested in waste recycling practices in the slaughterhouses in Kirinyaga County is those who manage the facility.

4.4.3 Waste Energy Recovery Management Practices

The study sought to find out; different types of waste energy recovery practices; factors influencing waste energy recovery practices and the stakeholders interested in waste energy recovery practices in slaughterhouses in Kirinyaga County. However all 65 respondents indicated that no slaughterhouse visited in Kirinyaga County had implemented any energy recovery practice like natural gas production, biomass production and others.

Table 4.11 Factors Influencing Waste Energy Recovery Management Practices

Factors	Frequency	Percentage
Cost of the machinery	35	53.3%
Lack of trained personnel	30	46.7%
Lack of support from local authority	9	13.3%
Poor waste management plan	9	13.3%
Poor information flow from NEMA	48	73.3%
Location of the slaughterhouse	39	60%
Others	9	13.3%

In responding to the factors influencing waste energy recovery practices, 48 (73.3%) of respondents indicated that there is a poor flow of information from NEMA while 39 (60%) mentioned the location of the slaughterhouse. 35 (53.3%) of the respondents indicated the cost of the machinery while 30 (46.7%) lack of trained personnel. Lack of support from local authority, poor waste management plan, and others are indicated by 9 (13.3%) respondents each. These findings indicated that waste energy recovery needs the relevant information, convenient location of the slaughterhouse and funds availability.

The study shows that 65 (100%) respondents did not indicate any stakeholder interested in waste energy recovery in the slaughterhouses in Kirinyaga County. They were asked whether the County Government, NEMA, recycling companies, residentsin the area, slaughterhouse management, educational institutions or any other entity were stakeholders interested in

waste energy recovery. This data may indicate that there is lack of knowledge of waste energy recovery practices or no felt need for such energy.

4.4.4 Waste Disposal Management Practices

The study sought to find out; different types of waste disposal practices; factors influencing waste disposal practices and the stakeholders interested in waste disposal practices in slaughterhouses in Kirinyaga County. The findings are shown in Tables 4.14 to 4.16.

Table 4.12 Waste Disposal Management Practices

Disposal practices	Frequency	Percentage
Rubbish pit	65	100%

The study indicated that all slaughterhouses in Kirinyaga County use rubbish pit to dispose the waste which cannot be recycled in any way as shown by 65 (100%) of respondents. Other practices like properly designed landfills, Combustion or collection by County Government were not present. These practices need financing, advanced technology and support of the local authority. These elements are lacking in many slaughterhouses in Kirinyaga County.

Table 4.13 Factors Influencing Waste Disposal Management Practices

Factors	Frequency	Percentage
Cost of the machinery	4	6.7%
Cost of construction and management	65	100%
Poor employees training	4	6.7%
Lack of support from local authorities	4	6.7%
Poor information flow	4	6.7%
Location of the slaughterhouse	53	81.5%
Others	4	6.7%

The respondents were asked to mention the factors influencing waste disposal practices and the analysis showed that 65 (100%) of the respondents mentioned cost of construction and

management as the most important factor while 53 (81.5%) of respondents indicated location of the slaughterhouse. Low technology factor was indicated by 43 (66.7%) of respondents whereas cost of the machinery, poor employee training, lack of support from local authorities, poor information flow and others were indicated by 4 (6.7%) of respondents each. These findings indicate that slaughterhouses in Kirinyaga County need enough funds, planning and right technology to implement waste disposal well.

Table 4.14 Stakeholders Interested In Waste Disposal Management Practices

Stakeholders	Frequency	Percentage
County Government	65	100%
NEMA	65	100%
Recycling Companies	0	0%
Residents in the area	43	66.7%
Slaughterhouse management	65	100%
Education Institutions	65	100%

The data showed that 65 (100%) of the respondents indicated that County Government, NEMA, slaughterhouses management and educational institutions were stakeholders interested in waste disposal management practices. The data also shows that 43 (66.7%) of respondents indicated residents in the area as stakeholders of waste disposal practices. Recycling companies were not mentioned as stakeholders.

4.5 Most Efficient Waste management Practices

The study sought to identify the most efficient waste management practices in slaughterhouses in Kirinyaga County.

Table 4.15 Most Efficient Waste management Practices

Waste management Practice	Frequency	Percentage
Waste reduction	30	46.7%
Waste recycling	26	40%
Waste energy recovery	4	6.7%
Waste disposal	7	13.3%

The data shows 30 (46.7%) of the respondents indicated that waste reduction practice is the most efficient in slaughterhouses in Kirinyaga County while 26 (40%) of the respondents mentioned waste recycling as the most efficient. 7 (13.3%) of the respondents waste disposal practice whereas4 (6.7%) of the respondents mentioned waste energy recovery. This data indicates that many people are aware of the waste generated from the slaughterhouses and they think reduction techniques should be established. Other practices of waste management need the provision of necessary information, training and funds.

4.6 Challenges Facing Implementation of Waste Management Practices in Slaughterhouses in Kirinyaga County and the Suggested Solutions.

The study also sought to establish the challenges experienced when dealing with waste management practices in slaughterhouses in Kirinyaga County and some solutions. The respondents were also asked to suggest the solutions to the challenges encountered.

Table 4.16 Challenges and Solutions of Waste Management practices

No.	**Challenges Facing Implementation of Waste Management Practices**	**Proposed Solutions**
1	Poor allocation of funds to manage waste by the owners of slaughterhouses	Start slaughterhouses owners association where they can learn from one another and also receive training from NEMA, County Government and other organizations
2	location of the slaughterhouse	Strict governmental control on all slaughterhouses.
3	Cost of the machinery	Government to facilitate loans to help the owners of slaughterhouses to implement efficient waste management practices
4	Lack of employees training	Staff should undergo adequate training to help them handle waste management practices.
5	Lack of information	NEMA and the County Government should avail the needed information to the slaughterhouses
6	New technology	NEMA and County government should update the slaughterhouse staff on all new technology and facilitate their use

As indicated in table 4.18 above, one of the challenges mentioned by the respondent is the poor allocation of funds to manage waste by the owners of slaughterhouses. Most slaughterhouses in Kirinyaga County are privately owned 49 (96%) as shown by the report of the County veterinary officer Appendix V. Some of these owners are not so keen on allocating enough funds to waste management. The solution to this challenge was suggested

by the respondents as to start slaughterhouses owners association where they can learn from one another and also receive training from the County Government and other organizations.

Respondents also mentioned location of the slaughterhouse as a challenge to waste management practices. Most of the slaughterhouses visited are located in private land and well isolated from any residential area. This environment does not stimulate the management of these slaughterhouses to come up with modern waste management practices. The solution to this challenge was suggested by the respondents as strict governmental control on all slaughterhouses.

The other challenge is cost of the machinery. For example a biogas digester would cost between 250,000 Kenya shillings to 300,000 which is an amount of money many slaughterhouses are not ready to utilise for this purpose. The solution to this challenge according to respondents is that the government to facilitate loans to help the owners of slaughterhouses to implement efficient waste management practices.

The respondents mentioned lack of employees training as another challenge facing waste management practices. The employees are trained to do their work by the owners of the slaughterhouses, fellow employees or by meat inspectors. Thus itôs difficult for them to know well organised processes which have to do with waste management practices. Respondents suggested that slaughterhouse staff should undergo adequate training to help them handle waste management practices. Lack of information on processes of waste management practices was mentioned by the respondents and they suggested that NEMA and the County Government should avail the needed information to the slaughterhouses. The new technology involved was also mentioned as challenge by the respondents. The suggestion was that NEMA and County government should update the slaughterhouse staff on all new technology and facilitate their use. Just as other institutions are updated in the new technology, slaughterhouse staff needs to be given the necessary information.

CHAPTER FIVE

SUMMARY OF THE FINDINGS, DISCUSSIONS, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

The Chapter provides the summary ofthe findings, discussions, conclusions and some recommendations of the study.

5.2 Summary of the Findings

The summary of the findings in this study has been categorized according to the themes drawn from research questions. They present the general findings on each of the variables studied.

5.2.1 Influence of Waste Source Reduction Management Practice on Natural Environment Conservation in Slaughterhouses in Kirinyaga County

The findings of this study indicated that 4 waste source reduction management practices were present in all the slaughterhouses visited namely; sufficient water to clean up the facilities, animal holding areas which were easy to clean, trained employees able to handle various processes of cleanliness in the slaughterhouses and healthy horticultural gardens which consume most of the waste water and manure. These practices reduce the accumulation of waste around the slaughterhouses hence they contribute in the conservation of the natural environment.

The respondents interviewed revealed as many as six factors which influence the implementation of waste source reduction practices which includes: Poor waste management plan, lack of support from local authority, location of the slaughterhouse, poor information flow from NEMA, lack of funds andlack of well trained personnel.The study findings also showed that there were 4 stakeholders interested in waste reduction management who were: Slaughterhouse management,NEMA, educational institutions, and County government.The activities of these stakeholders help in the conservation of the natural environment because they have adequate waste source reduction activities.

5.2.2 Influence of Waste Recycling Management Practices on Natural Environment Conservation in Slaughterhouses in Kirinyaga County

The study revealed the presence of 3 waste recycling management practices namely: producing mature, collection in rows and vessels, sorting and processing raw materials. Only the production of manure was common to all slaughterhouses while other practices sporadically implemented. The study findings revealed 6 factors influencing the implementation of waste recycling management practices namely: Location of the slaughterhouses,waste management plan, cost of machinery, information flow from NEMA, trained personnel and support from local authority. There were 5 stakeholders interested in waste recycling management practices that were: Slaughterhouse management, NEMA, educational institutions, residents in the area and County Government.

5.2.3 Influence of Waste Energy Recovery Management Practices on Natural Environment Conservation in Slaughterhouses in Kirinyaga County

The study revealed that there were no waste energy recovery management practices implemented in slaughterhouses in Kirinyaga County. There were 7 factors influencing the implementation of these practices which include: Information flow from NEMA, location of the slaughterhouses, cost of the machinery, trained personnel, support from local authority and waste management plan.There were no stakeholders interested in waste energy recovery management practices in the slaughterhouses in Kirinyaga County.

5.2.4 Influence of Waste Disposal Management Practices on Natural Environment Conservation in Slaughterhouses in Kirinyaga County

The study revealed only 1 waste disposal management practice in slaughterhouses in Kirinyaga County. There were 9 factors influencing the implementation of waste disposal practices in slaughterhouses in Kirinyaga County which are: Cost of construction and management, location of slaughterhouse,low technology availability, Cost of machinery, poor staff training, lack of support from local authority and poor information flow.The study revealed 4 stakeholders interested in waste disposal practices namely: County Government, slaughterhouses management, educational institutions andresidents in the area.

5.3 Discussion of the Findings of the Study

The findings of the study have been discussed according to the four variables of the study namely waste source reduction management practices, waste recycling management practices, waste energy recovery management practices and waste disposal management practices.

5.3.1 Waste Source Reduction Management Practices

The findings of this study revealedfour waste source reduction management practices implemented in all slaughterhouses visited. Implementation of these practices indicated a notable contribution to the conservation of the natural environment in this County and beyond.However, these four practices needs a lot of improvement so that they can be more focused. According to Lebersorger& Schneider (2014), the focus of waste source reduction management practices should be on transfer of best practices, information, education of employees and customers.

According to the findings of this study,there were 6 factors influencing the implementation of waste source reduction practices.This number of factors indicated that first, waste reduction management practices in actual facts influence the natural environment conservation and secondly they point to the need of innovative interventions to these practices. An observation byMorrissey & Brown (2004), is in agreement with the first point when it states thatthe presence of factors influencing the implementation of waste source management practices indicates these practices influence the natural environment conservation. The observation byHazra&Goel, (2009) indicates that factors which influence waste source reduction practices are the aspects which facilitate the performance of the practices which are technical, environmental, financial, social-cultural, institutional and legal entities goes in line with the second point. Educating the staff and management of slaughterhouses on these factors may promote the performance of the practices in the facilities.

This study also identified 4 stakeholders who had adequate waste source reduction activities. This is in agreement with the observation ofMorrissey & Brown (2004) that the focus of

waste source reduction management practices includes identification of stakeholders. According to Tai et al (2011) the stakeholders are people or organizations that may have adequate waste source reduction activities, a point in agreement with the findings of this study.

5.3.2 Waste Recycling Practices

According to the findings of this study there were 3 waste recycling management practices implemented at different degrees in slaughterhouses in Kirinyaga County. However the most popular recycling practice was the production of manure and other practices are very poorly implemented.According to the findings of the study, slaughterhouses in Kirinyaga County have not been able to implement waste recycling practices because they involve complicated processes and the slaughterhouse staff needs more relevant information and training. According toEPA (2013), waste recycling management practices is a complicated process which involves a series of activities that involves the collection of used, reused, or unused items that would otherwise be considered waste; sorting and processing the recyclable products into raw materials; and remanufacturing the recycled raw materials into new products.Slaughterhouses in Kirinyaga County are ill equipped to such a process. This means that recycling management practices need to be revamped in slaughterhouses in Kirinyaga County.

The research findings showed that there were 6 factors influencing the implementation of waste recycling management practices. According to the findings of the study, to enhance waste recycling in slaughterhouses, management of the facility is important and where it is located.This is in line with the observation by Top (2014) which indicatesthat there are factors that limit recycling practices while Gonzalez &Adenso (2010) says that there are factors that encourage recycling habits. These influencing factors need to be understood carefully by the managements of the slaughterhouses.

There were 5 stakeholders interested in waste recycling management practices a point in agreement with WASTE (2004) that any waste management practice needs stakeholders. The most important stakeholder according to the findings is the management of the slaughterhouse.

5.3.3 Waste Energy Recovery Practices

The research findings revealed that slaughterhouses in Kirinyaga County had not started waste energy recovery management practices. This is due to the fact that these practices calls for advanced technology as indicated by EPA (2013) which states thatwaste energy recovery is the conversion of waste materials into heat, electricity, or fuel energy through a variety of processes like combustion, gasification, anaerobic digestion, and landfill gas (LFG) recovery. Apart from high technology, these practices are very costly to implement and even manage.

The findings of the study indicated 7 factors which influence the implementation of waste energy recovery management. The factors reveals the need of relevant information, funds, and trained personnel because as Zafar (2014) says the three paths of converting organic waste materials which are thermal chemical, physic-chemical and bio-chemical technology involve advanced technology and are costly. The findings revealed that no respondent recognised any stakeholder in waste energy recovery. This is against the observation of Rotich, Zhao and Dong (2014) that waste energy recovery is popular in Kenya.

5.3.4 Waste Disposal Practices

The findings indicated that only 1 waste disposal management practice is implemented in slaughterhouses in Kirinyaga County. This is rubbish pit either open or closed to dispose the waste which cannot be recycled in any way. This is also confirmed by a report by Gakungu et al (2013) that waste collected from most institutions in Kenya is disposed off in the rubbish pits. According to the findings of the study, efficient waste disposal management practices are costly in construction and management. This is in agreement with EPA (2011) which points out those modern landfills must be properly designed, constructed and managed. In order for the slaughterhouses to play important role in natural environmental conservation, effort must be made to put in place modern waste disposal practices.

5.4 Conclusion

The study sought to establish the influence of waste management practices on natural environmental conservation in slaughterhouses in Kirinyaga County. The study targeted slaughterhouses staff in Kirinyaga County. It was concluded that the practices investigated influences the conservation of natural environment in different ways.

The implementation of waste management practices in the slaughterhouses is instrumental to the conservation of the natural environment. These practices help to reduce the generation of waste which otherwise would increase the work and cost of management. The practices come with many benefits to the society such as cleanliness, food from horticulture, trained persons and clean compounds. Waste management practices stimulate the manufacture of new goods hence generates wealth and create job opportunities. Waste management practices encourage the production of green energy like biogas. These practices also help control the spread of diseases which are caused by poor handling of waste materials because they recommend modern waste disposal methods.

There are different factors which influence waste management practices which have a double implication. One that waste management practices influence the natural environment conservation. Secondly these factors call for the right focus and the best innovative initiatives. The focus of waste management practices should be on transfer of best practices, information, education of employees and customers. To be innovative waste management practices have to be informed of the best available technology, best ways of environmental conservation, financial management, social-cultural sensitivity, institutional rules and legal entities requirements. This opens up a bright future for waste management practices not only in Kirinyaga County but in the whole Country.

Waste management practices need stakeholders who are people or organizations that may have adequate waste management activities. Stakeholders may include members of the community surrounding the slaughterhouse, legal entities, educational institutions and individuals. These would contribute in the innovation of waste management practices, market for the manufactured goods, challenge for new technology among others.

5.5 Recommendations

Based on the findings and Conclusions made above, the study makes the following recommendations.

5.5.1 Increase Waste Management Practices

According to the findings of the study there were 8 waste management practices operational in Kirinyaga County but these are not enough. Therefore there is the need to transfer the best waste management practices, promptly make available the needed information on waste management, and educate employees, customers and stakeholders on their roles in waste management. This should be a combined effort NEMA which has immense responsibility in environmental conservation, County Government which should be the first stakeholder in environmental matters in the locality and educational institutions which are constantly searching for information from these slaughterhouses.

5.5.2 Constant Renewal of Waste management Practices

Secondly the findings of this study revealed that waste management practices needs constantly to be revamped with thebest available technology, best ways of environmental conservation, financial management, social-cultural sensitivity, institutional rules and legal entities requirements. Again this is the responsibility of NEMA, management of slaughterhouses, County government, social groups, religious groups and individuals who have interest in natural environmental conservation.

5.5.3Support the Stakeholders of Waste management Practices

Thirdly the findings of this study confirmed that waste management practices needs to have stakeholders. These would play such roles as identifying the raw materials which can be obtained from the waste, proposing the possible goods which may be manufactured, searching for markets for these goods among others. Therefore these individuals and groups need to be organised, and educated on their roles in waste management practices. The responsible in this work is the management of the slaughterhouse because other groups can come in only through the initiative of this. However, again NEMA, County Government and educational institutions should educate the slaughterhouse management on this responsibility.

5.6 Suggestions for Further Studies

Slaughterhouses need to be given weight just like any other small scale industries and their influence on natural environmental conservation should not be under looked. Therefore, more studies can be carried out in the following areas.

Influence of advanced and affordable technology on the implementation of waste management practices in slaughterhouses.

Influence of waste management practices on natural environment conservation: Cases of slaughterhouses in other Counties.

Influence of waste management practices on natural environment conservation: Cases of other small industries and small urban centres in Kenya.

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APPENDICES

Appendix I: LETTER OF TRANSMITTAL OF DATA COLLECTION INSTRUMENTS

Kago Peter Kariuki,
Registration No. L50/82331/2012
School of Continuing and Distance Education,
College of Extramural Studies,
University of Nairobi, Nairobi Centre

Dear Sir/ Madam.

RE: ACADEMIC RESEARCH

I am a student atNairobi University pursuing a Degree of Masters of Arts in Project Planning and Management. I am conducting an academic research on the influence of waste management practices on natural environment conservation: A case of slaughterhouses in Kirinyaga County.

Your slaughterhouse has been selected for data collection on this topic. The questionnaire seeks to obtain information on: Demography, waste source reduction management practices, waste recycling management practices, waste energy recovery management practices and waste disposal management practices.

I am inviting you to participate in this research project by making it possible for my team of guides to conduct an oral interview from the already prepared questionnaire to the staff and management of your slaughterhouse. Only 4 people are needed for the interview. I guarantee that all the responses will remain confidential and will not be identified with anyone personally. The results and findings will be used for academic purposes.

I greatly appreciate your help in furthering this research endeavour.

Yours Sincerely

Kago Peter Kariuki

Appendix II: QUESTIONNAIRE FOR SLAUGHTERHOUSESSTAFF

Section A: Demographic Information

1. Gender: Male ( ) Female ( )

2. What is your age in years?

a) 18 ï 23 ( )
b) 24 ï 28 ( )
c) 29 ï 33 ( )
d) 34 ï 38 ( )
e) 39 ï 43 ( )
f) 44 ï 48 ( )
g) Over 54 ( )

3. How long have you been in slaughtering business?

a) Less than one year ( )
b) 1 to 5 years ( )
c) 6 to 10 years ( )
d) Over 10 years ( )

4. How long have you been in this slaughterhouse?

a) Less than one year ( )
b) 1 to 5 years ( )
c) 6 to 10 years ( )
d) Over 10 years ( )

Section B. Waste Source Reduction Management Practices

This objective seeks to identify how waste source reduction management practices influence natural environment conservation in slaughterhouses in Kirinyaga County.

5. Which of the following waste reduction practicesare used in this slaughterhouse? Put a tick in the space next to the right response.

Animal holding area which allow easy collection of waste and cleaning.	
Good water supply in animal slaughtering area.	
Not slaughtering infected animals	
Training employees in waste management	
Other	

6. Which of the following factors influence the implementation of waste reduction practices in your slaughterhouse?

Lack of funds	
Lack of trained personnel	
Lack of support from local authorities	
Waste management plan	
Poor information flow from environmental protection authorities	
Location of the slaughterhouse	
Others	

7. Which of the following stakeholders are interested with waste reduction practices in your slaughterhouse? Put a tick in the space next to the right response.

County Government	
National Environmental management Authority (NEMA),	
Recycling companies	
People in the nearby residential areas	
Slaughterhouse management	
Educational institutions	
Others	

Section C. Waste Recycling Management Practices

This objective seeks to determinehow waste recycling management practices influence natural environment conservation in slaughterhouses in Kirinyaga County.

8. Which of the following waste recycling practicesare used in this slaughterhouse? Put a tick in the space next to the right response.

Collection of waste in proper rows or vessels	
Sorting and processing the recyclable products into raw materials	
Remanufacturing the recycled raw materials into new products	
Combining organic waste to produce mature compost	
Others	

9. Which of the following factors influence the implementation of waste recycling practices in your slaughterhouse?

Cost of the machinery	
Lack of trained personnel	
Lack of support from local authorities	
Waste management plan	
Poor information flow from environmental protection authorities	
Location of the slaughterhouse	
Others	

10. Which of the following stakeholders are interested in waste recycling management practices in your slaughterhouse? Put a tick in the space next to the right response.

National Environmental management Authority (NEMA),	
County government	
Recycling companies	
Slaughterhouse management	
People in the nearby residential areas	
Educational institutions	
Others	

Section D. Waste Energy Recovery Management Practices

This objective seeks to determinehow waste energy recovery management practices influence the natural environment conservation in slaughterhouses in Kirinyaga County.

11. Which of the following waste energy recovery management practices are used in this slaughterhouse? Put a tick in the space next to the right response.

Natural gas energy production for heating, electricity and manufacturing.	
Biomass energy production	
Others	

12. Which of the following factors influence the implementation of waste energy recovery management practices in your slaughterhouse?

Cost of the machinery	
Low technology level	
Lack of employees training in waste management	
Lack of support from local authorities	
Waste management plan	
Poor information flow from environmental protection authorities	
Location of the slaughterhouse	
Others	

13. Which of the following stakeholders are interested in waste energy recovery management practices in your slaughterhouse? Put a tick in the space next to the right response.

National Government	
County Government	
National Environmental management Authority (NEMA),	
Recycling companies	
People in the nearby residential areas	
Slaughterhouse management	
Educational institutions	
Others	

Section E. Waste Disposal Management Practices

This objective seeks to examinehow waste disposal management practices influence natural environment conservation in slaughterhouses in Kirinyaga County

14. Which of the following waste disposal management practices are used in this slaughterhouse? Put a tick in the space next to the right response.

Landfills which are properly designed constructed and managed.	
Combustion which is controlled burning of waste	
Rubbish pit, open or closed	
Collected by County authority	
Others	

15. Which of the following factors influence the implementation of waste disposal management practices in your slaughterhouse?Put a tick in the space next to the right response.

Cost of the machinery	
Cost of construction and management	
Cost of transfer and transport	
Low technology availability	
Lack of employees training in waste management	
Lack of support from local authorities	
Poor information flow from environmental protection authorities	
Location of the slaughterhouse	
Others	

Section G. Efficient Waste Management Practices

The objective seeks to identify efficient waste management practices in slaughterhouses in Kirinyaga County.

16. From the following list which is the most efficient waste management practice for a slaughterhouse in order to conserve the natural environment?

Waste reduction method	
Waste recycle/composting method	
Waste energy recovery method	
Waste disposal method	
Any other	

Section H. Challenges and Solutions

17. Mentionthe challenges experienced when dealing with waste management practices.

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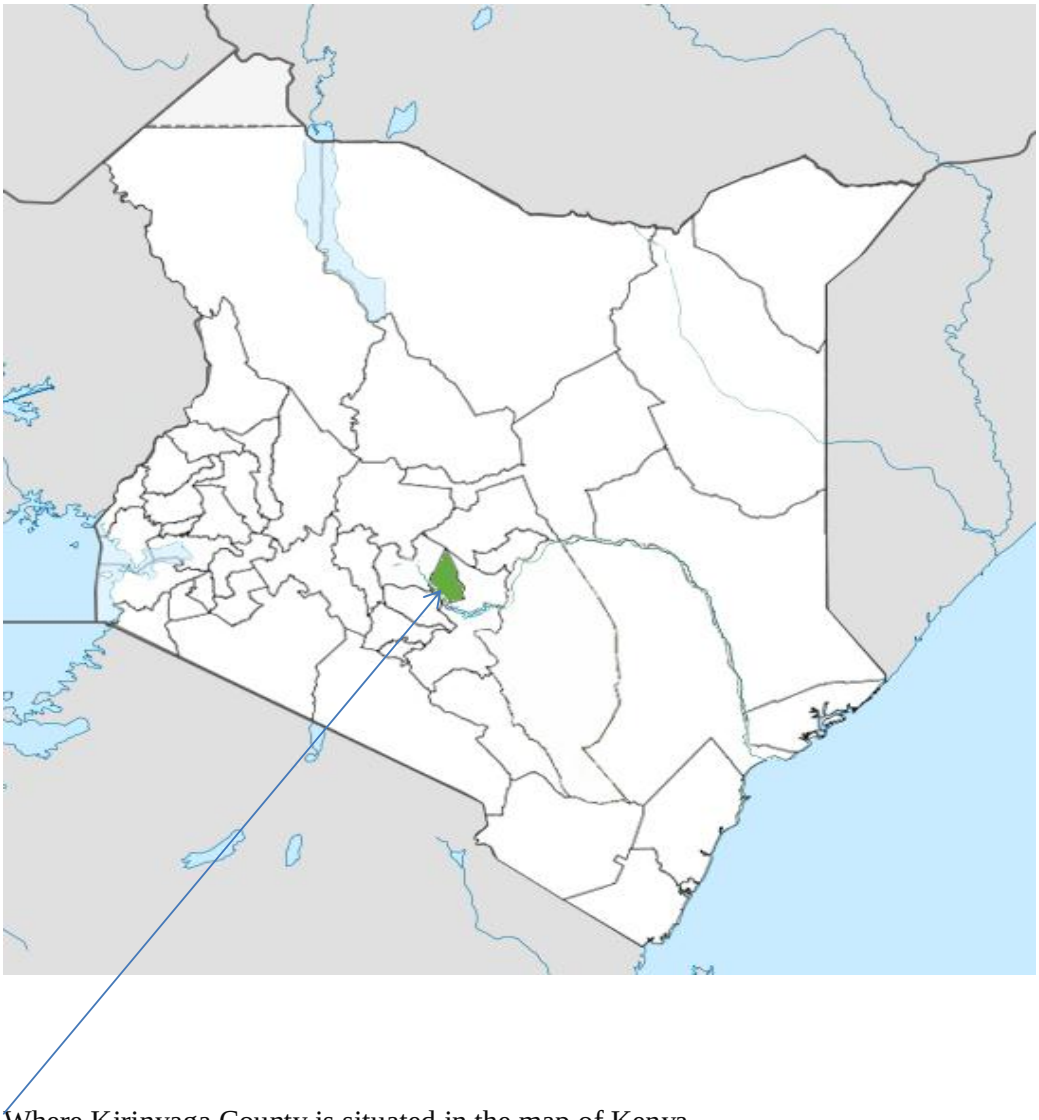
Appendix III: SLAUGHTERHOUSE FACILITIES: KIRINYAGA COUNTY, 2014. COMPILED BY DR. ABURI, KIRINYAGA COUNTY VETERINARY OFFICER.

S/NO	CENTRE	OWNERSHIP	SUB COUNTY
1.	Baricho	Private	Kirinyaga West
2.	Riakiania	County Government	Kirinyaga West
3.	Sagana	Private	Kirinyaga West
4.	Kibingoti	Private	Kirinyaga West
5.	Kianjege	Private	Kirinyaga West
6.	Kiangai	Private	Kirinyaga West
7.	Mathia	Private	Kirinyaga West
8.	Ndiriti	Private	Kirinyaga West
9.	Kutus	Private	Kirinyaga East
10.	Kutus	Private	Kirinyaga East
11.	Kianyaga	County Government	Kirinyaga East
12.	Kiamutugu	Private	Kirinyaga East
13.	Gathoge	Private	Kirinyaga East
14.	Muthigi-ini	Private	Kirinyaga East
15.	Karumandi	Private	Kirinyaga East
16.	Kamweti	Private	Kirinyaga East
17.	Kamugunda (cattle)	Private	Kirinyaga East
18.	Kamugunda (pigs)	Private	Kirinyaga East
19.	Kavote	Private	Kirinyaga East
20.	Kimunye	Private	Kirinyaga East
21.	Gatugura	Private	Kirinyaga East
22.	Rukenya	Private	Kirinyaga East
23.	Kianguenyi	Private	Kirinyaga East
24.	Kiangôombe	Private	Kirinyaga East
25.	Kabare	Private	Kirinyaga East
26.	Githure	Private	Kirinyaga East
27.	Kamwana	Private	Kirinyaga East
28.	Kerugoya (cattle)	Private	Kirinyaga Central
29.	Kerugoya (pigs)	Private	Kirinyaga Central
30.	Kiaratha (pigs)	Private	Kirinyaga Central
31.	Gitumbi	Private	Kirinyaga Central
32.	Kangaita (A)	Private	Kirinyaga Central
33.	Kangaita (B)	Private	Kirinyaga Central
34.	Karaini	Private	Kirinyaga Central
35.	Kibingo	Private	Kirinyaga Central
36.	Gatwe	Private	Kirinyaga Central
37.	Kiamaina	Private	Kirinyaga Central
38.	Kagumo	Private	Kirinyaga Central
39.	Kiandegwa	Private	Mwea West
40.	Mutithi	Private	Mwea West
41.	Gatuiri	Private	Mwea West
42.	Ciagini	Private	Mwea West
43.	Karii	Private	Mwea West
44.	Kimicha	Private	Mwea West
45.	Gathoge	Private	Mwea East
46.	Togonye	Private	Mwea East
47.	Mururi	Private	Mwea East
48.	Difathas	Private	Mwea East
49.	Murubara	Private	Mwea East
50.	Kimbimbi	Private	Mwea East
51.	Ndindiruku	Private	Mwea East

Appendix IV: MAP OF THE STUDY AREA



Where Kirinyaga County is situated in the map of Kenya

Appendix V: TABLE FOR DETERMINING SAMPLE SIZE FOR RESEARCH ACTIVITIES

Population Size	Confidence = 95.0% — Degree of Accuracy/Margin of Error				Confidence = 99.0% — Degree of Accuracy/Margin of Error			
	0.09	0.035	0.025	0.01	0.09	0.035	0.025	0.01
10	9	10	10	10	10	10	10	10
20	17	20	20	20	18	20	20	20
30	24	29	29	30	26	29	30	30
50	35	47	48	50	40	48	49	50
75	46	69	72	74	55	71	73	75
100	54	89	94	99	67	93	96	99
150	66	126	137	148	87	135	142	149
204	75	162	180	200	102	177	190	202
250	81	190	215	244	113	211	229	246
300	85	217	251	291	122	246	270	295
400	92	265	318	384	136	309	348	391
500	96	306	377	475	145	365	421	485
600	99	340	432	565	153	416	490	579
700	102	370	481	653	159	462	554	672
800	103	396	526	739	163	503	615	763
900	105	419	568	823	167	541	672	854
1,000	106	440	606	906	170	575	727	943
1,200	108	474	674	1067	175	636	827	1119
1,500	110	515	759	1297	180	712	959	1376
2,000	112	563	869	1655	186	808	1141	1785
2,500	113	597	952	1984	189	879	1288	2173
3,500	115	641	1068	2565	194	977	1510	2890
5,000	116	678	1176	3288	197	1066	1734	3842
7,500	117	710	1275	4211	199	1147	1960	5165
10,000	117	727	1332	4899	201	1193	2098	6239
25,000	118	760	1448	6939	203	1285	2399	9972
50,000	118	772	1491	8056	204	1318	2520	12455
75,000	118	776	1506	8514	204	1330	2563	13583
100,000	118	778	1513	8762	204	1336	2585	14227
250,000	119	782	1527	9248	205	1347	2626	15555
500,000	119	783	1532	9423	205	1350	2640	16055
1,000,000	119	783	1534	9512	205	1352	2647	16317
2,500,000	119	784	1536	9567	205	1353	2651	16478
10,000,000	119	784	1536	9594	205	1354	2653	16560
100,000,000	119	784	1537	9603	205	1354	2654	16584
264,000,000	119	784	1537	9603	205	1354	2654	16586

Krejcie & Morgan (1970)

Appendix VI: PHOTOS TAKEN IN VARIOUS SLAUGHTERHOUSES VISITED

Waste collection point in Sagana slaughterhouse

Waste water in Kibingoti Slaughterhouse used to grow bananas

Skins treated with salt in Kagumo (Mutira) slaughterhouse

Condemnation pit in Sagana slaughterhouse

Sagana slaughterhouse building

Waste water used to cultivate coffee in Kibingo slaughterhouse

Waste water left in the open and some of it is used to grow maize at the background

Cattle holding area at Murubara slaughterhouse

Meat ready to be collected by retail traders at Murubara