



**UNIVERSITY OF NAIROBI**

**STATUS OF WASTE MANAGEMENT AMONG HORTICULTURAL  
PROCESSING MICRO, SMALL AND MEDIUM ENTERPRISES IN KENYA**

**Benson Ouma Nyankone**

**A Thesis Submitted in Partial Fulfillment of the Requirements for the Award of  
the Degree of Doctor of Philosophy in Environmental Governance and**

**Management**

**Department of Earth and Climate Sciences**

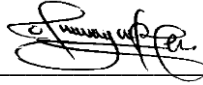
**Faculty of Science and Technology**

**University of Nairobi**

**2022**

## DECLARATION

This thesis is my original work and has not been presented for a degree in any other university.



**Benson Ouma Nyankone** 30/11/2022

**A82/53457/2018**

This thesis has been submitted with our approval as University Supervisors.

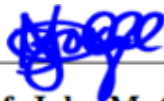


30/11/2022

**Prof. Michael W. Okoth**

Department of Food Science, Nutrition and Technology

University of Nairobi

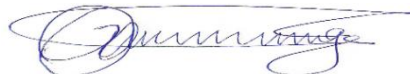


30/11/2022

**Prof. John Muthama**

Department of Earth and Climate Sciences

University of Nairobi



November 30, 2022

**Prof. George Abong'**

Department of Food Science, Nutrition and Technology

University of Nairobi



**UNIVERSITY OF NAIROBI  
DECLARATION OF ORIGINALITY FORM**

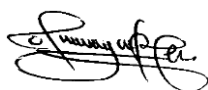
**Name of Student: NYANKONE BENSON OUMA**  
**Registration Number: A82/53457/2018**  
**Faculty: FACULTY OF SCIENCE AND TECHNOLOGY**  
**Department: EARTH AND CLIMATE SCIENCES**  
**Course Name: PhD IN ENVIRONMENTAL GOVERNANCE AND  
MANAGEMENT**

**Title of the work**

**STATUS OF WASTE MANAGEMENT AMONG HORTICULTURAL  
PROCESSING MICRO, SMALL AND MEDIUM ENTERPRISES IN KENYA**

**DECLARATION**

1. I understand what Plagiarism is and I am aware of the University's policy in this regard
2. I declare that this **THESIS** is my original work and has not been submitted elsewhere for examination, award of a degree or publication. Where other people's work or my own work has been used, this has properly been acknowledged and referenced in accordance with the University of Nairobi's requirements.
3. I have not sought or used the services of any professional agencies to produce this work
4. I have not allowed, and shall not allow anyone to copy my work with the intention of passing it off as his/her own work
5. I understand that any false claim in respect of this work shall result in disciplinary action, in accordance with University Plagiarism Policy.

**Signature:**   
.....

**Date: 30<sup>th</sup>, November, 2022**

## **DEDICATION**

I sincerely dedicate this dissertation to my late Father-William and Mother Priska - To my wife, Janet popularly referred to as Jano, my beloved children Eng. Howard Franklin, Louis Eleanor and Abraham Banneker, you are behind all my achievements in today's life. To you my siblings, your rivalry, healthy competition, quest for scholarly journey, productive life and future, propel me to success. And in Wise Words of the Holly Book-Proverbs 30; 28, a lizard's journey continues.

## ACKNOWLEDGEMENT

This thesis would not have been successfully completed without valuable support received from several sources. I acknowledge with immense gratitude, the support received from my supervisors, Prof. Michael W. Okoth, Prof. John Muthama and Dr. George Abong'. Your guidance, patience, and time in the whole process were phenomenal and appreciated. My tribute to the late Cousin Prof. Antony Jude Were and Step Father-Jeremiah Odundo, friends, kindly accept my sincere gratitude for your great support and for being part of my academic journey.

I also acknowledge and recognize the effort made by the Wangari Mathaai Institute of Environmental and Peace Studies for imparting valuable knowledge. I salute the Horti-Green project led by Fundacion Sustalde, Spain and funded by the European Commission (Project Grant; ENV/2017/391-393), for being part of my journey by providing resources for the research. Last but not least, my appreciation also goes to all horticultural processing Micro, Small and Medium Enterprises (MSMEs) in Kenya that I worked with for availing themselves for capacity building towards adoption of Sustainable Consumption and Production (SCP) Practices for better resource use and waste management, and the Horti-Green Project in the University of Nairobi for their support in fieldwork and ensuring timely deliverables.

## TABLE OF CONTENTS

<b>DECLARATION.....</b>	<b>ii</b>
<b>DEDICATION.....</b>	<b>iv</b>
<b>ACKNOWLEDGEMENT.....</b>	<b>v</b>
<b>TABLE OF CONTENTS .....</b>	<b>vi</b>
<b>LIST OF FIGURES .....</b>	<b>xi</b>
<b>LIST OF TABLES .....</b>	<b>xii</b>
<b>LIST OF APPENDICES .....</b>	<b>xiii</b>
<b>LIST OF ABBREVIATIONS .....</b>	<b>xiv</b>
<b>DEFINITIONS OF TERMS .....</b>	<b>xv</b>
<b>GENERAL ABSTRACT .....</b>	<b>xx</b>
<b>CHAPTER ONE: GENERAL INTRODUCTION .....</b>	<b>1</b>
1.1 Background to the Study .....	1
1.2 Statement of the Problem .....	8
1.3 Research Objectives .....	8
1.3.1 Overall Objective.....	8
1.3.2 Specific Objectives .....	8
1.4 Research Questions .....	9
1.5 Justification of the Study.....	9
<b>CHAPTER TWO: LITERATURE REVIEW.....</b>	<b>11</b>
2.1 Introduction .....	11
2.2 Waste, Society and Environment .....	11
2.2.1 Waste Production and Challenges by Horticultural MSMEs .....	12
2.2.2 Challenges Facing MSMEs Across the Globe .....	13
2.2.3 Climate Change Mitigation .....	20
2.2.4 Climate Change and Waste Management.....	22
2.3 The SDGs and Management of Waste by MSMEs.....	24
2.3.1 United Nations Conference on Environment and Development (UNCED) .....	26
2.3.2 UN-Habitat on Waste Management .....	26
2.3.3 Waste Management and the Constitution of Kenya, 2010 .....	28
2.3.4 NEMA Benefactions to Sustainable Waste Management .....	30

2.3.5 Vision 2030 towards Sustainable Industrial Waste Management .....	31
2.4 Knowledge, Attitude and Practices (KAPs) on Wastes Management .....	31
2.5 Capacity Building on Waste Management amongst MSMEs .....	33
2.6 Quantities of Wastes Generated by Horticultural Processing MSMEs.....	35
2.6.1 Nature and Extent of Fruit and Vegetable Losses .....	36
2.7 Legal and Regulatory Frameworks on Waste Management .....	37
2.7.1 Lack of Policy Enforcement and Responsibility .....	40
2.7.2 Enactment and Enforcement of Policy/Programs.....	41
2.7.3 A Comparative Synopsis of Waste Management policy, Legislation and Strategy Frameworks in the European Union, South Africa, Tanzania and Kenya .....	44
2.8 Waste Management Across the Globe .....	47
2.8.1 Sustainable Source Separation of Wastes in Panaji, India .....	49
2.8.2 A Vision towards Zero Wastes in San Francisco, USA .....	50
2.8.3 Financial Sustainability achievement in Latin America, Argentina and Colombia .....	52
2.8.4 Israel’s Automated waste collection.....	54
2.8.5 Waste Management amongst Horticultural Processing MSMEs in Kenya .	55
2.9 Integrated Waste Management.....	57
2.9.1 Inclusivity in Designing a Waste Management Service System .....	60
2.10. Sustainable Consumption and Production (SCP) Perspective .....	62
2.10.1 Technology Trends toward Waste Management.....	64
2.11 Theories on Waste Management.....	65
2.11.1 Behavioural Change Theory .....	66
2.11.2 The Environmental Citizenship Theory .....	67
2.12 Conceptual Framework .....	68
2.13 Research Gaps .....	70
<b>CHAPTER THREE: KNOWLEDGE, ATTITUDE AND PRACTICES ON WASTE MANAGEMENT AMONG HORTICULTURAL PROCESSING MSMEs IN KENYA.....</b>	<b>72</b>
Abstract .....	72
3.1 Introduction .....	73
3.2. Materials and Methods .....	76
3.2.1 Area of Study.....	76

3.2.2 Research Design .....	78
3.2.3 Study Population.....	78
3.2.4 Sampling Strategy and Sample Size.....	78
3.2.5 Research Instruments.....	80
3.2.6 Data Analysis.....	81
<b>3.3 Results .....</b>	<b>82</b>
3.3.1. Demographic Characteristics.....	82
3.3.2 Knowledge on Waste Management.....	84
3.3.3 Attitude on Waste Management .....	85
3.3.4 Practices on Waste Management amongst MSMEs .....	86
3.3.5 Waste Reduction amongst MSMEs.....	87
3.3.6 Regression Analysis to Show the Relationships of Variables.....	90
3.3.6.1 Influence of Knowledge on Waste Management Among Horticultural ...	90
3.3.6.2 Influence of Attitude on Waste Management Among Horticultural Processing MSMEs in Kenya .....	91
3.4 Discussion .....	93
3.4.1 Financial Impulses to Citizens on Waste Operation Enterprise .....	94
Fiscal.....	94
3.4.2 Social Instruments for Behavioral Change .....	97
3.4.3 Stakeholder’s Roles .....	98
3.5 Conclusions .....	99
3.6 Recommendations .....	100
<b>CHAPTER FOUR: EFFECTS OF CAPACITY BUILDING ON WASTE MANAGEMENT AMONG HORTICULTURAL PROCESSING MSMEs IN KENYA .....</b>	<b>102</b>
Abstract .....	102
4.1 Introduction .....	103
4.2 Materials and Methods .....	105
4.3 Results .....	106
4.3.1 Changes on Waste Management Before and After Capacity Building .....	107
4.3.2 The Effects of Capacity Building on Waste Management Among Horticultural Processing MSMEs in Kenya .....	109
4.4 Discussion .....	110
4.5 Conclusions .....	119



4.6 Recommendations .....	120
<b>CHAPTER FIVE: QUANTITIES OF SOLID AND LIQUID WASTES GENERATED BY HORTICULTURAL PROCESSING MSMES IN KENYA</b>	<b>121</b>
Abstract .....	121
5.1 Introduction .....	122
5.2 Materials and Methods .....	125
5.3 Results .....	126
5.3.1 Quantification of Waste Generated by Horticultural Processing MSMEs	126
5.3.2 SCP in Waste Management Among MSMEs Horticultural Processors in Kenya.....	128
5.4 Discussion .....	129
5.5 Conclusion.....	137
<b>CHAPTER SIX: INFLUENCE OF LEGAL AND REGULATORY FRAMEWORK ON WASTE MANAGEMENT AMONG HORTICULTURAL PROCESSING MSMES IN KENYA .....</b>	<b>139</b>
<b>Abstract.....</b>	<b>139</b>
6.1 Introduction .....	140
6.2 Materials and Methods .....	142
6.2.1 Study Setting.....	143
6.2.2 Sample Size and Sampling Procedure .....	144
6.2.3 Data Analysis.....	144
6.3 Results .....	145
6.3.1 Linear Regression Analysis of Legal and Regulatory Frameworks on Waste Management .....	148
6.4 Discussion .....	148
6.5 Conclusions .....	153
<b>CHAPTER SEVEN: GENERAL CONCLUSIONS AND RECOMMENDATIONS.....</b>	<b>155</b>
7.1 Conclusions .....	155
<b>REFERENCES.....</b>	<b>158</b>
<b>APPENDICES .....</b>	<b>181</b>
Appendix I: Kenyan Horticultural Processing MSMEs Questionnaire .....	181
Appendix II: Horti-green Project Field Visit Reports 2019/2020 .....	195
Appendix III: Field Activities .....	203

Appendix IV: Titles of Policy Frameworks Addressing Solid Waste Management in Kenya .....	209
Appendix V: Paired Samples Test on Before and After Capacity Building.....	211
Appendix VI: Pearson Correlation Analysis.....	212
Appendix VII: Abstract of Published Papers.....	216

## LIST OF FIGURES

Figure 2.1: Major Sources of Waste in Fruit and Vegetable Processing MSMEs; Source: Ouma et al., (2021) .....	57
Figure 2.2: Behavioral change Model (adapted from Hungerford & Volk, 1990) .....	66
Figure 2.3: Environmental Citizenship Model, adapted from Hungerford, 1990.....	68
Figure 2.4: Conceptual framework (Author, 2021) .....	69
Figure 3.1: Map of Kenya Showing the Four Areas of Study .....	77
Figure 3.2: Age of Respondents.....	83
Figure 3.3: Period in operation/Business .....	84
Figure 3.4: Methods of Waste Reduction Used .....	89
Figure 3.5: Waste Disposal.....	90
Figure 5.1: Waste Generation by MSMEs .....	129
Figure 6.1: Trained and certified Horticultural processing MSMEs in Kenya.....	143
Figure 6.2: Extent of Awareness and Compliance to Regulations .....	147
Figure 6.3: Extent of Awareness and Compliance to Regulations .....	147

## LIST OF TABLES

Table 3.1: Distribution of MSMEs Surveyed .....	75
Table 3.2: Strata of MSMEs Surveyed .....	79
Table 3.3: Marital Status.....	83
Table 3.4: Educational Level .....	83
Table 3.5: Knowledge on Waste management .....	85
Table 3.6: Attitude on Waste management.....	86
Table 3.7: Waste Management Practices .....	87
Table 3.8: Knowledge on Waste Management .....	91
Table 3.9: Attitude on Waste Management .....	92
Table 3.10: Practices on Waste Management .....	92
Table 4.1: Descriptive Analysis of Capacity Building on Waste Management .....	107
Table 4.2: The Extent (percent respondent) to which Changes have Occurred on Management of Waste in your Firm Before Training .....	108
Table 4.3: The Extent to which Changes have Occurred on Management of Waste in your Firm After Training .....	109
Table 5.1: Quantities of wastes Generated by Horticultural processing MSMEs .....	127
Table 5.2: Types of Wastes Generated by Horticultural Processing MSMEs.....	128
Table 6.1: Descriptive Analysis of Legal and Regulatory Frameworks in MSMEs ..	146
Table 6.2: Legal & Regulatory Framework on Waste Management .....	148
Table 6.3: Paired Samples Test.....	211

## **LIST OF APPENDICES**

Appendix I: Kenyan Horticultural Processing MSMEs Questionnaire .....	181
Appendix II: Horti-green Project Field Visit Reports 2019/2020 .....	195
Appendix III: Field Activities .....	203
Appendix IV: Titles of Policy Frameworks Addressing Solid Waste Management in Kenya .....	209
Appendix V: Paired Samples Test on Before and After Capacity Building.....	211
Appendix VI: Pearson Correlation Analysis.....	212
Appendix VII: Abstract of Published Papers.....	216

## LIST OF ABBREVIATIONS

<b>ASCU</b>	-	Agricultural Sector Coordination Unit
<b>EMCA</b>	-	Environmental Management and Co-ordination Act
<b>FAO</b>	-	Food and Agriculture Organization
<b>GHG</b>	-	Greenhouse Gas
<b>HRD</b>	-	Human Resources Development
<b>IWM</b>	-	Integrated Waste Management
<b>JICA</b>	-	Japan International Corporation Agency
<b>KAPs</b>	-	Knowledge, Attitude and Practices
<b>MSMEs</b>	-	Micro, Small and Medium Enterprises
<b>NDC</b>	-	Nationally Determined Contribution
<b>NEMA</b>	-	National Environmental Management Authority
<b>NGOs</b>	-	Non-Governmental Organizations
<b>NIH</b>	-	National Institute of Health
<b>SCP</b>	-	Sustainable Consumption and Production
<b>SDGs</b>	-	Sustainable Development Goals
<b>SMEs</b>	-	Small and Medium Enterprises
<b>SWMS</b>	-	Solid Waste Management Systems
<b>SWM</b>	-	Sustainable Waste Management
<b>UN</b>	-	United Nations
<b>UNEP</b>	-	United Nations Environment Programme
<b>UNESCO</b>	-	United Nations Educational, Scientific and Cultural Organization
<b>UNFCCC</b>	-	United Nations Framework Convention on Climate Change
<b>UNICEF</b>	-	United Nations International Children's Emergency Fund
<b>UNSD</b>	-	United Nations Statistics Division
<b>USAID</b>	-	United States Agency for International Development
<b>WM</b>	-	Waste Management

## DEFINITIONS OF TERMS

**Ashes:** Residue from fires used for cooking and heating.

**Attitude:** a Feeling or opinion about something or away of behaving that is caused by this.

**Biodegradable:** Capable of being broken down by biological process (Vaughan, Adam, 2016).

**Biodegradation:** Metabolic process by which high energy organics are converted to low energy, CO<sub>2</sub>, and H<sub>2</sub>O.

**Capacity Building:** In the Global context, it refers to the ability of individual and institutions to make and implement decisions and perform functions in an effective and sustainable manner. Whereas at individual level, it refers to the process of changing attitudes and behaviors by imparting knowledge and developing skills while maximizing the benefits of participation, knowledge exchange and ownership. At Institutional level, it focuses on the overall organizational performance and functioning capabilities as well as the ability of an organization to adapt to change. While at systematic level, it emphasizes the overall policy framework in which individuals and organizations operate and interact with the external environment (Aini et al., 2017).

**Circular Economy:** Products are design and optimized for a cycle of disassembly and reuse. The intention is to extend the lifespan of consumables and to minimize the environmental impact of fuel disposal (EU, 2018a).

**Collection:** Those activities associated with the gathering and hauling of wastes to the location where the collection vehicle is emptied.

**Community Based Organization:** refers to public or private non-profit organizations with almost similar NGO associated values but emphasis its' focus on issues of the community from which it draws its members.

**Constitution:** The set of basic rules and laws/ political principles by which a state or organization is governed; especially in relation to the rights of the people it governs (Kenya Law Reports, 2010).

**Decomposition:** Reduction of net energy level and change in chemical composition of organic matter because of actions of aerobic or anaerobic microorganisms.

**Disposal:** Those activities associated with ultimate disposal of solid wastes interrelationship of functional elements comprising a solid waste management system (EU, 2018b).

**Dumping:** The final disposal of all refuses by uncontrolled, indiscriminate deposition on sand areas, in pits or quarries, rivers, etc.

**Effluent:** Out flowing liquid and broken by the action of anaerobic bacteria.

**Environmental Management:** Is a system that incorporates processes for monitoring, reporting, developing and executing the environmental policies with an aim of ensuring a healthy state of our planet for future generations. Whereas in Business, environmental management is said to be a corporate strategy that monitors, develops and implements environmental policies of an organization which is gaining due prominence as consumers are looking for products and services that are Eco-friendly and Eco-aware



(World Business Council for SDGs (2017b).

**Garbage:** Organic and generally biodegradable wastes from the preparation and processing of foods in homes, Solid and Liquid Waste Management restaurants, food processing and packaging plants abattoirs and other similar establishments (U.S. Environmental Protection Agency. (2020a).

**Garden trash:** Grass clippings, flowers, shrubbery and tree trimmings, leaves, and other tree droppings (UNFCCC, 2017).

**Horticultural production technology:** This is the technique of providing favorable environment and artificial climatic conditions to plants including processing of food harvest scientifically with the aim of optimizing costs, minimizing input and maintaining a steady production (Kaza *et al.*, 2018).

**Influent:** Inflowing liquid/water that flows into a waste treatment center.

**Knowledge:** Awareness, understanding of a phenomena or information about a subject area or information that has been obtained by experience or study, and that is either in a person's mind or possessed by people generally (Adogu *et al.*, 2015).

**Legal Frameworks:** Comprise a set of documents that includes the Constitution, legislation, regulations and contracts (Henry *et al.*, 2017).

**On-site handling, storage, and processing:** Activities associated with the handling, storage, and processing of solid wastes at or near the point of generation.

**Practice (s):** Something that is usually or regularly done, often as a habit, tradition or custom. Also refers to the act of doing something regularly or repeatedly to improve

individuals' skill at doing it.

**Recyclable:** Materials or items which can economically sorted out and removed from refuse for sale refuse by private enterprise (Sagasti *et al.*, 2016).

**Residues:** Solid material which is left (discharged) at the end of burning (incineration).

**Rubbish:** Combustible wastes including paper, cardboard boxes, barrels, wood, tree branches yard trimmings, furniture originating from homes institutions hotels, markets, Stores etc.

**Sewer:** A pipe containing sewage or wastewater Solid and Liquid Waste Management.

**Solid wastes:** Is all the wastes arising from human and animal activities that are normally solid and that are discarded as useless or unwanted.

**Sullage:** Domestic dirty water not combined with excreta.

**Sustainable Consumption and Production;** Is about promoting resource and energy efficiency, sustainable infrastructure, and providing access to basic services, green and decent jobs and a better quality of life for all. Its implementation helps to achieve overall development plans, reduce future economic, environmental and social costs, strengthen economic competitiveness and reduce poverty (UNEP, 2017).

**Sustainable Development Goals:** The Sustainable Development Goals are the blueprint to achieve a better and more sustainable future for all. They address the global challenges we face, including those related to poverty, inequality, climate change, environmental degradation, peace and justice (UN-SDG, 2015).

**Sustainable Development:** Is development that meets the needs of the present without

compromising the ability of future generations to meet their own needs (UNESCO, 2018b).

**Transfer and transport:** Those activities association with the transfer of wastes from the smaller collection vehicle to the larger transport equipment and the subsequent transport of the wastes, usually over long distance, to the disposal site (Chaban Malt, 2016).

**Waste generation:** Those activities in which materials are identified as no longer being of value and are either thrown away or gathered together for disposal (Assefa, 2017).

**Waste Management:** Involves a process whereby wastes are collected, transported and disposed of in the best possible way of limiting or eliminating the harmful effect of wastes (Thompson *et al.*, 2016).

**Waste:** That part, whole or remains of a product after sorting or processing awaiting another user or disposal to known or unknown destination (New definition researcher) (Researcher, 2021).

## GENERAL ABSTRACT

Horticultural recycling Micro, Small and Medium Enterprises (MSMEs) in Kenya use raw agrarian yield to induce large amounts of solid and liquid waste. Waste operation includes the conditioning and conduct needed to manage wastes from commencement to its final disposal. These include collection, transportation, treatment and disposal of waste, and monitoring and regulating the waste operation. Shy and unhappy knowledge of the running of horticultural wastes may have serious health counteraccusations and a significant impact on the terrain as well. This is so because if people retain good knowledge of waste operations, they can cover themselves from contagious conditions and clean the terrain. Still, there's limited information on knowledge, station, and current waste operation practices among horticultural processing MSMEs in Kenya. Towards this line, the current exploration is to assess waste operation's influence among horticultural processing MSMEs on environmental operations in Kenya. With the help of a descriptive research design, basic information was gathered using structured questionnaires from forty-four (44) trained and Certified Horticultural processing MSMEs in Kenya derived from Nairobi, Central and Western regions after undergoing various training on waste management. The results indicated that most (90.3%) of those engaged in horticultural processing MSMEs businesses are married, affirming the family-oriented business tier model. The results showed that, before training for the MSMEs, their level of knowledge on reducing the quantity of waste and waste management was at 58% and 68%, respectively. The study established a significant association ( $p < 0.05$ ) between capacity building and waste management among horticultural processing MSMEs. Among the parameters measured, capacity building had the most impact on the respondents with a positive paradigm shift of behaviour and responsibility towards waste management only after undertaking specialised training. The respondents indicated that improper waste disposal has adverse effects and harms their environment (71%); their workplaces and neighbourhoods ought to be clean. About 83.9% segregated their waste, and 93.5% were not ISO 14001 certified. The respondent's knowledge of waste reduction showed that most MSMEs employ the principles of reuse and waste minimization to manage wastes at 52% and 45%, respectively. This was followed by recycling at 19% and Energy recovery at 16%. The result further indicated an association ( $p < 0.05$ ) of attitude and practices on waste management among Horticultural processing MSMEs. Therefore, there is a need to enhance knowledge through training towards sustainable consumption and production practices (SCP) among the horticultural processing MSMEs in Kenya. Results on Quantities of wastes generated by the horticultural processing MSMEs surveyed indicated that horticultural crop residues were the main contributor of wastes generated at 48% with a mean value of 3.355 and standard deviation of 1.199, followed by wastewater at 42% with a mean and Standard Deviation of  $M=3.194$  and  $Std. Dev.=1.167$  respectively. The results on awareness of Laws and regulatory frameworks governing waste management, the privilege of clean enough, safe drinking water and that there are penalties for violation of laws and regulations regarding improper waste disposal were; 93.5%, 100% and 96.8%, respectively. The regression analysis results on awareness and compliance with laws and regulatory frameworks on waste management among the horticultural processing MSMEs surveyed in Kenya showed a p-value of  $p < 0.05$  level, while the Standardized Beta Coefficient of 0.686,  $t=0.335$ . Therefore, there is a need to enhance knowledge through capacity building on waste management and implementation of legal and regulatory frameworks on waste. This will enhance the rapid-fire relinquishment of Sustainable Consumption and Production Practices (SCP) among the horticultural processing MSMEs within the Kenyan Territory.

## **CHAPTER ONE: GENERAL INTRODUCTION**

### **1.1 Background to the Study**

Globally, zero point seven four kilogrammes of waste are generated, while public waste accumulation changes from 0.11 to 4.45 kilogrammes per capita per day (OECD, 2015). It is projected that by 2050, waste generation quantities will triple the current volumes unless sustainable actions are adopted and practised. Solid and liquid waste management is a universal issue impacting everyone worldwide. Governments, citizens and business people make decisions concerning consumption and waste management, which impact everyday health, productivity, and environmental cleanliness (UNSD, 2017). According to the United Nations (World Population Report, 2017) ineffective waste management is polluting the world's oceans, seas, rivers, canals, arable lands for food production, clogging drains and causing floods, and transmitting diseases. This results from urbanization, economic development, and rapid population growth in many countries.

Currently, the Middle East and North Africa area produce the least garbage in absolute terms, while East Asia and the Pacific produce most of the world's waste 23 (6). However, Sub-Saharan Africa, South Asia, and the Middle East and North Africa areas are experiencing the largest increases in waste output; by 2050, total waste is expected to nearly quadruple in these regions. Food and green waste comprise further than 60% of waste in low and middle-income countries while in high-income countries; the number of organic wastes is generated in absolute terms. Globally, about thirty-seven per cent of waste is covered in dug-up holes, thirty-three per cent is thrown away openly, nineteen per cent is recycled and composted, and eleven per cent is incinerated

using modern technologies available (UN Report, 2015). In Kenya, the horticultural sub-sector plays an important part in food security, creating employment opportunities and poverty relief for many people (ASCU, 2014). The sub-sector contributes tremendously to food security and ménage inflows to maturity of local directors who operate the MSMEs. It also employs over 6,000,000 Kenyans, perfecting their livelihoods (Ministry of Agriculture, 2015a).

Waste may be used as a resource to help to realize economic, societal and environmental benefits, help create wealth and green jobs in the waste sector, and advance the circular economy to effectively and sustainably address the waste management issues (Constitution of Kenya, 2010). The European Council Directive (2011) defined waste operation as the collection, transportation, recovery, and disposal of waste, the management of related activities and the upkeep of disposal sites.

In a research conducted by Baran in 2014, he defined waste as the distinction between the position of the affair of helpful products and services that might be earned if all productive factors were allotted to their fashionable and loftiest uses underneath rational social order, and also the position that is really earned. Waste is one of the primary causes of nursery feasts, affects temperature change and successively affects farming product learning, so the requirement to develop property waste operation technologies and enterprise to cub this growing world challenge (Ngoc *et al.*, 2018). during this background, property Development factor number 11.6.1, as envisaged by the international organization, asserts that with rising population and rapid-fire urbanization trends, the population of civic solid waste has continued to extend in recent times, with waste operation services hard-to-please elevation and investment. Therefore, disposal of civic solid wastes may be a major drawback even though various

technologies and effective operations exist. Composting, recycling, and biomass chemical change offer enough technology to dispose of civic solid wastes (UNSD, 2017).

Waste originates from various streams and carries different characteristics, which can be further classified into breakable and non-breakable, as postulated by Demirbas (2016) and White *et al.* (2015). The major usually used teams are; Solid waste, Liquid and gassy waste (Physical state), Household/ Domestic waste (source), Artificial waste, marketable waste, agricultural waste, obliteration and construction waste, Mining waste, Dangerous waste and Non-hazardous waste (Environmental impact). Systematic waste management will scale back emigrations of nursery feasts, compromising the quality and health of the environment, contribute to the action of Kenya's Paris Agreement commitments, and reduce artificial waste, non-point run out and biodegradable pollution waste to Kenya's water bodies. Though farming products and the process has gathered instigation in recent times throughout Africa, there's no reliable documentation on the public position process and waste generated throughout product and process labour (Griesbach, 2016).

According to the farming Crops board (HCD, 2015), products inflated from MTs in 2011 to MTs in 2013. Still, many government agencies and development systems are acting on mango and have created helpful reports that validate their specific areas of interest. The Ministry of Agriculture (MOA) produces the sole public info on mango and different farming merchandise. This is often comprehensive of product in metric tons, space underneath product, yields and yield price in African shillings. Sadly, the reports contain numberless crimes. In 2015, the farming Crops Development Authority (HCDA) coordinated a technical team to validate flightless bird farming product

knowledge for 2015- 2017, including mango. Per the accurate report, Mango is the third most created fruit once, followed by bananas and pineapples. The most bothering farming product is pests, particularly the mango beetle and fruit cowl. A coordinated IPM programme for persecutor management is important for higher quality mangoes products. Different price addition enterprises, just like the frozen mango, that was reportable to possess associate implicit niche request, have to be compelled to be explored (Kaminchia, 2017). Kenya Agricultural Analysis Institute (KARI) experimenters have worked on farming products various times and created a variety of specialized reports on farming merchandise within the Kenyan Territory.

A number of researches have been done on knowledge, attitudes and practices on wastes management. Adogu *et al.*, (2015) research findings showed that awareness of waste management accounted for 90% and a positive attitude on waste management was 97.5%. According to UNEP (2015) study industries/processors undertake their own disposal of mixed waste and transport to non-designated waste landfills. The research by Akenji *et al.*, (2016) on waste disposal and management also showed a result of tested hypotheses of 0.05 level of significance- negative attitude towards management and disposal of wastes. Therefore, inadequate data on the determination of status on waste management among horticultural processing MSMEs in Kenya motivated the researcher to evaluate these phenomena and find solutions thereafter.

The Kenya's 2010 Constitution incorporated proper legislation and other measures to protect the benefits of our environment today and tomorrow for future generations. Further, it assigns responsibility for solid waste disposal in the Counties as stipulated in the *Fourth Schedule, Part 2, Paragraph 2 (g)*.



Policy Frame is a set of principles, comprising of long – term pretensions and used as a base of making rules, decision timber, planning and development of any organizational system that leads to intervention (Ogutu, 2019). Policy frame on Solid Waste Management includes National laws, Acts, regulations, indigenous and transnational conventions, covenants and agreements which are ratified and domesticated to by public governments (UNEP, 2016). The policy frame transcends all the situations, transnational (global), indigenous, public and original. Policy spells out what's to be done and the asked issues and citizens use it encyclopedically to hold Governments Responsible for public service delivery, for case solid waste operation. programs do evolve, and a good policy should lead to the development of several regulations.

The elaboration of policy perpetration on SWM in Kenya has taken a progressive development of the policy geography. The first policy frame applicable to SWM was the Penal Code of 1948 that proscribed anyone to contaminate the atmosphere and water sources. The original Government Act Cap 265(1963), which gave super eminent authorities power over sanitation of SWM services. The Public Health Act Cap 242(1986). still, norms for service provision wasn't defined by these Acts, neither did the demand for waste minimization, resource recovery or recycling. also, solid waste wasn't defined or classified (Gakungu *et al.*, 2017). According to UNCED (1992), the Rio Declaration on Environment and Development, which forms docket 21, states that effective operation of solid waste, is a concern in the drive towards achieving sustainable development in all countries across the globe.

The global programs and regulations aim at fostering integration of sustainable development (SD) principles into specific country programs and program enterprise that are in line with the global programs in operation of solid waste. The rearmost policy frame on waste operation, is the Sustainable Waste Management Act, no. 31 of 2022. The Act, consists of 35 papers and divided into ten corridors, provides for the establishment of a legal and institutional frame for the sustainable operation of waste; for icing the consummation of the indigenous provision on the right to a clean and healthy terrain and for connected purposes. The Act covers domestic waste, waste electronic outfit, extended patron responsibility, dangerous waste, artificial waste, organic and non-organic waste, payment for environmental service, pollution, private sector reality, patron, public reality, reclaim, throw away, recovery, sustainable waste operation, waste operation installation.

Policymakers put a lot of work into defining the concept of MSMEs in various countries, which differ from one nation to another depending on the indicators utilized (Visser, 2014). SMEs are primarily defined as businesses with fewer than a certain number of employees under the primary criteria, which is backed by the number of employees (i.e. can range from 10 to 50 employees). The second criteria identify SMEs and distinguish between the formal and informal economies based on the degree of legal formality. Micro, small, and medium-sized businesses (MSMEs) aren't registered and don't adhere to the country's legal and regulatory frameworks.

Although the definition varies from one nation to another (depending on the economic structure), the legislative and institutional framework for Kenya's SMEs has been largely supported by the number of workers and, therefore, the company's yearly revenue. MSMEs Act, 2012). For instance, micro businesses are defined as those with

fewer than ten employees, yearly revenues of less than KES 500,000, and capital formation of but KES 5 million for services or but KES 10 million for manufacturers. Small businesses are those that employ between 10 and 50 people, have annual revenues between KES 500,000 and KES 5 million, and capital formation between 5 million and 20 million shillings for service-based businesses or between KES 5 million and 50 million for manufacturing-based businesses (Department of Trade and Industry, 2014).

According to OECD (2015), financial assets are used to define medium enterprises within the European Union. It requires an increase in the financial ceilings such that companies with between Fifty to Two Hundred and Forty-Nine workers could not make more than Fifty million in revenue. In addition, a balance sheet for a medium-sized, small, or micro-business shouldn't be over Forty-Three Million Euros in a given financial year.

Generally, the manufacturing and commerce (wholesale and retail) sub-sectors of the MSMEs sector in the nation are heavily involved in agro-based activities, which directly impact a wider population in society. For example, horticultural processing MSMEs in Kenya utilize raw agricultural produce, converting them to processed products for human utilization. During processing, large quantities of solid and liquid wastes are generated depending on the nature of raw materials, processing scale and adopted practices (World Bank Report, 2021).

## **1.2 Statement of the Problem**

Horticultural processing MSMEs surveyed utilize raw agricultural produce, converting them to processed products for human utilization. During processing, large quantities of wastes are generated per the nature of raw materials, the scale of processing and adopted practices. However, there is limited information on knowledge and current waste management practices, especially among horticultural processing MSMEs in Kenya. In this domain, this research sought to analyze the effects of Knowledge, Attitudes and Practices (KAPs), capacity building, quantities of waste generated, and the influence of legal and regulatory frameworks on waste management among horticultural processing MSMEs in Kenya.

## **1.3 Research Objectives**

### **1.3.1 Overall Objective**

The overall objective of this research was determine the status of waste management among horticultural processing micro, small and medium enterprises in Kenya.

### **1.3.2 Specific Objectives**

- i) To assess knowledge, attitude and practices on waste management among horticultural processing MSMEs in Kenya.
- ii) To analyse the effects of capacity building on waste management among horticultural processing MSMEs in Kenya.
- iii) To determine quantities of solid and liquid wastes generated by horticultural processing MSMEs in Kenya.
- iv) To analyse the influence of legal & regulatory frameworks on waste management among horticultural processing MSMEs in Kenya.

## **1.4 Research Questions**

The following questions guided the study:

- i) How do knowledge, attitude and practices influence waste management among horticultural processing MSMEs in Kenya?
- ii) What are the effects of capacity building on waste management among horticultural processing MSMEs in Kenya?
- iii) What quantities of solid and liquid wastes are generated by horticultural processing MSMEs in Kenya?
- iv) To what extent does legal and regulatory framework influence waste management among horticultural processing MSMEs in Kenya?

## **1.5 Justification of the Study**

The study aimed to improve or enhance the horticultural processing of fruits and vegetables through adoption of SCP practices which will enhance the supply of country's population with much-needed jobs while generating substantial money for local and foreign farmers. This study will be critical because it adds to the limited existing information on KAPs towards waste management among the MSMEs in Kenya. The study will be important to the horticultural processing MSMEs as it will provide them with a basis for adopting SCP practices toward efficiently waste management in their firms. At policy formulation levels, the research will become handy in providing the needed information on waste management policy updates and practices, for example, the adoption and practices of the three Rs in processing amongst the MSMEs, general public, and researchers, thereby engaging both public and private entities in managing waste generated during processing.

Horticultural processing MSMEs are a dully recognized sector through which middle-income and low-income Nations achieve their developmental goals and objectives. The output of the study will provide evidence and developed inputs for developing Waste management policies that aim to improve the sustainable waste management amongst these horticultural processing MSMEs in Kenya, thereby improving their life without compromising the quality of todays and future environment. This research will be important too since it will add information to scanty ones on the factors influencing waste management practices among horticultural processing MSMEs with regards to efforts towards sustainable environmental management and in compliance with SDG numbers 12, 13 and Vision 2030 as envisioned by the Kenyan government.

## **CHAPTER TWO: LITERATURE REVIEW**

### **2.1 Introduction**

Chapter two entails thorough scrutiny of related-scholarly work on the topic of study to shed more light on the theoretical and conceptual framework regarding the determination of status on waste management among horticultural processing MSMEs in Kenya.

### **2.2 Waste, Society and Environment**

Waste operations result in various categories impacting societies. Consequently, managing waste in any region impacts the daily livelihood and health of people living in a given environment. In tandem with the USA Environmental Protection Agency (2018), any waste or waste stream affects societal rubric and survival. According to a World Bank report (2018b), the informal sector in any community needs to be engaged and informed on the attributes of maintaining a clean and healthy environment, despite their economic status in the society. Additionally, modern and sustainable technologies are required to aid in effective waste management amongst these vulnerable communities.

Both liquid and solid waste operations have been linked to adverse environmental issues across the Globe. At the onset of unplanned waste gathering, indecorous dumping and setting of installations negatively impact the serenity of a given environment (World Bank, 2017a). Globally, waste is a major contributor to climatic changes and variations since it pollutes the environment on an unprecedented scale. In numerous middle-income Nations, shy collection and the unbridled jilting of wastes are going on by such populations, contaminating the environment and inhibiting fresh

oxygen/air circulation to people (Thompson, 2016).

In addition, leachate, a hazardous liquid discharge produced by garbage piles, may seep into gutters, groundwater, and soil. When organic waste enters aqueducts, less oxygen is available, which encourages the growth of harmful organisms (Bhada-Tata and Hoornweg, 2016). Additionally, runoff from sewage, weakening aqueducts, improperly disposed of solid waste onshore, and inadequate maritime vessel dumping practices contribute to marine pollution. Universal plastic operation is additionally resulting in adding non-biodegradable waste to natural surroundings.

A study on geographical areas validated that profitable levels of unmanaged wastes ditched or discarded aqueducts about three hundred seventy-five USA dollars; on the other hand, World Bank estimated IWM cost to be between fifty to one hundred dollars per ton (McKinsey, 2016). By conducting an environmental impact assessment, governments may better understand the costs of solid waste operations and their effects on the environment. Of the metropolises studied with available data, 29 indicated the completion of an EIA within once five times, whereas metropolises reported that nil EIA exercises were conducted.

### **2.2.1 Waste Production and Challenges by Horticultural MSMEs**

Among all horticulture crops, fruits and vegetables are the most frequently consumed (FAO, 2018). But significant waste in the sector results in cumbersome economic bearings to the environment. According to FAO (2020), horticultural crop losses currently stand at sixty per cent. The horticultural processing MSMEs produces significant wastes products which constitute about twenty-five to thirty per cent of the entire fruit/vegetable-which includes; seeds, skin, rind and pomace that according to



Food and Agricultural Organization, (2020) research postulates that wastes contain good and some of the potential valuable bioactive compounds such as carotenoids, polyphenols, dietary fibres, vitamins, enzymes and oil.

### **2.2.2 Challenges Facing MSMEs Across the Globe**

In Africa, horticultural processing products have historically been the domain of women. When given, it guarantees them not just a stable source of money but also a reinforced standing within the family and in society. Development association interventions frequently fail to consider issues of access and power as well as unstable social ties. In this industry, technological advances from outside have frequently affected women, who have often been on the losing end of these developments OECD (2017b).

Enterprises that provide processing services that are community-based cooperatively or collaboratively controlled allow directors to demand a share of the value added produced through processing. Specifically, if they move into new, non-traditional crops, directors can ensure and increase their demands by developing and strengthening the relationship between husbandry and assiduity. The relationship between husbandry and processing in reverse is crucial for the operation of most horticultural companies. Many small-scale processors purchase raw accoutrements from dealers every day at their nearby public request. Despite being straightforward, this leads to a number of issues: Processors have limited control over the price that dealers charge each day, and seasonal price fluctuations make it more difficult for MSMEs. The latter process a range of horticulture goods to manage cash flow and pricing (OECD, 2016d).

The processor is additionally unfitted to record the raw accoutrements within the amounts needed, and merchandise could fall short of expectations if there aren't enough raw accoutrements materials available for trade on a certain day. Additionally, the processor has little control over the quality of the accoutrements because of how they are handled throughout production and transportation to the requests.

To get around these problems, a processor might create direct relationships with producers through contracts. As a result, the processor could have less control over raw ingredients' availability, pricing, and quality (OECD, 2017a). The benefits to growers, in turn, include a fixed price for their crop, a generally guaranteed request for the full crop, and cash that is generally always accessible after the crop. Unfortunately, when traders and middlemen secure the harvest, they frequently pay little attention to quality and do not connect it to cost.

As farmers typically lack access to banks, dealers might also serve as the planter's sole supply of labour as well as an immediate source of informal credit. Dealers that come to an area to buy crops are always in rivalry with small processors. Growers may formerly be tied into agreements with dealers if processors wanted to barter contracts. Small processors are ill-equipped to shop for larger quantities of materials to process all at once since they have little money. This is often the aspect that restricts their ability to operate throughout the off-season. Large horticultural processing companies occasionally provide growers with training and extension services. Copping tools or bulk toxins are examples of more limiting backing (IBRD, 2015).

In Kenya, for illustration, the request for authorities and squashes appears to be small and largely met by significance. Gravies, log Multitudinous small-scale businesses produce jams and chutneys. These products are mostly sold in public spaces, where they once again face fierce competition from significance. Locally made officials, squashes, gravies and logjams are heavily sold to civic customers, excursionists and deportees in Uganda. They compete fiercely with imported goods. Some pastoral families cultivate dried fruits for the corporate fruits of the Nile, which ships the harvest to a UK company, Whole Earth Foods (Wasswa and Schlupe, 2018). However, horticultural processing MSMEs in Kenya face a spread of problems. These are also considered in two orders; persons external to enterprises and those within the control of the enterprise (internal).

#### **2.2.2.1 Financing MSMEs Operations**

Small-scale processors in both nations have major challenges due to the difficult access to funds needed to launch or grow a processing business. Credit is difficult to attain and is valuable for supporting investments and dealing with cash. Banks' requirement for collateral to get the necessary loan is a significant barrier for a variety of small-scale business owners, especially women (World Bank, 2017b). This oppressively restricts businesses' ability to contemporize or increases their product installations. Banks are especially hesitant to provide those MSMEs with short-term asset-based loans. Entrepreneurs in the horticultural processing industry rely on capital to purchase raw accoutrements as stock, especially when such raw accoutrements are in short supply or in season. For instance, seasonal fruits such as Mangoes, papaws etc. Small-scale directors purchasing smaller quantities of raw accoutrements at a time ends up pricing their products disproportionately higher. When material supplies are depleted, micro-

businesses typically halt processing. As a result, they seldom have indispensable products for the off-season. Product gridlocks are harmful once a business has made a significant investment in equipment because the expenses to cover fixed costs (primarily capital costs) keep growing (Kolsut, 2016).

#### **2.2.2.2 Choice of Outfit, Conservation Services and Packaging Accoutrements**

Identifying and getting applicable outfits by small-scale entrepreneurs may be a big constraint within the horticultural processing firms in Kenya. Small-scale business import opportunities are extremely restricted, and medium-sized business owners find it challenging to establish contacts and communicate with foreign suppliers (NEMA, 2015). Administrative costs by suppliers in other countries are excessive compared to the small sums involved. Entrepreneurs have very little information at their disposal that will enable them to determine whether a piece of outfit produced abroad will meet their needs. As a result, people frequently purchase expensive, unsatisfactory clothing. Development organizations that support small-scale horticultural processing usually provide and disseminate only one type of technology (the one they deem "appropriate"); potential business owners are not given a choice. Kenyan efforts to build specialized conservation programs in pastoral regions have fallen short, (Akinyi, 2016).

Many times, entrepreneurs must be their mechanics. Replacing worn corridors may end up agony for entrepreneurs whose capital bases are limited. Extra opportunity is usually available only to the association that has developed the applicable' outfit, resulting in people travelling long distances to be able to access the poorly demanded opportunity. Original shops aren't trained and equipped to manufacture or worn doctor corridor to a high standard. Accordingly, the processing effectiveness of the enterprise reduces while

the production costs increase. Maintaining an imported outfit is more of an issue than a blessing to work optimally and yield profit. The high cost of spare corridors is a big challenge, while the difficulties associated with carrying them are also indeed further agony for small-scale entrepreneurs (Parker *et al.*, 2017). The dearth of the vacuity of spare corridors contributes to product gridlocks and damages companies' fiscal situation. Packaging accoutrements for re-used finished products to customers is veritably delicate in both countries. Good packaging is necessary to assure a specific product's shelf-life for the products, as well as make it more seductive and charming to the client.

### **2.2.2.3 Competition from Imported Products**

Once request liberalization gains momentum, original directors lose some of the protection they used to have against international competitors. Throughout the inquiry, business owners regularly complained about "illegal" competition. Imported items are perceived by consumers as being of greater quality, more desirable, and maybe less valuable (Matui *et al.*, 2012). As a result, locally produced items are seeing their request share decline. Based on this study, it would be difficult to determine how unfair competition with foreign suppliers is for small- and medium-sized business owners. However, there is a significant indication that business owners must develop and practice a stronger request exposure for their enterprises. In this case, the term 'illegal' may apply where original food examination and customs don't apply the public norms and rules to imported goods.

#### **2.2.2.4 Technical and Operation Skills required by MSMEs**

The growth of MSMEs engaged in horticulture processing is severely hampered by entrepreneurs' inadequate business planning and management knowledge. The maturity of processors, for instance, lacks the knowledge necessary to set pricing for their products, execute rapid-fire request assessments, analyse consumer requirements, or segment requests. They also lack the knowledge necessary to plan their company's financial operations, (FAKT, 2016). Entrepreneurs must have access to a variety of technologies so they can choose the ones that work best for their specific circumstances. Few resources exist to aid business owners in relating to products made abroad, carrying enough information outlining the technologies currently available or providing support services for importing technologies of high-quality shops and mechanics that can assist the business owner in maintaining outfit. If similar services are not offered, maintaining the operation of the business will be extremely challenging. They adhere to green consumerism, green energy, and sustainable production practices.

#### **2.2.2.5 Specialized Training and Advice for the MSMEs**

Small entrepreneurs have access to a wealth of competent institutions and individuals that can help them solve complex issues or advance the development of their products to process further. The issue of hygiene and quality assurance is one unique problem that adds significance. There are a lot of business owners in the food processing industry that has received specialized training.

As a result, business owners have little understanding of the need for hygiene in processing and little understanding of how to maintain and ensure it. In addition, government food control inspectors lack significant practical expertise in maintaining appropriate hygiene during production, (PWDS, 2017). In Kenya, entrepreneurs still lack a sufficiently developed understanding of quality. Due to absent feedback from the request, the entrepreneurs are unsure of what their customers want, which causes this to be incomplete. In the same way, request exposure and growing competition require entrepreneurs to embrace new strategies and ways of thinking regarding product quality adoption and SCP practices in their businesses.

Numerous entrepreneurs have little business management experience. Entrepreneurs are now more vulnerable to competition due to the opening of the requests, and consumer demands and opportunities have grown. The long-term success of businesses operating in a free market requires that entrepreneurs respond to these Supports through training/capacity building and situation-specific assistance on business operation issues. In order to ensure the sustainability of both business and the environment, processing technology training and quality operation are similarly important, (UNEP, 2014).

#### **2.2.2.6 Required Exploration, Marketing and Dealings for the MSMEs**

In Kenya and the neighboring countries like Uganda and Tanzania, small-scale horticultural processors have limited information on the requests within the environment in which they operate. Due to a lack of knowledge and understanding, request assessments and analyses are not carried out. This leads to a limited selection of goods and services and an inability to seize opportunities for diversification.

Entrepreneurs must comprehend the dynamics of the requests they want to make and the implicit clients who make up their request members. They must also be aware of these consumers' likes and dislikes and the development requests being made to adjust to changes and remain afloat. These firms, outlets, and stations are underdeveloped, especially among micro-entrepreneurs that are new to the industry (FAKT, 2016).

### **2.2.3 Climate Change Mitigation**

Continuous generation of hothouse gases as a result of indoor-farming activities is a major factor in climatic changes across the Globe. Carbon dioxide-fellow (CO<sub>2</sub>-fellow) emigrations, which were estimated to be 1.6 billion tons in 2016, are expected to reach 2.6 billion tons by 2050. The CURB tool was used to estimate the emigrations of solid waste management and disposal, which account for around 5% of the world's total GHG emigrations and are mostly caused by disposal in open dumps and points without tip gas collection systems (World Bank, 2018a; Hausfather, 2017). Shy waste collection, uncontrolled jilting, and waste burning all contribute to GHG emigration.

Waste produces methane gas when disposed of in an area with limited oxygen, such as a dump or a tip. It also releases pollutants and particulate matter through inefficient transportation and burning. The main contributor to GHG emigration from the solid waste sector is methane, produced when organic waste decomposes. It is significantly more potent than CO<sub>2</sub>. 3 The formalization of waste management can greatly cut down on GHG emigration. For instance, a study by Zero Trash Europe found that with improved waste operation procedures, the European Union could prevent levels as high as 200 million tons of GHG emigrations annually by 2030, (Ballinger and Hogg, 2015). In recent years, advancements have been made.



A United Nations Framework Convention on Climate Change report states that, compared to other sectors, the waste sector experienced the highest relative decline in GHG emigrations from 1990 to 2015, at 20%, (UNFCCC, 2017). The decline in emigrations is partially attributable to the increasing burden many metropolises must bear regarding mitigation conditioning in solid waste operation. Diligence is bound to change the processing of goods and lessen the quantum of inputs demanded or adopted the three **Rs** in line with SCP practices. In the initial stage, recycled products can be utilized to make more valuable goods, for example, fencing posts, baskets and mats (Growth Revolution Magazine, 2016). The design indicates about Fifty metropolises globally have espoused mitigating environmental challenges (Carbon Disclosure Project, 2013; IPCC, 2017a). The United Nations conducted similar studies in Kampala, Uganda, in 2017. The results showed that solid and liquid waste generation and disposal is a major contributing factor to climatic changes realized (Kampala Waste Management, 2017).

Efficient and strategic collection, reduction, re-use or recycling of wastes can be achieved by adoption of SCP practices during the processing of products via capacity building to those involved in the processes of the adverse effects of waste on the environment –a source of the raw materials we require for processing of consumable products (Seto *et al.*, 2014). In 2018, the Indonesian government, in conjunction with World Bank, conducted a study to underscore the impacts of waste on the environment; the results showed introductory advancements, similar as adding waste collection rates from 65 per cent to 85 per cent and introducing waste disposal controlled landfilling and reduce by 21% GHG emigrations (World Bank, 2018b). According to the Government of Indonesia (2016), an essential component of Indonesia's married

Nationally Determined Contributions to the Paris Climate Agreement is these GHG reductions from the waste sector.

#### **2.2.4 Climate Change and Waste Management**

The Global Community should consider solid waste adaptability and mitigation in the long run. Waste management systems must be ready for extreme rainfall patterns that could result in waste clogging drainage systems during cataracts, tip and dump collapses, or damage to civic infrastructure that could result in considerably higher waste volumes. Metropolises should strive to ensure that their collection, transportation, and disposal systems can function no matter what kind of shock they encounter. They should also bring out the need for flexible installations. The following planning and policy behavior may be included in the original position's climate change adaptation.

Careful point selection for waste disposal is based on geomorphology and geology, natural resources, sociocultural variables, patterns of natural disasters, and frugality 20 and safety (Al-Jarrah and Abu-Qdais, 2016). For example, a threat assessment can be performed in urban areas prone to flooding to identify where waste installations should be placed and how they should be installed, operated, and decommissioned (Winne *et al.*, 2017). Sufficient waste operating capability to handle the megacity's anticipated and actual growth protrusions. There are urgent disposal locations and stakeholders to ensure that systems work in the event of a crisis.

Identify structural weaknesses that could lead to installation failure and the required investments in conservation and upgrades. To prevent waste from clogging gutters or harming girding areas, formal education, community mindfulness initiatives, and

governmental pressures are applied to encourage appropriate waste disposal and reduction. In addition, indirect thrift moves toward indirect frugality are gaining some traction, especially in Europe. The indirect frugality model seeks to recover waste for exercise and recovery while using waste aqueducts as a secondary income, (Halkos and Petrou, 2016).

Products are created and optimized for a cycle of disassembly and exercise in an indirect frugal way. The goal is to increase the useful life of consumables while reducing the environmental damage caused by final disposal. Better disposal outcomes and exercise could be part of the design approach from the start for taxing products, similar to computers that are subject to rapid-fire technological innovation and other durables, including essence and plastics that don't smoothly disintegrate. The European Commission endorsed a European Union Action Plan for Indirect Frugality in December 2015, (EU, 2015). Furthermore, the EU endorsed a set of measures supporting the implementation of the Action Plan and the European Union's indirect frugality vision in 2018 (EU, 2018a). These actions accomplish the following; Set a goal to have all plastic packaging recyclable by 2030 and develop a comprehensive strategy to achieve the quality and economics of plastic recycling.

Crucial pointers for covering and achieving adoption of SCP practices in processing operations evaluate conduct processes for further indirect consumption of the most common accoutrements used in frugality. Technology trends toward Waste Management squarely impact waste management. Despite capability in a given technology used for production, the output will vary accordingly and as per the planned finished product to consumers (Sagasti *et al.*, 2016).

Societies differ in terms of terrain, specialized technology, level of financing the operations, and ability to handle waste dictate the pace of improvements in a firm's entire waste management chain. However, Kajihara (2017) and Vaughan (2016) postulated that the technologies employed in processing goods justify the quality of the end products and quantities of waste the individual firm generates.

### **2.3 The SDGs and Management of Waste by MSMEs**

According to a UNESCO report (2018b), climate change education is crucial for lowering susceptibility and boosting resilience. According to a United Nations report (2015), education about climate change aids citizens in understanding its causes, effects, and impact on lives. Environmental education helps in changing consumption patterns, promoting sustainable practices and lifestyles and promoting environmental stewardship SDG number 4.7.1 (UNESCO, 2018). SWM is a subject that cuts across all three areas of sustainability: ecological, frugal living, and society. It has an impact on and affects these vibrant areas of sustainable development. Living conditions, public health, marine and terrestrial ecosystems, sanitation, access to good jobs, and the sustainable use of natural resources are all impacted.

As a result, SWM is directly related to at least 12 of the 17 Sustainable Development Goals (SDGs) of the 2030 Agenda for Sustainable Development, which the 193 UN Member States endorsed in September 2015. However, a recent Global Waste Management Outlook (GWMO) by UNEP made the case that the cross-cutting nature of SWM and its implication on not just one but 12 SDGs should only highlight the importance and enhance the political priority of SWM. SWM is not a high-level SDG in and of itself, which could reduce the visibility of SWM as a political priority, (Wilson

*et al.*, 2015).

Waste jilting is an issue that is specifically addressed in SDG 6 on water and sanitation in its Target 6.3. The target for member states is to minimize their discharge into the air, water, and soil to minimize their detrimental effects on human health and the environment (UN-SDG, 2015). Adding value to the attainment of the envisioned Sustainable Development Goals by the United Nations and the Kenyan Vision-2030, SWM, in Kenya, requires overall metamorphosis efforts and strategies toward the relinquishment and practices of SCP borders.

To achieve the SDGs and the Kenya Vision 2030, Kenya should also concentrate (as a long-time ideal) on a complete metamorphosis of the current inadequate MWM system to sustainable waste and resource operation. This will ameliorate overall livability, civic adaptability, metropolises/ municipalities competitiveness, as well as production jobs, and give income generation openings to original citizens. Extensively accepted Waste Hierarchy, in confluence with both; the Integrated SWM (where waste is considered as a resource) and RBF innovative backing, should be the best option for Kenya. But, one still needs to be realistic and start with a small way, fixing originally what's the most egregious and essential. That would be the stinking putrefying stacks of uncollected scrap that have remained a permanent feature and a painful eyesore in most corridors of Kenyan civic- centers.

The success of sustainable environmental management is ultimately threatened by improper waste management, which also endangers climate change hence the need to establish and effect sustainable waste management technologies and efforts because waste is a major source of greenhouse gases, which impacts climate change and,

consequently have an impact on horticultural producing operations (El-Haggar, 2017).

### **2.3.1 United Nations Conference on Environment and Development (UNCED)**

In 1992, Kenya advocated for urgent issues related to geography and development in Rio de Janeiro. Since then, Kenya has locally ratified most international treaties, covenants, and conventions that align with its aims for sustainable development. The biggest result was that Kenya joined the Climate Change era (UNFCCC), whose aim is to collaboratively evaluate actions that will prevent irreversible rises in global average temperature; the United Nations Convention on Biological Diversity, meetings convened under these conventions and held the Kyoto Protocol's second alternative meeting (CMP 2) in Nairobi from November 6 to 17, 2006. However, supporting the Rio and subsequent agreements required each member nation to accept specific conditions and implement desertification (Vivian, 2016).

### **2.3.2 UN-Habitat on Waste Management**

Utmost Nations across the Globe experience difficulties in waste operations. These challenges range from reduction in waste generations and attention given to the solid waste operation in developing nations. This issue will continue to prevail in these areas if a good enterprise is not implemented. Waste operation includes; rapid population growth coupled with high consumption rates, insufficient operations by original authorities or governments and a lack of concern for a clean and healthy environment, according to UN-Habitat (2010). Fifty-seven per cent of the waste is made up of food waste, 13 per cent is plastic, and 8 per cent is paper. The effects of improper waste management are minimal in terms of the total amount of waste produced. Middle-to-high-income regions have better waste collection, mostly because private institutions

have the funding. Consequently, they are more vulnerable to waste operation problems, which raise issues of safety, health, and the environment in development plans.

Poor waste disposal may distort the terrain to the extent critical in icing present and unborn children to a healthy and sustaining terrain (Mitlin, 2016). Evaluating certain behavioural patterns in high viscosity flash populations, such as military populations and student groups (Purcell & Magett, 2015) and which concentrate on furnishing instructions on how what, and where sweats should be concentrated in various waste operations affecting or involving waste by a multitude of factors, such as the awareness of the effects of doing as asked; concern for the community; and knowledge of the negative or positive effects of their actions (Davis, 2016) re-used rather of mixing similar accoutrements with others that will contribute to contaminating the terrain. This separation also aids in the reduction of the time –frame for handling the waste streams (Mallak *et al.*, 2015).

Proper housekeeping is essential in particular that ought to be re-used, eventually assisting in reducing waste. Eco markers are a crucial system to ensure waste is further environmentally friendly accoutrements; they could also be used to distinguish applicable accoutrements that don't have to be veritably important in developing sustainable waste results. It's absolutely imperative to establish whether workers can duly characterize bracket, Composition and information about its factors. Likewise, an environmental distance is aimed to collect information regarding where the waste operation by training individualities towards waste dogmatism is a plus since; the individualities will ply pressure on the companies and authorities that will also provide a critical system of icing waste operation and sustainability. Examined the part that public participation plays concerning a solid aggregate of 196 homes were aimlessly

tried. The study findings revealed that Wain pushers carried out the waste operation, resource merchandisers, private solid waste collect government, collects and transports waste to a specific jilting point. Waste collection, transportation, sorting, financing, and eventually implicit places that the public played were waste separation, composting, distribution of waste holders and posterior re-usage of collected operation for case; shy coffers, disinclination, poor stations and solid waste operation knowledge gaps of waste operation (Mitlin, 2016).

### **2.3.3 Waste Management and the Constitution of Kenya, 2010**

The constitution easily aligns with the principles of conserving options, quality and access (Composition 60 (1)). It assumes that land is sustainable and in accordance, among other things, with the principles of productive activities of land coffers, transparent, and COS environmentally sensitive areas. By strengthening and shielding the rights of the land, such a provision of the constitution fosters privatisation as volition to intimately handed waste operation has been explored for developing countries. Bartone *et al.* (2014) concluded that efficiency could be achieved in the private sector rather than in the public domain in furnishing external solid waste nostrum to perfect solid waste operation in developing countries. For illustration, in Nairobi, two formal sector companies give privately suitable to travel yearly figures. Neither company gambles into the informal agreements since they're unfit to gather freights from residing do, they furnish any backing to personal companies to enable them to control in informal agreements (Particular Communication, NCC's a numerous reason arising from policy perpetration (Wilson *et al.* 2015).



A constitution lays down the fundamental foundation of a state, as well as the obligations and rights of its citizens. In a particular country, it is supreme over all other legal tools. However, constitutions are difficult to amend as guiding principles, sometimes requiring a democratic majority vote in the legislature or a popular vote (Kenya Law Reports, 2010).

While a legislature passes some laws, others are enacted solely by the chief. The best-designed policies are created through extensive stakeholder consultation that incorporates their input and offers a clear explanation of public policy. Additionally, more general regulations, such as those governing labour, environment, land management, and taxes, frequently contribute significantly to the framework for the industry. Legislation is occasionally enacted in democracies by a procedure that calls for the legislative and, consequently, executive branches of government to act. Amending the principles reflected in legislation also needs to be approved by the legislature (Chapter 4 of the 2010 Constitution).

To practice law, an executive body of a state typically creates regulations as the implementing rules. They frequently refer to law but offer much more information. For example, regulation Four of the Environmental Management and Co-ordination Act (2006) prohibits someone from taking out any waste on property right, street or road or anywhere except in a designated receptacle. In many countries, the information about present levels of generated, available, and re-used wastewater amounts, for instance, among MSMEs engaged in horticulture processing, is dispersed, rarely monitored and reported, or missing (Joshi *et al.*, 2016). This makes it difficult to gauge the scope of the nation's anticipated resource recovery both now and in the future. When the world is starting to achieve the Sustainable Development Goals (SDGs) set by the United

Nations, such information is essential for sustainable development associated with water and energy.

Above all, SDG 6.3, that also aims to significantly increase recycling and safe re-use while reducing to half the amount of untreated wastewater globally; this is a crucial step in extending our capacity to adapt to climate change (SDG 13.1) and ensuring that everyone has access to modern, affordable, and reliable energy services (SDG 7.1). Recovery of organic matter and nutrients from wastewater is also crucial since it helps prevent and considerably reduce nutrient pollution of water bodies while enhancing operational efficiencies in production and consumption. This is directly related to SDG 12.5, which calls for a significant decrease in waste generation by prevention, reduction, recycling, and re-using (Otoo & Drechsel, 2018)

#### **2.3.4 NEMA Benefactions to Sustainable Waste Management**

The National Environment Management Authority (NEMA) is a non-supervisory body of the ministry of terrain and mineral coffers (MEMR). However, certain government agencies or ministries are important, too, as they play an integral role in this sector. They include MOH and operation of dangerous wastes; The Ministry of Forestry and Wildlife (against coddling and deforestation); Agriculture (controls husbandry techniques to aid in soil conservation); and Water Development (operates water coffers application). However, the Environmental Management and Coordination Act of 1999 clearly states environmental challenges, and SD complies with current and future standards.

The New Constitution promulgated in 2010 outlines care and sustainability of the environment for all her citizens. Effective and efficient management and application of the terrain via Article 69 (1 and 2), where everyone is obligated to cover and protect the land to preserve ecological sustainability and the exploitation of natural resources. The benefits that accrue from sustainably exploiting, using, operating, and conserving the land and its resources ensure equitable sharing of the benefits that accrue. Land protection is consequently emphasized by the constitution on ecological and religious grounds, advancing Agenda 21 and the 1987 Brundtland report's environmental sustainability goals.

### **2.3.5 Vision 2030 towards Sustainable Industrial Waste Management**

Although the terrain isn't listed as a pillar in Vision 2030, the Kenyan government has implemented a wide range of institutional policies that negatively affect ageing ecosystems from artificial and lucrative development programs (Vivian, 2016). The Environmental Management and Coordination Act (EMCA) provide a legal and institutional framework for managing the terrain and any issues that may arise. In Kenya, a country that is a member of the Convention on Biological Diversity (CBD), one of the issues of the United Nations Conference on Environment and international development covenants like Agenda 21 and the SDGs that are inclined to terrain care and sustainability (UNSD, 2017).

### **2.4 Knowledge, Attitude and Practices (KAPs) on Wastes Management**

Adogu *et al.* (2015) research findings showed that awareness of waste management accounted for 90%, and a positive attitude toward waste management was 97.5%. According to UNEP (2015), industries/processors undertake their own disposal of

mixed waste and transport it to non-designated waste landfills. The research by Eneji *et al.* (2016) on waste disposal and management also showed a result of tested hypotheses of 0.05 level of significance-negative attitudes towards management and disposal of wastes.

Many across the Globe view or define waste in different dimensions depending on the nature of work and the environment they live in (Moore, 2012). For example, DANDORA DUMPSITE trash pickers in Nairobi, Kenya-view “waste” as a worthwhile business venture that allows the participants to generate their daily livelihood, while those in the developed world see this as a burden. Often, the reverse is true. However, recognising waste as an issue does not stop littering or other irresponsible waste management behaviours. Coupled with certain norms or behaviours, a lack of awareness of effective waste management techniques can be quite challenging when defining waste (Milea, 2016; O’Connell, 2011).

According to Yousif and Scott (2017), the discrepancies were observed first-hand when they conducted observations in developing-world societies. Whenever changes are made, individuals don't alter their disposal behaviour just out of habit or tradition. Ultimately this produces communities where individuals have limited knowledge of or are concerned about how they impact the environment and therefore compromise the environmental management strategies in such countries (Poswa, 2017).

Without prior knowledge, acquiring information may not be enough to affect change. However, these communities could be more willing to accept and implement these changes if their prior understanding of waste management was matched with new information. Researchers have realized the need to improve public understanding of

waste management and community involvement to create sustainable waste management systems and encourage environmental responsibility amongst community members (Lumbreras, 2014A). Research conducted in Palestine focused on this educational gap and found a correlation between the level of education and the degree to which the population participates in restorative activity (Al-Khatib *et al.*, 2015)

## **2.5 Capacity Building on Waste Management amongst MSMEs**

Lack of awareness of and education on efficient waste-operation techniques is a significant barrier present across the developing globe. The research in Gaborone, Botswana, found out that although citizens were wary of recycling and other environmentally friendly garbage disposal methods, this doesn't inevitably translate into engagement in improving environmental factors like the recovering business. Despite their limited understanding of similar conditions, they don't seem to have adopted waste operation reforms (Bolaane, 2010). Lack of interest in the environment fosters a culture where communities don't participate in decision-making. That situation encourages a lack of accountability for waste and environmental problems. A study in Malaysia by Aini and associates (2017) found that for solid waste extremity to be properly managed, the “Heart of the individual requirements to be raised through environmental mindfulness and challenges, inculcation of sustainable consumption practices and education on the waste operation.”

Environmental awareness and knowledge on conservation were designed to positively influence recovering stations, but if knowledge about them was lacking, positive stations might not have regenerated in recycling (Aini *et al.*, 2017); waste directors must thus take action to ensure that the information shared with the public is in line

with the prior knowledge that these individuals possess. Therefore, building capacity and training programs are crucial to any sector's growth. Similarly, horticultural training programs aimed at MSMEs engaged in horticulture processing would help them acquire entrepreneurial skills and grow accustomed to efficient waste management practices.

A study on small growers in Bangladesh concluded that building growers' capacity through training is more beneficial than just the provision of financial support meant to raise product and income. According to research on the efficacy of training for growers. Most program failures in developing nations are linked to the propensity to excessively focusing on a specific technology transfer rather than a wider perspective of planter commission encompassing knowledge separations (Oreszczyn, & Carr, 2010). However, a study by Noor & Dola (2015) shows that most training intervention was deemed necessary, timely, and favorable to the farmers.

Although it was difficult to gauge the immediate effects, the evidence they obtained suggested that mature growers regarded themselves as better ranch directors after attending training. In cognitive psychology, learning transfer has a specific meaning (Gick & Holyoak, 2014). However, in the context of training, transfer refers to the degree to which literacy acquired during training is later transferred to the workplace or impacts later job performance. Consequently, a connection between learning scores (during training) and performance criteria may be used to measure training transfer (on the job). Successful training evaluates angles inside the transfer terrain and the fundamentals that will affect training beforehand (Greyson, 2017). Given the environment, education is vital to waste operation enterprise. Educating people to waste operations will help them understand the magpie disposal of waste to the terrain and

human health and empower them to act consequently (Chakrabarti *et al.*, 2016).

## **2.6 Quantities of Wastes Generated by Horticultural Processing MSMEs**

Waste product implies using accoutrements and energy and reducing the earth's renewable and non-renewable coffers. Waste issues and their results are inescapably linked to product and consumption throughout all life cycle categories. Among horticultural processing, MSMEs in Kenya induce waste in cleaning, drying and processing vegetables and fruits. While the general public's mindfulness of the significance of recycling has surely risen recently, sorrowfully, little material consumed is reclaimed back into product processes among the horticultural processing MSMEs (UNEP & IRP, 2013). A recent study estimated the Global total recycling rate at only around 6 of the total material input in 2015, which indicates a lack of incarnation of indirect frugality (Troschinetz and Mihelcic, 2016).

In many countries, the information on the present situations of generating, availing and reusing wastewater volumes, for example, among MSMEs engaged in horticulture processing, is scattered, infrequently covered and reported, or accessible (Joshi *et al.*, 2016). This makes it difficult to gauge the scope of planned resource recovery in current and future public situations. In a period when the world is starting to work toward meeting the Sustainable Development Goals (SDGs) set by the United Nations, it's crucial to have similar information related to sustainable development connected to water and energy. Significantly, SDG6.3 aims to primarily promote wastewater recycling and safe management globally; a crucial step to improve our capacity to adapt to climate change (SDG13.1) and to ensure that everyone has access to relatively affordable, dependable, and modern energy services (SDG7.1).

Recovery of nutrients and organic matter from wastewater is crucial in reverse, taking into account the need to improve resource efficiency in product and consumption, as well as to contribute to and considerably reduce nutrient pollution of water bodies and improve water quality. This is closely related to SDG12.5, which calls for a significant decrease in waste creation through prevention, reduction, recovery, and exercise (Otoo & Drechsel, 2018). According to Figure 2.4 Vert exports firm practices an effective waste operation process that's sustainable to the terrain. Vert was one of the unique waste operation systems rehearsed by the surveyed Horticultural recycling MSME. Africa Limited in the Eastern region-Machakos County as shown in Figure2.4 below. At Vert. Africa Limited, the mango husks are dried and used as energy to heat water employed in processing their products. This process is environmentally friendly, sustaining and cost-effective in terms of waste operation (Ilgin and Gupta, 2017) *ref Appendix III.*

### **2.6.1 Nature and Extent of Fruit and Vegetable Losses**

Losses and wastes are the portions of fruits, vegetables, and other food products that are not utilized or consumed because of the morphological qualities of the product, improper handling procedures, or simply being thrown away for a diverse range of reasons (FAO, 2021). In addition, waste from processing horticulture goods' by-products is considerable. However, the quantity and kind of FVWs vary according to the commodity and the morphological components, such as leaves, roots, tubers, skin, pulp, seeds, stones, and pomace (Panouill'e *et al.*, 2017). Many fruits and vegetables produce waste that might range from at least 25% to 30% of waste materials and isn't used again (Ajila *et al.*, 2010). Laufenberg *et al.* (2017) have estimated the assembly and overall loss of product while processing. Since many fruits and vegetables aren't



eaten fresh, they must first be processed to produce the desired item. (Ayala Zavala, 2016). Examples of goods made from sources that have extremely rich biomolecules are coffee and macadamia nuts (Bignami *et al.*, 2015).

In terms of waste, apples produce 10.91 per cent of seed and pulp as by-products and 89.09 per cent of the finished product when sliced. Approximately 8.5 per cent of the papaya peel, 6.5 per cent of the seeds, 32 per cent of the pulp (due to imperfections in the cubes), and roughly 53 per cent of the finished product are wasted during the dicing process. Approximately 16 per cent of the peels and 84 per cent of the final product are produced when mandarins are peeled. Around 11% of the mangoes' peels, 13.5% of the seeds, 18% of the inedible pulp and 58% of the completed product are produced during processing (Ayala Zavala *et al.*, 2016; Joshi *et al.*, 2016). The global grape and wine processing industries produce 5 to 9 MMT of solid waste annually, accounting for world 20 to 30 per cent of processed materials (Schieber *et al.*, 2016). Canning and frozen fruits and vegetables generate approximately 6 MMT of solid waste annually, consisting of 20% to 30% of leaves, stalks, and stems (Panouill'e *et al.*, 2017).

## **2.7 Legal and Regulatory Frameworks on Waste Management**

Kenya has made substantial efforts in the policy arena to oversee, regulate, and promote good practices in SWM and safeguard human beings and healthy environmental management from the consequences of uncontrolled waste-stream disposal (Constitution of Kenya, 2010). The relevant efforts manifested by Kenya, as being a signatory, or a party to, the main International Conventions and Treaties, enacting numerous laws and by-laws relevant to SWM. Notwithstanding the existing legal framework, Kenyans do continue witnessing, day after day, an overwhelming number

of cases of non-compliance, with the set performance standards and regulations, on SWM. It has been said that WM is a mirror reflection of the state of society itself (Da Zhu *et al.*, 2017). The Kenya's 2010 Constitution incorporated proper legislation and other measures to protect the benefits of our environment today and tomorrow for future generations. Further, it assigns responsibility for solid waste disposal in the Counties as stipulated in *the Fourth Schedule, Part 2, Paragraph 2 (g)*.

According to NEMA (2015), uncontrolled dumping is directly affecting the health of the waste handlers and people who live near dumping sites. In addition, heaps of garbage everywhere create visual pollution and environmental pollution of all environmental mediums (air, water, and soil), thereby contributing to Global warming.

According to Okot-Okumu's (2017) research, he postulates that data on quantities of waste produced within major urban areas coupled with the rapid increase in inhabitants can help both National and County Governments in dynamic and modern plans. The information facilitates governments in designing systems, setting targets for waste management; inform management to be in tandem with changes in population patterns. Based on correct information, governments can objectively set aside financial obligations and spaces and evaluate essential and applicable technology for waste management disposal. More so, apply the Public-Private partnership approach for effective and efficient service delivery. Therefore, the basis of sustainable management of solid and liquid waste resonates with proper planning and audits from central commands of County governments (Kombo *et al.*, 2016).

Since the management of waste is operated locally, the National government plays an integral role in developing and disseminating legal and regulatory frameworks

concerning waste to be harmonized and, in turn, incite private-sector engagement (NEMA, 2015). Generally, national governments are responsible for drafting laws for fair and transparent service procurement from the private sector as well as environmental requirements for waste management. Counties are encouraged by federal laws to uphold social and environmental standards. The 47 County Governments in Kenya also enact yardsticks that guide their people and various organizations operating within effective and sustainable waste management under their jurisdictions and in line with County Acts on waste management.

Recently, Kenyan action to ban plastic bags is an important attempt to reduce SW in the country. Disposal of plastic bags has been the biggest SWM problem in Kenya (Wakhungu, Judy, 2017). According to UNEP, supermarkets give close to 100 million plastic bags out every time in Kenya, most of which end up in scrap lockers, contaminating the terrain. The government was trying doubly, ahead in a decade, to exclude what's perceived as the country's worst waste problem. Prior attempts to ban plastic bags were picky, focusing on regulating light-weight carrier bags with a consistency of fewer than 30 microns, making monitoring compliance nearly impossible (NEMA Report 2017a, 2017 b, 2017 c and 2017d).

The current Ban, with effect from 28<sup>th</sup> August, 2017, covers all plastic carrier bags (single-use bags; carrier bags with handles, and flat bags without handles) used as secondary packages. Still, accoutrements used for artificial primary packaging, disposal bags, running of biomedical and dangerous waste, and scrap caddy liners, are exempted. Kenya joins more than 40 other nations that have legislated similar laws, but Kenya's is far stricter than all of the others, to date; malefactors face a jail term of four years or a fine of KES 4 million (USD\$ 000). Nevertheless, Kenya hopes the Ban will greatly

reduce plastic pollution (Tukker, 2016 Wakabi, Michael, 2015).

### **2.7.1 Lack of Policy Enforcement and Responsibility**

More often than not, the issue's root is not the environmental legislation per se, although some developing nations have more complex laws than wealthy nations. Rather, the greatest challenge to a sustainable waste business is the lack of enforcement (Al-Khatib *et al.*, 2016). A serious institutional problem contributing to improper solid waste management in the developing world may also be the lack of implementation of policies and regulations. Kenya is an example of this; although the country has enough legislation governing garbage operations, the initial authorities justify their applicability (Henry *et al.*, 2017).

In 1985, for instance, the Federal Government of Nigeria introduced a major action called “the environmental sanitation clean-ups crusade.” Once a month, every resident of the community was required to do necessary environmental cleanups once a month. Unfortunately, although it was an emotional act, more terrible issues were caused by it because of institutional issues, bad functioning, and a lack of law enforcement. As a result, waste was dumped along roadways and on the fringes of towns where many of the poorest people lived. In addition, residents did not fit into the program, and there was no agency existed to enforce the rules, (Ogbonna *et al.*, 2015).

The conduct continued until the program was abandoned, obviously that there were unclear lines of authority among the various players. On the other hand, cosmopolitans recommended that the program did not give the necessary coffers and services to negotiate it. According to Ogbonna *et al.* (2015), programs like this bear strong leadership and operation association to become sustainable and effective in these

settings. However, the conversation and communication between private and public stakeholders and drug addicts regularly fail. Original residents aren't always aware of the many operations. Thus they cannot participate in them or, in some instances, disobey the rules, regulations, and programs in place.

### **2.7.2 Enactment and Enforcement of Policy/Programs**

A country's proper SWM strategies operation depends on having a clear, unambiguous, nonsupervisory legislative framework that includes examination and enforcement procedures in local, public, and original situations (Marshall and Farahbakhsh, 2015). Making solid and acceptable regulations from both public and native situations to direct waste operation practices and attitudes is pivotal (Asase *et al.*, 2016). These programs should specialize in improving the civic poor's knowledge, education, skills, and commission to improve their living situations (Murad *et al.*, 2015).

Authorities in underdeveloped nations frequently disregard the importance of waste minimisation techniques. As a result, all "wastes" are sent to dumpsites for eventual disposal, considerably increasing the value of the waste operation. In cities that haven't previously had them, the government should step in to improve opportunities for the recovery and use of waste accoutrements and consumer awareness initiatives (Oteng-Ababio, 2016). Governments may also make executives more accountable for disposal and minimise waste by giving producers incentives by raising the expense of sourcing raw materials and including them in the cost of doing away with their goods. In the end, customers will start to want more items made of materials that can easily be returned to producers and do not bear disposal as they become more knowledgeable about the benefits of and wish to decrease and exclude solid waste (O'Connell, 2011). However,

the effectiveness of these initiatives depends on the involvement of citizens and the effective enforcement of laws by residents.

It is stated in the 2015 UNEP Annual Report (cited in Périou, 2015) that the best barriers to effective and ecologically friendly solid waste management in many developing nations are managerial rather than technological. Since some developing nations have more complex environmental laws than industrialized ones, the issue is frequently not with the laws themselves. The challenge to effective waste management is really the weakening of enforcement (AlKhatib *et al.*, 2015). A significant institutional problem that contributes substantially to the improper management of solid waste in the developing world may be the lack of enforcement of regulations and laws. In Kenya, for instance, there is adequate legislation governing waste management, but local governments cannot put it into effect (Henry *et al.*, 2017).

Another instance of how a lack of regulation may lead to improper garbage management is frequently observed in Nigeria. A noteworthy endeavor was launched in 1985 in Nigeria, an initiative called “The environmental sanitation cleanup campaign.” Every resident was obligated to do specific environmental cleanups once every month. It was undoubtedly a strong initiative, but the project made waste problems worse because of institutional issues, such as a lack of enforcement and bad management. Many of the most disadvantaged residents were on the outskirts of towns where waste was deposited, or residents refused to participate in the program, and there was no agency to police the rules. The situation persisted until the program was terminated (Ogbonna *et al.*, 2015).

The many stakeholders' lack of a clear understanding of who was responsible for what

was apparent in this case. For these programs to be effective and sustainable in these environments, they require strong leadership and management (Ogbonna *et al.*, 2015). The effective functioning of municipal WM plans depends on a clear, transparent, and simple legislative and regulatory framework that includes functional enforcement and inspection operations at the national, provincial, and native levels (Marshall and Farahbakhsh, 2015).

It is crucial to enact sound and adequate legislation at the national and local levels to direct waste management decisions and procedures (Asase *et al.*, 2016). In addition to enforcement, these policies should focus on advancing the urban poor's knowledge, skills, education, and empowerment to improve their living situations (Murad *et al.*, 2012). Authorities in developing nations sometimes disregard the value of waste reduction techniques, which leads to situations where all "wastes" are dumped in dumpsites, significantly raising the cost of waste management. In addition to consumer awareness efforts in places that don't already have them, state involvement should increase the chances of recycling and reusing waste products (Oteng-Ababio, 2016). More so, adopting SCP practices by those processing goods has to be enhanced to facilitate the effective use of by-products. Curitiba, Brazil, is a classical illustration of how some of these institutional reforms have been implemented successfully, (Ahmed *et al.*, 2014). When implementing waste management systems, waste managers in Curitiba consider operation strategies, monitoring, and institutional controls. To achieve sustainability in the waste management industry, their program strongly emphasizes integrated public-private partnerships and deliberative democracy techniques.

### **2.7.3 A Comparative Synopsis of Waste Management policy, Legislation and Strategy Frameworks in the European Union, South Africa, Tanzania and Kenya**

Comparing the frameworks for waste management policies, laws, and strategies in the European Union, South Africa, and Tanzania reveals critical lessons that might aid in advancing Kenya's waste management initiatives. This cutting-edge approach to waste management, which places a strong emphasis on waste prevention and recycling rather than waste disposal and specifically recognizes waste as a valuable resource to be used, is the foundation of European Union waste management policy and legislation, as specifically expressed by the Waste Framework Directive (2008/98/EC). Hence, the European Union was given a long-term objective to become a recycling society that prevents waste and uses trash as a resource when the Thematic Strategy on Prevention and Recycling of Waste was adopted in 2005. Furthermore, the Waste Framework Directive 2008/98/EC introduced the lifecycle concept within the Common Market waste policy and the waste management hierarchy, favouring waste prevention, recycling, reuse, recovery, and waste disposal as the last option in the order of priority. As a result, the Waste Framework Directive may be a significant innovation to waste management thinking and practice (European Commission, 2018).

Through the Waste Framework Directive, the European Union established specific legal provisions to boost waste prevention efforts within each EU member state's waste prevention programs. Additionally, the Waste Framework Directive established baseline requirements for recycling operations in member states and established strategies to manage the collection, reuse, recycling, and recovery targets, which are often evaluated and changed (European Commission, 2018). Through the application of targets to the Landfill Directive, substantial waste, particularly Biowaste, has been



recovered from landfill recycling of these efforts have encouraged reuse markets, recycling and energy recovery industries.

The waste management policy and legislation of the European Union have resulted in considerable stabilization of waste generation. They have resulted in the reduction of the impacts of waste on people's health and the environment. Also, the waste management policy and legislation have resulted in a rise in the availability of raw materials through material recovery and sustained waste management and recycling industries (European Commission, 2018).

To start, the Environmental Management Policy for South Africa Nation, 1998 is a framework policy that directs and advises all governmental institutions in developing specific subsidiary and sectoral policies and methods on issues of the day-to-day management of the environment. This policy offers a variety of principles and strategic goals that are required to guarantee that the environmental policy is realised (City of Johannesburg Integrated Waste Management Plan, 2011). It's interesting to note that, like the Waste Framework Directive of the European Union, the Environmental Management Policy for South Africa of 1998 promotes the hierarchy of waste management practices, such as minimizing waste at source, reuse, and recycling with safe disposal as a last resort.

All national, regional, and local waste management legislation and operations in South Africa are governed based on the instruments of the four waste management policies and legislative frameworks, including the Environmental Management Policy, 1998; National Environmental Management Act (NEMA), No. 344, 2012.

It should be mentioned that the global organisation supports the idea of a waste management hierarchy. The Waste Framework Directive 2008/98/EE, which has waste prevention, reduction of waste, recycling, and effective resource utilisation as its top priorities, is also the most fundamental law guiding South African waste management policy, legislation, and practice. The final comparable case is waste management of the Tanzanian legislation and policy framework. The most relevant laws governing waste management in Tanzania are the National Environmental Policy of 1997, the National Health Policy of 1990, and the Sustainable Industrial Development Policy of 1996. These regulations appear to be fairly generic and don't appear to be primarily geared toward trash management. Nevertheless, the two laws form the foundation of the legislative and institutional framework for environmental sustainability, particularly municipal solid waste management.

The Tanzanian Environmental Management Act No. 20 of 2004 and the government's (Urban Authorities) Act No. 95 8 of 1982 are two examples of such laws. The authorities (Urban Authorities) Act No. 8 of 1982 in Tanzania, on the other hand, gives any or all urban local authorities in Tanzania authority over waste management within their respective administrative areas and gives them the authority allows them to draft the by-laws necessary for carrying out that responsibility. As a result, the municipalities of Kinondoni, Ilala, and Temeke (2015) in Dar-es-Salaam City each have their waste management by-laws.

Additionally, Tanzania's current solid waste policy and legal framework are based on outdated practices that see waste management primarily as a question of waste collection rather than disposal. As a result, waste minimisation, prevention, recycling, and reuse are not practised to a great extent. Therefore, one of the key distinctions

between Tanzania's waste management policy and legislative framework on the one hand and South Africa's and the international organisation's waste management legislative frameworks on the other is that Tanzania doesn't find the idea of a waste management hierarchy to be onerous. This is often a severe weakness because all waste management efforts are out-of-date. Without using the waste management hierarchy, it is impossible to win the battle against the large volumes of waste produced daily in the major urban centres, (Dar-es-Salaam City Environment Outlook, 2011).

Several public and commercial organisations in Kenya with specific statutory and institutional responsibilities oversee the horticulture sector. The agriculture ministry offers general policy, law, and operational guidance. The Agriculture Act created the sector that is governed by the Horticultural Crops Development Authority (HCDA). The horticulture sector in Kenya is to be developed, promoted, coordinated, and regulated with the help of HCDA. Such projects must be connected together in order to facilitate awareness of waste and environmental management amongst horticultural processing MSMEs in Kenya.

## **2.8 Waste Management Across the Globe**

Early waste management strategies were developed to stop the spread of disease. Still, due to the periods then prevailing political and social problems, waste management did not advance very much (Nathanson, 2015, Metzger, 2015). In this "Age of Sanitation", Communities set up garbage collection and disposal to help maintain public health. Europe and the US were experiencing rapid development throughout the Industrial Revolution, which increased the amount of waste produced. Technological advancements led to the use of trash cans, the development of incinerators, and the

introduction of dumpsites, the latter of which replaced the practice of open dumping and has since become standard practice throughout the developed world. Waste management became a priority in the latter part of the 19th century and into the 20th century (Bhada-Tata *et al.*, 2017).

Modern trash management has come a long way in the industrialized world, and with recycling and other innovations, it will continue to expand and change to meet community needs, (Tangri, 2017). However, many of those modifications to developing nations' solid waste management systems have yet to be implemented (SWMS). As a result, the production of waste on a global scale has nearly doubled over the last ten years. In 2025, 2.5 billion tons of rubbish will be produced annually due to urbanization and shifting consumption patterns. Due to their combined impact on urban development and changes in consumption patterns, global garbage production has almost doubled in the past ten years. It will reach 2.5 billion tons annually in 2025 (Périou, 2017).

Consistent with Japan International Cooperation Agency (JICA, 2018), difficulties in SWM are often attributed to the following aspects: (i) Problem factors (Population, economic level, climate, topography, rises in waste production, changes in waste volume, seasonal variations, floods, and other natural disasters, poor urban infrastructure, operational challenges, challenges finding disposal sites, and diversification of city dwellers (ii) Social factors, such as a lack of knowledge of waste management, resistance to collaborate, gaps between the rich and the poor, the growth of slum communities, and the disintegration of indigenous societies; Institutional factors (iii), inadequate HRD policies (iv), and inadequate technical data (v) are all factors.

NEMA (2012) specifically highlighted the following issues with MSWM in Kenya: the legislative framework (complete absence of SWM policy); institutional structures; a gap that exists in sector-specific regulations; a limited capacity; and weak enforcement; low-income areas); infrastructure; illegal structures and informal urban settlements; and developing collection centres and waste disposal/treatment zones. Additionally, more details on each of the subsequent barriers: (i) Regulatory and Policy Barriers; (ii) Economic/financial Barriers; (iii) Technical Barriers; (iv) Awareness; and (v) Training Barriers. Since they believe they see no other options for managing their waste products, communities in developing nations frequently promote waste disposal practices like open dumping and burning (or unregulated landfills), which are harmful to human health and, consequently, the environment, (Narayana, 2016).

He further acknowledged that, although burning trash is illegitimate, many thousands of individuals with no garbage collection haven't any other choice for disposal of their waste. Households maintain localised trash pits in these communities, where waste is dumped daily and burned biweekly. The waste remnants are moved to larger pits on the edge of the town once the pits are full.

### **2.8.1 Sustainable Source Separation of Wastes in Panaji, India**

In the Southwest of India lies Panaji-the capital city of Goa, characterized by Metropolitan inhabitant's courtesy of India's National census in 2011. The city is rich in artistic culture, good sightseeing locations, and good scenery. In 2005, the megacity resorted and adopted sustainable waste-source separation and, to date, serves as a role model in managing wastes in the entire state. Domestic waste separation is done in 5 aqueducts via coloured lockers. Herbage lockers- wet waste, black or slate lockers -

Glass and essence, pin lockers- Paper and cartons, orange lockers- Plastics and white lockers -Non- recyclables (Banna, 2017).

The City Corporation of Panaji offers door-to-door waste pickup. Home waste is picked up twice weekly for dry and wet waste. In contrast to wet waste from business establishments, which is handled via windrow recycling at two bulk processing units and used for public horticulture systems, household wet trash is composted at one of 96 decentralised compost units. Hospice wet waste may occasionally be processed on-site to create biogas. About 24 tonnes of wet trash are processed daily in the megacity (World Bank Report, 2017). Dry garbage from the megacity is gathered and stored at one of 12 sorting units after collection. The dry waste is divided into twenty different aqueducts at one of two Material Recycling Installations. The cement industry in Wadi, Karnataka, receives roughly 4 tonnes of dry trash daily, and 3 tonnes of recyclables are sold at auction to merchandisers. About \$5 million in profit was made from the trade in recyclables in 2016 (Mckay, 2016).

### **2.8.2 A Vision towards Zero Wastes in San Francisco, USA**

San Francisco announced its intention to produce no waste at all by the year 2020 in 2002. San Francisco has worked, through enterprise, to promote recycling and composting. As a result, it is currently among North America's greenest cities and is a waste management case study (Economist Intelligence Unit, 2011). The solid public policy implemented by relentless political leadership, strong public-private partnerships, resident education, and financial waste reduction incentives have contributed to San Francisco's success. San Francisco is the first American megacity to implement stringent regulations regarding the usage or operation of particular

accessories. The megacity required mandatory recycling for building debris in 2007, outlawed plastic bags in pharmacies and supermarkets in 2009, and prohibited using Styrofoam and polystyrene froth in the hospitality industry in 2006. (2009). 2014 saw the most recent prohibition on selling plastic water bottles in San Francisco (EPA, 2017).

Modern communication initiatives span a variety of locations, enterprises, seminars, and events, and financial incentives promote recycling and waste reduction. Each home or building receives a detailed bill for waste operation freights to make it easier for the community to comprehend its waste disposal practices and financial impact. Locals save money if they divert their waste from mixed garbage lockers to bins for composting or recycling. In addition, the size of the recovering holders was increased, while the size of the handed mixed trash lockers was cut in half. Regular waste locker audits are conducted, and residences that do not comply with program requirements receive warnings before being penalized monetarily. San Francisco also launched the country's first and biggest municipal food waste composting collection program, which includes both the home and commercial markets. A million tons or more of food waste, yard waste, and other biodegradable materials have been gathered in San Francisco. These materials have been transformed into compost for local vineyards and producers. San Francisco had the highest rate of desolate diversion of any major US metropolis in 2012, at about 80%, thanks to its successful initiatives (EPA, 2017).

### **2.8.3 Financial Sustainability achievement in Latin America, Argentina and Colombia**

The frequently crucial challenges associated with external waste operations are the deficit in Fiscal coffers. Inadequate state backings often occasion these deficits, support freights and reliability on the costs of offering such services (IDB, 2015). Colombian and Argentinian governments are effectively gaining fiscal sustainability with partnerships with other Latin American states. However, a number of Cosmopolitans, both in Colombia and Argentina, lacked accounting systems and methodologies for charging freights involved in waste management (Galgani *et al.*, 2015).

The Secretariat of Environment and Sustainable Development (EPA, 2017), which is in charge of the Integrated Solid Waste Management Project, and fully supported by the World Bank, Saw the development of the Integrated Urban Solid Waste Management Economic and Financial Matrix tool, which helps in city dwellers understand the important of the investment and service's real costs and value. This tool analyses each step in the value chain of the solid waste operation, determines the percentage of expenses covered by freight and suggests ways to repurpose budget funds to improve fiscal sustainability. All cosmopolitans in Argentina have access to the tool.

Cosmopolitans in Argentina have access to the tool. The following expectations for cosmopolitans were set by SAYDS and the Ministry of the Environment based on its deployment; calculation of all integrated costs for solid waste operations as well as identification of all associated profits to regularize waste operation accounts; the creation of implicit new cost-recovery strategies and the use of data to calculate the corresponding freight (UNEP, 2015).



The polluter-pays concept is being upheld so that larger waste producers pay more. To do this, external and local employees were trained through in-person and online training, and cosmopolitans representing 26% of the population used the technology to gather financial data. The fiscal matrix has been used by the urban centres of Mar del Plata, Rosario, Viedma, Concordia, and Posadas to impose cost recovery mechanisms. After an extensive radio crusade and outreach challenge, Mar del Plata, a significant coastal megacity, implemented a differentiated figure system across all the poor neighbourhoods. The tip's operational costs, as well as its variable costs, are both covered. On the other hand, Rosario assigned a specific figure to significant garbage producers. Peer-to-peer guidance on strategic plans, opportunities for technicians from global cities to share in support exchange programs with other municipalities and facilities within their jurisdiction, and other external networks have also been built to exchange information and challenges (EPA, 2017).

Having the appropriate financial and physical resources was essential for the fiscal tool's execution. SAyDS was fully staffed with competent brigades that could conduct capacity-building and outreach programs to local and foreign governments, customize training to the unique needs of the original governments, and assess training across the country. Through this success, citizens built up their trust in the government and received the necessary significant support to improve cost recovery. In addition, support for an institutional framework created by the Integrated Solid Waste Management Project, which allowed for quick collaboration between the federal, state, and local governments, supplemented the instrument.

#### **2.8.4 Israel's Automated Waste Collection**

In 2012, Israel's largest megacity, Yavne, opened as a green district known as Neot Rabin (Cohen, 2013). The nation's first Automated Vacuum Collection (AVAC), also known as a curvaceous garbage collection system, is located in Neot Rabin. AVAC systems connect each home unit with a centralized waste storage unit using a network of subterranean pipelines. Residents dispose of their rubbish in two scrap dumps, one for dry waste and the other for wet waste, on each bottom. These cataracts automatically move garbage to a unit for underground storage. Once a week, residential garbage is sucked or vacuumed via a conduit at speeds of 50 to 80 kilometres per hour to an accumulated storage facility. Based on the success of the serviceman AVAC system in Neot Rabin, Yavne started converting the public trash cans in the megacity to curved lockers in 2014.

In 2015, approximately thirty curvaceous locations for waste assembling were employed in public domains, such as premises and seminaries, consequently eliminating waste smells and reducing business traffic issues. In addition, Ra'anana and Bat Yam's cosmopolitans also began manufacturing and assembling automated waste-collection gadgets used in domestic structures (Revolvyn.d.). Still, the new technology has certain limitations. Similar issues include a significant initial investment required to set up the system, functional issues when pipes become clogged, pool training, public response in engaging in processes such as separation and disposal, and difficulties collecting large and electronic waste (Benardos, and Kaliampakos, 2014).

### **2.8.5 Waste Management Amongst Horticultural Processing MSMEs in Kenya**

Research conducted by Agamuthu *et al.* (2015) showed that human, Economic, Institutional and environmental aspects must be incorporated fully to manage waste sustainably for better outcomes. In Africa, for instance, similar issues include a significant initial investment required to set up the system, functional issues, wide variance between waste production between urban and rural areas, lack of human resources and technical support, public response in engaging in processes such as separation and disposal, and difficulties collecting large and electronic waste (Couth & Trois, 2014).

Within the Kenyan economy, the horticultural sector is among those experiencing the quickest growth. Within the Kenyan economy, the horticultural sector is among those experiencing the quickest growth, while over 3.5 million people benefit directly (FAO, 2014). Nevertheless, this resource use poses significant sustainability and waste management challenges, especially considering Kenya's vulnerability to climate change. This means that every Horticultural processing MSME must incorporate SCP practices as envisioned by United Nations under SDG numbers 12 and 13, clearly outlining the mandate to produce efficiently while consuming sustainably. According to Liss (2015), waste management efforts should concentrate on identifying value and redistributing it to the community where there are producers, processors, and consumers. Unfortunately, most of the collection and dumping could be complex activity were, crushing all waste materials together and making separation an expensive and occasionally impossible effort to manage trash, (Liss, 2015). As the urban population in major urban centres in Kenya and other East African state grows, So does the burden of managing solid waste, which is made worse by inadequate funding for

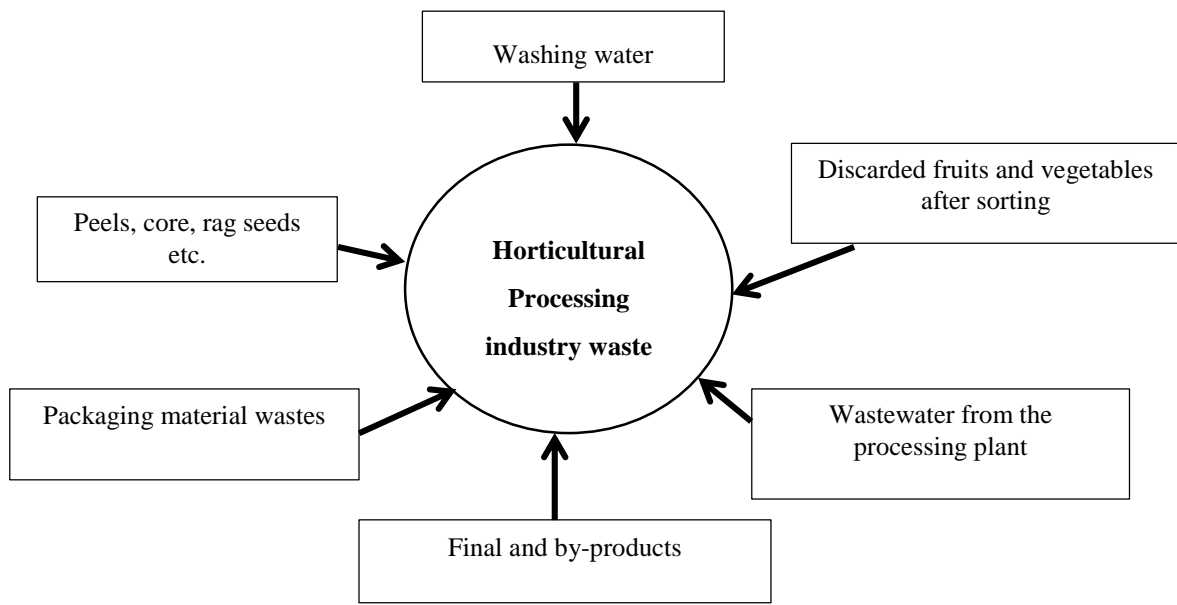
city and county sanitation departments and poor implementation of sanitation laws.

At least 100 million people in the region don't have access to better sanitation (Troschinetz and Mihelcic, 2016). As a result, solid waste is frequently deposited at closed quarries or other locations without the proper controls. For instance, in Nairobi, municipal rubbish is transported to the disused quarry that became the Dandora dumping site. People residing next to the dumpsite are therefore in danger of potential pollution and diseases. Most of the time, the disposal sites are situated in low-lying, environmentally delicate places like marshes, woodland edges, or close to bodies of water. But, as is the case in the majority of developing nations, they frequently lack liners, fences, soil covers, and compactors (Troschinetz and Mihelcic, 2016).

According to Environmental Protection Agency (EPA, 2017), having efficient and sustainable waste management systems in place will assist regulate trash disposal and, therefore, can help relieve some of the pressure consumption has imposed on the environment. Additionally, it's important to address this issue head-on because waste management can negatively affect environmental and human health if neglected (Narayana, 2016). Due to the variety of needs and challenges faced by the Horticultural processing MSMEs sector in Kenya, a versatile though comprehensive approach to handling waste effectively.

A complete integrated waste management system that uses a wide range of waste management solutions enhances the ability to adapt to shifting environmental, social, and economic factors (McDougall *et al.*, 2017). Figure 2.5 is a schematic diagram showing waste streams amongst the horticultural processing MSMEs. As they undertake the processing of fruits and vegetables, wastes and discarded parts are piled

up either for recycling or sale to other end users. The Horticultural processing MSMEs surveyed generate solid wastes and wastewater where water is primarily used in natural and vegetable cleaning, water fuming, cooking and blanching.



**Figure 2.1: Major Sources of Waste in Fruit and Vegetable Processing MSMEs;**  
**Source: Ouma et al., (2021)**

## **2.9 Integrated Waste Management**

Because no one wastes management strategy can handle all potential waste products in an economically sustainable way, waste management practices cannot be standardized across areas and industries (Staniškis, 2015). Requirements change; thus, procedures must also change following those changes to ensure that these conditions are frequently effectively satisfied. Systematic waste management must be adaptable to changing economic, environmental, and social circumstances (McDougall *et al.*, 2017; Scharfe, 2010). In most cases, waste management is administrated by various processes, many

of which are closely interrelated; therefore, it's logical to style holistic waste management systems instead of alternative and competing options (Staniškis, 2015).

A framework for waste management offers Flexibility in analyzing quantitative and qualitative data at various scales. Structure to clearly define important goals and values. Logic to consider the probability and effects of a certain course of action and communicate key concepts to key stakeholders (Owen, 2015). So as to achieve certain aims and goals, Integrated Waste Management (IWM), a comprehensive approach to managing waste, combines and applies several practical approaches, technologies, and management programs (McDougall *et al.*, 2017; Tchobanoglous & Kreith, 2015).

There is no perfect IWM system capable of processing all waste sustainably. In addition to strategic planning, WM is defined by using a comprehensive approach that evaluates the system's financial costs and environmental responsibilities. Use a broad range of collection and treatment techniques that focus on reducing waste production and managing waste that is still being created efficiently. A broad range of collection and treatment techniques that focus on reducing waste production and managing waste that is still being created efficiently, handling every component of the solid waste stream rather than concentrating just on certain components or sources of components (Hazardous materials should be restricted within the system but in a very separate stream). Being successful in terms of the environment by diminishing environmental burdens such as emissions to the air, land, and water. Being economically affordable by reducing costs and taking a market-focused approach by developing client-supplier connections with waste products that can be recycled or used to generate income. Social acceptability is achieved by incorporating public participation and ensuring that people know their responsibilities within the waste management system. As the urban

population in Kenya's major cities and other parts of the world grows, so does the burden of managing solid waste, which is made worse by a lack of financing for municipal sanitation services and lax implementation of cleanliness laws.

IWM is characterized by a holistic approach that evaluates the system's entire environmental loads and financial costs, enabling strategic planning. Using a variety of collection and treatment methods that focus on reducing waste production and handling waste that is still created efficiently, managing all accoutrements in the solid waste sluice as opposed to focusing just on certain accessories or additional sources (Dealing with dangerous accoutrements ought to be undertaken within the system but in a different sluice.)

Being successful in protecting the environment by minimizing environmental burdens, including emigration to air, land, and water (GIZ, 2015b). Becoming financially efficient by reducing expenses and promoting a request-acquainted approach while establishing relationships between clients and suppliers for waste materials that have been used and can generate cash.

Social appropriateness is achieved by including public engagement and helping people understand their role in the waste operation system. In general, an IWMS strategy seems to be the most efficient and long-lasting choice for addressing the growing solid waste problems in the developing world. However, to fulfill its goals, this strategy requires extensive planning and restructuring, and developing nations must be aware of all the restrictions related to waste operations (EPA, 2017).

### **2.9.1 Inclusivity in Designing a Waste Management Service System**

According to GIZ (2017a), there is no question about the necessity of an initial waste collection service. If a service is not provided, individuals will repeatedly resort to unlawful dumping if it is still not provided or is (considered to be) costly. Waste generators-households, businesses, and others-generally have a lot to say about their choices and initiatives when an SWM system is being created and developed, whether for the first time or in a renewed form. For instance, whether in Kumasi, Ghana, or Lyon, France, residents in homes without yards in densely populated areas are less likely to separate their garbage (Aparcana & Salhofer, 2013). Because of this, experience indicates that new or enhanced service initiatives have a better likelihood of success if they are proposed, discussed, and agreed upon by the people whose circumstances they seek to address. This is more likely to happen if people have already been "burned" by unethical waste management techniques, such as when harmful waste was improperly disposed of and impacted people's homes and water supplies or when soot from early incinerators had lax outflow restrictions. People will be hesitant to think that the governance components required to make that happen will truly be delivered, so consolation that experts would handle potential risks or explanations that contemporary engineering processes are much superior will not be helpful (Okot-Okumu *et al.*, 2017).

For instance, this was typical of the challenging installation site circumstances in Europe in the 1980s, when waste occasionally had to be kept temporarily until factory-produced limitless disposal. In similar situations, it's critical to consult with the community about potential locations that are named based on prudent environmental and technical requirements, as demonstrated by a high-quality Environmental Impact



Assessment (EIA), instead of choosing a wrong location just because no one from the general community has made an exception there. Similar procedures could entail offering compensation to the households and more in-depth discussions about why the facilities for waste installation were necessary in the first place (Curtis *et al.*, 2016).

Transparent information sharing and the existence of a robust complaint (grievances) channel are methods of "downward accountability" toward service stoners in a working system. Complaints provide honest and valuable input regarding the effectiveness of the services provided and their quality. Additionally, if concerns are promptly resolved and satisfactorily, this fosters client confidence and goodwill, which is a solid foundation for future collaboration on issues like waste insulation at the source and appropriate garbage placement at appropriate locations and times. While participatory approaches promise larger public support for the programs or regulations at hand, true interest in one another's viewpoints is essential, directed by clear and agreed-upon pretensions, and supported by a suitable environment for a fruitful dialogue place (Ezeah *et al.*, 2013).

Alternatively, there is a risk that the exchange will just be a matter of "going through the motions" without any true significance, leading to "participation fatigue" and heightened tension between the government and the public. Although a participatory approach may not ensure cooperation, consensus, and agreement, i.e. while it may not affect substantial advantages for the decision-making process at hand, it generally has ethical benefits for society. Stakeholder participation is, therefore, therefore more often encouraged as a process of social knowledge, a way to both improve procedural fairness and challenge what is, initially, in the interest of the public. It also helps to incorporate social values into technical opinions and quality assurance into expert-centred decision-

making. Additionally, it promotes the legitimacy of institutions, builds public confidence in viewpoints and decision-makers, and eventually advances democracy. Each of these would be a priceless development in and of itself (Cohen *et al.*, 2013).

## **2.10. Sustainable Consumption and Production (SCP) Perspective**

Sustainable Consumption and Product (SCP) has recently attracted increasing interest. Researchers contend that more environmentally friendly and sustainable supply chains may give organizations a competitive edge. In contrast, unsustainable consumption and production patterns are the main contributors to major environmental concerns (Seto *et al.*, 2014).

2002 saw Johannesburg at that time (UNEP, 2010). Therefore, SCP is one of the key components of sustainable development, which supports the efficient use of resources and energy, sustainable architecture, access to basic amenities, environmentally friendly industries, and well-paying jobs. There exist a substantial body of research on SCP initiatives and adoption from academics who have suggested that effective SCP policy revolves around three organizing principles: deliberation, (ii) effectiveness, and (iii) adequacy. Young *et al.* (2017) have classified pointers under environmental, social, and profitable orders for assessing the effectiveness of SCP.

Recent research by Scheinberg *et al.* (2017) has examined the impact of variables and problems such as values and stations, literacy, and product features, as well as the blending of social, financial, environmental, and institutional elements to try and understand SCP and related behaviours. Among the horticultural processing MSMEs surveyed, SCP practices are viewed as a way of minimizing waste and maximizing product output while sustaining the environment in terms of waste disposal. According

to scholars, top operation commitment is essential for achieving sustainability (Carter *et al.*, 2016; Liang *et al.*, 2017).

According to studies (Abdulrahman *et al.*, 2015; Sofyan *et al.*, 2016), the commitment of senior management is essential for adopting sustainable practices. While the institutional proposition helps explain how transformation is reached during strengthening SCP characteristics, distinct SCP characteristics occur under similar institutional setups. Agency Theory (Eisenhardt, 1989) has proposed that in a basic contract, one party (the "top") assigns control and decision-making regarding duties (and later delegated power) to a different party, "the agent", to clarify this variety.' Even though OM and SCM experts have employed the agency concept to explain supplier threat, effectiveness (Ketchen 75 and Hult, 2017) and conflicts of interest arising in supplier relationships (Zhang *et al.*, 2015), This notion has not been used much in SCP. To understand top operation as a top agent that converts institutional pressures into appropriate behaviour for SCP practices, we employ Agency Theory. However, strategies for encouraging sustainable consumption are likely ineffective if they ignore the people's pressing, general societal concerns about equality, power, honour, and justice that they perceive to be present in the affected communities and society at large.

According to Liang *et al.*, 2017), Telling people to reduce their consumption when so many people already struggle to consume enough or what to try to do when political institutions barely address their own consumption problems won't go down well. Consumption goes beyond simply meeting our physical requirements for shelter, food, and clothing. For better or worse, the act of consuming serves various functions, including creating life and maintaining specific connections as well as exhibiting status and social bourses (UNEP, 2012d). Therefore, suggested sustainable druthers must be

an acceptable relief not just in respect to the functionality of the products, but in addition to terms of those symbolic values and meanings to be successful. In the end, how can an individual live sustainably when society is not oriented toward it? (Sofyan *et al.*, 2016), Products are usually not repairable since planned obsolescence is a requirement during design.

Similarly, it can be challenging to develop sustainable, "green" personal choices amid societal structures and cultures that emphasize physical materialism, promoted by government and media messages about the need to increase consumption to encourage frugality. Simple solutions that disregard the current sociocultural climate of consumerism will fall short. Further significant modifications are required, but nothing that necessitates a paradigm shift. Businesses have a significant role in facilitating and promoting sustainable consumption and products, which plays a large part in direct control over consumption patterns.

### **2.10.1 Technology Trends Toward Waste Management**

Technology influences how people live interact and transfer information, but it also impacts how waste is managed globally. Governments and businesses that manage waste integrate technology at the lowest point in the value chain, save costs, increase energy recovery accoutrements, and connect with citizens (Kajihera, 2017). The use of technology varies by environment, notwithstanding the potential of technology solutions to improve how coffers are used and recovered. Communities differ in terms of their topography, specialization, waste composition, and socioeconomic standing, and frequently the trendy outcome is neither the most current nor the most technologically advanced, bearing in mind the fiscal capabilities of the horticultural

processing MSMEs in Kenya. Technologies utilized in the manufacturing firms enable the exercise of accoutrements or drop the utilization of virgin accoutrements (Halkos *et al.*, 2016). Packaging inventions similar to biodegradable spoons and bags lower plastic waste and infrequently allow druggies to decompose these accoutrements. Still, new accoutrements bear applicable operation, and when dumped or discarded, poorly managed biodegradable packaging can increase GHG emissions and may not entirely disintegrate under the wrong conditions (Vaughan, 2016). There is available software that enables producers to consider waste throughout the product design process and choose accessories that have the least negative impact on the environment (Building Ecology n.d.). Some businesses have created methods for turning waste materials into new products, much to how new clothes are made from textiles and plastic. Eventually, new platforms are developing that create a market for old items, decreasing the need to produce new ones (Sustainable Brands, 2018).

## **2.11 Theories on Waste Management**

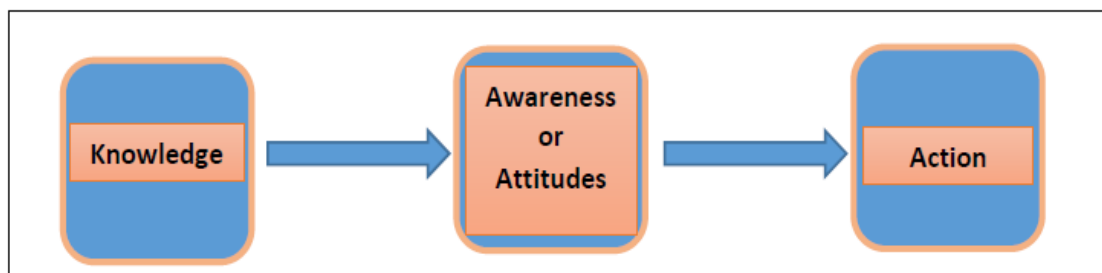
According to Swanson et al. (2014), a theory is a well-established principle which has been produced to clarify certain elements of plants. Theories result from repeated observations and tests, combining universally acknowledged facts, rules, predictions, and tested premises.

A theory offers a systematic approach to understanding behaviours, events, and circumstances. It is a group of interrelated definitions, ideas, and claims that use relationships between the variables to forecast or provide an explanation for certain occurrences or situations (National Institute of Health, 2015). Thus, a probe study's theory may be expressed on a platform provided by the theoretical framework. It

describes and presents the theory put out to explain why the research problem under the study occurs (Swanson *et al.*, 2014).

### 2.11.1 Behavioural Change Theory

This reasoning was closely tied to the idea that if people were more informed, they may be more sensitive to environmental issues and, as a result, driven to act in an environmentally conscious way. Many of these theories establish connections between information, attitudes, and behaviour. Therefore, as illustrated in Figure 2.3, attitudes that result in responsible environmental activities improve as knowledge develops (Hungerford & Volk, 1990).



**Figure 2.2: Behavioral change Model (adapted from Hungerford & Volk, 1990)**

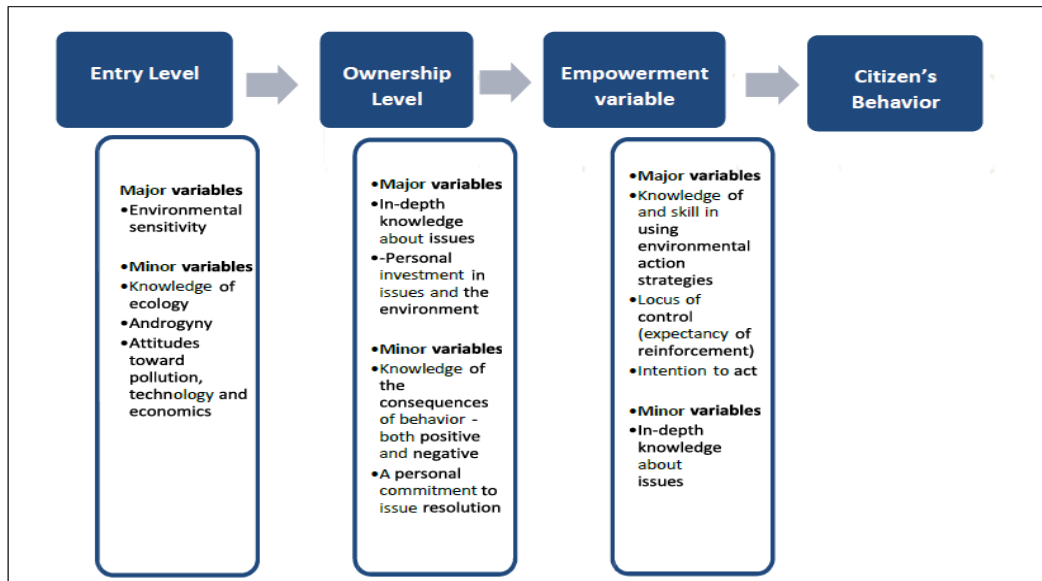
However, further studies disproved those who believed this Model captured the fundamentals of human behavioural development. Because of this, the validity of such a simplistic linear model wasn't acknowledged or supported for a very long time (Hungerford & Volk, 1990).

Although relatively simplistic, the behavioural Model offers a foundation for thinking about potential connections between environmental knowledge, environmental awareness, and attitude and how these might translate to action or inaction. Understanding environmental factors may not always translate into ethical and

sustainable environmental behaviour. This means that once the horticultural processing MSMEs are trained on waste management and resource use, for example, water, energy, and knowledge. They are bound to be aware of the consequences. Being aware of the consequences of employing SCP practices in their daily operations, changes are likely to occur in attitude and actions (Dijksterhls & Van Baaren *et al.*, 2010).

### **2.11.2 The Environmental Citizenship Theory**

Hungerford and Volk provided the basis for the theory (1990). This theory is crucial because it can create citizen's sensitive to environmental concerns and endure those burdens to the point of having the skills necessary to act in the environment's best interest. Solid waste is a common example of an environmental variable, and this theory reminds horticultural processing MSMEs and all citizens of the sustainability of the environment. Accordingly, residents would be most concerned with a sustainable approach to waste generation disposal and management based on avoidance, reduction, reuse, and recycling, particularly among Kenyan MSMEs engaged in horticulture processing. Within the Model below, Hungerford (1990) grouped the elements that drive whether a private taken action under four domains; entry point, level of ownership, and empowerment factors and therefore, the Citizen's behaviour where environmental sensitivity, in-depth knowledge about environmental issues and using environmental strategies to attain environmental soundness as shown in Figure 2.4 below, adapted from Hungerford's Model, 1990.



*Figure 2.3: Environmental Citizenship Model, adapted from Hungerford, 1990*

## 2.12 Conceptual Framework

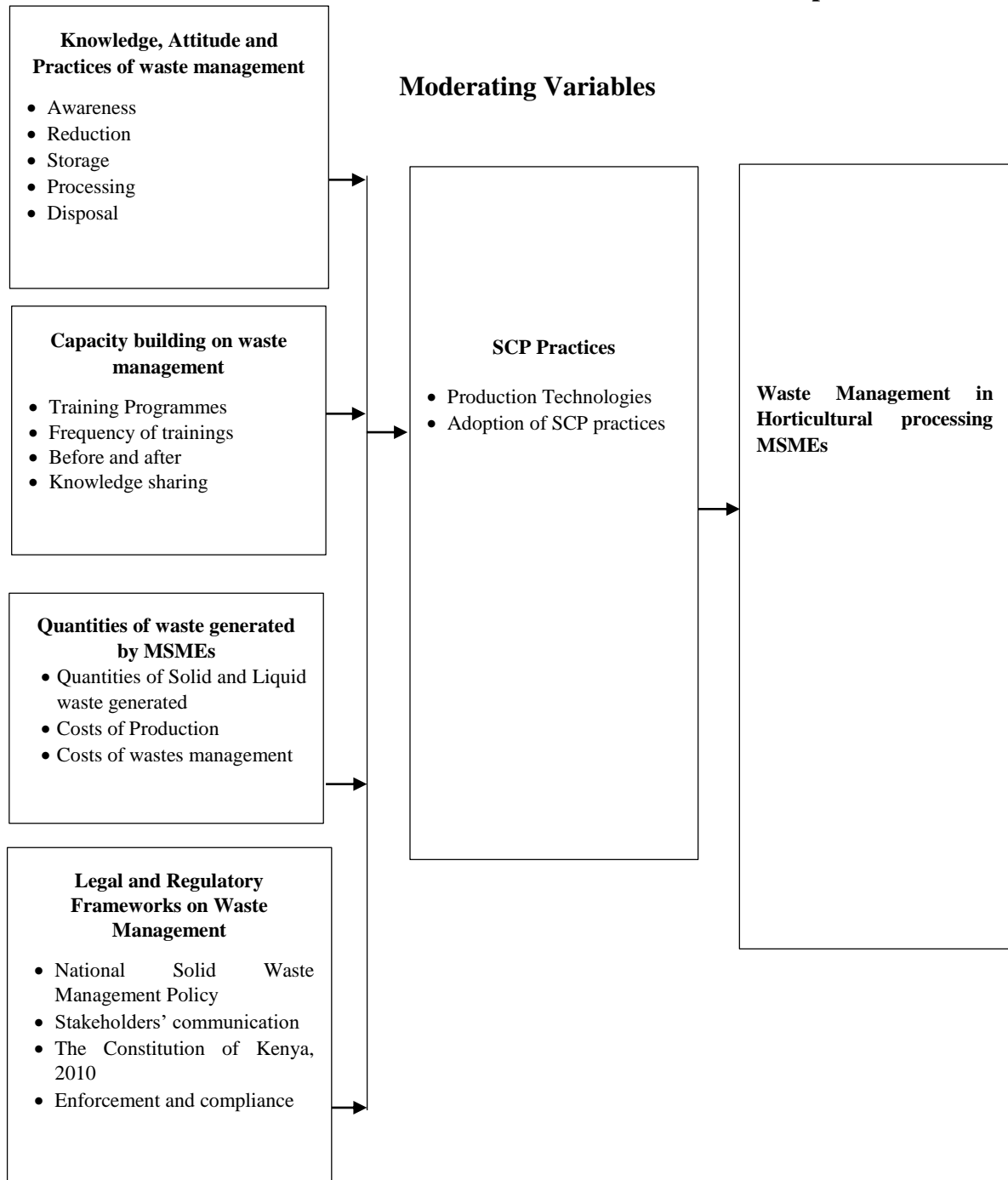
The schematic framework below (Figure 2.5) embodies the specific direction in which the research was conducted (Mugenda and Mugenda, 2016). It shows the relationships between independent, moderating and dependent variables. It further outlines the input, process and output of the whole research. Grant and Onsanloo (2016) asserted that a framework is a systematic sequence that helps the researcher and reader understand the causal relationships of the variables in a study. Luse *et al.* (2016) postulated that the framework could be graphed or in narrative structure showing the main Independent and Dependent constructs to be studied and the presumed association between them.

Therefore, in this study, the researcher narrowed down the Independent, Moderating, and Dependent variables to get answers or solutions to the study's objective. These variables were; KAPs, Capacity building, quantities of waste generated, and Legal and regulatory frameworks, with SCP Practices and waste management as Moderating and Dependent variables, respectively.



## Independent variables

## Dependent variables



*Figure 2.4: Conceptual framework (Author, 2021)*

### **2.13 Research Gaps**

The reviewed literatures showed that environmental awareness and knowledge on conservation were designed to positively influence recovering stations, but if knowledge about them was lacking, positive stations might not have regenerated in recycling (Aini *et al.*, 2017). A study on small growers in Bangladesh concluded that building growers' capacity through training is more beneficial than just the provision of financial support meant to raise product and income.

The study also showed a shift of behaviour and responsibility on wastes management after the respondent's undertaken training despite having prior college/diploma, undergraduate degree and Master's degree certification and Secondary level (Table 3.4) Meaning, an individual's rapid uptake of capacity building on awareness of impacts of wastes on the environment facilitates them to initiate strategies on sustainable waste management. A further review of a study done in Palestine focused on the influence of education came to the conclusion that there was a positive relationship between the extent of education and the participatory behaviour of the people in recycling activities (Al-Khatib *et al.*, 2015).

The Environmental management and Co-ordination Act of 199 stipulates the importance of environmental management in Kenya especially underscoring the sole responsibility for solid-waste collection while the disposal of waste lies in the hands of Counties. According to research conducted by Wakhungu, Judy (2017), these legislations are not respected by processors, manufactures and even Citizens who have the duty to care for their environment. Consequently, the question or gap is, despite the existence of all these legislation governing waste management, including the recent

One-Sustainable Waste Management Act, 2021. Why are wastes being disposed anyhow against the desired ways of ensuring a clean and healthy environment as envisioned by the 2010 Constitution?

**CHAPTER THREE: KNOWLEDGE, ATTITUDE AND PRACTICES ON  
WASTE MANAGEMENT AMONG HORTICULTURAL PROCESSING  
MSMEs IN KENYA**

**Abstract**

Horticultural processing Micro, Small and Medium Enterprises (MSMEs) in Kenya utilize raw agricultural produce and generate large quantities of solid and liquid wastes. Inadequate data on the determination of status on waste management among horticultural processing MSMEs in Kenya motivated the researcher to evaluate these phenomena and find solutions thereafter. The survey adopted quantitative and qualitative data collection method, forty-four (44) Certified MSMEs from Nairobi, Central and Western regions were surveyed using a structured questionnaire. The MSMEs indicated that improper waste disposal has adverse effects on the environment, reuse/reduce/recycle was the core principles of waste management and wastes pollute the environment. Segregation of wastes was considered good practice while improper waste disposal compromises quality of the environment. Improper waste disposal is harmful to their environment, their work place and neighbourhoods ought to be clean (71%) each respectively while different waste management practices were used (6.8%). About 83.9% segregated their waste and 93.5% were not ISO 14001 compliant certified. The respondents' knowledge on wastes reduction showed that majority of the MSMEs employ the principles of reuse and waste minimization to manage wastes at 52% and 45% respectively. This was followed by recycling at 19% and energy recovery at 16%. The standardized beta coefficient on knowledge, attitude and practice on waste management indicated; values of 0.097(t=0.526), 0.628 (t=4.349) and 0.739 (t=5.913) respectively. There was no significance relationship of knowledge on waste

management with p-value ( $p > 0.05$ ). There was a significant relationship ( $p < 0.05$ ) between attitude and practices on waste management among Horticultural processing MSMEs. There is need to enhance knowledge through training towards a sustainable consumption production and practices in MSMEs.

### **3.1 Introduction**

A number of researches have been done on knowledge, attitudes and practices on wastes management. Adogu *et al.* (2015) research findings showed that awareness of waste management accounted for 90% and a positive attitude on waste management was 97.5%. According to UNEP (2015) study industries/processors undertake their own disposal of mixed waste and transport to non-designated waste landfills. The research by Akenji *et al.* (2016) on waste disposal and management also showed a result of tested hypotheses of 0.05 level of significance- negative attitude towards management and disposal of wastes. Some people such as the trash pickers of DANDORA DUMPSITE in Nairobi, Kenya see “waste” as a resource or a way to make an income in an otherwise limited job market. On the other hand, you have a majority of people living in the developing world that see waste as a burden and a problem that needs to be addressed. To say people in developing countries don’t recognize trash as an issue is an untrue statement. The opposite is often true. However, recognizing trash as a problem does not prevent littering or other negative behaviours concerning waste management (Moore, 2012). This attitude-behaviour gap often emerges and can be further affected by a variety of reasons including convenience, social norms, lack of public participation, and lack of education and awareness on better ways of managing wastes (O’Connell, 2011).

Within this attitude/behaviour gap exists an inconsistency between one's values and actions. This specifically refers to the discrepancy between people's concern over the environmental harm posed by household waste and the limited action by those same people to reduce their waste or engage in other pro-environmental behaviours (O'Connell, 2011).

There is a distinction between knowledge and information and being presented with the information without prior knowledge may be ineffective in creating change. However, if prior knowledge of waste management was met with new information, these communities may be more willing to accept it and implement these changes. The need to improve public awareness of, and community participation in, waste management has been widely recognized by researchers as necessary to create sustainable waste systems and to promote environmental citizenship amongst community members (Lumbreras, 2014). A study done in Palestine focused on this educational gap came to the conclusion that there was a positive relationship between the level of education and the participatory behaviour of the people in applying the 3Rs in waste management, (Al-Khatib *et al.*, 2015).

**Table 3.1: Distribution of MSMEs Surveyed**

<b>Region</b>	<b>County</b>	<b>No. of Processors</b>
<b>Nairobi</b>	Nairobi	11
<b>Central Kenya</b>	Nyeri	32
	Kiambu	6
	Meru	3
	Murang'a	1
	Kirinyaga	1
	Laikipia and Nyandarua	2
<b>Western Kenya</b>	Vihiga	27
	Busia	6
	Bungoma	7
	Kakamega	13
	Kisumu	2
	Kisii and Homa- Bay	5
<b>Rift valley and Eastern Kenya</b>	Nakuru	3
	Embu	1
	Kitui	1
	Kajiado	1
	<b>Total</b>	<b>122</b>

*(Source: Author, 2021)*

The baseline survey results showed that good environmental practices and awareness during processing scored poorly. Most of the processors (70.3%) did not have properly installed waste and waste-water treatment equipment, Wastes and waste-water generated during processing were not treated before releasing them into the ecosystem, SCP practices were very low and therefore lot of awareness and sensitization needed to be done. The pilot study results further showed that the number of MSMEs involved in horticultural processing were relatively low and this necessitated the second stage of survey (Obiero *et al.*, 2021).

At the second stage, the horticultural processing MSMEs were selected for interviews and training on waste management, energy efficiency and SCP Practices after undergoing several trainings on waste management and environmental management systems and audit. Wherever possible, the Director/Manager/owner of the MSME was

the survey respondent. In the absence of the head, the next most senior Employee of the MSME was interviewed. This survey was complemented between July 2020 and March 2021 by in-depth and Key Informant interviews. In-depth interview participants were purposively selected on the basis of their work affiliation within the target organizations/Horticultural processing MSMEs and capacity to provide the researcher with rich information on the four objectives of the study.

### **3.2. Materials and Methods**

This chapter is a presentation of the methodologies to be employed in conducting the study. The chapter outlines research area, research design, and target population, sampling design, research instrument and statistical treatment of data obtained. There were two stages of sample selection in the survey. At the first stage, a baseline survey was conducted where purposive sampling was used to select due to homogeneity of the MSMEs. According to Saunders *et al.* (2017), purposive sampling is a non-probability sampling method that is used when elements selected for the sample are chosen by judgment or criteria by the researcher. These horticultural processors were involved in the processing and preservation of fruits and vegetables at the micro, medium, and small-scale operations for commercial purposes, which were the main criterion. A total of 122 processors distributed across 19 counties of Nairobi, Rift Valley, Central, Western, and Eastern Kenya (Table 3.1) were assessed from 08/07/2018 – 14/12/2018.

#### **3.2.1 Area of Study**

The study was conducted in four regions namely Nairobi, Central, Rift Valley, Eastern and Western in Kenya due to high production and processing of horticultural crops capacity and MSMEs dominance (*Figures 3.1*).





(Source; Survey of Kenya, 2009)

Figure 3.1: Map of Kenya Showing the Four Areas of Study

### **3.2.2 Research Design**

The researcher adopted descriptive research design. A descriptive study design describes characteristic of a population or a phenomenon such as measures of central tendency including the mean, variation, percentages and correlation between the variables (Cooper and Schindler, 2017). Qualitative data such as literacy level, gender, training and awareness, waste management practices and legal and regulatory frameworks were analyzed qualitatively while quantitative data such as price of raw materials, quantity of waste generated were tabulated along a continuum in numerical form, such as scores. Likert's Scale of between 1-5 (1 being lowest and 5 highest scores) was used to analyze, practices and attitude on waste management as it allows the researcher to operationalize perceptions, attitude of respondents as postulated by (Likert, 2015).

### **3.2.3 Study Population**

A total of four regions were stratified after the baseline survey results based on certification and capacity of production of horticultural processing MSMEs from Nairobi County, Central Economic block comprising of Nyeri, Kirinyaga, Muranga, Kiambu and Nyandarua Counties, Rift Valley and Eastern Regions; Nakuru, Embu, Machakos, Kitui, Kajiado and Western Economic block comprising of Kisumu, Kakamega, Vihiga, Bungoma, Busia, Siaya, Migori, Homa-Bay, Kisii, and Nyamira Counties to a total of 50 certified Horticultural MSMEs processors.

### **3.2.4 Sampling Strategy and Sample Size**

A sample is a finite part of a statistical population whose properties are studied to gain information about the whole (Kombo *et al.*, 2015). The MSMEs surveyed as per Table

3.2 below included; GAEA Foods, Exotic Foods, Executive Foods, Pamat Foods, Midrow Kenya, cheer up Group, Her kitchen, Bettana Ventures, Tenseness Africa and Interveg. Quenching streams, Export, UON Pilot Plant, Natures Noble, Terra lifestyle and Meru Greens, Charney Agri Processors, Miyonga Fresh, Nairobi region.

The G-Star Youth Group, Kambiti Mango processors, Kakai Foods, Icobo Healthy Foods, Wedo Foods, Karurumo Horticulture Group and Laikipia Permaculture represented Central region of Kenya. In Western regions, the researcher surveyed; Kenya Papaya Products, Rehot Bakers, Organi Limited, Kabondo Processors, Take-off Ventures, Dala Bakery, Joopers/ Modest Bakers, PAMCO, Njalo Foods, Agro Foods, Nyangorara Banana Processors and Agro Foods. Whereas in the Rift Valley and Eastern regions, Mace Foods, Masses Enterprise, Vokenel Enterprises, Azaavi Foods, Vert Limited, Kalamba Mango processors, Bomet sweet Potato processors Goshen Firms were surveyed.

**Table 3.2: Strata of MSMEs Surveyed**

<b>Region</b>	<b>County</b>	<b>No. of Processors</b>
<b>Nairobi</b>	Nairobi	22
<b>Central Kenya</b>	Nyeri	2
	Meru/Embu	4
	Laikipia	1
<b>Western Kenya</b>	Vihiga	2
	Kisumu	3
	Kisii and Homa- Bay	7
<b>Rift valley and Eastern Kenya</b>	Eldoret	2
	Kibwezi	1
	Kajiado	1
	Machakos/Makueni	5
	<b>Total</b>	<b>50</b>

The areas are Central, Nairobi, Rift Valley, Eastern and Western Kenya were the scope of the study, reason being high production and processing of horticultural MSMEs. The research used cross-sectional survey as a design. The target population comprises of 50 certified processing MSMEs and random stratified sampling techniques were used based on the yardstick set and selected the samples size using Yamane's formula (1967).

$$n = \frac{N}{1 + N(e)^2}$$

Where;

$n$  = is the sample size,

$N$ = is the population size and

$e$ = is the level of precision.

$$n = \frac{50}{1 + 50(0.05)^2}$$

$$n = \frac{50}{1 + 50 (0.125)}$$

$$n = \frac{50}{1.125}$$

$$n = 44 \text{ Certified horticultural processing MSMEs}$$

### 3.2.5 Research Instruments

According to Cooper and Schindler, (2017) a questionnaire is a research instrument that consists of a set of questions or other types of prompts that aims to collect information from a respondent. It is typically a mix of close ended questions and open -ended questions. Open-ended questions offer the respondents the ability to elaborate on their thoughts. Primary data was collected by the use of structured questionnaire administered to the selected and certified horticultural processing MSMEs in Nairobi,

Central and Western Economic blocks in Kenya (*Appendix I*).

### **3.2.6 Data Analysis**

According to Cooper et al. (2017) data analysis is the process of editing and reducing accumulated data to a manageable size, developing summaries, looking for patterns and applying statistical techniques. Inferential and descriptive statistics were employed as the basis of analysis. Descriptive statistics is recommended for ordinal measurement scale items such as mode, median for central tendency, while inferential statistics is concerned with making predictions or inferences about a population from observations and analysis of the sample (Kothari, 2014). Researcher used various methods of regression analysis such as T-test, multivariate, cross tabulations among others.

The researcher and assistants used the Open Data Kit (ODK) mobile digital platform using smartphones to collect data on current practices for adopting sustainable consumption and production practices in the Kenyan horticultural processing industries and the support needed to transform an inclusive green economy. Data was collated and retrieved from the servers (Ona.io, 2019), cleaned, and then subjected to analysis using Statistical Package for Social Science (SPSS) Version 22. Descriptive statistics were used to obtain the frequencies, percentages, means, and standard deviations for the variables under study.

Linear regression analysis was appropriately used to compare mean scores for KAPs among respondents in various domains. This level of score was chosen based on previous studies (Samapundo *et al.*, 2015; Sharif *et al.*, 2013; Talaei *et al.*, 2015; Thimoteo *et al.*, 2014). Pearson's correlation was used to establish an association between knowledge, attitude and practices on waste management among the

respondents. Adjusted linear regression was used to assess their effects while Statistical significance was set at  $p < 0.05$  (*Appendix VI*).

### **3.3 Results**

#### **3.3.1. Demographic Characteristics**

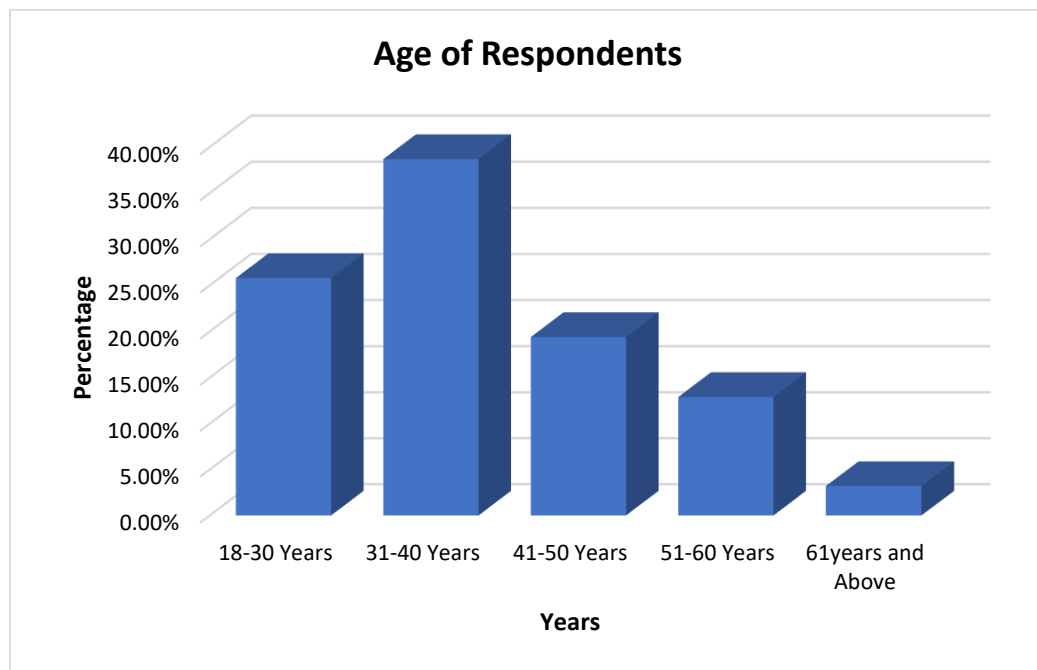
Majority (58.1%) of the respondents were females, while 41.9% were male. On Marital status, the results in Table 3.3 indicates that 90.3% of those engaged in horticultural processing MSMEs businesses are predominantly married thereby demonstrating the family business tier, while 9.7% of respondents were either single, separated or divorced.

The survey data revealed that the majority of those involved in Horticultural processing MSME businesses are aged between 31-40 years (38.7%), followed closely by 18-30 (25.8%), 41-50 (19.4%) and 51-60 (12.9%) years of age respectively, while those above 61 years of age, was only one person at 3.2% (*Figure 3.8*).

Among the respondents, 64.6% indicated that they had undertaken College/Diploma and undergraduate degree courses to certification, while 22.6%, 9.7% had Master's degree and secondary school level qualifications respectively as shown in Table 3.4. In Figure 3.3, the results show that most of the Horticultural processing MSMEs business were started between 1-3 years ago (41.9%), 38.7% were above 6years, 16.1% and 3.2% accounted for 4-6 years and below 1 year respectively.

**Table 3.3: Marital Status**

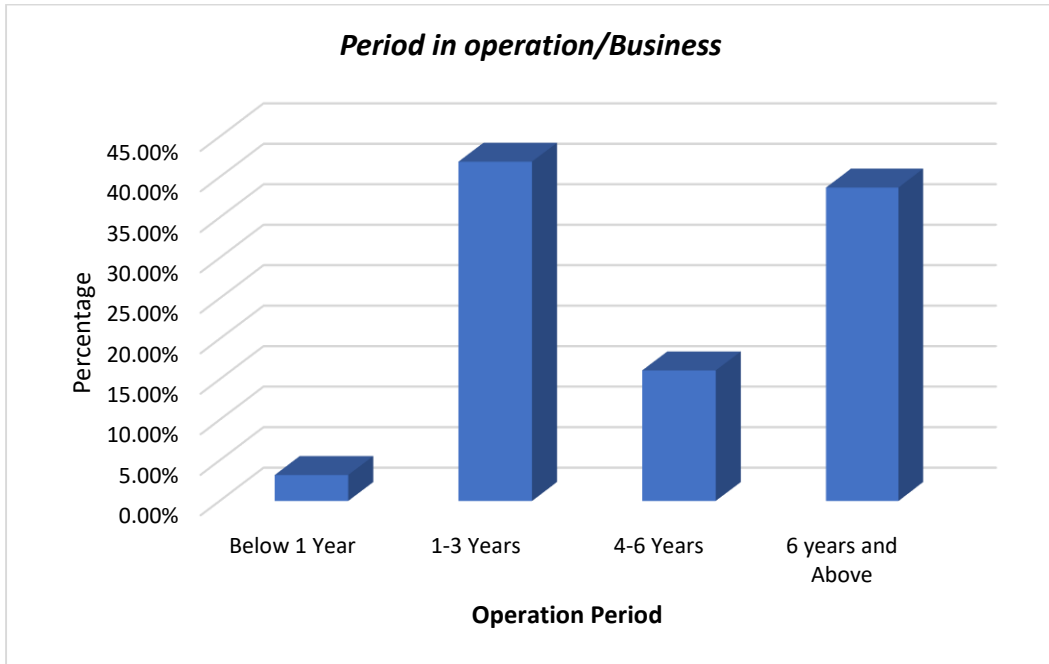
<b>Marital Status</b>	<b>Frequency</b>	<b>Percentage</b>
Single	2	6.5
Married	28	90.3
Separated/Divorced	1	3.2
<b>Total</b>	<b>31</b>	<b>100.0</b>



**Figure 3.2: Age of Respondents**

**Table 3.4: Educational Level**

<b>Education Level</b>	<b>Frequency</b>	<b>Percentage</b>
Primary	1	3.2
Secondary	3	9.7
College/Diploma	10	32.3
Undergraduate Degree	10	32.3
Master's Degree	7	22.6
<b>Total</b>	<b>31</b>	<b>100.0</b>



**Figure 3.3: Period in operation/Business**

### **3.3.2 Knowledge on Waste Management**

Results from surveyed data revealed that, majority of the Horticultural processing MSMEs were aware of the impacts of improper waste management, yet it was observed that handling of waste was still a major challenge among the horticultural processing MSMEs. For example, all the 31 of the respondents agreed that improper waste disposal has adverse effects on the environment. The result further showed that, Reuse/reduce/recycle were the core principles of waste management, wastes pollute the environment, at 100% each and segregation of wastes is considered good practice, improper waste disposal compromises quality of the environment at 96.8% each. This means that they have ideas of the negative impacts of wastes within the environment. The respondents also acknowledged that dumping of wastes in streams/rivers/bush and discharge or disposals anyhow of wastes into the environment are not acceptable at 90.3% and 93.5% respectively.



**Table 3.5: Knowledge on Waste management**

<b>Statement</b>	<b>TRUE (%)</b>	<b>FALSE (%)</b>
a) Improper waste disposal has adverse effects on the environment	100.00	0.00
b) Banning of plastic wastes is good for the environment	48.40	51.60
c) Dumping of wastes in streams/rivers/bush is acceptable	9.70	90.30
d) Improper Waste Management does not pose safety hazard to food processing firm	6.50	93.50
e) Segregation of wastes is considered good practice	96.80	3.20
f) Improper waste disposal compromises quality of environment	96.80	3.20
g) Reuse/Reduce/Recycle are the core principles of waste management	100.00	0.00
h) Wastes pollute the environment	100.00	0.00
i) The best way of dealing with solid wastes is by burning	60.6	39.4
j) I can discharge/dispose anyhow my wastes into the environment	6.50	93.50
k) Do you know that reduction in consumption of resources will lead to less waste generation?	96.80	3.20
	<b>Std. Dev.</b>	<b>0.922</b>

### 3.3.3 Attitude on Waste Management

Table 3.6 shows the attitude of the respondents on waste management. Ranking the respondents' responses attitude towards waste management, the results showed that "improper waste disposal is harmful to our environment," my workplace and neighborhoods should be clean had the highest mean (**M= 4.710**) each while, 'the government is responsible for the management of wastes and not me'' had the lowest mean (**M= 1.970**). This means that the respondents had high and positive attitudes on waste management in their firms.

**Table 3.6: Attitude on Waste management**

Statement	1 SD (%)	2 D (%)	3 N (%)	4 A (%)	5 SA (%)	Mean	Std dev
a) Way wastes is handled by my firm	0	3	10	48	39	4.230	0.762
b) Improper waste disposal	0	0	0	29	71	4.710	0.461
c) Cleanliness of work place/neighborhood	0	0	0	29	71	4.710	0.461
d) Appropriate on waste disposal	0	0	0	42	58	4.580	0.502
e) Attitude on waste burning	61	29	0	10	0	1.580	0.923
f) Responsibility on waste disposal	0	0	0	55	45	4.450	0.506
g) Effort on manage waste management	42	36	1	10	0	1.900	0.978
h) Care for environment	45	39	7	3	7	1.870	1.118
i) Concerned for waste management	45	45	3	3	3	1.740	0.930
j) Clean working environment	0	3	0	42	55	4.480	0.677
k) Educating the public on waste management	0	0	3	55	42	4.390	0.558
l) Impact of waste on environment	0	0	0	48	52	4.520	0.508
m) Waste is a resource	0	3	7	45	45	4.320	0.748
n) Segregation of wastes	0	0	0	42	58	4.580	0.502
o) Cleanliness is next to godliness	0	0	0	39	61	4.610	0.495
p) Environmental concern	0	0	3	39	58	4.550	0.568
q) Status in the environment	58	13	7	13	10	2.030	1.449
r) Recycling	55	0	3	39	3	4.260	0.815
s) Reduction of wastes	55	0	0	45	0	4.450	0.506
t) Waste management sensitization	48	0	0	52	0	4.520	0.508
u) Wastes management facilities	29	19	19	23	10	3.350	1.305
v) Government/citizen responsibility on waste	10	48	10	0	32	1.970	0.912

*Legend; (SD-Strongly Disagree, D-Disagree-Neutral, A-Agree-Strongly Agree).*

### 3.3.4 Practices on Waste Management amongst MSMEs

The results in Table 3.7 showed that there were different waste management practices used by the surveyed horticultural processing MSMEs, accordingly, **96.8%** of respondents acknowledge this. The results also showed that among the 31 horticultural processing MSMEs surveyed, **93.5%** have competent employee to implement EMS Policy, and **83.9%** do separate their wastes into streams. But about **93.5%** of the respondents were not ISO 14001 (EMS Compliance) Certification thereby indicating that there is need to further encourage the MSMEs to work towards such certification for better productivity and external competitiveness.

**Table 3.7: Waste Management Practices**

<b>Statements</b>	<b>Yes (%)</b>	<b>No (%)</b>
a) Are you aware of waste management practices in your firm?	96.8	3.2
b) Do you separate your wastes according to their components?	83.9	16.1
c) Do you practice solid waste storage?	51.6	48.4
d) Does your firm have Environmental Management System?	51.6	48.4
e) Is your firm ISO 14001 Certified?	6.5	93.5
f) Does your firm have a competent employee to implement an EMS Policy?	93.5	6.5

### **3.3.5 Waste Reduction Amongst MSMEs**

#### **3.3.5.1 Waste Reduction**

The respondent's knowledge towards wastes reduction showed that majority of the MSMEs employ the principles of Reduce, Minimization and reuse to manage wastes at **52%**, **45%** and **32%** respectively. This was followed by Recycle at **19%** and Energy recovery at **16%** as shown in Figure 3.4. This means that all the Horticultural processing MSMEs have embraced the principles of wastes reduction.

#### **3.3.5.2 Waste Storage**

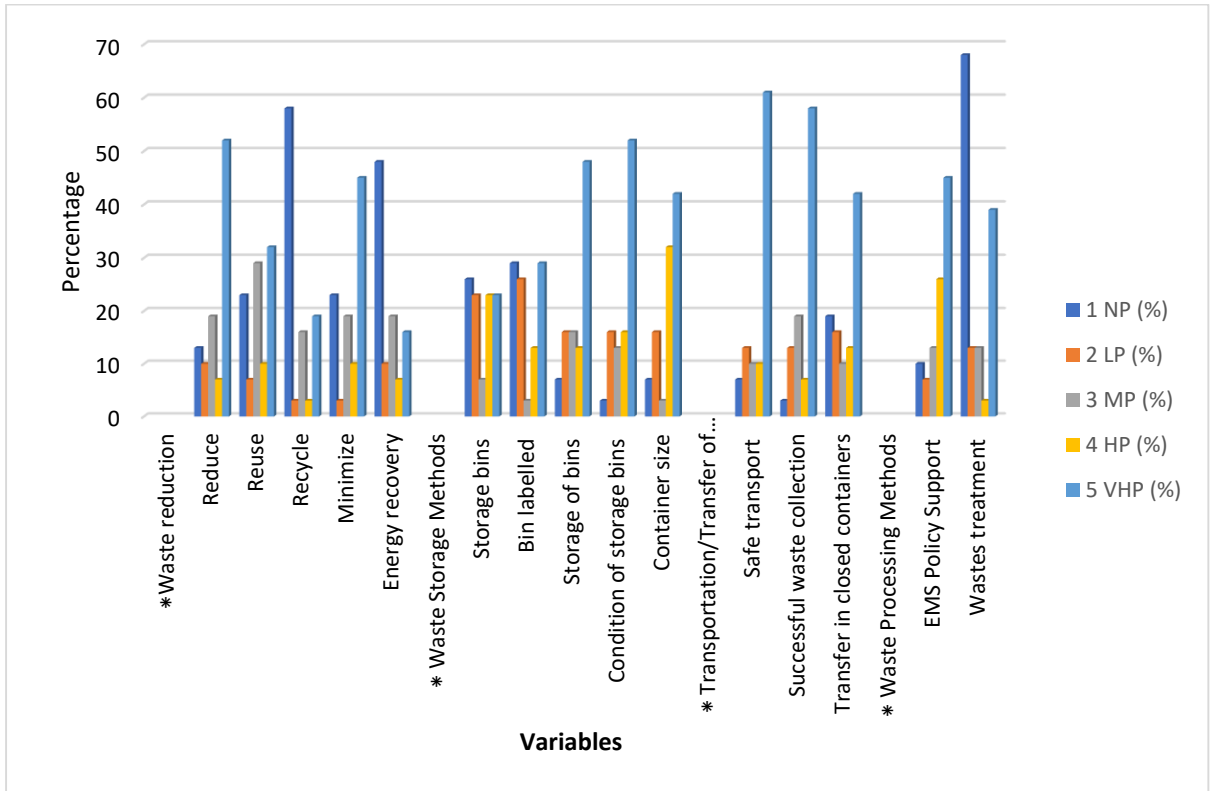
Amongst the different aspects of waste storage methods, **52%** indicated that their waste storage facilities are kept clean and neat, **48%** stores waste at collection points, large containers are used to accommodate larger volumes of waste before collection while bins are consistently labelled with correct information and have different colours to help in sorting of wastes at **29%** and **23%** respectively as shown in Table 3.11. The results show that proper waste storage is highly practiced by the horticultural processing MSMEs.

### **3.3.5.3 Waste Transportation/Transfer**

According to the results shown in Table 3.4 on waste transportation/transfers, **61%** of the respondents Transfer/Transports wastes safely to disposal sites, the efficient participation of the MSMEs on collection and transfer of wastes at **58%**, and transfer of waste is done in compact containers at **42%**, indicating that the respondents understand the impacts of improper wastes disposal on the environment.

### **3.3.5.4 Waste Processing**

The respondents were also tasked to indicate the aspects of wastes processing in their firms. Those who highly supported the development of an EMS system and reused or recycled wastes other than throw them away were all at **45%** while **39%** indicated they highly practiced Treatment of wastes and modification of production process and equipment-a positive attribute towards Sustainable production and consumption practices.

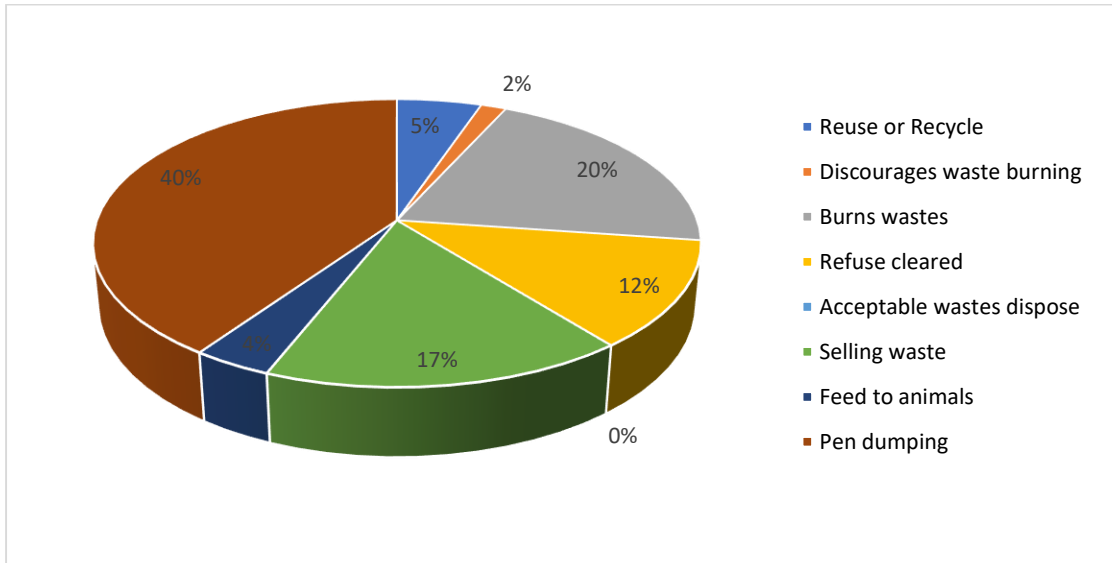


Legend; (NP-Not Practiced-Low practiced, MP-Moderately Practiced-Highly practiced and VHP-Very highly practiced).

Figure 3.4: Methods of Waste Reduction Used

### 3.3.5.5 Waste Disposal

The results in Figure 3.5 below on waste disposal methods showed that the majority of the horticultural processing MSMEs use their wastes to feed animals at **61%** followed by disposal through socially environmentally acceptable manner and also discourages burning of wastes at **55%** each respectively.



**Figure 3.5: Waste Disposal**

### 3.3.6 Regression Analysis to Show the Relationships of Variables

The succeeding Tables; 3.8, 3.9 and 3.10 present the relationships among the variables of the study.

#### 3.3.6.1 Influence of Knowledge on Waste Management Among Horticultural Processing MSMEs in Kenya

According to the regression analysis on Table 3.8, influence of knowledge on waste management among horticultural processing Medium and Small Microenterprises (MSMEs) had no Significant with a *p-value of (0.603b)*. Which is higher than **0.05** level of significance and therefore, the results were not statistically significant. The standardized Beta Coefficient on Knowledge on waste management indicated; **Beta 0.097(t=0.526)**. That means, respondent’s knowledge does not affect waste management efforts amongst these MSMEs.

**Table 3.8: Knowledge on Waste Management**

<b>Model Summary</b>						
<b>R</b>	<b>R Square</b>	<b>Adjusted R Square</b>		<b>Std. Error of the Estimate</b>		
		<b>Sum of Squares</b>	<b>df</b>	<b>Mean Square</b>	<b>F</b>	<b>Sig.</b>
Regression		0.526	1	0.526	0.276	<b>.603b</b>
Residual		55.181	29	1.903		
Total		55.707	30			
<b>Coefficients</b>						
		<b>Unstandardized Coefficients</b>		<b>Standardized Coefficients</b>		
		<b>B</b>	<b>Std. Error</b>	<b>Beta</b>	<b>T</b>	<b>Sig.</b>
(Constant)		1.815	2.437		0.745	0.462
Overall score on knowledge of waste management		0.144	0.273	0.097	0.526	<b>0.603</b>

### **3.3.6.2 Influence of Attitude on Waste Management Among Horticultural Processing MSMEs in Kenya**

The regression analysis result showed that there was significant relationship or influence between Attitude and Practices with the *p-value (0.000b)* on waste management amongst Horticultural processing MSMEs as shown on the regression analysis Table 3.8 and 3.9 respectively. The standardized Beta Coefficient of attitude on waste management indicated; **Beta= 0.628 (t=4.349)**. In behavioural actions, one's intention is influenced by attitude towards the action and subjective norms. The more fervent the intention is, the more likely the behaviour will be performed, reinforcing the Theory of Planned Behaviour as postulated by Ajzen (1991).

**Table 3.9: Attitude on Waste Management**

<b>Model Summary</b>					
<b>R</b>	<b>R Square</b>	<b>Adjusted R Square</b>		<b>Std. Error of the Estimate</b>	
	<b>Sum of Squares</b>	<b>df</b>	<b>Mean Square</b>	<b>F</b>	<b>Sig.</b>
Regression	21.992	1	21.992	18.916	<b>.000b</b>
Residual	33.716	29	1.163		
Total	55.707	30			
<b>Coefficients</b>					
	<b>Unstandardized Coefficients</b>		<b>Standardized Coefficients</b>	<b>t</b>	<b>Sig.</b>
	<b>B</b>	<b>Std. Error</b>	<b>Beta</b>		
(Constant)	1.555	0.402		3.863	0.001
Attitude	0.514	0.118	0.628	4.349	<b>0.000</b>

**3.3.6.3 Influence of Practices on Waste Management**

A further Linear regression analysis was done to find out the influence of Practices employed by MSMEs on waste management in their firms. The results showed awareness by those interviewed of practices employed to manage wastes among with a significance p-value of  $P < 0.05$ , Beta Confidents of 0.379 and  $t=5.913$ .

**Table 3.10: Practices on Waste Management**

<b>Model Summary</b>					
<b>R</b>	<b>R Square</b>	<b>Adjusted R Square</b>		<b>Std. Error of the Estimate</b>	
		<b>Sum of Squares</b>	<b>df</b>	<b>Mean Square</b>	<b>F</b>
Regression		30.45	1	30.45	34.962
Residual		25.257	29	0.871	
Total		55.707	30		
<b>Coefficients</b>					
		<b>Unstandardized Coefficients</b>		<b>Standardized Coefficients</b>	<b>T</b>
		<b>B</b>	<b>Std. Error</b>	<b>Beta</b>	<b>Sig.</b>
(Constant)		0.557	0.46		1.212
Waste management practice		1.171	0.198	0.739	5.913



### 3.4 Discussion

To find out the relationship between knowledge and waste management, regression analysis was employed, and the results indicated that there was no significant relationship between knowledge and waste management amongst horticultural processing MSMEs in Kenya. This is supported by the Theory of the Behavioural Model as postulated by Hungerford & Volk, (1990). The weak relationship between knowledge, environmental attitudes and behavior can be associated with the refusal to abandon the comforts of modern life and responsibility as postulated by (Diekmann and Preisendorfer, 2016). This is also in concurrence with the previous studies conducted by Jones and Donlap (2015).

In this context, knowledge is important to waste management among the horticultural processing MSMEs. Training them to understand the indiscriminate disposal of waste to the environment and better management alongside human health will empower them to act responsibly on environmental management and sustainability, (Desa, Kadir *et al.*, 2015). Above all, waste awareness is an environmental campaign phenomenon which aims not only to educate people on the consequences of improper waste management, but also to form their right attitude which will consequently motivate them to act appropriately on waste management within their environment.

However, the results on practices used to manage wastes showed a significant relationship on waste management amongst the surveyed horticultural processing MSMEs in Kenya as indicated in Table 3.8 and 3.9. This is in concurrence with Ajzen (1991) Theory of Planned Behaviour. On the other hand, while it is true that human beings may be drawn by one's intentions and attitude, it could also be argued that self-

interest can play an important role in the decision making and acting as anchored in the Rational Theory of Choice as postulated by Adams Smith who asserted that an individual act with prudence and logic. The decision to act or not to act is based on rational calculation and the choice is made from the available options that will guarantee the greatest satisfaction or profit to the same individual, (Green and Fox, 2017).

The Rational Theory of Choice implies that proper waste management may not always be altruistic rather it may be influenced by weighing its costs and benefits within a given organization. Ehrampoush and Moghadam (2015) conducted a cross-sectional study of knowledge, attitude and practice of solid waste disposal and recycling of 237 students from Yazd University of Medical Sciences. The findings showed that the students had moderate knowledge of solid waste disposal, but their knowledge did not influence them to practice segregation of solid wastes into different wastes streams. This also concurred with Adeolu and Adeolu, (2016) study on knowledge, attitude and practices of 358 secondary school students towards waste management in Ibadan, Nigeria.

Furthermore, the results revealed that the respondents surveyed were” aware of waste management practices used in the firm” and “have a competent employee to implement Environmental Management Systems” (EMS) and practice waste separation according to the streams at 96.8%, 93.5% and 83.9% respectively, concurring with the UNEPA study report of 2015.

#### **3.4.1 Financial Impulses to Citizens on Waste Operation Enterprise**

Fiscal impulses are important tool for motivating sustained geste change. Governments and associations have used colorful mechanisms to tie fiscal impulses to participation

in the waste operation system. Financial impulses can be linked to source separation, waste collection, reduction in the volume of waste disposed of, and disposal according to designated locales and schedules. For illustration, in Ningbo, China, results-grounded backing is being used to encourage homes in high-rise apartment complexes to separate organics and recyclables (Lee *et al.*, 2014). The government saves plutocrat since lower waste is landfilled and returns a portion of the savings as a fiscal incitement for citizens who separate their waste. In addition, some metropolises only charge citizens for the disposal of residual waste or set freights for mixed waste disposal that are advanced than freights for recovering services.

In Kitakyushu, Japan, the government provides compost lockers to homes and holds public composting forums that thousands of citizens have attended. Managing organic waste at the ménage position is cheaper for Kitakyushu citizens than paying by volume for formal disposal services (Matsuon.d.). Several associations and companies have espoused the conception of particular prices to encourage environmental engagement and change public geste. There are websites where citizens can earn points for taking environmentally friendly conduct, similar as recycling or sharing in a literacy program, and also can use their points to earn abatements at stores or make donations to community associations (Reclaim bank, n.d.).

The quality of solid waste operation affects the civic poor in critical ways, with impacts on their health, casing quality, service access, and livelihoods. In civic low-income neighbourhoods, up to two-thirds of solid waste isn't collected (Baker, 2012). In areas with poor service content, the prevalence of diarrhea is doubly as high and acute respiratory infections are six times advanced than in areas with frequent waste collection (UN-Habitat, 2010). Waste is frequently ditched or burned, releasing

poisonous airborne chemicals and liquid runoff that contaminates water sources (Akinbile and Yusoff, 2011). The ditched waste can also be a source of food and sanctum for rats, mosquitoes, and scavenging creatures, which could carry conditions similar as dengue fever.

The homes closest to dumpsites are frequently those of vulnerable populations who make a living by scavenging for recyclables with a financial value. Just as gaps in solid waste services disproportionately affect the poor, advancements in service delivery can dramatically ameliorate the lives of vulnerable populations. In the informal sectors, waste recycling is a common livelihood for the civic poor in low and middle- income countries. About 1 percent of the civic population, or further than 15 million people, earns their living informally in the waste sector (Medina, 2017). In civic centers in China alone, about 3.3 million to 5.6 million people are involved in informal recycling (Linzner and Salhofer, 2014).

The horticultural processing MSMEs and other manufacturing industries can consider an alternative employment opening beyond Solid Waste Management. Integrating waste selectors into the solid waste operation system might not always be effective or indeed preferred by waste pickers. However, waste selectors might be more productively employed outside of the waste operation system. If original recycling requests are weak or if the waste collection or sorting requirements of the megacity don't bear expansive labour (Li, *et al.*, 2021). Since waste selectors frequently warrant chops for indispensable livelihoods, external employment requires social support and vocational training to insure a smooth transition. Job retraining or skill- structure programs, in combination with social support programs similar as in health care and child education, can support adult career transitions and minimize ages of vulnerability.

Although the individualized attention and coffers demanded to support indispensable livelihoods can be substantial, when handed duly, this support can help break the cycle of poverty for several unborn generations. An illustration of education reducing waste selecting is that of the tentative cash transfer program, Bolsa Familia, in Brazil (Dias, 2018; Medina, 2017). It included giving a fiscal incitement to vulnerable families for transferring their children to academy and redounded in further than children leaving waste picking to attend academy.

### **3.4.2 Social Instruments for Behavioral Change**

Social instruments are applicable to situations in which government aims to raise people's mindfulness and influence, or indeed change, people's stations and geste, and where 'command and control' and profitable instruments are supposed either shy on their own, or indeed unhappy or undesirable. Social instruments are grounded on commerce and communication among stakeholders, with or without the direct participation of the government. While there are numerous possibilities for intervention through social instruments, it's delicate to ensure that the chosen instruments will indeed be effective in achieving behavioural change. This is because people are started and motivated by any number of veritably different factors and circumstances, including, for illustration, social status and bournes, accepted morals of geste, the broader societal environment including the media, a sense of agency (the belief that our conduct matter) and diurnal habits (Heath & Heath, 2012). In other words, what people actually do with their waste depends on a complex interplay of factors and circumstances, which may not inescapably be within the reach or the sphere of influence of the waste operation department.

In order to capture people's attention effectively and raise their interest, it's essential for social instruments to take as a starting point the 'sense making' of the citizens and their realities – their lives and surroundings. Likewise, as numerous officers in public and original authorities have endured and exploration substantiation constantly shows, information alone is infrequently sufficient to bring about the asked and lasting change in people's geste. While information and instruction are necessary, it takes engaging people at a position deeper than intellectual understanding to prompt them into action (Darnton, A. (2016). Also, encouraging people to borrow new patterns of geste while not overrunning their freedoms is a grueling task, with possible political counteraccusations. In addition to conduct of reaching out towards the public, government agencies and associations have at their disposal a 'important, emblematic and largely visible signal of changing morals' in society if they illustrate the asked geste and thereby lead by illustration. For the credibility of any policy, there's no cover for 'walking the talk', as stated in the 2006 UK Government report of a telling title 'I'll if you will towards sustainable consumption (ISWA, 2016).

Waste isolation at source and, particularly, public procurements towards sustainable, green choices, are some typical exemplifications. In the ultimate case, governments can include conditions of design for sustainability into their public procurement rules and thereby directly emplace their purchasing power to encourage and support manufacturers (and importers) who borrow similar approaches.

### **3.4.3 Stakeholder's Roles**

Waste operation involves a multitude of stakeholders (or actors), directly and laterally. The stakeholders play different places in the system as they're interested in waste from

different perspectives and for different reasons. Four main orders of stakeholders' places can be distinguished. Waste operation starts with waste creators, which includes principally everyone, either as a person and consumer, an occupant or a sightseer, or as a business proprietor or a hand of a company or an association. Waste creators are also druggies of waste operation services and therefore have a binary part in the system, which pertains to two different stages in a product's life cycle. Hence these stages presumably bear different approaches to involve citizens and impact their geste (Lerpiniere *et al.*, 2016).

As a stakeholder, citizens may be represented by community- grounded associations, advocacy NGOs and community leaders. Depending on the culture, community leaders may have an authoritative position and their station may determine that of the community, which is important to bear in mind when designing governance instruments. Another important order of stakeholders includes government and government agencies, as they produce the political setting, initiate and guide the process of strategic planning, prepare a supporting legal frame within which waste is addressed, and define and elect colorful other instruments that will be applied to support the perpetration. At least inversely important for the waste operation system's performance, albeit conceivably in a position of lower power, are colorful service providers, from waste collection to transport to drivers of installations.

### **3.5 Conclusions**

This research therefore has demonstrated that, attitude, practices and the horticultural processing MSMEs are significantly correlated, while knowledge is not. For effective environmental management, the horticultural processing MSMEs require tailor-made

awareness on impacts of waste on the environment. This will enable them become more concern with the ever-mounting problems of wastes while undertaking production and consumption to a sustainable manner. Therefore, there is a need to implement a strategic approach an Environmental Management Systems (EMS) to support a successful waste management. This is because, the MSMEs play an integral role in making their employees conscious of the repercussion of their actions towards waste management and environmental management (i.e. reasoned actions), planned behavior (i.e. Planning appropriately on waste management) as stipulated in ISO 140001 rational choice (i.e. in terms of costs and benefits that might accrue).

### **3.6 Recommendations**

The MSMEs needs to be taught continuously on sustainable consumption and production practices thereby promoting effective and efficient waste management. The county leaders also need to offer incentives towards sustainable environmental management in order to motivate the MSMEs. Emphasis on the necessity for information about environmentally responsible behaviors, like recycling and waste minimization, must be presented in a culturally and emotionally appropriate context. Behavior change and waste prevention policy must be designed with convenience in mind, supported the requirements of today's households for time and space. This has been proven to encourage householders who are consumers of horticultural processed products to interact in waste management practices, as long as such a scheme is well publicized. More emphasis to be put in establishing sorting centers amongst Horticultural processing MSMEs as platforms for resource recovery while minimizing amounts of solid wastes finding their way into disposal sites.



The study explicates the intricacies between Knowledge, attitude, and practices of the horticultural processing MSMEs before and after training on waste management aspects towards a paradigm shift in their mindsets and adopting Sustainable Consumption and Practices (SCP).

**CHAPTER FOUR: EFFECTS OF CAPACITY BUILDING ON WASTE  
MANAGEMENT AMONG HORTICULTURAL PROCESSING MSMEs IN  
KENYA**

**Abstract**

Waste management includes those activities and actions required to manage wastes from inception to its final disposal. These include collection, transport, treatment and disposal of waste together with monitoring and regulation of waste management process. Inadequate and inappropriate knowledge of handling of horticultural wastes may have serious health implications and a significant impact on the environment as well. This is so because, if people possess good knowledge towards waste management, they can protect themselves from infectious diseases and keep the environment clean. This affects people's attitude and most people due to lack of capacity or training on how to handle wastes, do not bother to dispose wastes appropriately. This study therefore, assesses the influence of capacity building on waste management amongst horticultural processing Micro, Small and Medium Enterprises (MSMEs) in Kenya. Using descriptive research design, the data were collected using structured questionnaires from 44 Certified Horticultural processing MSMEs in Kenya derived from Nairobi, Central and Western regions after undergoing various trainings on waste management. The results indicated that the majority of those engaged in horticultural processing MSMEs businesses are married (90.3%), affirming the family-oriented business tier. Further, the results showed that, before conducting training to the MSMEs, their level of knowledge on reduction in quantity of waste, waste management was at 58% and 68%, respectively. After training the result showed a high level of improvement at 87% and 83.9% on the same variables. The results further showed

changes on waste management before and after capacity building with a mean of 9.29 and 16.70 respectively. Therefore, the study established a significant relationship with a p-value of 0.000 between capacity building and waste management in horticultural processing MSMEs in Kenya.

#### **4.1 Introduction**

The researcher evaluated the effects of Capacity building among the certified MSMEs. A series of organized training were conducted to capacity build their knowledge and awareness on SCP practices, sustainable waste management for example reuse, recycle, prevention, minimization among other methods. The Certified Horticultural processing MSMEs were also trained on how to quantify and cost waste generated during production process. Thereafter a follow up of indicators were employed to evaluate the influence of training on waste management among the processing MSMEs on Sustainable environmental management in Nairobi, Central, Rift Valley, Eastern and Western regions in Kenya. The cost of training was fully catered by the horti-green project, Spain.

Developing countries have a range of solid waste problems, including shy waste collection systems, open jilting and other forms of indecorous final disposal and the performing environmental pollution, scavenging at tip spots by waste selectors, and illegal jilting. These problems are being exacerbated by growing waste generation rates associated with profitable growth, increases in consumption situations, and the transition to mass consumption cultures in developing countries. There's concern that these problems, if left unaddressed, will come a serious challenge for generations to come. This concern has been participated by the transnational community since the

1990s. Docket 21, a global action plan for sustainable development espoused at the UN Conference on Environment Development in Rio de Janeiro (the Earth Summit) in 1992, called for the environmentally sound operation of solid wastes, among other precedence issues. Concept of capacity structure came an essential element in development proposition and practice in recent times.

Lieder *et al.* (2017) also postulated that capacity structure as either as a process or outgrowth exertion that improves the capability. He further argued that capacity structure can be seen in two axes where in one extreme resides the increase of knowledge and development of chops of individualities through training programs and the other, in a much broader environment which integrates wide range of systems similar as policy timber, operation and finance. Capacity structure provides an occasion to understand strengths, sins, pitfalls and openings towards a flexible future through identification of broader issues around waste operation, SCP practices relinquishment and sustainability of the terrain, a particular program, design or process, including their unique artistic, social, and ecological characteristics.

This study shows that by offering training and strengthening the capacity of MSMEs on waste operation and SCP practices, MSMEs were more prone to integrating SCP practices in their horticulture product. Still, adding growers' and MSMEs' capacity in sustainable horticultural product will bear support from the original authorities (i.e., county governments). Policy makers can familiarize themselves with specific target groups in order to conform training programs according to original requirements and challenges. Similar interventions also call for a close collaboration between the (original) government and development associations, planter or patron groups, and non-profit associations that are at the van in immolation capacity structure.

Acquiring knowledge and developing specialized moxie is essential to know what to decide and apply. Still, adding growers' and MSMEs' capacity in sustainable horticultural product will bear support from the original authorities (i.e., county governments). Policy makers can familiarize themselves with specific target groups in order to conform training programs according to original requirements and challenges. Similar interventions also call for a close collaboration between the (original) government and development associations, planter or patron groups, and non-profit associations that are at the van in immolation capacity structure.

#### **4.2 Materials and Methods**

The research adopted descriptive survey method to gather data on the influence of capacity building on waste management amongst selected and trained horticultural processing MSMEs in Kenya. In the first stage, the researcher recruited **69** Horticultural processing MSMEs in order to undergo several stages of capacity building on waste management, environmental management system and environmental audit. In the second stage, those who did not meet the required thresholds as per the project's specifications were dropped remaining with population of **50** horticultural processing MSMEs spread across Nairobi area and its environs, central and western regions in Kenya. While both interview and questionnaire augurs well with descriptive research design, a questionnaire was the most appropriate for the study (Saunders, 2017). The questionnaire sought to get information on influence of capacity building on waste management among the trained and certified owners/key employees of horticultural processing MSMEs in the three regions in Kenya.

The data collected were both qualitative and quantitative. Using Online Data Kit (ODK) platform, primary data were collected, and analyzed using Statistical Package for Social inferential data analysis using linear regression. This was so, because the linear regression analysis is a reliable method of identifying which variables has impact in the topic under study. It allows the researcher to confidently determine which factors matter most, those which can be ignored and how the factors influence each other (Franson and Garling, 2015).

To quantify the relationship and strength of the relationship between variables, the study used Karl Pearson's coefficient of Correlation-Bivariate. This is a measure of the strength of a linear association between two or more variables and is denoted by  $r$  - which can take a range of values from + 1 to -1. A value of 0 shows that there is no correlation between the two variables, while a value greater than 0 indicates a positive association or significance. A value less than 0, shows a negative association (i.e. the value of one variable increases as the value of the other variable decreases) (*Appendix VI*).

### **4.3 Results**

According to the results in **Table 4.1**, the majority (96.8%) respondents surveyed had attended training on waste management and had started implementing knowledge gained in their respective firms. This was confirmed by all respondents agreeing 100% that management supports capacity building initiatives. On conducting capacity building on waste management, 90.3% of the respondents indicated to have attended between 1-6 Months, while 77.4% indicated a frequency of two times annually.

**Table 4.1: Descriptive Analysis of Capacity Building on Waste Management**

<b>Statement</b>	<b>Percentage</b>		
	<b>Yes</b>	<b>No</b>	
a) Have you ever attended any training on waste management?	96.8	3.2	
b) Has the knowledge acquired on wastes management during the training been implemented in your firm?	96.8	3.2	
c) Does the management support Training and capacity building on waste management?	100.0	0.0	
	1	2	3
d) When was the last training conducted?	<b>1 - 6 Months ago</b> 90.3%	<b>7 - 12 Months ago</b> 6.5%	<b>1 year and above</b> 3.2%
e) How often do you attend trainings on wastes management?	<b>Once a year</b> 12.9%	<b>Twice a year</b> 77.4%	<b>Others</b> 9.7%

#### 4.3.1 Changes on Waste Management Before and After Capacity Building

In **Table 4.2**, the respondents indicated a low-level of responsibilities in waste management before undergoing capacity building on waste management and related topics. Outstanding results indicating not practiced includes “Reduction in quantity of wastes realized” (58%), “Reuse of wastes is practiced” (52%), “waste management is another department all together (81%) “EMS is practiced” (68%) and “we are aware of the importance of waste management practices,” at (68%).

**Table 4.2: The Extent (percent respondent) to which Changes have Occurred on Management of Waste in your Firm Before Training**

	Yes	No
Reduction in quantity of wastes realized	45.2%	54.8%
Reuse of wastes is practiced	48.4%	51.6%
Waste segregation is practiced	41.90%	58.10%
Repair of waste pipes undertaken	45.20%	54.80%
Treatment of wastes done	16.10%	83.90%
Burning plastic bottles/paper discouraged	35.50%	64.50%
Improper waste disposal affects environment	67.70%	32.30%
Waste is segregated according to category	45.20%	54.80%
Healthy and clean environment	64.50%	35.50%
Responsibility to manage wastes	54.80%	45.20%
Safe transport / transfer of wastes	48.40%	51.60%
3Rs embraced	45.20%	54.80%
Waste management is another department	19.40%	80.60%
Waste is a resource to the firm	54.80%	45.20%
Awareness of wastes effects	61.30%	38.70%
Energy savings and recovery is possible	48.40%	51.60%
Environmental management system is practiced	32.30%	67.70%
Adoption of SCP practices	41.90%	58.10%
Reduction in cost of resources	45.20%	54.80%
Importance of waste management practices	32.30%	67.70%

The results in **Table 4.2** show that, high level of waste management responsibilities mainly after undertaking training on how to manage wastes. Ranking the results, the respondents agreed that; “It’s everyone’s responsibility to manage wastes, “waste is a resource to the firm, employees are aware of the effects of wastes on the environment”, and “we are aware of the importance of waste management practices, (87.1%) each respectively. This was followed by the respondents also acknowledging that; “reduction in quantity of wastes realized”, “Reuse of waste is practiced”, “our firm has adopted SCP Practices, and “the main principles of wastes reduction i.e., reduce, reuse and recycle are embraced, each at 83.9 % respectively.



**Table 4.3: The Extent to which Changes have Occurred on Management of Waste in your Firm After Training**

Statement	Yes	No
Reduction in quantity of wastes realized	83.9%	16.1%
Reuse of wastes is practiced	83.9%	16.1%
Waste segregation is practiced	74.2%	25.8%
Repair of waste pipes undertaken	71.0%	29.0%
Treatment of wastes done	45.2%	54.8%
Burning plastic bottles/paper discouraged	77.4%	22.6%
Improper waste disposal affects environment	87.1%	12.9%
Waste is segregated according to category	77.4%	22.6%
Healthy and clean environment	83.9%	16.1%
Responsibility to manage wastes	87.1%	12.9%
Safe transport / transfer of wastes	80.6%	19.4%
3Rs embraced	83.9%	16.1%
Waste management is another department	54.8%	45.2%
Waste is a resource to the firm	87.1%	12.9%
Awareness of wastes effects	87.1%	12.9%
Energy savings and recovery is possible	77.4%	22.6%
Environmental management system is practiced	74.2%	25.8%
Adoption of SCP practices	83.9%	16.1%
Reduction in cost of resources	80.6%	19.4%
Importance of waste management practices	87.1%	12.9%

#### **4.3.2 The Effects of Capacity Building on Waste Management Among Horticultural Processing MSMEs in Kenya**

The linear regression results showed a high level of individual awareness and change in waste management among the horticultural processing MSMEs surveyed, **M=7.567**, Standard deviation of **9.46** and significant relationship with *a p-value less than 0.05 level of significance set. (Appendix VI).*

#### 4.4 Discussion

According to the demographic characteristics results, majority of the respondents engaged in horticultural processing MSMEs business were married (90.3%) affirming the family-oriented tier. Sharma *et al.* (2016) also recognize that the strategic management of a family firm is dynamic and interactive. They further postulate that this approach focuses on dynamic capabilities and resources, both elements and their interactions being the key antecedents of the firm's dynamism in doing business together. Chrisman *et al.* (2012) in their research opine that a family's intangible resources such as values or traditions impact the choice of strategies employed to manage their enterprises. Family enterprises are linked to economically viable or noneconomic performances, the latter being main variations from non-family businesses seek the idea of maintaining their existence into the future (Chu, *et al.*, 2011). Other scholars give the same sentiments and argue that family owners seek to maintain control of the firms to satisfy family goals of wealth, tradition, job security, status as well as power and future generations (Claassen *et al.*, 2012).

A better understanding of the motivations for business ownership can help policymakers design policies that encourage and promote the creation of companies. Being a business owner offers a private challenge that some individuals prefer over being an employee. The entrepreneurs accept the non-public financial risks of owning a business but also like the potential success of the business. The high failure rate of small businesses makes it necessary to further examine if demographic factors like age and business size influence the success of start-ups (Alasadi and Abdelrahim, 2017).

Most scholars argue that tiny firms should enjoy the best performance in environments characterized by local institutions that don't unduly favour large firms at their expense. MSMEs firms lack the tangible or intangible resources necessary to effectively construct or gain access to those informal networks; they rely totally on the publicly available markets that lead to higher-than-average transaction costs (Li L, Grimshaw *et al.*, 2017). Accordingly, empirical evidence suggests that small firms in emerging economies have historically suffered because of lack of managerial and technical skills that constrains their performance.

The results of this study also validated that capacity building had a positive relationship with waste management activities amongst horticultural processing MSMEs in Kenya. Therefore, capacity building on waste management will help horticultural processing MSMEs understand the dangers of indiscriminate disposal of wastes to the environment and to human health thereby empowering them to act appropriately and produce sustainably (Chakrabarati *et al.*, 2010). Active participation in implementing environmental management systems (EMS) is important for successful environmental protection and sustainable consumption and production practices amongst horticultural processing MSMEs. The outcomes of this study further conceptualize the Theory of Capacity Building-an approach that seeks to improve the performance of workouts departments and entire firm to achieve its objectives and missions. According to UNEP (2010), Capacity building is empowering individuals, communities and institutions to perform functions and solve problems meant to achieve their developmental objectives in a sustainable manner.

To successfully adopt suitable methods of waste management by horticultural processing MSMEs, **Asnani, P.** (2016) suggested making awareness programmes simple and accessible to change the mind-set to perceive wastes as resource rather than something without value. More so, the role of private sector, NGOs, CBOs and the informal sector should strengthen to minimize waste in the environment while at the same time providing social and economic benefits to the MSMEs in horticultural processing business.

The findings showed a paradigm shift of behaviour and responsibility on wastes management after the respondent's undertaken training-with results indicating 64.6% of the respondents had college/diploma and undergraduate degree courses to certification while 22.6% and 9.7% had acquired Master's degree certification and Secondary level respectively. Meaning, an individual's rapid uptake of capacity building on awareness of impacts of wastes on the environment facilitates them to initiate strategies on sustainable waste management. A study done in Palestine focused on the influence of education came to the conclusion that there was a positive relationship between the extent of education and the participatory behaviour of the people in recycling activities (Al-Khatib *et al.*, 2015).

This is supported by the Situated Learning Theory which is anchored on the principle that knowledge is made if the learner becomes an active participant of a highly connected community during which knowledge and culture are integrated. Learning should even be an unintentional process instead of a deliberate one a process which will happen through "legitimate peripheral participation" (Lave and Wenger, 2015). One of the first goals of education is to make sure that learners can apply their acquired knowledge in various ways and under different circumstances. However, this expected

transfer doesn't always occur and therefore, the acquired knowledge can't flexibly be employed in several contexts.

According to Noor and Dola (2015), their findings suggested that generally training intervention provided was seen as imperative, timely and brought forth positive impact to the farmers. Even though it was difficult to measure and quantify immediate impact, the evidence they gathered implied that majority farmers considered themselves as better farm managers after undergoing trainings. As postulated further by Brown et al. (2015), learning and transfer occurs when learners are given a chance to "observe and practice in situ".

Learning transfer has a very specific meaning in the cognitive psychology domain (Gick & Holyoak, 2014). However, in the training domain, transfer refers to the extent to which learning during training is subsequently applied on the job or affects job performance. Successful training not only considers the factors which will influence training beforehand, but it also examines facets within the transfer environment (O'Connell, 2011). Given the context, education is vital to waste management initiatives. Engaging on Capacity building on waste management will help people understand the connection between indiscriminate disposal of waste to the environment and human health and empower them to act accordingly (Chakrabarati *et al.*, 2010).

A study conducted in over twenty-two developing countries (Guerrero *et al.*, 2013) suggests that when citizens receive information about the advantages of recycling, the way they sort the waste, and they participate within the designing of the programs; they're more likely to participate in recycling campaigns. Social norms can also play a crucial role in changing waste behaviour and participation in recycling activities,

(O'Connell, 2011). People are more likely to recycle once they observe others in their community recycling, so it might be beneficial to succeed in making key members of the communities to be at the forefront in changing negative environmental behaviors (Olli *et al.*, 2011).

Interestingly, the results also revealed a shared conscious effort by both employees and management towards effective waste management such that the former supports 100% waste management initiatives in the MSMEs. This was further validated by the results showing that employees had attended training on waste management and that knowledge on wastes management acquired during the training had been implemented in their respective firms at 96.8% respectively.

Capacity building engagement on waste management will help Citizens understand the connection between indiscriminate disposal of waste to the environment and human health and empower them to act accordingly (Chakrabarti *et al.*, 2010). Success of sustained solid waste operation is critically linked with public engagement and trust. Waste directors calculate on citizens to purposely reduce the quantum of waste they induce, separate or manage specific waste types at home, dispose of waste duly, pay for waste operation services, and authorize new disposal spots. To motivate this support, governments must gain the trust of citizens. Metropolises and countries are engaging the public by furnishing high-quality services that earn blessing and trust and that, in turn, motivate citizens to pay for services, be environmentally apprehensive, and misbehave with guidelines and regulations. Although changing citizen geste can take time, the benefits of a strong relationship with the public are inestimable to a waste operation system.

Educational tailor made towards waste management are a crucial aspect of raising mindfulness for solid waste. Numerous countries reach citizens using media. Effective programs distribute content in a variety of languages and through both introductory and advanced technology, similar as radio, TV, and mobile phone operations. Other governments concentrate on seminars to educate youthful citizens who'll ultimately come environmentally conscious grown-ups. For illustration, in Kingston, Jamaica, academy programs incorporate environmental and waste operation issues into the formal class and share in hands-on conditioning similar as onsite recycling, composting, and gardening. Vegetables grown in academy auditoriums are used at the seminars or given to scholars (UNESCO, 2018b).

Some seminars also encourage scholars and citizens to visit waste installations similar as recycling centres or tips. Of the countries and metropolises studied, several make waste operation information available to the public. The most common types of information made available include collection schedules and waste drop-off locales, budgets and freights, original statistics on waste generation and composition, and community programs and recovering juggernauts. For illustration, Bangkok, Thailand, publishes the Bangkok State of the Environment Report periodically, furnishing a comprehensive review of solid waste operation in the megacity (Bangkok Metropolitan Administration, 2012).

Yokohama, Japan, reports on GHG emigrations performing from waste; Bern, Switzerland, provides recovering information specifically for callers and settlers; and Montevideo, Uruguay, provides guidance to homes on how to request a waste caddy (City of Yokohaman.d.; Hello Switzerlandn.d.; City of Montevideon.d.). Countries generally par take information on public waste operation statistics, legislation and

programs, freights, and structure similar as tips and transfer stations. Common platforms for information distribution include face-to-face relations, signage, media, websites, periodic reports, mobile operations, physical pamphlets, and fliers.

The participation of multiple parties in the SWM system is one of the most important points that the system aspires to, as the metamorphosis from the traditional government sector to the government as a mate by espousing multi-lateral hookups similar as the private sector, non-governmental associations, and the original community has come ineluctable and necessary for the success of the SWM system, also establishes hookups with other sectors similar as assiduity and trade. All of that's a result of the government sector in developing countries' consummation of its limited capability alone to meet the adding demand for SWM services. And its need to profit from the original and foreign guests of the private sector, ensure the application of the mortal capital and the accumulated gests of the informal sector, and the addition of the original community in relating the factual requirements and assessing the services handed to it, all of that to support the enhancement of the SWM system's performance (FAO, 2019). Hookups with benefactors also give openings to support the system technically and financially. This supports the achievement of the 17 SDGs by making use of the gests gained from hookups and their resource rallying strategies. Therefore, capacity building in form of Training, knowledge sharing and information gathering is vital in developing human resource and institutional capacities at all levels and is a continuous process.

Connecting horticultural MSMEs to public institutions (public hospitals, seminaries, etc.) can also grease a stable demand for sustainable produces and reduce crop loss. It's thus important that the public sector considers GPP to foster the consumption of sustainable and locally produced fruits and vegetables. GPP can give the MSMEs with



important demanded access to the domestic request and therefore offer volition to the largely competitive yet unpredictable import requests. In July 2021, the government of Kenya launched a discussion for its new green public procurement frame (GPPF). At present, this discussion process is still ongoing. Still, it can be hoped that once the frame is approved, the public sector will start prioritizing the procurement of sustainably produced goods and services.

Also, the design heirs will stand to gain since they've a competitive advantage, having formerly espoused SCP practices in the horticultural product. Global consumers are getting more and more environmentally conscious and are keen on knowing and being suitable to trace the origin of the products they're consuming. Hence, there's a growing trend in the relinquishment of sustainability norms and ecolabels encyclopedically. Horticultural MSMEs would need to be enabled to apply aspects of the sustainability norms. This won't only help MSMEs to pierce original organic or green requests but also import requests where demands for sustainable products are adding, for illustration, in Europe. The public government may consider furnishing specialized and fiscal support for growers and MSMEs to gain instrument similar as KS 1758 on sustainable horticulture. Carrying instruments from being norms, similar as KS 1758, has proven to be a rigorous and unaffordable process for the design's devisee MSMEs. Similar sustainable norms bear considerable investments (e.g., high- quality ranch inputs, outfit, executive costs) by MSMEs who are formerly floundering to pierce credit.

The instrument can help original consumers separate sustainable products from non-sustainable bones and make informed opinions when buying fresh yield. Horticultural MSMEs feel to be more willing to switch to sustainable product if a stable original demand can be guaranteed. Thus, there's the need for mindfulness- raising juggernauts

on sustainable consumption targeting consumers in public and private spheres, to make them apprehensive of the benefits of consuming products that are sustainably and locally produced (e.g., advanced quality and nutrition, supporting original directors and original frugality). Promoting the relinquishment and perpetration of SCP practices by horticultural MSMEs need to be aligned with Kenya's public pretensions. As the backbone of the frugality, MSMEs can play a strategic part towards the achievement of Kenya's Green Economy Strategy and Perpetration Plan (GESIP) 2016–2030 on SCP, equity and social addition, as well as resource effectiveness.

An education and mindfulness- raising program would be enforced among children and grown-ups. Environmental education would be offered at the original academy by trained levies and preceptors in confluence with the class. In addition, yearly fieldtrips to original locales of environmental significance will be arranged for all interested parties for farther openings for informal education. These passages would be funded by recovering buy-back plutocrat and donations. Daily forums could be handed to make environmental knowledge and chops. For illustration, one week we could educate composting and also give demonstrations as to how to produce and manage a compost pile. Another illustration would be how to establish a community tree nursery using compost as a soil correction.

All forums would add to the environmental. Knowledge base of the community and promote further pro-environmental behaviors that transcend simple waste operation. The ISWM conditioning could give profitable openings for the community. For illustration, this exploration design could integrate other types of employment systems for some locals. Some may have access to their own transportation, with employment openings in the collection and transportation of waste to the tip. Each trip would need

trained workers to manage them. Finances to support a minimal sized staff might come from a public source related to bettered environmental operation. Another profitable occasion could include perpetration of recycling buy-back programs. Each month buy-back events could be held and community members could come and vend their recyclables for payment.

In turn, these accoutrements would moreover be reused by the city or transported to the nearest major megacity to be vended to larger recycling shops. The payments earned from this bid could be bestowed back to the community to fund affiliated conditioning. This modified ISWMS could include not only profitable impulses similar as steal- tails but also penalties including forfeitures for littering that could be executed by the megacity with the cooperation of colorful community groups. As mentioned earlier, creating terrain where public participation and engagement is intertwined with the entire waste operation process allows for a more effective and sustainable system. This study design would strive for decision translucency; networking; cooperation; communication; collaborative action; and availability of information throughout the waste operation decision-making process. Giving all stakeholders involved the occasion to contribute to this process creates a populace that's empowered and takes responsibility not only for their opinions but also their conduct.

#### **4.5 Conclusions**

This study has showed that Training and Capacity building has a relationship with waste management amongst horticultural processing MSMEs in Kenya. Therefore, Capacity building on waste management will help Horticultural processing MSMEs understand the dangers of indiscriminate disposal of wastes to the environment and human health

thereby empowering them to act appropriately and sustainably produce. Active participation in implementing Environmental Management Systems (EMS) is important for successful environmental protection and sustainable consumption and production practices amongst horticultural processing MSMEs in Kenya.

#### **4.6 Recommendations**

To successfully adopt suitable methods of waste management by horticultural processing MSMEs, it is important to make awareness programmes simple and accessible to change the mind-set of the perceive wastes as resource rather than something without value. Also, the role of private sector, Non-Governmental Organizations (NGOs), Community Based Organizations (CBOs) and the informal sector should be strengthened to minimize waste in the environment while at the same time, providing social and economic benefits to the MSMEs in horticultural processing businesses in Kenya. Seminars/capacity building on waste management should be conducted amongst horticultural processors, consumers in the communities to encourage them on effective waste management.

## **CHAPTER FIVE: QUANTITIES OF SOLID AND LIQUID WASTES GENERATED BY HORTICULTURAL PROCESSING MSMEs IN KENYA**

### **Abstract**

Aspects of waste generation in major urban Cities are characterized by inefficient collection methods, poor transportation infrastructure, insufficient financial resources, storage and treatment or reuse, lack of environmental values and ethics amongst Citizens, inappropriate technologies, institutional structures and challenges in implementation and enforcement of policy regulations. In Kenya, managing solid waste is becoming more difficult, especially among manufacturers. However, there hasn't been a corresponding increase in the ability of the relevant urban authorities to handle this difficulty as waste creation has increased. Nevertheless, various capacity-building initiatives on EMS, waste management practices and adoption of Sustainable Consumption and Production (SCP) practices among the MSMEs in Kenya have validated a waste reduction due to such practices. On quantities of waste generated, peels, core as waste from pineapples of 1110kg, which are donated to other farmers. Also, MSMEs total wastes generated is lower than products processed. Further, the results showed that horticultural crop residues and waste water were the main waste streams at **32%** of the total with the highest Mean and Std. deviations of **3.355 (1.199) and 3.199 (1.167)**, respectively, among the horticultural processing MSMEs. The results showed a reduction in waste generated by the horticultural processing MSMEs due to the adoption of SCP Practices in their firms. In addition, about **45%** of the MSMEs have partnered with the farmers to grow the fruits and vegetables for further processing, thereby increasing the efficiency and avoiding wastage of raw materials needed for processing. According to the study, quite a number of MSMEs are *practicing the core*

*methods of waste reduction; namely, Reuse, Minimize Reduce and Recycle at 52%, 45%, 32% and 19%, respectively.*

## **5.1 Introduction**

Rapid and expansive processing of horticultural crops has resulted in numerous products and by-products in global waste streams. This is due to unreliable storage facilities, handling techniques, nature of production in pursuit of adopting SCP Practices (FAO, 2014). The Food and Agriculture Organization of the United Nations (FAO), for instance, estimates that every year, at least one-third of entire food produced worldwide (or 1.3 billion metric tons) is wasted (FAO, 2019). All stages of the supply and handling chain experience wastage, including harvesting, transportation to packing facilities or markets, grading and classification, processing, marketing, storage, and at home before or after preparation. Losses happen at every level of the availability chain, from production to postharvest to consumption. They are an unexpected consequence of how the institutional and legal structures that support food production and supply networks work (Parfitt *et al.*, 2010).

Conversely, waste refers to food suitable for consumption but thrown because of improper consumer or retailer behaviour (FAO, 2019). While waste and losses are frequently seen as separate concepts with their causes and remedies, they are still connected and occasionally difficult to distinguish. Waste and losses can be measured quantitatively and qualitatively (FAO, 2020). Quantitatively inquire in terms of masses or volumes, which decrease the amount of food accessible for consumption. Qualitatively, they signify declines in consumer acceptability, caloric value, edibility, nutrition, and value, all of which are recognized before the food item is thrown away.

Losses and waste of horticultural commodities are high in developing countries but at different points of the handling chain. In other words, food losses are common due to technical limitations in infrastructure and handling, such as storage, packing, packaging, and marketing. Desa Kadir *et al.* (2016) postulated that 1/3 of horticultural processes across the globe get spoilt immediately after every harvest and do not reach intended consumers. Additionally, waste after reaching the customer is quite important, especially in industrialized nations. Relying on the commodities, postharvest losses within the use are predicted to range from 2 to 23% and an overall average of 12 per cent (Desa Kadir *et al.*, 2016).

It is generally advised to use a 9 per cent postharvest loss estimate for food from the United Kingdom, excluding produce abandoned in the field because it does not meet quality and acceptability standards (Garnett, 2016). According to Kummu *et al.* (2012), it was estimated that global agricultural losses might be cut by 47% and global consumption wastage by 86%, highlighting that the opportunity for improvement globally is greatest in areas with the least demand for additional food supplies. Over the past two decades, the horticultural and food processing industries have experienced unprecedented global growth and significant losses and processing waste. Fruit and vegetable wastage include the indirect waste of vital resources such as land, water, chemical, fertilizers, energy, and labour, in addition to the waste of food products. These enormous amounts of lost and discarded food also contribute greatly to environmental concerns since they decay in dumps and release harmful greenhouse gases (Venkat, 2011; Vilariño, 2017).

After household wastes, fruit and vegetable processing facilities reportedly emit the most waste into the environment. The waste from horticulture may be a rich source of bioactive chemicals that are undoubtedly beneficial. Because very valuable biomolecules can be recovered using FVWs, the situation has recently changed. Unfortunately, horticulture by-products weren't previously considered to be very important resources. Horticultural waste products are great providers of minerals, dietary fibre, phenolic compounds, pigments, sugar derivatives and other nutrients (Yahia, 2017). During harvesting, Horticultural runs close to huge tons of produce, as postulated by Acedo and Weinberger (2016).

Additionally, these techniques result in decaying material that has undesirable areas that were not seen in the field or that is distant from packaging lines and is not delivered to the customer. The situation is similar to Kenya's Horticultural Processing Micro, Small and Medium Enterprises and therefore forms the basis of this study. Proper handling of undesired materials significantly the chances of polluting the environment (Kasza *et al.*, 2020).

According to FAO research, fruits and vegetables are indeed the horticultural crops that are most widely used (2018). Still, waste generation within the sector is becoming a significant economic and environmental problem. For example, FAO (2018) estimated that the preparation of fruits and vegetables results in losses and waste reaching 60%, making them the best among all food types. It has also been reported that the horticultural processing MSMEs produce a great amount of waste that constitutes between 25% to 30% of an entire product (FAO, 2018). These wastes are composed of seed, skin, rind and pomace. Consistent with Food and Agricultural Organization (2018), they contain good and a few possible beneficial bioactive substances such as



dietary fibre, polyphenols, and carotenoids. The major waste streams are organic (including fruit and vegetable rejects, peels and pomace) and other staple wastes. As the urban population in major centres in Kenya and other East African Countries rapidly increases, managing solid and liquid waste becomes cumbersome. In East Africa, it is estimated that 100 million people lack access to adequate sanitation (Troschinetz and Mihelcic, 2016). Therefore, the objective of the study was to determine quantities of solid and liquid wastes generated by horticultural processing MSMEs in Kenya.

## **5.2 Materials and Methods**

Quantification of waste generated from a representative sample of **50** from the processing horticultural MSMEs as per the following criteria; the processing of fruits and vegetables owns an operational enterprise and must have been inconsistent operation for three months. **Table 3.2 and Figure 6.1** further explain the strata of MSMEs and the actual sample summary, respectively. Data were obtained within thirty days to ascertain wastes generated during production. Longitudinal research design since quantification was done before training and after. Sources, types, quantities and costs of wastes from horticultural processing MSMEs were also tabulated and analysed. A manual structured questionnaire focused on daily recording the quantities of waste generated by the MSMEs while processing various horticultural crops. The data in this study were analyzed with the help of a statistical application, namely SPSS version 21. The findings were reported using frequencies and percentages.

## 5.3 Results

### 5.3.1 Quantification of Waste Generated by Horticultural Processing MSMEs

The extent of waste streams generated among the horticultural processing MSMEs was analyzed as shown in Table 5.1. The results indicated that horticultural crop residues and waste-water were the main waste streams (VHE-Very High Extent) at 19% and 13% Mean and Std. Deviation *3.355/1.199 and 3.194/1.167* respectively among the horticultural processing MSMEs surveyed. According to the results in Table 5.1, about 10% of waste is generated during the processing of horticultural crops. For example, MSME A produces 111 peels, core as waste from pineapples of 1,110kg, which are donated to other farmers. Other MSMEs do recycle/reuse the waste generated for further processing. Further, the results showed that peels, core, seeds, coarse, leaves, pulp, husks, stalks, shells, stems and waste-water are both recycled or given to other users, for example, pig farmers, thereby reducing open dumping or disposal. The result of waste generated by MSMEs as indicated in Table 5.1 and 5.2 was as a result of waste processing practices in the firms.

**Table 5.1: Quantities of wastes Generated by Horticultural processing MSMEs**

MSME	Waste-stream sources per Products		Production per day (kg)	Raw Materials per month (kg)	Total quantity of products processed per month (kg)	Quantities of waste generated per Kg	Wastes Per/Kgs product	Nature of Wastes	Destinatio n of Waste generated
	Solid	Liquid							
A.	Pineapple		37	1,110	999	111	0.111	Peel, core and coarse solids, seeds, pulp, waste- water used as animal feeds  Waste water	Donated to farmers  Reused or recycled
	Mango		212	6,360	5724	636	0.111		
	Lemon		12.5	370	333	37	0.111		
	Passion fruit		255	7,650	6885	765	0.111		
		Washing/ pulping				4,800			
B.	Fruits		13	390	351	39	0.111	Peel, stalks, leaves, stems  Waste water	Donated to farmers  Disposed
	Vegetable		4.5	135	121.5	13.5	0.111		
		Washing				1,040			
C.	Solid wastes		4.5	135	121.5	13.5	0.111	Peels, seeds, leaves  Water waste	Reused or recycled  Disposed
	Waste papers		1	30	27	3	0.111		
		Washing				120,000			
D.	Fruit		15,850	475,500	427,950	47,550	0.111	Peels, seeds, stalks, stem, leaves  Waste water	Reused or recycled, donated to farmers, used as firewood Reused or recycled
	Vegetable		5160	154,800	139,320	15,480	0.111		
		Washing/ pulping				826,000			
E.	Waste from French beans		325	9,750	8,775	975	0.111	Stem, strings, shell, rejects, seeds  Waste water	Donated to farmers  Released to drainage
	French beans (rejects)		121	3,630	3,267	363	0.111		
	Waste from snow peas		10.2	306	275.4	30.6	0.111		
	Snow peas (rejects)								
		Washing				32,000			
F.	Waste from OFSP		117	3,510	3,159	351	0.111	Peels, fibre used as animal feeds  Waste water	Reused or recycled Reused or recycled
			103	3,090	2,781	309	0.111		
		Washing				13,500			
G.	Papaya/green tea wastes		180	5,400	4,860	540	0.111	Peels, stems, seeds, core, skin  Waste water	Donated to farmers Reused or recycled
			94	2,820	2,538	282	0.111		
		Washing/ pulping				8,650			
H.	Wastes, majorly banana peels		3.5	105	94.5	10.5	0.111	Peels, stalks used as animal feeds  Waste water	Donated to farmers  Reused or recycled
			91	2,730	2,457	273	0.111		
		Washing				1,900			
I.	Baobab seeds		105	3,150	2,835	315	0.111	Baobab shells used as fuel wood for further processing  Waste water	used as fuel wood for further processing Reused or recycled
		Washing				3,100			

**Table 5.2: Types of Wastes Generated by Horticultural Processing MSMEs**

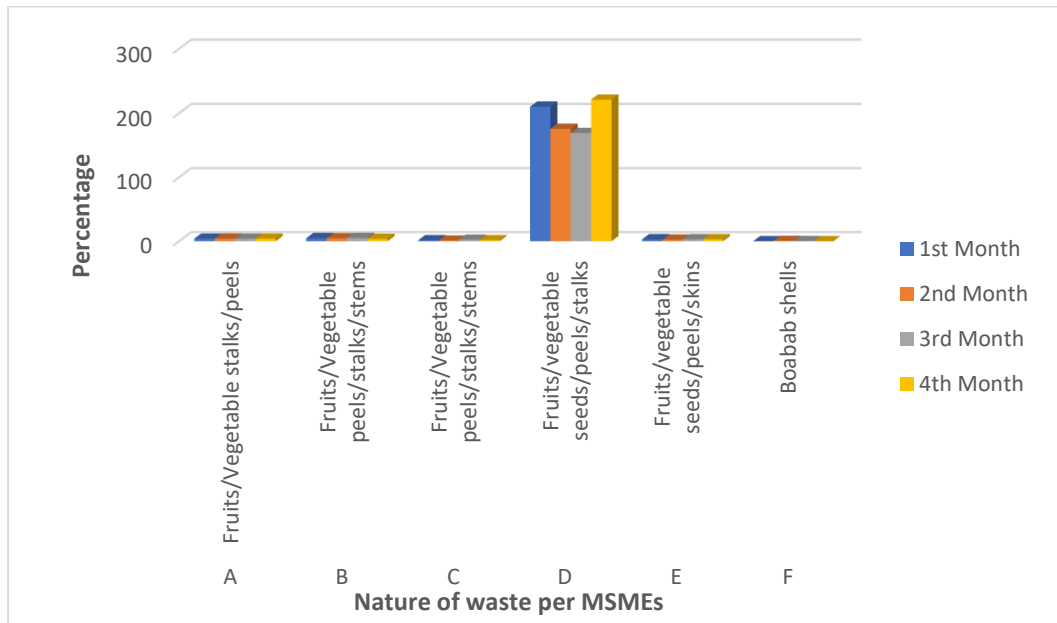
<b>Statement</b>	<b>1 NE</b>	<b>2 LE</b>	<b>3 ME</b>	<b>4 HE</b>	<b>5 VHE</b>	<b>Mean</b>	<b>Std. Dev</b>
Plastic bags	36%	58%	7%	0%	0%	1.710	0.588
Waste paper	36%	45%	13%	3%	3%	1.936	0.964
Ash	61%	19%	19%	0%	0%	1.581	0.807
Horticultural crop residue	7%	19%	26%	29%	19%	3.355	1.199
Rubber	81%	19%	0%	0%	0%	1.194	0.402
Metal Crap	71%	26%	3%	0%	0%	1.323	0.541
Wood	61%	32%	7%	0%	0%	1.452	0.624
Waste water	10%	16%	32%	29%	13%	3.194	1.167
Bottle tops	68%	23%	7%	0%	3%	1.484	0.890
Use containers	42%	36%	16%	7%	0%	1.871	0.922
Old/Worn out machine parts	48%	45%	3%	3%	0%	1.613	0.715
Argo-chemical wastes	71%	19%	7%	3%	0%	1.419	0.765
Used oil	52%	36%	7%	3%	3%	1.710	0.973
Others	84%	10%	3%	0%	3%	1.290	0.824

**Legend 1: NE-No extent, LE-Low extent, ME-Moderate extent, HE-High extent and VHE-Very high extent**

**Legend 2: Unit of measurement; kg/lts**

### **5.3.2 SCP in Waste Management Among MSMEs Horticultural Processors in Kenya**

A comparative analysis between raw materials received and waste generated was conducted to understand how horticultural MSMEs were efficiently managing wastes. Further, inquiries were made on where the waste generated ended up at. This forms the core part of the principles of sustainable consumption and production practices. The results showed various streams of waste, for example, peels, seeds, stems, stalks, skins, and shells, from the first to the fourth month of study.



**Figure 5.1: Waste Generation by MSMEs**

#### 5.4 Discussion

According to the results, various types of wastes were generated by the horticultural processing MSMEs surveyed, with horticultural crop residues and waste-water leading at 29% each and with the highest **Mean and Std. Deviation of 3.355 and 1.199**, respectively (Table 5.2). A further analysis was conducted to ascertain quantities of wastes generated by the MSMEs while producing respective products for consumption/sale. The result showed horticultural crop residues in peels, stems, stalks, and seeds as the major waste quantities generated during production (Figure 5.1). This concurred with the study conducted by Baran (2014), where waste was defined at the point of its creation other than its generation. This situation seems to have created a paradigm shift in the minds of many researchers since defining waste at this point will not only help people change their attitude toward waste disposal but also focus on optimal production and consumption of products towards efficient environmental management for a better tomorrow.

On the other hand, the horticultural processing MSMEs would rapidly adopt SCP Practices to maximise raw materials usage and reduce the burden of waste quantities generated currently. According to the study, quite a number of MSMEs are practising the core methods of waste reduction. Namely, Reuse, Minimise, Reduce, and Recycle at 52%, 45%, 32% and 19%, respectively.

Above all, 45% of those MSMEs surveyed have partnered with Local farmers to grow the required products. Examples include MACE processors, Vert Africa, GAEA Foods, Interveg Exports, Orchard Juices, and Organi ltd. This has helped them reduce spoilage of products; sorting and unnecessary cleaning since the products delivered to their premises meets production thresholds and hardly generates much waste.

Relating to an old adage, "An ounce of prevention is worth a pound of cure," waste minimization is by far the most desirable alternative within the waste management process and, as such, a fundamental goal and directive of future waste strategies (Cavé, 2015). Additionally, waste prevention plays a significant role in the broader Sustainable Consumption and Production (SCP) issues. There is growing concern that human civilization is approaching the limits of the planet's finite environment. Ecologist Lerpiniere *et al.* (2016) states that we're running out of the planet, as the saying goes. We are running out of sources and sinks to use systems thinking language. Despite local efforts to restore the balance, we are depleting the natural environment at unprecedented rates. We also are approaching the limits of the assimilative capacity of the planet's sinks, which are locations where emissions, discharges, and trash can be dumped, absorbed, and processed safely.

Waste reduction can lower the need for sinks while also saving resources. Although waste prevention can be seen in various ways, there are ultimately two distinct types of prevention: quantitative and qualitative. Quantitative prevention involves reducing the amount of equipment, materials, and products that end up in waste (Kasza G. *et al.*, 2020). The so-called strict avoidance of excessive consumption, the acceptance of fruits and vegetables that are less-than-perfect or that deviate from an acceptable standard size and the design of products and production practices that use fewer materials while still being designed for durability and disassembly are examples of this. Or, after a product is purchased, it is kept from going to be wasted by being reused by the owner or another person, perhaps after some maintenance and repair to extend the object's lifespan.

Qualitative prevention immediately enhances the environmental performance of the impacted goods or manufacturing procedures by reducing the use of certain hazardous compounds in materials and products that end up in waste. Furthermore, waste reduction is a global climate issue. Waste prevention has the potential to lower carbon emissions across many economic sectors, including agriculture, mining, forestry, construction, transport, manufacture, and logistics, because a large portion of global gas emissions are related to the manufacture and distribution of the food that we eat (Soos, 2010). Therefore, waste will be avoided at almost every stage of a product's life cycle, from the harvesting of a staple to its processing into such a functional material to the manufacture of a product, as well as during packaging, distribution, and retail, as well as during the consumption stage and end of use.

Technology tools and waste reduction policies are developed and aimed at the relevant key stakeholders to deal with each stage of the life cycle. For instance, in addition to reuse, cascading use offers opportunities to boost materials employment and reduce waste. This is a good use for raw materials from renewable resources like wood, which is first utilized as lumber for high-end products like furniture and cardboard. They are only burned to recover energy (World Bank, 2017).

Caring about waste prevention is also dismissed in talks of waste management goals as a "luxury" of wealthy nations that have taken care of their waste public health and environmental protection concerns. Because of the enormous amounts of waste that must be managed daily in their towns, emerging economies must take waste avoidance just as seriously, if not more so. Waste quantities are produced by their expanding urban populations amid the changing generated waste. With these growth rates, waste amounts in many cities in Sub-Saharan Africa are prone to change over the next decade or two, as most other waste practitioners from an African capital will confirm (World Bank, 2017).

It will always be "running to face still" to concentrate simply on technical, end-of-pipe remedies rather than expanding collecting and developing environmentally appropriate treatment and disposal facilities. Developing countries are more aware of this than other countries. As a result of their population growth, reliance on tourism as a source of income, and lack of available landfill space, they confront particular issues with garbage management (Sustainable Brands, 2018). However, because their populations have the opportunity to increase personal spending for the first time, low- and middle-income nations may find it challenging to envision prevention as a viable option. Prevention must be carefully explained and positioned within the specific setting to



avoid this. The results on quantities of waste generated by the MSMEs underscore the idea of SCP practices adoption for better production and efficiency on raw materials. The majority of the respondents indicated awareness and application of SCP practices by applying the principles of Reduce, Minimization and reuse to manage wastes at 52%, 45% and 32 %, respectively. The idea of Eco-efficiency comes in handy.

World Business Council for Sustainable Development studies indicates that an eco-efficiency framework encourages the production of value with lesser effect by integrating environmental and financial constraints into specific initiatives, conditions, or processes (2017b). Eco-efficiency is not a particular operating framework or method used to manage waste. This operational gospel demonstrates how lucrative activity interacts with nature and can be used with other fabrics to monitor environmental and profitable performance, (Hellweg *et al.*, 2017). (Schoer & Seibel, 2018) the mathematical definition of eco-efficiency is eco-efficiency (Bohne *et al.*, 2018).

The principle of eco-efficiency has three main goals: decreasing consumption of resources by reducing materials and icing of the accoutrements circle; decreasing impact on the environment by trying to minimize pollution and encouraging the sustainable use of resources; and increasing the value of goods and services by providing goods that satisfy customer demands while using fewer resources and coffers (WBCSD, 2017b).

Some guidelines can be applied to gauge eco-efficiency. Pointers typically fall into two categories: environmentally friendly performance or economic performance. Product numbers, agreements, and net gains are some of the more general application guidelines for successful performance. Pointers related to the environmental influences include

waste volume generated, waste to the tip, waste to incineration, and packaging amounts. They also include energy consumption, water consumption, ozone-depleting substance emigrations, hothouse gas emigrations, and hothouse gas emigrations.

Because there is a limited correlation between eco-efficiency pointers, generally represented by the rate of good value addition to environmental impact, adopting eco-efficiency to waste operation systems needs particular consideration. End-of-pipe solutions are intended to eliminate or manage pollutants after they have been produced. They typically do so at the end of a process without any anticipated financial advantage Hellweg *et al.* (2017). To more accurately quantify the environmental advantages obtained per new costs involved, it is suggested to use a dimension of environmental cost-effectiveness (ECE). ECE pointers calculate the environmental advantages of one technology over another for each additional dollar of cost. The specific pointers utilised in an eco-efficiency centered frame will eventually be decided on a design-by-design basis. It will vary based on the data provided and the type of the components and processes under investigation, (Schoer & Seibel, 2018).

According to the results, the leading waste stream is horticultural crop residues. This means that if all the Horticultural processing MSMEs partner with selected farmers to grow fruits and vegetables, they would, in return, supply quality raw materials for further processing. Additionally, the use of a force chain too can enhance efficiency in the final products; environmental force chain operation refers to incorporating environmental operating practices throughout a product's full force chain, (Hage, 2017). Environmental force chain operations can improve environmental and financial performance by reducing the collection, recovery, and disposal of habituated products (Ilgin & Gupta) (2017). These enterprises are typically employed to address one of four

key issues: environmental concerns, profitable concerns, cost-cutting concerns, and irresolvable concerns (Eltayeb *et al.*, 2017). There are various justifications for force chain operations, including environmental issues, financial benefits, and the necessity to violate legislation (Hage, 2017). Various businesses can be used in environmental force chain operations, namely eco-design or design for terrain, green purchasing, supplier environmental collaborations, customer environmental collaboration, and rear logistics (Eltayeb *et al.*, 2017).

Results from this study further validated that Capacity building has a positive relationship with waste management activities amongst horticultural processing MSMEs in Kenya. Therefore, Capacity building on waste management will help Horticultural processing MSMEs understand the dangers of indiscriminate disposal of wastes to the environment and human health, empowering them to act appropriately and produce sustainably (Chakrabarati *et al.*, 2016). Active participation in implementing environmental management systems (EMS) is important for successful environmental protection and sustainable consumption and production practices amongst horticultural processing MSMEs. Environmental training helps change consumption patterns, promote sustainable practices and lifestyles, and promote environmental stewardship–Sustainable Development Goal (SDG) number 4.7.1 (UNESCO, 2018b).

***Information and education*** can shift people's norms or ways of doing things and facilitate the adoption of SCP practices amongst processing enterprises. Categorization of wastes is pivotal while strategically designing and enforcing operations centred on sustainable waste management (Armijo de Vega *et al.*, 2018). The outcomes of such studies can form the basis of capacity b-building thematic areas for Citizens to

participate fully and understand the importance of adopting SCP Practices for sustainable and optimum use of scarce resources for production and minimizing waste generation (ISWM Stakeholders Workshop Report, 2016).

The horticultural processing MSMEs in Kenya should undertake proper waste management by applying suitable waste treatment or technology. It is apparent from this and earlier studies that waste from the fruit and vegetable processing firms is a rich source of several constituents and has a great potential for preparing value-added products. Therefore, adopting the SCP approach/strategy would be of utmost importance for waste management. Strategies that could be adopted include:

- i) Selection of processing techniques that generate no or less waste, e.g., enzyme technology for juice extraction.
- ii) Recovery of maximum useful materials (e.g., oil from apricot stones, pectin/fibre from apple pomace, lactose from whey).
- iii) Waste material conversion into useful products (ethanol from fruit waste, citric acid from pomace, the enzyme from wheat bran, animal feed from waste).
- iv) Ensuring that the waste material of fruit and vegetable origin is used first for the production of food/feed-related products, followed by biogas.
- v) Ensuring that waste-water treatment meets the requirements of pollution control agencies.

## **5.5 Conclusion**

The results showed a reduction in waste generated by the horticultural processing MSMEs due to the adoption of SCP Practices in their firms. In addition, about **45%** of the MSMEs have partnered with the farmers to grow the fruits and vegetables for further processing, thereby increasing the efficiency and avoiding wastage of raw materials needed for processing. However, it requires further intervention from private and NGO funding for better tools, human capital, and continuous capacity building for those engaged in the Horticultural sector in Kenya. As the backbone of the Economy, MSMEs can play an integral and strategic role in the achievement of Kenya's Green Economy Strategy and Implementation Plan (GESIP) 2016-2030 on SCP, equity and social inclusion, as well as resource efficiency and recovery amongst the processors of horticultural products.

## **5.6 Recommendations**

Tackling the key aspect of quantities of waste generation by the Horticultural processing MSMEs, the study recommends enhancing the adoption of SCP practices that includes; supporting MSMEs to get Certification, thereby increasing consumer awareness of SCP, connecting the MSEs to public service, Institutions, for example, Universities, Hospitals, Secondary and Primary Schools to spur stable demand for sustainable finished products (outputs) and reduce spoilage that ends up as wastes. In addition, the Government can amend the Basic Education Act to include a robust feeding programme that entails fruits and vegetable products supplied by the MSMEs, especially for the young learners in all the 47 Counties in Kenya.

Also, encourage Green Procurement to foster the consumption of locally and sustainably produced fruits and vegetables to avoid wastage. Consequently, this will spur better earnings from the MSMEs and create more employment opportunities for the educated and yet unemployed /adults in Kenya. Capacity building on waste management should also be enhanced to provide learning paths on waste streams and how effectively they can be managed while processing horticultural products.

**CHAPTER SIX: INFLUENCE OF LEGAL AND REGULATORY  
FRAMEWORK ON WASTE MANAGEMENT AMONG HORTICULTURAL  
PROCESSING MSMEs IN KENYA**

**Abstract**

Kenya's programs and regulations on solid and liquid waste operation are grounded on the principles of environmental law meant to cover the thresholds of sustainable development in which development process and artificial products are integrated with environmental protection. The study assesses the impacts of Legal and Regulatory fabrics on waste operation amongst the horticultural processing MSMEs in Nairobi, Western, Rift Valley and Eastern regions of Kenya. The study espoused a descriptive exploration design, interrogating Legal and Regulatory fabrics in place, how they're enforced/ actioned, and goods on the waste operation. An airman study was conducted before the inception of exploration, and the results narrowed down to the effective, registered and processing MSMEs in three regions, as shown in Tables 3.1 and 3.2. The data collection tool was through a structured questionnaire fed into the ODK platform, later subordinated to statistical package analysis of social wisdom (SPSS) interpretation 21, enciphered, anatomized and epitomized using frequencies tables and numbers. The results showed that 93.5% and 96.8% of respondents were aware of the laws and regulations governing waste management and acknowledged penalties for violating such laws in Kenya. Further, the results showed a **Mean score of 5.13** and a **Standard Deviation of 1.13** on the extent of awareness and use of regulations. In contrast, awareness and compliance with the regulation on waste management yielded a **Mean score of 3.504 and Std. Deviation of 1.33**. Results further indicated a p-value less than **0.05** level of significance set. This indicated sufficient knowledge of the laws and

regulations governing waste management within their environment operations.

## **6.1 Introduction**

Like many other low- and middle-income nations, Kenya is anxious to demonstrate that it quickens the pace of its industrial development, many of which were taking place in its large urban areas. Increased production of solid waste by industrial, home, and other activities has been caused by growing urbanization, product processes such as manufacturing, rising standards of living, and rapid development related to increasing (Gakungu *et al.* 2017). In Kenya, for instance, the challenge caused by Solid Waste Management is real (Gakungu, 2016). He also asserts that less than 50% of the population is served and that 30 and 40 per cent of the solid trash produced in urban areas are not collected. He also claims that up to 80% of collection vehicles are out of service or in need of repair. He contends that if the challenge of sustainable solid waste management in Kenya is not promptly addressed, all of Kenya's municipalities will be submerged in waste. Therefore, Kenya has passed several laws and legal requirements, in addition to creating institutions and mechanisms at various governmental levels, to deal with the possible problems associated with solid waste and its management and other secondary aims.

Above all, the legislative and nonsupervisory environment for SWM is dispersed, disintegrated, and deficient, and so doesn't tend to grease the conformation of cross-sectoral-partnerships (Haregu *et al.*, 2017). The challenges with SWM continue to be a major concern, he further posited, despite the variety of SWM programs that Kenya has established over the past few decades. The focus has been more on ecological problems and maintaining cleanliness and orderliness than on environmental health



complications, and the gap between accepted action and legislation is still incredibly wide. Moreover, due to inadequate institutional competence and capacity, soft non-supervisory fabric enforcement and the sector's control by felonious syndicates. Poor collaboration between multitudinous- institutions and agencies dealing with the issues of environmental protection, and the perpetuation of espoused regulations and laws, was also cited by Aliu *et al.* (2014).

According to Guerrero *et al.* (2013), the problems in perpetration are due to lack of alert and enforcement, lenient penalties; corruption; political hindrance; lack of provocation to misbehave, as well as hamstrung execution system. In addition, lack of public commitment, mindfulness, and poor backing was cited by Okot-Okumu (2017). Examination and enforcement procedures in public, parochial, and original situations are important for fully working MSWM strategies (Marshall & Farahbakhsh, 2015). On the other hand, an interview with NEMA officers established that the- authority is presently oppressively understaffed, having only ten inspectors; hence, NEMA finds it delicate to send its inspectors to the field regularly, as needed by the law. On the other hand, most County inspectors find it delicate to apply its by-law since it acts as a regulator and service provider simultaneously (Haregu *et al.*, 2017). In addition to the poor policy perpetration, although all the 47 Counties by- laws enjoin illegal disposal of waste, specify storehouse and collection responsibilities for SW creators, and indicate the County's Right to collect MSWM charges, all of these aren't adequately enforced (UNEP, 2015).

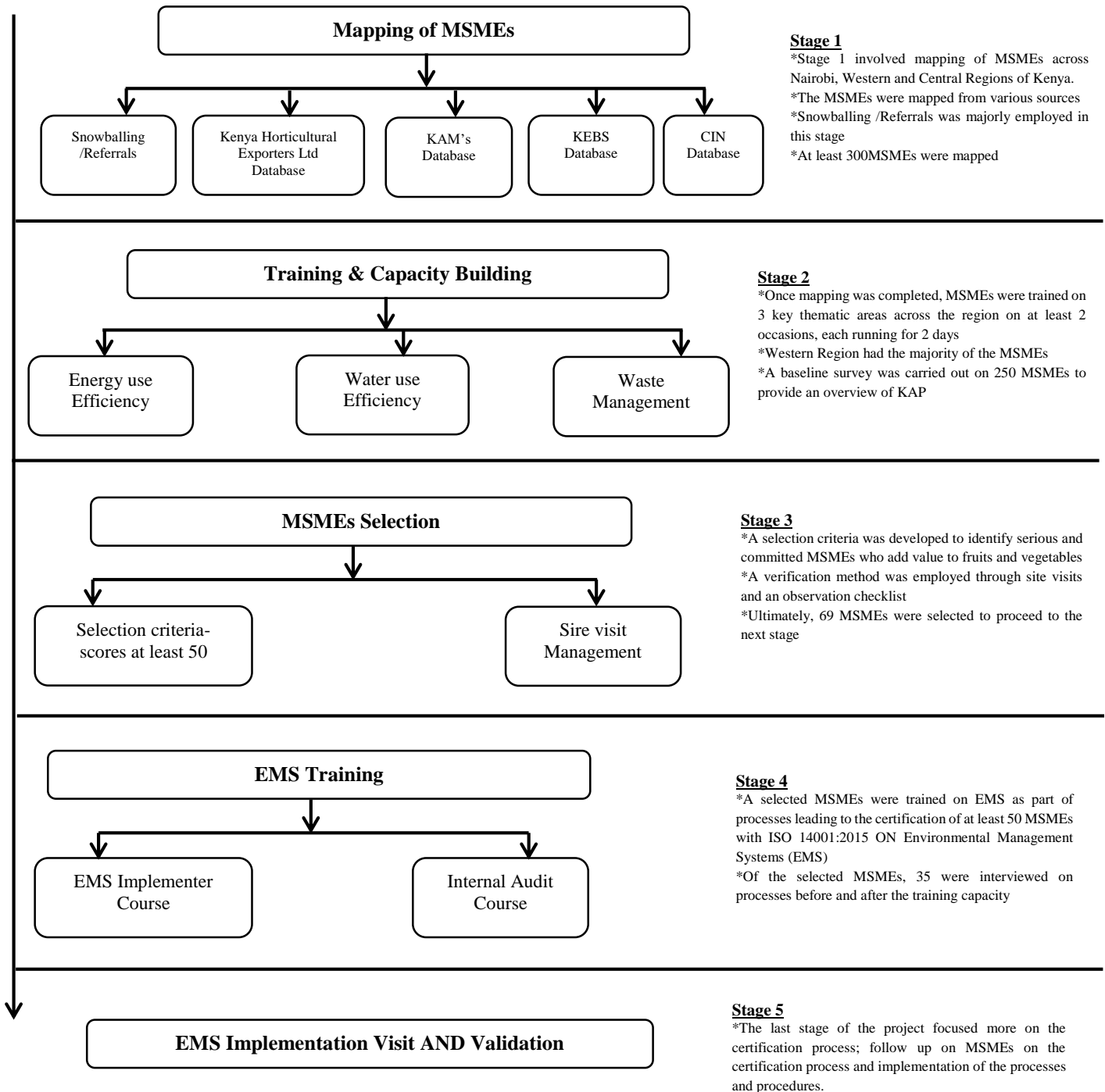
On the other hand, perpetration of some policies can produce new/arising problems/hazards no way endured before; the coming section provides one similar illustration. New issues/pitfalls are arising due to the plastic ban in 2017. Concerning policy perpetration, particularly on the rearmost ban on plastic bags, 2017, the experimenter observed several times. In different areas of Kenya, road food dealers package their food for guests using old journals caused by the recent ban on plastic bags, 2017. These products include popular cut vegetables' Sukuma wiki', fruits, fried and boiled sludge, and fried chips, among other foodstuffs. Therefore, the objective of the study was to analyse the influence of legal & regulatory frameworks on waste management among horticultural processing MSMEs in Kenya.

## **6.2 Materials and Methods**

The researcher reviewed the influence of existing legislations and regulatory frameworks concerning a clean and healthy environment. To underscore their influence on waste management, there has to be an evaluation of compliance with the legislation. These include laws on waste disposal, recycling, and the overall influences among Horticultural processing MSMEs in Kenya. Therefore, the Horticultural processing MSMEs were taken through a series of questions regarding Legal and regulatory frameworks influencing waste management and environmental management.

## 6.2.1 Study Setting

The current research was conducted among the Trained and certified Horticultural processing MSMEs in Kenya (**Figure 6.1 below**).



**Figure 6.1: Trained and certified Horticultural processing MSMEs in Kenya**

### **6.2.2 Sample Size and Sampling Procedure**

A cross-sectional procedure design using structured questionnaires was conducted in 2020. Exhaustive sampling was used to target all Horticultural Processing MSMEs in Kenya based on certain criterion. These were; a) the MSME must have been processing fruits/vegetables, b) owns an enterprise which is operational in a premise and c) must have been in consistent operation for at least three months. Thereafter initial training was conducted to equip the horticultural processing MSMEs with the required and right methods of processing and managing wastes in their firms (**Figure 6.1**).

In order to collect data from the chosen processors, a modified structured questionnaire was designed based on the outcome of the baseline survey as postulated by Kothari (2014). The questionnaire was divided into four sections namely; Demographic information, horticultural processing plant information, influence of KAPs, quantification of wastes generated, legal and regulatory frameworks influence on waste management in horticultural processing MSMEs in Kenya.

### **6.2.3 Data Analysis**

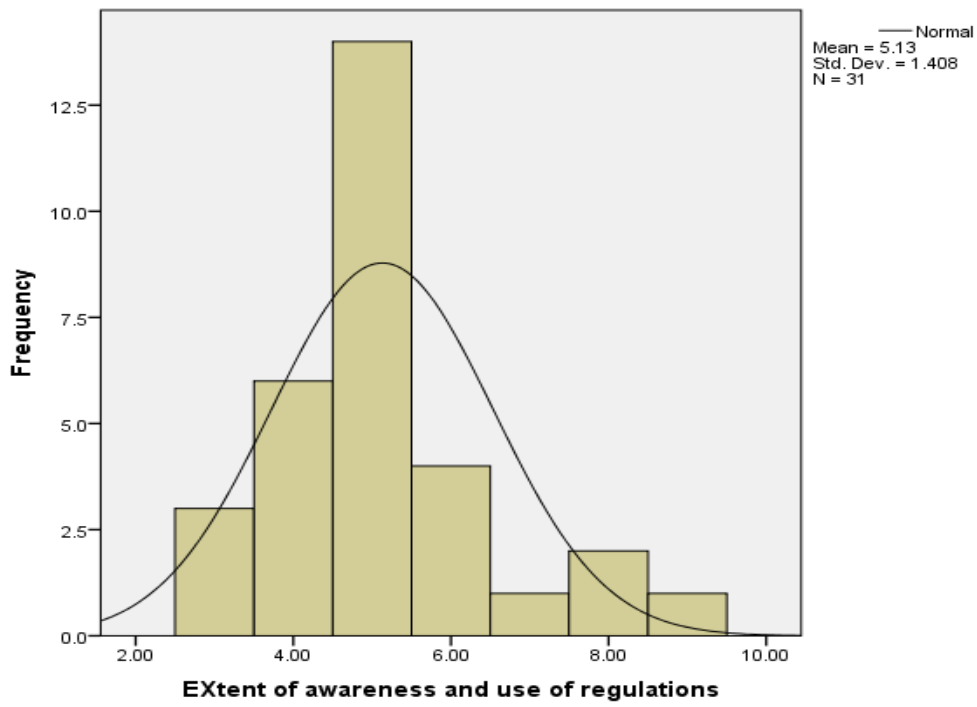
This was conducted using statistical Package for Social Sciences Software (SPSS Version 21). Each Legal and Regulatory Frameworks response was categorized as descriptive question with a Yes or No answer. Frequencies were employed to summarize results for each research question on Legal and Regulatory frameworks. Linear Regression analysis was done in order to establish an association or relationship of the influence of Legal and Regulatory Frameworks on waste management amongst the horticultural processing MSMEs surveyed-where the statistical significance was set at  $p < 0.05$ .

### **6.3 Results**

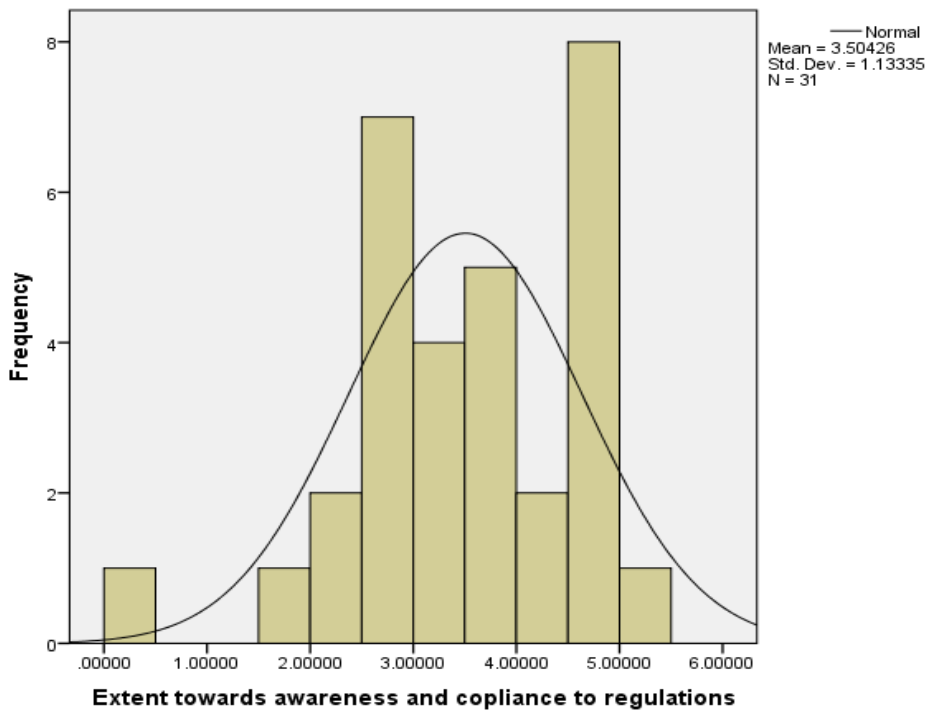
According to the scores, 93.5% and 96.8% of those surveyed indicated awareness of the laws, regulations governing management of wastes and acknowledge that there are penalties for violation of these laws in Keya respectively. Further, the results showed **Mean score of 5.13** and Standard Deviation of **1.13** on extent of awareness and use of regulations, while awareness and compliance to regulation on waste management, yielded **Mean score of 3.504** and **Std. Deviation of 1.33**. Further, the results showed a **p-value** of  $p > 0.05$  indicating a positive significant with Standardized Coefficient Beta of **0.686**. This indicates knowledge on the laws and regulations governing waste management within their environment and therefore, NEMA can exploit this avenue to empower these MSME horticultural processors fully manage their wastes and serve as role models for other manufacturers in the Kenya (**Tables; 6.1 and 6.2**).

**Table 6.1: Descriptive Analysis of Legal and Regulatory Frameworks in MSMEs**

	<b>Yes</b>	<b>No</b>
a) Have the employees embraced new knowledge on waste management after training?	96.8%	3.2%
b) Are you aware of the laws and regulations governing waste management in Kenya?	93.5%	6.5%
c) Are these laws and regulations on waste management documented for reference by employees in your firm?	41.9%	58.1%
d) Does your firm dispose waste according to environmental regulation in Kenya?	77.8%	22.2%
e) Does your firm segregate wastes?	74.2%	25.8%
f) Does your firm use waste water for irrigation purposes?	16.1%	83.9%
g) All Citizens are entitled to clean drinking-water in adequate quantities	100.0%	0.0%
h) I can dump/discharge wastes into a river/stream anyhow	0.0%	100.0%
i) Liquid wastes in our firm is treated before disposal	22.6%	77.4%
j) Is your firm constructed near a river/stream?	35.5%	64.5%
k) Do you know that there are penalties for violation of laws and regulations regarding improper wastes disposal in Kenya?	96.8%	3.2%
l) Are you aware of legal and regulatory frameworks governing waste disposal in Kenya?	88.9%	11.1%



*Figure 6.2: Extent of Awareness and Compliance to Regulations*



*Figure 6.3: Extent of Awareness and Compliance to Regulations*

### 6.3.1 Linear Regression Analysis of Legal and Regulatory Frameworks on Waste Management

The Table 6.2 indicates the regression analysis results on legal and regulatory frameworks on waste management among the MSMEs surveyed.

**Table 6.2: Legal & Regulatory Framework on Waste Management**

	<b>Sum of Squares</b>	<b>df</b>	<b>Mean Square</b>	<b>F</b>	<b>Sig.</b>
<b>Regression</b>	26.186	1	26.186	25.723	.000b
Residual	29.522	29	1.018		
Total	55.707	30			
	<b>Unstandardized Coefficients</b>		<b>Standardized Coefficients</b>	<b>t</b>	<b>Sig.</b>
	<b>Beta</b>	<b>Std. Error</b>	<b>Beta</b>		
(Constant)	0.2	0.598		0.335	0.74
Extent towards awareness and compliance to laws and regulations	0.824	0.163	0.686	5.072	0.000

### 6.4 Discussion

Results on the period the respondents have been in the horticultural processing business showed that; those below one year were (3.2%), 1-3 years (41.9%), 4-6 years (16.1%) and those above six years in operation were (38.7%). This demonstrated the value of enterprise age and size as well as their impact on firm success, as noted by many researchers. In addition, the size of the business and firm performance has been positively correlated in previous studies (Wiklund and Shepherd, 2015).

Up to a certain level, small enterprises typically operate more efficiently; after that, they start to lag. Accordingly, these businesses are more likely to succeed if they are entrepreneurial than otherwise. This affirms the explanations of why many MSMEs die or collapse during the start-up periods. For example, during the pilot period of my



present study, I visited many initiated MSMEs. However, some couldn't proceed to the subsequent level as they could not meet the project's inclusion criteria.

The extent of awareness and compliance with Environmental Laws and regulations was affirmed by the results indicating a positive relationship, with 96.8% with a *p-Value*  $p > 0.05$  **Significance**. Further, those surveyed about the Right to clean and safe water in adequate quantities affirmed yes at 100%, clearly indicating the positive impact of capacity building on EMS conducted to the horticultural processing MSMEs in Kenya (Table 6.2). Capacity building and awareness of laws and regulatory frameworks on effective waste management are increasingly important in today's manufacturing/processing sectors. Moreover, applying laws like polluter's pays principles is handy for the offenders. This means a waste generator pays for the appropriate disposal of his/her wastes into the environment.

Another principle which can be applied to the horticultural processing of MSMEs and others towards quantities of waste generated is the **Extended Producer Responsibility** (EPR). This philosophy and strategy promote the integration of all costs incurred with finished products throughout their life cycle. In case of expiry of the products at any stage of sale or manufacture, they are fully responsible for recall or disposal, which is environmentally sound. It concurs with the research conducted by Ambiat (2014). However, Kenya has made substantial efforts in the policy arena to oversee, regulate and promote good practices in SWM and safeguard the dignity of human beings and their ecosystems from the consequences of uncontrolled waste discarding (Njoroge *et al.*, 2015). The relevant efforts manifested by Kenya as a signatory, or a party to the main International Conventions and Treaties, enacting numerous laws and by-laws, relevant SWM, and creating institutions and systems at different levels of governance.

However, notwithstanding the existing legal framework, Kenyans do continue witnessing, day after day, an overwhelming number of cases of non-compliance, with the set performance standards and regulations, on SWM. It has been said that WM is a mirror reflection of a society's state (Zuckerman, 2015).

Planning properly and receiving sufficient supervision from central authorities are essential components of a sustainable waste operation. Although waste management is mostly a localized service, both public and national governments have a role in developing the nonsupervisory framework that allows for the efficient and sustainable management of solid waste management services. Public administrations are often responsible for creating fair and transparent service procurement regulations from the private sector and environmental standards for waste operations (Akinyi & Lucy, 2016). In addition, public laws promote adherence to accepted social and environmental norms by local governments. National governments also adopt laws and norms to direct individuals, households, and institutions in proper waste management.

In most cases, the fact that operates regulate services to push responsibility is separated from the fact that governs waste management. Law enforcement may frequently present difficulties. Adequate staffing, the enforcement of fines or other penalties, and artistic conformity with legislative intentions are all necessary for effective enforcement. For instance, Malaysia's National Solid Garbage Management Policy was developed to standardize and improve waste management throughout the nation (Wee *et al.*, 2017). However, the policy's limitations, minimal personnel specialization, and nebulosity presented difficulties for deployment implementation. A public bag prohibition was strictly enforced in Rwanda, employing border command guards to help with illicit imports and various penalties for offenders, ranging from forfeitures, jail time, and

public jeering (de Freytas-Tamura, 2017). Original laws and regulations are typical since original governments are often in charge of implementing solid waste operation systems. Source separation, ménage and transportable freight, disposal locations, restrictions on plastic or accessories, and the government agencies responsible for policing waste operations and enterprise are all covered in the original legislation. In response to complaints from citizens about poor waste operations, the Kenya National Environmental Management Authority produced Kenya's National Solid Trash Management Strategy in 2014, proposing cooperative action methods to completely improve waste operations (NEMA 2014; Akinyi, 2016).

Another example is a public policy for integrated waste operation in Mozambique, which describes the existing state of waste operation and specifies a timeline for taking measures to address one of the most pressing solid waste operation concerns. The plan determines the locations of all players, including central governments, cosmopolitan firms, waste selectors, residents, and nonprofit associations. It offers direction on problems from tip building to the association of waste selectors (Tas and Belon, 2014). National policies usually specify criteria comparable to recycling rates to monitor progress over time.

Managing the volume of trash produced by MSMEs in Kenya also necessitates a broader perspective on the public good and nature of MSWM. Controlling access to MSWM services is difficult, and if some citizens are exempt from MSWM obligations, they may save some money on their costs but at the expense of other people and society as a whole (Su *et al.*, 2017). Waste operation is a mileage service which does not allow for detaching drug addicts who don't pay without influencing others, in contrast to other public or mileage services that run on distinct measurements like electricity or water.

Druggies who regularly pay for the service benefit from a clean environment and the accumulation of waste in the neighbor's backyard that is not paying. The degree to which each component might be viewed as a "public good" differs when considering the various SWM rudiments. Roads and safe disposal, for instance, are public goods because the use of pure land cannot be restricted.

On the other hand, the door-to-door collection is consumed by individuals but still used by everyone, making it largely a public good. Finally, the creation, exchange, and processing of recyclable waste are examples of private goods. Therefore, the lines separating public goods from private commodities are hazy in the case of waste operations. Occasionally, this is referred to as an "impure public good," (Helm, 2016).

Cosmopolitans are typically responsible for icing a satisfactory service for SWM. When the value creation from waste's accoutrements turns into a lucrative enterprise in and of itself, the question of "Who owns external solid waste?" emerges. The battle for access to rich waste aqueducts is waning. Until recently, the costs of separating the collection of reusable accoutrements in industrialized nations were only partially compensated by the profits derived from dealing with the accoutrements due to the relatively low and fluctuating pricing for secondary raw materials. The expense is reasonable when compared to acceptable methods of treatment or disposal or to achieving policy-set recycling goals.

In impoverished nations, informal recycling plants can support themselves by selling salvaged materials (Greyson, 2017). However, when resource shortages and rising costs are present, situations arise where individuals in developed countries can make a decent living by removing recyclables from "formal" systems, or even where large public

enterprises in developing nations are motivated to "contend" with both megacity and the private sector in offering MSWM services in order to get access to raw materials. The project's assistance for MSMEs was intended to: promote innovation; deliver liquidity via microfinance banks (MFBs), savings and credit cooperative organizations (SACCOs); digital platforms (particularly instruments that will leverage more private capital); and reduce lending risk. It also had plans for offering project management help and technical support. The project aimed to use implementation agreements to leverage parallel finance from other development agencies and raise more money from the private market. While the project addressed the pandemic's short-term effects, it also aims at addressing structural issues that will hinder MSME financing in the medium and long.

## **6.5 Conclusions**

While there is a lot of waste due to careless littering and dumpsites despite the existence of institutional and regulatory frameworks managing solid and wet waste management, demonstrating a lack of coordination and implementation of numerous regulations throughout the 47 Counties in Kenya. Above all, the results showed that most (27%) of the MSMEs had acquired both College and University education but were still unable to manage waste as required. Above all, Capacity building and awareness of laws and regulatory frameworks will enhance effective waste management as it is increasingly important in today's manufacturing/processing sectors and the application of certain laws like polluter's pays principles comes in handy for the offenders.

## **6.6 Recommendations**

To achieve milestones in legal and regulatory frameworks on waste management, it's important to; Translate all laws and regulations concerning waste and environmental management in simpler terms into simple policy briefs to help the MSMEs and other stakeholders in the horticultural sector get more informed; Promote and maintain people's awareness, ecological values, and ethical behavior by including all parties in the management of both solid and liquid wastes efficiently and effectively without compromising the quality of the environment and future generations; To foster cooperation among all of the stakeholders and improve institutional capacity, infrastructural, regulatory, and financial incentives for efficient and effective policy implementation regarding waste management, there is a need for a transparent control and coordination mechanism of regulatory, execution, and assessment. There is also a need to institutionalize good governance on solid and liquid waste management by bridging the gap between different stakeholders (for example, processors and consumers) by inclusiveness and participation as envisioned in the 2010 Constitution of Kenya.

## **CHAPTER SEVEN: GENERAL CONCLUSIONS AND RECOMMENDATIONS**

### **7.1 Conclusions**

The research aimed to assess the Status of waste management among horticultural processing micro, small and medium enterprises in Kenya and outline measures for enhancing sustainable waste management among horticultural processing MSMEs in the County. Based on the current findings, horticultural processors displayed a low level of waste management despite having attained higher levels of education. However, the horticultural processing MSMEs displayed better knowledge of waste management after undertaking capacity building on waste management and adopting SCP practices in processing fruits and vegetables. Capacity building/ training as an intervention improved knowledge and practices on waste management and adopted the three Rs- reuse, recycle and reduce in the processing of their products. The results further showed that the quantity of waste generated was vegetable residues and fruit peels reused as animal feeds or organic fertilizers. And despite excellent and documented laws and regulatory frameworks on waste management in Kenya, people still indiscriminately discard waste.

The research showed that by offering training and strengthening the capacity of MSMEs on SCP practices, MSMEs were prone to integrating SCP practices in their horticultural processing activities. Accordingly, the study further showed that Training/Capacity building is related to waste management amongst horticultural processing MSMEs in Kenya. Therefore, Capacity building on waste management will help Horticultural processing MSMEs understand the dangers of unprecedented waste

disposals within our ecosystem, empowering the horticultural processors to act appropriately and produce sustainably. Therefore, active participation in implementing Environmental Management Systems (EMS) is important for successful environmental protection, sustainable consumption, and production practices amongst horticultural processing MSMEs in Kenya.

## **7.2 Recommendations**

As per the results of the study, the researcher recommends various ways, namely;

- i) **Encourage Public-Private Partnership in ensuring adoption of SCP** - it would be productive for other private entities, such as Multi-Nationals, NGOs, CBOs, and Government-both National and County Governments, to fully partner with these performing entities horticultural MSMEs in Kenya for better results and environmental management.
- ii) **Capacity Building Programmes for the Horticultural Processing MSMEs in Kenya** -If this is well planned amongst the horticultural processing MSMEs in Kenya, then the adoption of SCP practices and efficient waste management will be a daily practice by these manufacturers towards Zero wastes-a beneficial to both the County and National government.
- iii) **Implementation of Recyclable Buy-Backs Programme**-into the environmental Legal land regulatory frameworks (other than just enforcement/punishment). Monthly buy-back activities are undertaken to facilitate the processor's trade-in outputs for other valuable items for re-processing.



- iv) **Involvement of environmental researchers/experts in policy formulation and reviews.** Whenever an opportunity comes for environmental policy reviews, researchers like me must be allowed to participate fully in the exercise, not just Legal experts who might lack environmental expertise.

### **7.2.1 Recommendations for Further Research**

- i) Society's Viewpoint on SCP; How can Policy aims and Instruments be shaped to promote more Sustainable production and Consumption practices?
- ii) Consideration for the effects of stringent standards that governs exports of Horticultural products
- iii) Production perspective; how do we design and produce goods and services that are sustainable to the Environment -today and tomorrow?
- iv) Do the legislation/Policy instruments achieve the desired change in Behaviour or Attitude of Citizens on waste management?
- v) Does the Regulator (e.g., NEMA) get the message out on appropriate standards and compliance Issues?
- vi) Why do people just waste anyhow despite status (well educated, rich, or poor.)?
- vii) Why does a mad person keep waste instead of throwing them anyhow despite their mental status?

## REFERENCES

- Abdulrahman, M.D., Gunasekaran, A., Subramanian, N. (2015). Critical barriers in implementing reverse logistics in the Chinese manufacturing sectors. *International Journal of Production Economics*, 147, 460-471.
- Abedini, A.R. (2017). Solid Waste Management Specialist, and Founder and CEO, ISWM Consulting Ltd. Personal communication between A. Abedini and Iran Municipal and Rural Management Organization (MRMO).
- Acedo, Jr. and Weinberger, K. (2016). "VEGETABLES POSTHARVEST Simple techniques for increased income and market," AVRDC–The World Vegetable Center, Taiwan and GTZ-Regional Economic Development Program, Cambodia.
- Adeolu, A.T., Enesi, D.O., & Adeolu, M.O. (2016). Assessment of Secondary School students' Knowledge, Attitude and Practice towards Waste Management in Ibadan, Oyo State, Nigeria. *Journal of Research in Environmental Science and Toxicology*, 3(5), 66-73.
- Adogu, P., Uwakwe, K., Egenti, K., Okwuoha, A. & Nkwocha, I. (2015). Assessment of Waste Management Practices among Residents of Owerri Municipal Imo State Nigeria. *Journal of Environmental Protection*, 6, 446-456.
- Agamuthu, P., Fauziah, S. and Khidzir, K. (2015). Evolution of Solid Waste Management in Malaysia: Impacts and implications of the Solid waste bill.
- Agricultural Sector Coordination Unit [ASCU]. (201). National Food and Nutrition Security Policy. Nairobi: Government of Kenya.
- Ahmed, S.A. and Ali, M. (2015). 'Partnerships for Solid Waste Management in Developing Countries: Linking Theories to Realities'. *Habitat International*28(3): 467 – 479.
- Aini, M.S., Razi, A.F., Lau, S.M., and Hashim, A. H. (2017). Practices, Attitudes and Motives for Domestic Waste Recycling. *International Journal of Sustainable Development and World Ecology*, 9(3), 232.
- Ajila, C.M, Aalami M. Leelavathi, K., Rao U.P. (2010). Mango Peel Powder: A Potential Source of Antioxidant and dietary fiber in macaroni preparations. *Innov Food Sci Emerg Technol* 11:219–24.
- Ajzen, I. (1991). The Theory of Planned Behaviour. *Organizational Behaviour and Human Decision Processes*. 50: 179-211.
- Akenji, L & Bengtsson, M., (2016). 'Is the Customer Really King? Stakeholder Analysis for Sustainable Consumption and Production Using the Example of the Packaging Value Chain', in *Sustainable Consumption and Production in the*

Asia- Pacific Region: Effective Responses in a Resource Constrained World, Institute for Global Environmental Strategies, pp. 21-

- Akinbile, Christopher O., and Mohd S. Yusoff. 2011. "Environmental Impact of Leachate Pollution on Groundwater Supplies in Akure, Nigeria." *International Journal of Environmental Science and Development* 2 (1): 81–86. <http://www.ijesd.org/papers/101-F10106.pdf>.
- Akinyi, L. (2016). "NEMA Launches Solid Waste Management Strategy." *Citizen Digital*, September 15. <https://citizentv.co.ke/news/nema-launches-solid-waste-management-strategy-141364/>.
- Alasadi, R., Abedelrahim, A. (2017). Critical analysis and modeling of small business performance (case 14 Study: Syria), *Journal of Asia Entrepreneurship and sustainability*, 3 (2), pp. 320-355.
- Aliu, I.R., O.E, Adeyemi., and A, Adebayo., (2014), Municipal household solid waste collection strategies in an African megacity: analysis of public private partnership performance in Lagos, *Waste management & Research* Vol. 32, No. 9, supply P. 67-78.
- Al-Jarrah, O., and H. Abu-Qdais. (2016). "Municipal Solid Waste Landfill Siting Using Intelligent System." *Waste Management* 26 (3): 299–306. <https://www.ncbi.nlm.nih.gov/pubmed/16019199>.
- Al-Khatib, I.A., Kontogianni, S., Abu Nabaa, H., Alshami, N., and Al-Sari', M. I. (2015). Public perception of hazardousness caused by current trends of municipal solid waste management. *Waste Management*, 36323-330.
- Al-Khatib, I.A., Monou, M., Abu Zahra, A.F., Shaheen, H.Q., and Kassinos, D. (2016). Solid waste characterization, quantification and management practices in developing countries. A case study: Nablus district – Palestine. *Journal of Environmental Management*, 91(5), 1131-1138.
- Ambiat, Jocelyn (2014). *Domestic Solid Waste Management in Borongan, Eastern Samar; Proposed Technology Intervention*. Unpublished Dissertation, Cebu State College of Science and Technology, Cebu City.
- Aparcana, S. & S. Salhofer (2013). Application of a methodology for the social life cycle assessment of recycling systems in low-income countries: Three Peruvian case studies, *International Journal of Life Cycle Assessment* 18(5): 1116-1128.
- Armijo de Vega, C., Ojeda Benítez, S., & Ramírez Barreto, M. E. (2018). Solid waste characterization and recycling potential for a university campus. *Waste management* (New York, N.Y.), 28, S21-6. doi: 10.1016/j.wasman.2018.03.022.
- Asase, M., Yanful, E.K., Mensah, M., Stanford, J., and Amponsah, S. (2016). Comparison of municipal SWMS in Canada and Ghana: A case study of the cities of London, Ontario, and Kumasi, Ghana. *Waste Management*, 29(10),

2779-2786.

Asnani, P.U. (2016). Solid Waste Management, E-Book.

Assefa, M. (2017). Solid Waste Generation Rate and Characterization Study for Laga Tafo Laga Dadi Town, Oromia, Ethiopia. *International Journal of Environmental Protection and Policy*, 5(6), 84. <https://doi.org/10.11648/j.ijepp.20170506.11>.

Ayala-Zavala, J.F., Rosas-Domínguez C., Vega-Vega, V., González-Aguilar, G.A. (2016). Antioxidant enrichment and antimicrobial protection of fresh-cut fruits using their own byproducts: looking for integral exploitation. *J Food Sci* 75:175–81.

Babalola, A. (2017). The Practice and Challenges of Solid Waste Management in Damaturu, Yobe State, Nigeria. *Journal of Environmental Protection*, 1(4), 384-388.

Baker, Judy. 2012. *Climate Change, Disaster Risk, and the Urban Poor: Cities Building Resilience for a Changing World*. Washington, DC: World Bank.

Ballinger, Ann, and Dominic Hogg. (2015). “The Potential Contribution of Waste Management to a Low Carbon Economy.” Eunomia Research and Consulting, Bristol, UK. [http://www.acrplus.org/images/publication/Contribution\\_low\\_carbon\\_economy/EN\\_Main-Report-.pdf](http://www.acrplus.org/images/publication/Contribution_low_carbon_economy/EN_Main-Report-.pdf).

Bangkok Metropolitan Administration, “Bangkok State of the Environment (2012). (Revised edition).” Department of Environment. <http://203.155.220.174/pdf/BangkokStateOfEnvironment2012RevisedEdition.pdf>.

Banna, Farouk. (2017). “Municipal Solid Waste Management in Burkina Faso: Diagnostic and Recommendations.” World Bank, Washington, DC.

Baran, P.A. (2014). Reflections and under Consumption. In *the Allocation of Economic Resources: Essays by Moses Abramovitz and Others*. Stanford University Press: Stanford. pp 52-64. (15)

Bartone, C.R., Leite, L., Triche, T., & Schertenleib, R. (2014). Private Sector Participation in Municipal Solid Waste Service: Experiences in Latin America. *Waste Management & Research*, 9(6), 495-509.

Bhada-Tata, Perinaz, and Daniel Hoornweg. (2016). “Solid Waste and Climate Change.” *State of the World 2016: Can a City Be Sustainable?* Washington, DC: Worldwatch Institute. <http://www.worldwatch.org/http%3A/%252Fwww.worldwatch.org/bookstore/publication/state-world-can-city-be-sustainable-2016>.

Bignami, G., Milikovic, D. (2015). Nutraceuticals and methods of obtaining nutraceuticals from tropical crops. U.S. Patent Application No. 10/067,569.

- Bohne, R. A., Brattebø, H., & Bergsdal, H. (2018). Dynamic Eco-Efficiency Projections for Construction and Demolition Waste Recycling Strategies at the City Level. *Journal of Industrial Ecology*, 12(1), 52-68. doi: 10.1111/j.1530-9290.2018.00013. x.
- Bolaane, B. (2010). Constraints to Promoting People Centred Approaches in Recycling. *Habitat International*, 30(4), 731-740.
- Brown, Charlotte. (2015). “Waste Management Following Earthquake Disaster.” In *Encyclopedia of Earthquake Engineering*, edited by M. Beer, E. Patelli, I. Kougiumtzoglou, 3921–34. Berlin, Heidelberg: Springer.
- Carbon Disclosure Project. (2013). “CDP Cities 2013: Summary Report on 110 Global Cities.” Carbon Disclosure Project, London. <http://www.c40.org/researches/c40-cdp-2013-summary-report>.
- Carter, C.R., Kale, R., Grimm, C.M., (2016). Environmental purchasing and firm performance: an empirical investigation. *Transportation Research: Part E* 36 (3), 219-228.
- Cavé, J. (2017). *La ruée vers l’ordure. Conflits dans les mines urbaines de déchets* [In French]. Presses universitaires de Rennes.
- Chakrabrati, A., Allison, M., Smith, H.G., Kindness, H.M., & Kelley, J. (2016). Municipal waste management in Sicily: practices and challenges. *Waste Management*, 28, 1201 – 1208.
- Chakrabrati, S., Majumder, A., & Chakrabrati., S., (2010). Public-Community Participation in Household Management in India. An Operational Approach. *Habitat International Journal*.18 (1) pp.89-108.
- Chrisman, J.J., Chua, J.H., & Litz, R. (2012). A unified systems perspective of family firm performance: An extension and integration. *Journal of Business Venturing*, 18(4), 467–472. Google Scholar | ISI retrieved on 10.04.2021.
- Chu, W. (2011). Family ownership and firm performance: influence of family management, family control, and firm size. *Asia Pacific Journal of Management*, 28(4), 833–851.
- City of Johannesburg. (2011). “City of Johannesburg Integrated Waste Management Plan.” Johannesburg, South Africa. <http://www.pikitup.co.za/wp-content/uploads/2015/10/City-of-Joburg-Integrated-Waste-Management-Plan-2011.pdf>.
- Claessens, S., Djankov, S., Fan, J.P.H., & Lang, L.H.P. (2012). Disentangling the incentive and entrenchment effects of large shareholdings. *The Journal of Finance*, 57(6), 2741–2771.
- Cohen, Peter, Jeroen Ijgosse, and Germán Sturzenegger. (2013). “Preparing Informal Recycler Inclusion Plans: An Operational Guide.” Inter-American Development Bank, Washington, DC. <https://publications.iadb.org/>

handle/11319/697? locale-attribute=en#sthash.AIIheLww.dpufhttp://  
publications.iadb.org/handle/11319/697?locale-attribute=en.

- Cooper, D.R., & Schindler, P.S. (2017). *Business Research Methods* (9<sup>th</sup> edition). USA: McGraw-Hill.
- Couth, R., Trois, C., (2014). Carbon reduction strategies in Africa from improved waste management. May 2014. *Waste Management* 30 (11), 2336–2346.
- Curtis, J., Lyons, S., O’Callaghan-Platt, A. (2016). Managing household waste in Ireland: Behavioural parameters and policy options. *J. Environ. Plan. Manag.* 2016, 54, 245–266. [CrossRef].
- Da Zhu, P. U. Asnani, Chris Zurbrugg, Sebastian Anapolsky, Syamala Mani (2017). *Improving Municipal Solid Waste Management in India: A Source Book for Policy Makers and Practitioners*, World Bank Development Studies, World Bank Institute, Washington D.C.
- Dar-es-Salaam City Environment Outlook, (2011). Second Draft, Vice President’s Office, Division of Environment, United Republic of Tanzania, Dar-es-Salaam.
- Darnton, A. (2016). *Practical Guide: An Overview of Behaviour Change Models and their Uses*. For the Government Social Research Unit. [http://www.civilservice.gov.uk/wp-content/uploads/2011/09/ Behaviour-change\\_practical\\_guide\\_tcm6-9696.pdf](http://www.civilservice.gov.uk/wp-content/uploads/2011/09/Behaviour-change_practical_guide_tcm6-9696.pdf).
- Davis, J., S. Haase, and A. Warren. 2016. “Waste-to-Energy Evaluation: U.S. Virgin Islands.” Technical Report NREL/TP-7A20-52308. National Renewable Energy Laboratory, Office of Energy Efficiency and Renewable Energy, U.S. Department of Energy, Washington, DC.
- de Freytas-Tamura, Kimiko. (2017). “Public Shaming and Even Prison for Plastic Bag Use in Rwanda.” *New York Times*, October 28. <https://www.nytimes.com/2017/10/28/world/africa/rwanda-plastic-bags-banned.html>.
- Demirbas, A. (2016). Waste management, waste resource facilities and waste conversion processes. *Energy Conversion & Management*, 52(2), 1280-1287. <https://doi.org/10.1016/j.enconman.2010.09.025>.
- Desa, A., Kadir, N. B. Y. A., & Yusooff, F. (2015). Environmental awareness and education: A key approach to solid waste management (SWM) - a case study of a University in Malaysia. In L. F. M. Rebellion (Ed.), *Waste management - an integrated vision*. Retrieved from DOI: 10.5772/48169.
- Desa, A., Kadir, N.B.Y.A., & Yusooff, F. (2016). A study on the knowledge, attitudes, awareness status and behaviour concerning solid waste management. *Procedia-Social and Behavioural Sciences*, 18, 643-648.

- Dias, Sonia. (2018). "Fórum Lixo e Cidadania: Catadores de Problema Social à Questão Sócio-Ambiental." Paper presented at the First World Conference of Waste Pickers, Bogotá, March.
- Diekmann, A., & Preisendorfer, P. (2016). Environmental behaviour; Discrepancies between aspirations and reality. *Rationality and society*, 10(1), 79-102.
- Dieleman H. and Cramer J. (2004). Strategies to implement cleaner production: towards a systems approach. Erasmus Centre for Sustainability and Management, Erasmus University Rotterdam.
- Dijksterhuis, A., Chartrand, T.L., & Aarts, H. (2010). Effects of priming and perception on social behaviour and goal pursuit. In J. A. Bargh (Ed.), *Social psychology and the unconscious: The automaticity of higher mental processes* (pp. 51–132). Philadelphia, PA: Psychology Press.
- Dixon, N., & Jones, D.R.V. (2015). Engineering properties of municipal solid waste. *Geotextiles & Geomembranes*, 23(3), 205-233  
<https://doi.org/10.1016/j.geotexmem.2004.11.002>.
- DTI (Department of Trade and Industry), (2014). Micro, Small, and Medium Enterprise Statistics. Philippines, February. Retrieved on May 1, 2020 from <http://dti.gov.ph/dti/index.php/msme/msme-statistics>.
- Economist Intelligence Unit. (2011). US and Canada Green City Index—Assessing the Environmental Performance of 27 Major US and Canadian Cities. Munich: Siemens, A.G. [https://www.siemens.com/entry/cc/features/greencityindex\\_international/all/en/pdf/report\\_northamerica\\_en.pdf](https://www.siemens.com/entry/cc/features/greencityindex_international/all/en/pdf/report_northamerica_en.pdf).
- Ehrampoush, M.H., & Moghadam, M.B. (2015). Survey of Knowledge, Attitude, and practice of Yazd University of Medical Sciences Students about Solid Wastes Disposal and Recycling. *Journal of Environmental Health Science & Engineering*, 2(2), 26-30.
- Eisenhardt, K.M., (1989), Agency theory: An assessment and review", *Academy of Management Review*, 14: 57-74.
- El-Haggar, S.M. (2017). Sustainable industrial design and waste management: Cradle-to-cradle for sustainable development (p.424). Oxford: Elsevier/Academic Pres.
- Eltayeb, T.K., Zailani, S., & Ramayah, T. (2017). Green supply chain initiatives among certified companies in Malaysia and environmental sustainability: Investigating the outcomes. *Resources, Conservation and Recycling*. Elsevier B.V. doi: 10.1016/j.resconrec.2017.09.003.
- Eneji, O., Ogar, E., Ngoka, V.N. & Abang, M. (2016). Attitude towards Waste Management and Disposal Methods and the Health Status of Cross River State, Nigeria, *SCIREA Journal of Agriculture*, Volume 1, Issue 2.

- Environmental Management and Coordination (2006) (Waste Management) Regulations, Legal Notice No 121. The Environmental Management and Coordination (Water Quality) Regulations, Legal Notice No 120 City of Nairobi (Medical Facilities) By-Laws.
- EPA (United States Environmental Protection Agency). (2017). “Zero Waste Case Study: San Francisco.” Managing and Transforming Waste Streams—A Tool for Communities. <https://www.epa.gov/transforming-waste-tool/zero-waste-case-study-san-francisco>.
- EU (European Union) (2015). “Closing the Loop—An EU Action Plan for the Circular Economy.” European Commission, Brussels. <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52015DC0614>.
- EU (European Union). (2018a). “Implementation of the Circular Economy Action Plan.” European Commission, Brussels. [http://ec.europa.eu/environment/circular-economy/index\\_en.htm](http://ec.europa.eu/environment/circular-economy/index_en.htm).
- European Commission (2014 “Marine Litter: Time to Clean Up Our Act.” European Commission, Brussels. [http://ec.europa.eu/environment/marine/pdf/flyer\\_marine\\_litter.pdf](http://ec.europa.eu/environment/marine/pdf/flyer_marine_litter.pdf).
- European Commission (2018). Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: A European Strategy for Plastics in a Circular Economy [Staff Working Document]. Brussels. Available at: <https://eurlex.europa.eu/legal-content/EN/TXT/?qid=1516265440535&uri=COM:2018:28:FIN> [Accessed 17 March 2018].
- Ezeah, C., J.A. Fazakerley & C.L Roberts (2013). Emerging trends in informal sector recycling in developing and transition countries. *Waste Management*, 33, 2509-2519.
- FAKT. (2016). Small-scale oilseed processing in Tanzania. An evaluation of the current situation and suggestions for developments. Stuttgart, Germany: Fordergesellschaft fur Techniken in der Dritten Welt.
- FAO, (2014). Global food losses and food waste – Extent, causes and prevention. Rome.
- FAO, (2018). Gender and food loss in sustainable food value chains –A guiding note. Rome. (Also available at <http://www.fao.org/3/I8620EN/i8620en.pdf>).
- FAO. (2019). The State of Food and Agriculture Report: Moving Forward on Food Loss and Waste Reduction. Food and Agriculture Organization of the United Nations. <http://www.fao.org/3/ca6030en/ca6030en.pdf>.



- FAO. (2020). The State of Food Security and Nutrition in the World. Food and Agriculture Organization of the United Nations. <https://doi.org/10.4060/ca9692en>.
- Fransn, N. & Garling, T. (2015). Environmental Concern; Conceptual definitions, Measurements, Methods and Research Finding. *Journal of Environmental Psychology*, 19.369-582.
- Gakungu, N K, A N Gitau, B N K Njoroge and M W Kimani (2017), “Solid Waste Management in Kenya: A case study of public technical training institutions”, *ICASTOR Journal of Engineering Vol 5, No 3*, pages 127–138.
- Gakungu, N. K. Solid waste management; A case of Technical Institutions in Kenya; Unpublished MSc. Thesis, University of Nairobi, Kenya, 2016.
- Galgani, Francois, Georg Hanke, and Thomas Maes (2015). “Global Distribution, Composition and Abundance of Marine Litter.” In *Marine Anthropogenic Litter*, edited by Melanie Bergmann, Lars Gutow, and Michael Klages, 29–56. London: Springer.
- Garnett, T. (2016). Fruit and vegetables and UK greenhouse emissions: exploring the relationship. UK: Food and Climate Research Network, Univ. of Surrey.
- Gick, M.L., & Holyoak, K.J. (2014). Schema induction and analogical transfer. *Cognitive Psychology*, 15(1), 1–38. [https://doi.org/10.1016/0010-0285\(83\)90002-6](https://doi.org/10.1016/0010-0285(83)90002-6).
- GIZ,2015b. “Country Report on Solid Waste Management in Algeria.” German Corporation for International Cooperation (Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH [GIZ]), Bonn; and Regional Solid Waste Exchange of Information and Expertise Network in Mashreq and Maghreb Countries (SWEEP-Net), on behalf of the German Federal Ministry for Economic Cooperation and Development (Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung [BMZ]), Tunis.
- GIZ.,2017a. “Country Report on the Solid Waste Management in Lebanon.” German Corporation for International Cooperation [Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH (GIZ)] and Regional Solid Waste Exchange of Information and Expertise Network in Mashreq and Maghreb Countries (SWEEP-Net), on behalf of the German Federal Ministry for Economic Cooperation and Development [Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung (BMZ)]. April.
- Government of Indonesia. (2016). “First Nationally Determined Contribution: Republic of Indonesia.” [http://www4.unfccc.int/ndcregis/try/Published Documents/Indonesia%20First/First%20NDC%20Indonesia\\_submitted%20to%20UNFCCC%20Set\\_November%20%202016.pdf](http://www4.unfccc.int/ndcregis/try/Published Documents/Indonesia%20First/First%20NDC%20Indonesia_submitted%20to%20UNFCCC%20Set_November%20%202016.pdf).

- Government of Kenya GOK. (2007). *Kenya Vision 2030*. Ministry of Planning and National Development. <http://vision2030.go.ke/inc/uploads/2018/05/Vision-2030-Popular-Version.pdf>.
- Gowe, C. (2015). Review on potential use of fruit and vegetables by-products as a valuable source of natural food additives. *Food Sci Qual Manag* 45: 47–61.
- Grant, C. & Osanloo, A. (2016). Understanding, Selecting, and Integrating a Theoretical Framework in Dissertation Research: Creating the Blueprint for ‘House’. *Administrative Issues Journal: Connecting Education, Practice and Research*, Pp. 12-22 DOI: 10.5929/2014.4.2.9.
- Green, D.P. & Fox, J. (2017). Rational choice theory. In W. Outwait & S. P. Turner (Eds.), *The SAGE handbook of social science methodology* (pp. 269-281). Thousand Oaks, CA: SAGE. Retrieved from <http://dx.doi.org/10.4135/9781848607958.n15>.
- Greyson, J. (2017). An economic instrument for zero waste, economic growth and sustainability. *Journal of Cleaner Production*, 15(13-14): 1382-1390.
- Griesbach J. (2016) Mango growing in Kenya. GTZ/MOA (2017), ICRAF.
- Growth Revolution Magazine. (2016). “Teresa: Waste Management.” [modelhttps://growthrevolutionmag.wordpress.com/2009/09/21/teresawaste-management-model/](https://growthrevolutionmag.wordpress.com/2009/09/21/teresawaste-management-model/).
- Guerrero, L.A., Maas, G., and Hogland, W. (2013). Solid Waste Management Challenges for Cities in Developing Countries. *Waste Management*, 33(1), 220-232.
- Gupta, K., Joshi, V.K (2015). Formative Utilization of Food Processing Waste. In *Postharvest Technology of Fruits and Vegetables*. (L.R. Verma, and V.K Joshi; Eds.) The Indus Publ., New Delhi.
- Hage, O. (2017). The Swedish producer responsibility for paper packaging: An effective waste management policy? *Resources, Conservation and Recycling*, 51(2), 314-344. doi: 10.1016/j.resconrec.2017.10.003.
- Halkos, George E., and Kleoniki N. Petrou (. 2016). “Moving towards a Circular Economy: Rethinking Waste Management Practices.” *Journal of Economic and Social Thought* 3 (2): 220–40. <http://www.kspjournals.org/index.php/JEST/article/view/854/912>.
- Halkos, George E., and Kleoniki N. Petrou. (2016). “Moving towards a Circular Economy: Rethinking Waste Management Practices.” *Journal of Economic and Social Thought* 3 (2): 220–40. <http://www.kspjournals.org/index.php/JEST/article/view/854/912>.
- Hausfather, Zeke. (2017). “Analysis: Global CO2 Emissions Set to Rise 2% in 2017 after Three-Year ‘Plateau’.” *Carbon Brief*, November 13. <https://www.carbonbrief.org/analysis-global-co2-emissions-set-to-rise -2-percent -in ->

2017-following-three-year-plateau.

- Heath, C. & D. Heath (2017). *Switch. How to change things when change is hard.* Random House Publishing Group.
- Hellweg, S., Doka, G., Finnveden, G., & Hungerbühler, K. (2017). Assessing the Eco-efficiency of End-of-Pipe Technologies with the Environmental Cost Efficiency Indicator A Case Study of Solid Waste Management. *Journal of Industrial Ecology*, 9(4).
- Helm, D.R. (2016). Economic Instruments and Environmental Policy. *The Economic and Social Review*, 36(3): 205-228. [http://www.esr.ie/ESR\\_papers/vol36\\_3/02\\_Helm\\_article.pdf](http://www.esr.ie/ESR_papers/vol36_3/02_Helm_article.pdf).
- Henry, R.K., Yongsheng, Z., and Jun, D. (2016). Municipal solid waste management challenges in developing countries – Kenyan case study. *Waste Management*, 26(1), 92-100.
- Hoornweg, Daniel, and Perinaz Bhada-Tata. (2017). *What a Waste: A Global Review of Solid Waste Management.* Washington, DC: World Bank. <https://openknowledge.worldbank.org/handle/10986/17388>.
- Horticultural Crops Development Authority (HCDA) Borasoft Team. (2014). *National Horticulture Market Information System Baseline Survey Report.* Nairobi: National Horticulture Market Information System Secretariat. 2007 Validation Report. Nairobi: Government of Kenya.
- Horticultural Crops Development Authority [HCDA]. (2015a). *Horticultural Crops Development Authority [HCDA] Customer Service Charter.* Nairobi: Government of Kenya.
- Hungerford, H.R, Volk TL. (1990). Changing learner behavior through environmental education. *The journal of environmental education* 21: 8-21.
- IBRD, (2015). *Trade Adjustment Costs in Developing Countries: Impacts, Determinants and Policy Responses*, International Bank for Reconstruction and Development/The World Bank, Washington D.C.
- IDB, (2015). “Status of Solid Waste Management in Latin America and the Caribbean” [“Situación de la gestión de residuos sólidos en América Latina y el Caribe”]. IDB, Washington, DC.
- Ilgin, M.A., & Gupta, S.M. (2017). Performance improvement potential of sensor embedded products in environmental supply chains. *Resources, Conservation and Recycling.* Elsevier B.V. doi: 10.1016/j.resconrec.2010.05.001.
- IPCC, (Intergovernmental Panel on Climate Change). (2017a). “Climate Change 2017: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change.” Edited by M. L. Parry, O. F. Canziani, J. P. Palutik of, P. J. van der Linden, and C. E. Hanson. Cambridge University Press, Cambridge, UK.

- ISWA, (2016). Waste and Climate Change. White Paper. International Solid Waste Association. Vienna, Austria. December 2016.
- ISWA, (2016b). Wasted Health – The tragic case of dumpsites. A. Mavropoulos ISWA STC Chair, with contributions from D. Newman, ISWA President. Vienna.
- ISWM Stakeholders Workshop Report, (2009). Report on UNEP/CCN 3rd ISWM Stakeholder Workshop to Identify Issues of Concern for the ISWM Plan - December 2009. Pan Afric Hotel, Nairobi.
- Japan International Corporation Agency (JICA) (2018). Website. Available from <http://www.jica.go.jp/english/index.html>.
- Jones, R.E. & Dunlap, R.E. (2015). The Social Bases of Environmental Concern, have they changed over time? *Rural Sociology*, 57(1), 134-144.
- Joshi, V.K., Kumar, A., Kumar, V. (2016). Antimicrobial, antioxidant and phytochemicals from fruit and vegetable wastes: a review. *Intl Food Ferm Technol* 2:123–36.
- Kader, A.A. (2015). Increasing food availability by reducing postharvest losses of fresh produce. *Acta Hort* 682:2169–75.
- Kajihara, Hiroyuki. (2017). “Introduction to the Municipal Waste Administration.” Presented at the Solid Waste Management Technical Deep Dive in Tokyo, Japan, March.
- Kaminchia, N. (2017). Mango Production and Marketing Study, GTZ/MOA.
- Kampala Waste Management. (2017). “Kampala Waste Treatment & Disposal PPP Project.” Investor Conference.
- Kasza, G., Dorkó, A., Kunszabó, A., & Szakos, D. (2020). Quantification of Household Food Waste in Hungary: A Replication Study Using the FUSIONS Methodology *Sustainability*, 12(8), 3069. <https://doi.org/10.3390/su1208306>
- Kenya Gazette Supplement no. 121 of 2022. The Sustainable Waste Management Act 2022.
- Kenya Law Reports, (2010). The Constitution of Kenya, 2010. The National Council for Law Reporting with the Authority of the Attorney General. Available from <http://www.kenyaembassy.com/pdfs/the%20constitution%20of%20kenya.pdf>.
- Ketchen, Jr., D.J. & Hult, G.T.M. (2017). Bridging organization theory and supply chain management: The case of best value supply chains. *Journal of Operations Management*, 25, 573-580.
- KNPCPC, (2016). A Comprehensive Plastic Waste Management Strategy for the City of Nairobi. Nairobi: Kenya National Cleaner Production Centre.

- Kolsut, B. (2016). "Inter-Municipal Cooperation in Waste Management: The Case of Poland." *Quaestiones Geographicae* 35(2): 91–104.
- Kombo, D.K & Tromp, D.A. (2015). *Proposal writing and Thesis Proposal. An introduction*, Paulines Publication, Nairobi, Kenya.
- Kombo, P.N., Kipkorir, E.C., & Ekisa, G.T. (2016). Public-Private Partnership approach towards enhancing water accessibility in Busia Municipality, Kenya. *Water Practice and Technology*, 9(3), 353–361. <https://doi.org/10.2166/wpt.2014.037>.
- Kothari, C.R. (2014). *Research methodology, Methods and technique* (4<sup>th</sup> ed.) New Delhi: Prakashan.
- Kummu M, de Moel H, Porkka M, Siebert S, Varis O, Ward PJ. (2012). Lost food wasted resources: global food supply chain losses and their impacts on freshwater, cropland, and fertiliser use. *Sci Total Environ* 438:477–89.
- Laufenberg, G, Schulze N, Waldron K. (2017). A modular strategy for processing of fruit and vegetable wastes into value-added products. In: Waldron KW, editor, *Handbook of waste management and co-product recovery in food processing*. New York, N.Y.: Woodhead Publishing Limited. p 286–353.
- Lave, J., Wenger, E. (2015). *Legitimate Peripheral Participation in Communities of Practice. Situated Learning: Legitimate Peripheral Participation* Cambridge: Cambridge University Press; 2015.
- Lee, M., Farouk, B., Renee, H., Perinaz, BT., and Silpa, K. (2014). *Results-Based Financing for Municipal Solid Waste*. Washington, DC: World Bank.
- Lerpiniere, D., D.C. Wilson, C.A. Velis et al. (2016). *Review of International Development Co-operation in Solid Waste Management*. Report prepared by University of Leeds and formatted by D-Waste on behalf of ISWA Globalisation and Waste Management Task Force. International Solid Waste Association, Vienna.
- Li L, Grimshaw, J., Graham, I., Neilsen, C., Judd, M., Coyte, P. (2017). *Knowledge translation in health care communities: Use of communities of practice for the dissemination and uptake of best practices. A research synthesis project* Prepared for: Canadian Institute of Health Research; 2017.
- Li, Y., Wang, L., Liu, G., & Cheng, S. (2021). Rural household food waste characteristics and driving household food waste characteristics and driving factors in China. *Resources, Conservation and Recycling*, 164, 105209. <https://doi.org/10.1016/j.resconrec.2020.105209>.
- Liang, H., Saraf, N., Hu, Q., & Xue, Y. (2017). Assimilation of enterprise systems: the effect of institutional pressures and the mediating role of top management. *MIS quarterly*, 31(1), 59-87.

- Lieder, M., Asif, F.M.A., Rashid, A., (2017a). Towards Curcular Economy implementation: an agend-based stimulation approach for business model changes. *Auton. Agent. Muti. Agent. Syst.* 31, 1377-1402. <https://doi.org/10.1007/s10458-017-9365-9>.
- Likert, R. A technique for the measurement of attitudes. *Arch. Psychol.* 2015, 140, 55.
- Linzner, R., and Salhofer, S. (2014). "Municipal Solid Waste Recycling and the Significance of Informal Sector in Urban China." *Waste Management and Research* 32 (9): 896–907. doi: <http://dx.doi.org/10.1177/0734242X14543555>.
- Liss, G. (2015). Local government incentives for zero waste. *Grassroots Recycling Network*. Retrieved from [http://www.grrn.org/zerowaste/articles/loc\\_gov\\_zw\\_incentives.html](http://www.grrn.org/zerowaste/articles/loc_gov_zw_incentives.html).
- Lumbreras, Martín, J., and Fernández, G.L. (2014). Comprehensive solid waste management: The Ciudad Saludable model in Peru. Retrieved February 10, 2015.
- Luse, A., Mennecke, B., & Townsend, A. (2016). Selecting a Research Topic: A Framework for Doctoral Students. *International Journal of Doctoral Studies*, 7, 143-152.
- Mallak, K.M., Ishak, M., Kasim, M., & Samah, M.A.A. (2015). Assessing the Effectiveness of Waste Minimization Methods in Solid Waste Reduction at the Source by Manufacturing Firms in Malaysia. *Polish Journal of Environmental Studies*, 24(5), 2063-2071.
- Marshall, R. E., and Farahbakhsh, K. (2015). Systems approaches to integrated solid waste management in developing countries. *Waste Management*, 33(4), 988-1003.
- Matui, M.A., Saavedra, Gonzalez, Y., Gema, J., Koomen, I., (2012), From Aid to sustainable Trade: Driving Competitive Horticulture Sector development: A quick scan of the Horticulture Sector: Report 3RKenta-16-03-045. Available online: <https://edopot.wur.nl/473425> (accessed on 23<sup>rd</sup> November 2021).
- McDougall, F. R., White, P. R., Franke, M., & Hindle, P. (2017). *Integrated solid waste management: a life cycle inventory* (2nd ed., p. 544). Blackwell.
- McKay, Jim. (2016). "City of Toronto Solid Waste Management Services." Presented at "Property Management Expo," November 30. <https://ccitoronto.org/sites/default/uploads/files/Jims-waste-presentation-Jan2017.pdf>.
- McKinsey. (2016). "The Circular Economy: Moving from Theory to Practice." McKinsey Center for Business and Environment Special Edition. <https://www.mckinsey.com/~media/McKinsey/Business%20Functions/Sustainability%20and%20Resource%20Productivity/Our%20Insights/The%20circular%20economy%20Moving%20from%20theory%20to%20practice/The%20circular%20economy%20Moving%20from%20theory%20to%20practice>.

ashx.

- Medina, C. et al., (2017). Evaluation of two starch extraction methods from cotyledons of mango. *Bioagro*, 22 (1): 67-74.
- Mentzer, J.T., DeWitt, W., Keebler, J.S., Min, S., Nix, N.W., Smith, C.D., et al. (2018). Defining supply chain management. *Journal of Business logistics*, 22(2), 1–26. COUNCIL OF LOGISTICS MANAGEMENT. Retrieved from <http://www.allbusiness.com/management/1070025-1.html>.
- Metzger, T. (2015). Waste Watchmen. Retrieved February 10, 2015. [http://waste360.com/Collections\\_And\\_Transfer/sanitation-recycling-throughhistory-200905](http://waste360.com/Collections_And_Transfer/sanitation-recycling-throughhistory-200905).
- Milea, A. (2016). Waste as a social dilemma: Issues of social and environmental justice and the role of residents in municipal solid waste management, Delhi, India. Master's thesis, Lund University. Lund, Sweden.
- Ministry of Agriculture. (2010a). National Horticulture Policy. Nairobi: Government of Kenya.
- Mitlin, D. (2016). Human Settlements and Sustainable Development. Nairobi, KE: United Nations Centre for Human Settlements (Habitat).
- Moore, S.A. (2012). Garbage matters: Concepts in new geographies of waste. *Progress in Human Geography*, 36(6), 780-799.
- Mugenda, O.N., & Mugenda, A.G. (2016). *Research Methods: A Quantitative and Qualitative Approach*. Nairobi, KE: ACTS press.
- Murad, W.M., Hasan, M.M., and Shoeb-Ur-Rahman, M. (2015). Relationship between personality traits of the urban poor concerning solid waste management and household income and education. *Interdisciplinary Description of Complex Systems*, 10(2), 174-192.
- Murshed-E-Jahan Khondker and Diemuth E. Pemsil (2011). The impact of integrated aquaculture–agriculture on small-scale farm sustainability and farmers' livelihoods: Experience from Bangladesh. *Agricultural Systems*.
- Nakou, D., A. Benardos, and D. Kaliampakos. (2014). "Assessing the Financial and Environmental Performance of Underground Automated Vacuum Waste Collection Systems." *Tunneling and Underground Space Technology* 41: 263–71. [https://www.researchgate.net/publication/260114762\\_Assessing\\_the\\_financial\\_and\\_environmental\\_performance\\_of\\_underground\\_automated\\_vacuam\\_waste\\_collection\\_systems](https://www.researchgate.net/publication/260114762_Assessing_the_financial_and_environmental_performance_of_underground_automated_vacuam_waste_collection_systems).
- Narayana, T. (2016). Municipal solid waste management in India: From waste disposal to recovery of resources? *Waste Management*, 29(3), 1163-1166.
- Nathanson, J. (2015). Solid-waste management. Retrieved February 10, 2015

- National Institute of Health (2015). E-Source National Institute of Health. Social and Behavioral Theories.
- NEMA – National Environment Management Authority (2017a). Clarification of Plastic Ban [Internet], 6 September. Nairobi, NEMA. Available at: [https://www.nema.go.ke/images/Docs/Notices/Clarification\\_on\\_plastic\\_ban.pdf](https://www.nema.go.ke/images/Docs/Notices/Clarification_on_plastic_ban.pdf) [Accessed 1 March 2018].
- NEMA – National Environment Management Authority (2017b). Gazette Notice No. 2334 [Internet], 14 March. Nairobi, NEMA. Available at: [https://www.nema.go.ke/images/Docs/Awarness%20Materials/Gazette\\_legal\\_Notice\\_on\\_carrier\\_bags.pdf](https://www.nema.go.ke/images/Docs/Awarness%20Materials/Gazette_legal_Notice_on_carrier_bags.pdf) [Accessed 1 March 2018].
- NEMA – National Environment Management Authority (2017c). Plastic bags illegalized in Kenya. NEMA news. A quarterly publication by NEMA. Nairobi, NEMA. July-September 2017.
- NEMA – National Environment Management Authority (2017d). Press Statement On Total Ban On All Plastic Bags [Internet]. Nairobi, NEMA. Available at: [https://www.nema.go.ke/images/Docs/Awarness%20Materials/PRESS\\_STATEMENT\\_ON\\_TOTAL\\_BAN\\_ON\\_ALL\\_PLASTIC\\_BAGS.pdf](https://www.nema.go.ke/images/Docs/Awarness%20Materials/PRESS_STATEMENT_ON_TOTAL_BAN_ON_ALL_PLASTIC_BAGS.pdf) [Accessed 2 September 2018].
- NEMA (2012). Waste management in Kenya. Available [online]: [http://www.nema.go.ke/index.php?option=com\\_content&view=article&id=311:waste-managementinkenya&catid=120&Itemid=659](http://www.nema.go.ke/index.php?option=com_content&view=article&id=311:waste-managementinkenya&catid=120&Itemid=659). (11/02/2018).
- NEMA (2015). The National Solid Waste Management Strategy. Nairobi: National Environment Management Authority (NEMA).
- NEMA (National Environment Management Authority, Kenya) (2014). The National Solid Waste Management Strategy. Nairobi: NEMA. <https://www.nema.go.ke/images/Docs/Media%20centre/Publication/National%20Solid%20Waste%20Management%20Strategy%20.pdf>.
- Ngoc, U N and H Schnitzer (2018), “Sustainable solutions for solid waste management in Southeast Asian countries”, *Waste Management* Vol 29, No 6, pages 1982–1995.
- Nicolella C, van Loosdrecht MCM, Heijnen SJ. (2016). Particle-based biofilm reactor technology. *Trends in Biotechnol (TIBTECH)*, 18:312-320.
- Noor, K., & Dola, K. (2015). Investigating Training Impact on Farmers’ Perception and Performance. *International Journal of Humanities and Social Science*, 1 (6).
- Obiero, L.M., Abong’g, O., Okoth, M., Muthama, J.N., Gekonge d O., Odhiambo, E.G., Villacampa M. (2021). Current practices concerning the environmental management systems among horticultural processing MSMES in Kenya.
- O’Connell, E.J. (2011). Increasing public participation in municipal solid waste reduction. *Geographical Bulletin*, 52(2), 105-118.



- OECD (2016d), Fostering Markets for SME finance: matching business and investor needs, OECD Working Party on SMEs and Entrepreneurship, CFE/SME (2016)4/REV1
- OECD (2017a), Small, Medium, Strong. Trends in SME Performance and Business Conditions, OECD Publishing, Paris.
- OECD (2017b), Increasing productivity in small traditional enterprises: programmes for upgrading management skills and practices, OECD Working Party on SMEs and Entrepreneurship, CFE/SME (2016)6.
- OECD, (2015), OECD SME and Entrepreneurship Outlook;2015, OECD Paris, Page 17.
- Ogbonna, D., Ekweozor, I., and Igwe, F. (2015). Waste management: A tool for environmental protection in Nigeria. *AMBIO: A Journal of the Human Environment*, 31(1), 55-57. Retrieved February 10, 2015, from JSTOR
- Ogutu FA (2019) Assessment of the effectiveness of the policy framework on solid waste management in Nairobi city county. Doctor of Philosophy, University of Nairobi, Nairobi.
- Okonko I.O., Olabode O.P., Okeleji O.S. (2016). The role of biotechnology in the socioeconomic advancement and national development: An Overview. *African J. Biotechnology* 5(19):2354-2366.
- Okot-Okumu, J. (2017). Chapter 1: Solid Waste Management in African Cities – East Africa, In the book ‘Waste Management - An Integrated Vision, published by INTECH.
- Ona.io. (2019). ona.io. <https://ona.io>
- Oreszczyn, S., & Carr, S. (2010). The role of networks of practice and webs of influencers on farmers’ engagement with and learning about agricultural innovations. *Journal of Rural Studies*, 26 (1), 404 – 417.
- Oteng-Ababio, M. (2016). Missing links in solid waste management in the Greater Accra Metropolitan Area in Ghana. *Geo-Journal*, 76(5), 551-560. Retrieved February 10, 2015, from Springer Link
- Otoo, M., & Drechsel, P. (Eds.). (2018). Resource recovery from waste: Business models for energy, nutrient and water reuse in low- and middle-income countries. London, England: Taylor & Francis.
- Ouma, et al., (2021). Capacity Building influence on waste management among horticultural processing Micro, Small and Medium Enterprises in Kenya. *East African Journal of Science, Technology and innovation* 2 (Special Issue).
- Ouma, et al., (2021). Knowledge, attitudes and practices synthesis of waste management among horticultural processing MSMEs in Kenya. *East African Journal of Science, Technology and Innovation* 2 (Special Issue).

- Owen, R. (2015). Preparing a recommendation to governments on clean-up options for the Sydney Tar Ponds and Coke Ovens sites: An evaluation of environmental decision-making tools.
- Panouill'e, M., Ralet M.C, Bonnin, E., Thibault, J.F. (2017). Recovery and reuse of trimmings and pulps from fruit and vegetable processing. In: Waldron KW, editor. Handbook of waste management and co-product recovery in food processing. Cambridge: Woodhead Publishing Limited. p 417–47.
- Pap N, Pongrácz, E., Myllykoski, L. & Keiski, R. (2016). Waste minimization and utilization in the food industry: Processing of arctic berries and extraction of valuable compounds from juice- processing by- products.
- Parfitt, J., Barthel, M., Macnaughton, S. (2010). Food waste within food supply chains: quantification and potential for change to 2050. *Philos Trans R Soc B* 365:3065–81.
- Parker, R.L., Riopelle, R. and Stell, W.F. (2017). Small enterprises adjusting to liberalization in fine countries. World Bank Discussion Paper No. 271. Washington, DC, USA: World Bank.
- Périou, C. (2015). Waste: The challenges facing developing countries. *Proparco's Magazine*, 1-27.
- Pongrácz, E. (2016). Re-defining the Concepts of Waste and Waste Management: Evolving the Theory of Waste Management. Doctoral Dissertation. University of Oulu, Department of Process and Environmental Engineering, Oulu, Finland. Available online at URL: <http://herkules.oulu.fi/isbn9514268210/>.
- Poswa, T.T. (2017). A comparison of attitudes towards and practices of waste management in three different socio-economic residential areas of Umtata. Published Master's Thesis, Durban University of Technology, KwaZulu-Natal, South Africa.
- PSDA, (2016). Report on Mango Value Chain Stakeholders Workshop, (March 2006).
- Purcell, M., & Magette, W.L. (2015). Attitudes and behavior towards waste management in the Dublin, Ireland region. *Waste Management*, 30, 1997-2006.
- PWDS, (2017). Workshop on community-based enterprise promotion for sustainable livelihood of the poor. Trivandrum, Germany: Fordergesellschaft fur Techniken in der Dritten Wel.
- Raj, D., Sharma, R. and Joshi, V.K (2015). Quality Control for Value Addition in Food Processing. New India Publishing Agency, New Delhi, pp. 324.
- Republic of Kenya, (2012). Micro and Small Enterprises Act 2012 p.26
- Royston, M. (2014) Pollution Prevention Pays, London: Pergamon.

- Sagasti, R., Carlos. (2016). "Waste Collection IT Systems for Waste Management— Case: Quito— EMASEO." Presented at World Bank event "Citizen Engagement & ICT in Solid Waste Management," Washington, DC, February 18.
- Samapundo, S., Climat, R., Xhaferi, R., and Devlieghere, F. (2016). Food safety knowledge, attitudes and practices of street food vendors and consumers in Port-au-Prince, Haiti. *Journal of Food Control*, 50: 457.
- Saunders, M., Lewis, P. & Thornhill, A. (2017). "Research Methods for Business Students" 6<sup>th</sup> edition, Pearson Education Limited p.288.
- Scharfe, D. (2010). Integrated Waste Management Plan. Cente & South Hastings Waste Services Board/Waste Diversion Ontario and Stewardship Ontario.
- Scheinberg, A., D.C. Wilson & L. Rodic (2017). Solid Waste Management in the World's Cities: Water and Sanitation in the World's Cities 2017. Prepared on behalf of UN-HABITAT. London: Earthscan. <http://www.waste.nl/en/product/solid-waste-management-in-the-worlds-cities>.
- Schieber, A, Stintzing, F.C, Carle, R. (2016). By-products of plant food processing as a source of functional compounds - recent developments. *Trends Food Sci Technol* 12:401–13.
- Schoer, K., & Seibel, S. (2018). Eco-efficiency indicators in German Environmental Economic Accounting. *Statistical Journal of the United Nations*, 19, 41-52.
- Seto, K. C., S. Dhakal, A. Bigio, H. Blanco, G. C. Delgado, D. Dewar, L. Huang, A. Inaba, A. Kansal, S. Lwasa, J. E. McMahon, D. B. Müller, J. Murakami, H. Nagendra, and A. Ramaswami. (2014). "Human Settlements, Infrastructure and Spatial Planning." In *Climate Change (2014): Mitigation of Climate Change: Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge, UK, and New York: Cambridge University Press.
- Sharif, L. Obaidat, M.M., and Al-Dalalah, M. (2017). Food Hygiene Knowledge, Attitudes and Practices of the Food Handlers in the Military Hospitals. *Food and Nutrition Sciences*, 2013 (4): 245-251.
- Sharma R, Oberoi HS, Dhillon GS. 2016. Fruit and vegetable processing waste: renewable feed stocks for enzyme production. In: Dhillon GS, Kaur S, editors. *Agro-industrial wastes as feedstock for enzyme production: apply and exploit the emerging and valuable use options of waste biomass*. London, UK, Academic Press Elsevier. p 23–59.
- Sofyan, N., Yuwono, A. H., Harjanto, S. (2016). Green and smart materials properties design and production for sustainable future: UNIV INDONESIA DIRECTORATE RESEARCH & PUBLIC SERV, UI CAMPUS, KAMOUS UNIV INDONESIA, DEPOK, 16424, INDONESIA.

- Soos, R. (2015). Section 5.2 Financial Sustainability, in Scheinberg, Wilson and Rodic, 2015 (listed under Chapter 1, Waste Management), 164-183.
- Staniškis, J. (2015). Integrated Waste Management: Concept and Implementation. *Environmental research, engineering and management*, 3(33), 40-46.
- Su, B.W., A. Heshmati, Y. Geng et al. (2017). A review of the circular economy in China: Moving from rhetoric to implementation. *Journal of Cleaner Production*, 42: 215-227.
- Sustainable Brands. (2018). “2018 Circulars Nominate 43 Changemakers Paving the Path to a Circular Future.” [http://www.sustainablebrands.com/news\\_and\\_views/next\\_economy/sustainable\\_brands/2018\\_circularsnominate\\_43\\_change\\_makers\\_paving\\_path\\_](http://www.sustainablebrands.com/news_and_views/next_economy/sustainable_brands/2018_circularsnominate_43_change_makers_paving_path_).
- Swanson, R.A., Chermack, T.J. (2014). *Theory building in applied disciplines*. Berrett-Koehler Publishers.
- Talaei, M., Holakouie-Naienib, K., Foroushanib, A.R., and Asl, H.M. (2016). Knowledge, attitude and practice of people about foodborne outbreak in Isfahan city, Iran. *Journal of Food Safety and Hygiene*, 1(2): 39-45.
- Tangri, N. (2017). *Waste incineration: A dying technology* (pp. 1-101). Essential Action for GAIA Global Anti-Incinerator Alliance.
- Tas, Adriaan, and Antoine Belon (2014). “A Comprehensive Review of the Municipal Solid Waste Sector in Mozambique: Background Documentation for the Formulation of Nationally Appropriate Mitigation Actions in the Waste Sector in Mozambique.” Carbon Africa Limited, Nairobi, and Associação Moçambicana de Reciclagem, Maputo.
- Tas, Adriaan, and Antoine Belon (2014). *A Comprehensive Review of the Municipal Solid Waste Sector in Mozambique*. Nairobi: Carbon Africa. <http://www.associacao-mocambicana-reciclagem.org/wp-content/uploads/2017/08/2014-08-05-A-Comprehensive-Review-of-the-Waste-Sector-in-Mozambique-FINAL.pdf>.
- Tchobanoglous, G., & Kreith, F. (2015). *Handbook of solid waste management* (2nd ed., p. 950). McGraw-Hill.
- Temeke, Municipal Commission (Solid Waste Management) (Collection and Disposal of Refuse) By-Laws, (2015). <http://www.faolex.fao.org/docs/pdf/tan34434.pdf> (retrieved: 8.3.2021).
- The Constitution of Kenya, (2010). Articles 42 and 70 address the right to a clean and healthy environment Republic of Kenya, National Land Policy Nairobi Integrated Solid Waste Management Plan 2011 Urban Areas and Cities Act,
- Thimoteo, D., Stedefeldt, E., and Rosso, V. (2017). The role of theoretical food safety training on Brazilian food handlers’ knowledge, attitude and practice. *Food Control*, 43 (2014): 167-174.

- Thompson, Andrea. (2016). "For Air Pollution, Trash Is a Burning Problem." Climate Central. <http://www.climatecentral.org/news/where-trash-is-a-burning-problem-17973>.
- Troschinetz, A. M., and Mihelcic, J. R. (2016). Sustainable recycling of municipal solid waste in developing countries. *Waste Management*, 29(2), 915-923.
- Tukker, A. (2016). Identifying priorities for environmental product policy. *Journal of Industrial Ecology*, (10)3, 1-4.
- U.S. Environmental Protection Agency. (2020a). Wasted Food Report-  
[https://www.epa.gov/sites/production/files/2020-11/documents/2018\\_wasted\\_food\\_report-11-9-20\\_final\\_.pdf](https://www.epa.gov/sites/production/files/2020-11/documents/2018_wasted_food_report-11-9-20_final_.pdf).
- UNEP, (2010). ABC of SCP: Clarifying Concepts on Sustainable Consumption and Production. UNEP, Paris
- UNEP, (2012). 21 Issues for the 21st Century: Result of the UNEP Foresight Process on Emerging Environmental Issues. United Nations Environment Programme (UNEP), Nairobi, Kenya.
- UNEP, (2012d). Global Outlook on Sustainable Consumption and Production Policies. Taking action together.  
[http://www.unep.org/pdf/Global\\_Outlook\\_on\\_SCP\\_Policies\\_full\\_final.pdf](http://www.unep.org/pdf/Global_Outlook_on_SCP_Policies_full_final.pdf).  
Various other useful UNEP publications on this topic can be found at <http://www.unep.org/resourceefficiency/>
- UNEP, (United Nations Environment Programme).(n.d.).Retrieved February 10, (2015).  
<http://www.unep.org/gpwm/FocalAreas/IntegratedSolidWasteManagement/tabid/56457/Default.aspx>.
- UNEP. (2016). Frontiers 2016: Emerging issues of environmental concern | UN Environment. Retrieved from <https://www.unenvironment.org/resources/frontiers-2016-emerging-issues-environmental-concern>.
- UNESCO (United Nations Educational, Scientific, and Cultural Organization). (2018b). Management of solid wastes: Multimedia post graduate course in environmental engineering. France: UNESCO; P. 338.
- UNFCCC, (2017). "National Greenhouse Gas Inventory Data for the Period 1990–2015." United Nations Framework Convention on Climate Change. <http://unfccc.int/resource/docs/2017/sbi/eng/18.pdf>.
- UN-Habitat, (2010). Solid Waste Management in the World's Cities: Water and Sanitation in the World's Cities 2010. London and Washington, DC: Earthscan.[http://www.waste.nl/sites/waste.nl/files/product/files/swm\\_in\\_world\\_cities\\_2010.pdf](http://www.waste.nl/sites/waste.nl/files/product/files/swm_in_world_cities_2010.pdf).

- United Nations Environment Programme (2014). What is SCP? Available from: [19 October 2014]. n.d.a.
- United Nations, (2015) Sustainable Development Goals 2015 Available from: <https://sustainabledevelopment.un.org/?menu=1300>.
- United Nations. (2017). World Population Prospects: The 2017 Revision, Key Findings and Advance Tables. Working Paper No. ESA/P/WP/248. Medium Variant Scenario. New York: Department of Economic and Social Affairs, Population Division, United Nations.
- UNSD, (2017). Millennium Development Goals Report Statistical Annex 2008. United Nations Statistical Division 2008. <http://mdgs.un.org/unsd/mdg/Resources/Static/Data/StatAnnex.pdf>.
- Vaughan, Adam. (2016). “Biodegradable Plastic ‘False Solution’ for Ocean Waste Problem.” The Guardian, May 23. <https://www.theguardian.com/environment/2016/may/23/biodegradable-plastic-false-solution-for-ocean-waste-problem>.
- Venkat K. (2011). The climate change and economic impacts of food waste in the United States. *Intl J Food Sys Dyn* 2:431–46.
- Visser, J., & Hemerijck, A. (2014). A Dutch miracle: Job growth, welfare reform and corporatism in the Netherlands. Amsterdam University.
- Vivian, D. (2016). Private or Public: Debating the Meaning of Tenure Legalization. *International Journal of Urban and Regional Research*, 26, 449-461.
- Wakabi, Michael (2015). Rethinking plastics: Role of policies in resolving East Africa’s waste. *The East African* [Internet], 30 March. Available at: <http://www.theeastafrican.co.ke/news/ea/4552908-1735074-dihs0fz/index.html> [Accessed 1 October 2018].
- Wakhungu, Judy (2017). Free of plastic bags. How the menace of polythene bags has been handled in Kenya [Internet]. Nairobi, UN Environment. Available at: <http://web.unep.org/ourplanet/december2017/articles/free-plastic-bags> [Accessed 19 March 2018].
- Wasswa, J., & Schluep, M., (2018). E-Waste Assessment in Uganda. A situational analysis of e-waste management and generation with special emphasis on personal computers. Uganda Cleaner Production Centre, Kampala Uganda and EMPA Switzerland, UNIDO, Microsoft.
- Wee, S.T., Muhamad, A.A, Sulzakimin, M., Goh, K.C., and Rozlin, Z. (2017). “Good Governance in National Solid Waste Management Policy (NSWMP) Implementation: A Case Study of Malaysia.” AIP Conference Proceedings 1891. <https://aip.scitation.org/doi/pdf/10.1063/1.5005461>.
- White, P.R., Franke, M., & Hindle, P. (2015). *Integrated Solid Waste Management: A Lifecycle Inventory*. Berlin: Springer.

- Wiklund, J. and Shepherd, D. (2015). Entrepreneurial orientation and small business performance: A configurational approach, *Journal of Business Venturing*, 20, pp. 71-91.
- Wilson, S. (2015). Indicators of waste management efficiency related to different territorial Conditions. *Waste management*, 32, 785-792.
- Winne, S., L. Horrocks, N. Kent, K. Miller, C. Hoy, M. Benzie, and Power, R. (2017). "Increasing the Climate Resilience of Waste Infrastructure." Final Report under Defra contract ERG 1102. AEA Technology, Didcot, UK. [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/183933/climate-resilience-full.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/183933/climate-resilience-full.pdf).
- World Bank (2021). Report on Post -COVID Financial support to MSMEs in Kenya.
- World Bank, (2017). Results-based financing for municipal solid waste management. World Bank Urban Development Series Knowledge Papers. <http://www.worldbank.org/en/topic/urbandevelopment/publication/results-based-financing-for-municipal-solid-waste>.
- World Bank, (2017b). "Senegal Municipal Solid Waste Project. Project Information Document/Integrated Safeguards Data Sheet (PID/ISDS)." World Bank, Washington, DC. <http://documents.worldbank.org/curated/en/581531500995135875/pdf/ITM00184-P161477-07-25-2017-1500995132357.pdf>.
- World Bank, (2018a). "The CURB Tool: Climate Action for Urban Sustainability." World Bank, Washington, DC. [www.worldbank.org/curb](http://www.worldbank.org/curb).
- World Bank, (2018b). "Improvement of Solid Waste Management to Support Regional and Metropolitan Cities. Project Appraisal Document." World Bank, Washington, DC. <https://operationsportalws.worldbank.org/Pages/WorkingDocuments.aspx?projectid=P157245>.
- World Business Council for Sustainable Development. (2017a). Eco-efficiency: creating more value with less impact.
- World Business Council for Sustainable Development. (2017b). Measuring eco-efficiency: A guide to reporting company performance.
- Yahia, E.M, editor. (2017). Fruit and vegetable phytochemicals: chemistry and human health. Ames, Iowa: Wiley-Blackwell Publishing.
- Yamane, T. (1967). *Statistics, an Introductory Analysis*, 2<sup>nd</sup> Ed., New York: Harper and Row.
- Young, C.Y., Ni, S.P., & Fan, K.S. (2016). Working towards a zero-waste environment in Taiwan. *Waste Management & Research. The Journal of the International Solid Wastes and Public Cleansing Association*, ISWA, 28(3), 236-244.

- Yousif, D.F., and Scott, S. (2017). Governing solid waste management in Mazatenango, Guatemala. *International Development Planning Review*, 29(4), 433-450.
- Zhang, W., Phoungthong, K., Lü, F., Shao, L. M., & He, P. J. (2013). Evaluation of a classification method for biodegradable solid wastes using anaerobic degradation parameters. *Waste Management*, 33(12), 2632–40.
- Zuckerman, G. (2017). Development of reflection through learning activity. *European Journal of Psychology of Education*, 19, 9- 18.
- World Bank. (2017a). “Maldives Clean Environment Project: Combined Project Information Documents / Integrated Safeguards Datasheet (PID/ ISDS).” World Bank, Washington, DC. <http://documents.worldbank.org/curated/en/455971491655712283/pdf/ITM00194-P160739-04-08-2017-1491655709183.pdf>.



## APPENDICES

### Appendix I: Kenyan Horticultural Processing MSMEs Questionnaire

I am a PhD student at Wangari Maathai Institute for Peace and Environmental Studies, University of Nairobi, carrying out research on; “*Influence of Waste Management in Horticultural Processing Micro, Small and Medium Enterprises on Environmental Management in Kenya.*” Your response in this questionnaire will be kept confidential and used for no any other purpose other than for academic purposes only.

#### **PART A: DEMOGRAPHIC INFORMATION**

1. **Waypoint**  
Location \_\_\_\_\_  
Sub-County \_\_\_\_\_  
County \_\_\_\_\_  
Country \_\_\_\_\_  
Name of the MSME \_\_\_\_\_
2. KEBS Certification Number \_\_\_\_\_
3. ISO Certification Number \_\_\_\_\_
4. Name of the interviewee \_\_\_\_\_
5. Position in the MSMEs \_\_\_\_\_
6. How many employees to you have in your firm?  
\_\_\_\_\_
7. Gender of the respondent.  
Male [ ] Female [ ] Others \_\_\_\_\_
8. Marital status of the respondent  
Single [ ] Married [ ]  
Separated/Divorced [ ] Widow/Widower [ ]
9. Kindly tick the appropriate box that indicates your age take the actual age for proper analysis  
18-30 Years [ ] 31-40 Years [ ]  
41-50 Years [ ] 51-60 Years [ ]  
Above 61 Years [ ]
10. Education Level  
None [ ] Primary Level [ ]  
Secondary Level [ ] College Diploma [ ]  
Undergraduate Degree [ ] Master Degree [ ]  
Others specify \_\_\_\_\_

#### **PART B: HORTICULTURAL PROCESSING PLANT INFORMATION**

11. Indicate the ownership of the MSME processing plant land/building?  
Family inherited [ ] Rented House/Land [ ]  
Bought/Private [ ] Settlement Schemes [ ]  
Government Land/House [ ] Trust Land [ ]  
Others, Specify \_\_\_\_\_

12. What is the size of the built area of the processing plant in square meters?

\_\_\_\_\_

13. List the horticultural products you process.

\_\_\_\_\_

14. How long has your company been in Horticultural processing business?

Below One year [ ]                      1-3 years [ ]

4-6 Years [ ]                                Above 6 years [ ]

**PART C: KNOWLEDGE, ATTITUDE AND PRACTICES ON WASTE MANAGEMENT**

15. Poor waste management has human health impacts

Yes [ ]                      No [ ]

If Yes, list them \_\_\_\_\_

Indicate **True** or **False** the extent of your knowledge on waste management in your firm as per the statements in the table below.

**Knowledge on Waste Management**

<b>Statement</b>	<b>True</b>	<b>False</b>
16. Improper waste disposal has adverse effect on environment		
17. Burning of plastic wastes is good for environment.		
18. Dumping of waste in streams/rivers/bush is acceptable		
19. Improper waste management does not pose safety hazard to food processing firm		
20. Segregation of waste is considered good practice in waste management?		
21. Improper waste disposal compromises quality of environment		
22. Reuse/ reduce/ recycle are the core principles of waste management		

23. Waste pollute the environment?

True [ ]                      False [ ]

24. Which of the following is not True?

- A. There is no real waste in nature
- B. Waste from one-person process becomes input to another
- C. All processes of production and consumption produce waste
- D. All of the above

25. What is Zero waste Management?
- A. Separation of wastes at the source
  - B. Separation at collection point
  - C. Involvement of Community in all activities
  - D. All of the above
26. The best way of dealing with the solid waste is by burning  
True [ ] False [ ]
27. I can discharge/dispose anyhow my waste into the environment? True/Fales
28. Which is the most appropriate point for separation of wastes?
- A. Processing
  - B. Collection source
  - C. Landfilling site
  - D. None of the above
29. Do you know that reduction in consumption of resources will lead to less wastes generated?  
Yes [ ] No [ ]

**Attitude on Waste Management**

Using Liker 5-point scale with (1 – Strongly Disagree, 2 – Disagree, 3 – Neutral, 4 – Agree and 5 – Strongly Agree) Kindly tick (√) the appropriate box that describes the extent of your attitudes on waste management in your firm.

**30. Attitude on waste management**

<b>Statement</b>	<b>SD</b>	<b>D</b>	<b>N</b>	<b>A</b>	<b>SA</b>
a) I am happy with the way waste is handled by my firm					
b) Improper waste disposal is harmful to our environment					
c) My workplace and neighbourhood should be clean					
d) It is my responsibility to ensure that waste is disposed of appropriately					
e) I don't care that burning of waste can be harmful for my health and to others					
f) I am responsible for reminding other employees on proper waste disposal					
g) Our firm is not making effort to manage waste					
h) So long as my environment is clean, I don't care about others					
i) I am too busy to be concerned about waste					

management					
j) I prefer working in a clean place rather than where wastes are piled					
k) Educating the public on proper waste management is sure way to fix the waste problems					
l) Waste is one of the environmental problems that needs urgent attention by all of us					
m) Waste is a resource					
n) I Prefer segregation of wastes into different Bins					
o) Cleanliness is next to Godliness					
p) It is important to keep the environment clean because it has much right just last human beings					
q) I am superior in the universe, so why should I care about the environment					
r) Reusing Bags for shopping is good for reducing wastes					
s) I do encourage the reduction of waste amongst my colleagues, neighbors and across all levels of the society					
t) The society should be sensitized on waste management					
u) People improperly dispose of wastes since they lack waste management facilities					
v) The Government is responsible for the management of wastes and not I					

**Practices on Waste Management**

31. Are you aware of waste management practices in your firm?

Yes [ ] No [ ]

If Yes, list them \_\_\_\_\_

32. Do you separate your waste according to their components?

Yes [ ] No [ ]

If yes what categories do you sort \_\_\_\_\_

33. Do you practice solid waste storage?

Yes [ ] No [ ]

34. Does your firm have an Environmental Management System?

Yes [ ] No [ ]

35. What are the benefits of an Environmental Management System (EMS) to your employees?

- A. Increase their motivation and become environmentally conscious.
  - B. Actively reduces environmental risk and prevents incidents to both employees and the local environment.
  - C. Increase environmental awareness amongst entire work force.
  - D. A, B and C
  - E. None of the above
36. What are the benefits of an Environmental Management System (EMS) to you as the firm owner?
- A. Use the reduce, reuse and recycle approach to make tangible cost reductions.
  - B. Enhance my company image
  - C. Reduce impacts of any business activities on environment.
  - D. A, B and C
  - E. None of the above
37. What are the benefits of an Environmental Management System (EMS) to the customers?
- A. Reassures customers that they are working with the company which promotes a shared environmental ethos.
  - B. Proof that we are maintaining a forward thinking, environmentally aware firm.
  - C. A and B.
  - D. None of the above.
38. Is your firm ISO 14001 Certified?
- Yes                            No
39. Does your firm have a competent employee to implement the Environmental Management System policy?
- Yes                            No
40. Kindly tick the appropriate box that describes the frequency of waste disposal in your firm.
- Once a day            Twice a day
- Once a week            Monthly
41. Approximately, what is the distance between waste disposal point and processing area in meters/ Kilometer?
-

Kindly tick (√) the appropriate box that describes the kinds of waste management practices undertaken in your firm where; **5-Highly Practiced, 4-Moderately Practiced, 3-Fairly Practiced, 2-Low Practiced and 1-Not Practiced.**

**42. Methods of Waste Reduction**

<b>Statement</b>	<b>HP</b>	<b>MP</b>	<b>FP</b>	<b>LP</b>	<b>NP</b>
a) Reduce					
b) Reuse					
c) Recycling					
d) Minimization					
e) Energy Recovery					
f) Dispose					
g) Others, Specify					

**43. Waste Storage**

<b>Statement</b>	<b>HP</b>	<b>MP</b>	<b>FP</b>	<b>LP</b>	<b>NP</b>
a) Storage Bins have different colors to help with sorting of wastes					
b) Bins are consistently Labeled with correct information					
c) Wastes are stored at collection points					
d) Storage facilities in the firm are kept clean and neat					
e) Large containers are used to accommodate larger volume of waste before collection in your firm					

**44. Transportation and Transfer of Waste**

<b>Statement</b>	<b>HP</b>	<b>MP</b>	<b>FP</b>	<b>LP</b>	<b>NP</b>
a) Waste safely transported/transferred to disposed sites					
b) Successful collection and transfer of waste materials depends also on the efficient participation of the MSME					
c) Transfer of compacted waste is done in closed containers					

**45. Waste Processing**

<b>Statement</b>	<b>HP</b>	<b>MP</b>	<b>FP</b>	<b>LP</b>	<b>NP</b>
a) Support the development of environmental Management system policy in the firm					
b) Treatment of waste					
c) Modification of production process and equipment					
d) Re-use or Recycle waste other than throw away					

#### 46. Waste Disposal

Statement	HP	MP	FP	LP	NP
a) Discourages burning of waste					
b) Burning of waste is practiced					
c) Disposal of reusable and recyclable to land fill					
d) Cleared refuse site in the firm premises					
e) Dispose waste through socially and environmentally acceptable practice					
f) Selling to others					
g) Feed to animals					
h) Open dumping					

#### **PART D: QUANTIFICATION OF WASTE GENERATED**

47. Do you do waste segregation?

Yes [ ] No [ ]

48. Kindly tick (✓) the statement that describes the types of wastes generated in your Firm, Where **5- Very high extent. 4-High Extent 3-Modorate extent, 2- Low extent and 1-No extent**

Name of waste	5	4	3	2	1
a) Plastic bags					
b) Waste paper					
c) Ash					
d) Horticultural crop residues					
e) Rubber					
f) Metal crap					
g) Wood					
h) Waste Water					
i) Bottle tops					
j) Used containers					
k) Old/worn-out machine parts					
l) Agrochemical wastes					
m) Liquid Wastes					
n) Used oil					
o) Others-Specify					

49. Indicate in the table below the Quantities of Waste Generated in your firm Per Day/Week/Month?

<b>A. Solid wastes</b>	<b>Source of waste</b>	<b>Quantities in Kgs/Ltrs</b>	<b>Weekly</b>	<b>Monthly</b>	<b>Total</b>
Plastic bags					
Waste paper					
Ash					
Crop residues					
Rubber					
Metal crap					
Wood					
Bottle tops					
Used containers					
Old/worn-out machine parts					
Fruit peels/seeds/pulp					
Vegetable stalks/stems/leaves					
Others, specify					
<b>B. Liquid Wastes</b>					
Agrochemical wastes					
Used Oil					
Waste Water					
Others, specify					

50. How much does it cost you to manage waste generated monthly?

\_\_\_\_\_

51. Do the quantities of waste generated by your firm influence quality of environmental Management in Kenya?

Yes [ ] No [ ]

If Yes, Explain \_\_\_\_\_

52. Are there wastes handlers in your locality?

Yes [ ] No [ ]

If Yes, which ones \_\_\_\_\_

53. Are the waste handlers licensed to carry waste?

Yes [ ] No [ ]

54. Which kinds of wastes do they prefer to buy/take?

\_\_\_\_\_



55. Approximately, how much revenue is generated by wastes sold per Month?

<b>Types of waste</b>	<b>Quantities in Kgs/Ltrs</b>	<b>Price per Kg/Ltrs/ Ton</b>	<b>Monthly</b>	<b>Total</b>
<b>a) Solid Waste</b>				
Plastic Bags				
Waste Paper				
Ash				
Horticultural crop residues				
Rubber				
Metal Scrap				
Wood				
Bottle tops				
Used Containers				
Old/Worn-out Machine parts				
Used containers				
Others, Specify				
<b>b) Liquid Waste</b>				
Waste Water				
Used Oil				
Agrochemical wastes				
Others, Specify				

56. What mechanisms do you have in place to ensure that those who collect your wastes transport/transfers them safely to the intended sites/places?

---

57. Record your activities in the Firm as per the table below continuously for 3 days.

Types of Horticultural product	Quantity of raw products in Kgs/Ton	Quantity of end product in Kgs/Ton	Quantity of waste generated in Kg/Ton	No of days			Total
				Day 1	Day 2	Day 3	
<b>A. FRUITS</b>							
Orange							
Mango							
Tomatoes							
Carrots							
Beetroots							
Pawpaw							
Avocados							
Bananas							
Pineapples							
Watermelon							
Sweet melon							
Tangerines							
Apples							
Thorn fruit							
Passion Fruit							
Lemons							
Kiwi							
Others, Specify							
<b>B. VEGETABLES</b>							
French beans							
Runner Beans							
Kales							
Cabbages							
Irish potatoes							
Sweet Potatoes							
Cassava							
Arrow roots /Leaves							
Capsicum							
Cowpeas ( <i>Kunde</i> )							
Okra							
Broccoli							
Cauliflower							
Parsley							
Spinach							
Pumpkin							
Lettuce							
Slender leaf ( <i>Mitoo</i> )							
Slender plant ( <i>Dek</i> )							
African Nightshade ( <i>Managu, Osuga</i> )							
Jews Mallow ( <i>Apoth, Mrenda/Murere</i> )							
Amaranthus ( <i>Terere</i> )							
Pumpkin Leaves							
Egg Plant ( <i>Brinjal</i> )							
Others, Specify							

**PART E: CAPACITY BUILDING**

58. Have you ever attended any training on waste management?

Yes [ ] No [ ]

59. Who offered the training mentioned in question (58)? \_\_\_\_\_

60. Number of Employees Trained on SCP/Waste Management

1 – 5 [ ] 5 – 10 [ ]

11- 15 [ ] Above 15 [ ]

61. When was the last training conducted?

1-6 Months Ago [ ]

7-12 Months Ago [ ]

1 Year and Above [ ]

62. How often did you attend the training on waste management?

Once a year [ ] Twice a year [ ] Others, specify \_\_\_\_\_

63. What were the topics covered in the training program mentioned above?

\_\_\_\_\_

64. Has the knowledge acquired on waste management during training have been implemented in your organization?

Yes [ ] No [ ]

65. Does the management support training and capacity building on waste management?

Yes [ ] No [ ]

If No, explain \_\_\_\_\_

66. Kindly tick (√) and indicate Yes/No, the extent to which changes have occurred on management of waste in your firm before and after Training.

Activities	Before Training	After Training
	Yes	No
Reduction in quantity of waste generated realised		
Reuse of wastes is practiced		
Waste segregation is practiced		
High production		
No change in production		
Repair of waste pipes undertaken		
Treatment of wastes done		
Burning plastic bottles and papers discouraged		
I understand that improper waste disposal has adverse effect on the environment		
Waste is segregated according to categories		
Healthy and clean environment is given priority at our firm		
It is every one's responsibility to manage waste		
Safe transport/transfer of waste is practice		

The main principles of waste reduction are; reduce, re-use and recycle are embraced		
Waste management is another department altogether		
Waste is a resource to the firm		
Employees are aware of dangers of wastes in the environment		
Energy savings and recovery is possible		
Environmental Management system is practiced		
Non-performing Equipment are often replaced		
Our firm has adopted Sustainable Consumption Production Practices		
There has been reduction of costs on resources used		
We are aware of the importance of waste management practices		
Others, Specify		

67. Have the employees embraced new knowledge on wastes management after training?

Yes [ ] No [ ]

**PART F: LEGAL AND REGULATORY FRAMEWORKS**

68. Are you aware of the laws and regulations governing waste management?

Yes [ ] No [ ]

If Yes, state one \_\_\_\_\_

69. Are these laws and regulations on wastes management documented for reference by employees in your firm?

Yes [ ] No [ ]

70. How does your firm dispose waste?

\_\_\_\_\_

71. How does your firm ensure that wastes generated is Transported/Transferred to the designated waste disposal facility?

\_\_\_\_\_

72. Does your firm Segregate waste? Yes/No. If Yes, which are the defined wastes streams? If No, why doesn't the firm segregate waste?

\_\_\_\_\_

73. Does your firm use waste water for irrigation purpose?

Yes [ ] No [ ]

If Yes, Explain. \_\_\_\_\_

74. Using Liker 5-point scale with (1 – Strongly Disagree, 2 – Disagree, 3 – Neutral, 4 – Agree and 5 – Strongly Agree) Kindly tick (√) the appropriate box that describes the extent to which your firm complies with laws and regulations on waste management as Provided by **Occupational Safety and Health Act of 2007?**

Items	Statement	SD	D	N	A	SA
a)	The management ensures safety, health and welfare of the employees at workplace					
b)	The firm has a policy statement on safety and health in place					
c)	The firm often carry out Safety and health Audits					
d)	I am aware of my duty to ensure own safety, health and that of others as per my act at work place					
e)	Our firm has a mechanism to manage harmful or offensive substances to the environment					
f)	Our workplace at the firm is clean and free from effluvia					
g)	Machines and equipment in the firm are used for the intended purposes only					
h)	The Transmission lines and Machinery are securely fenced					
i)	I am not safe working in our firm					

75. How does your firm ensure that its activities do not cause immediate or subsequent Water pollution?

\_\_\_\_\_

76. Every person in Kenya has the right to clean and safe water in adequate quantities.

True [ ] False [ ]

77. I can just dump/discharge waste into a River/Stream anyhow. True/False

True [ ] False [ ]

78. Liquid waste in our firm is treated before disposal

True [ ] False [ ]

79. Is your firm constructed near a River/Stream?

Yes [ ] No [ ]

If Yes, approximately how many meters away \_\_\_\_\_

80. Do you know that there are penalties for violation of laws and regulations on improper waste Disposal in Kenya?

Yes [ ] No [ ]

81. Have you been briefed on Legal and regulatory frameworks governing waste Disposal in Kenya?

Yes [ ] No [ ]

82. Are there challenges in conforming to these laws and regulations on wastes management by your firm?

Yes [ ] No [ ]

If Yes, explain \_\_\_\_\_

83. Which organization (s) have you interacted with regarding laws and regulations on waste management? \_\_\_\_\_

84. How does environmental laws affect your operation as a business entity?

\_\_\_\_\_

85. Any other information on laws and regulations on waste management that can help your Firm.

\_\_\_\_\_

***Thank you for your participation!!***

## Appendix II: Horti-green Project Field Visit Reports 2019/2020

### Homa Bay Agricultural Technology Development Centre (ATDC)



The centre specializes in extension, conservation agriculture and agro-processing of crops within 4 counties of Nyamira, Homa Bay, Migori and Kisii. Currently, the centre is engaged in training of farmers, women and youth groups on value addition of farm produce. They also support entrepreneurs with development of technologies for processing. Currently have no regular processing activities and the site not well developed.

### Dala Bakeries limited, Kendu Bay



The bakery unit is located in Homa Bay County-Kendu Bay town and specializes on processing bread, doughnuts and bans using wheat and orange fleshed sweet-potato flour. It uses limited water but has high consumption of electricity. Waste is well managed but has room for improvement.

### Take off Venture Limited (Afya Pride



### Bakeries), Oyugis

The bakery unit is located in Homa Bay County-Oyugis town and specializes on processing bread, doughnuts and bans using wheat and orange fleshed sweet-potato flour. It uses limited water but has high consumption of electricity. Waste is well managed but has room for improvement.

### Rehot Bakers - Muhoroni



The MSME processes baked products including bread, buns, scones and cakes. It is a sole proprietor with Four employees and currently based in rented facility in Muhoroni town. The company makes use of pumpkins (flesh and seeds) to process these goods. It uses limited water but has high consumption of electricity. Waste is well managed after capacity building on EMS.



## **Kabondo Sweet Potatoes Marketing and Processing Co-operative**



The cooperative is composed of more than 50 farmers from Kabondo region in Homa Bay County. They produce sweetpotato of different varieties for fresh market. In addition, orange fleshed sweetpotato being produced by the group members is currently being processed into sweetpotato dried chips and flour for various uses. The main market of processed flour is Azuri Ltd, Dala processors and some local bakeries. Sparing use of water exists.

## **Organi Ltd**



Situated in Kabondo, Homa Bay County, the MSME has been operating for more than 6 years as the sole producer of orange fleshed sweet-potato puree that is being utilized by some retail bakeries for processing bread, buns, cakes e.t.c. there is sparing use of water and waste is manageable.

### **Agro-foods Limited**



Located in Kisumu mamboleo region, the company specializes in acquisition of roots, tubers and bananas of all kinds, sorts, cleans and packages them-adds value before sales. The company has added processing line. Main area of focus is on waste management.

### **Njalo Foods**

Started as a small processing unit in Kisumu Kenya Industrial, Research and Development Institute. It specializes on processing of potato crisps. Key areas of green focus are on waste management and power consumption.

### **Nakuru Nuts Ltd.**



The company is located in Nakuru town and specializes in processing assorted nuts, oilseeds, fruits and vegetables. There is limited water use and small amounts of wastes to be managed. The set up requires improvement in the environment location and possible alternative sources of energy.



### **Euro Ingredients**





The company is located in Kikuyu town, Kiambu County and specializes in processing fried and baked products from orange fleshed sweet potato puree as a functional ingredient. Main activity to focus on to ensure greening is on power reduction.

**Pamco Foods and Nyngorora**

The two MSMEs are located in Kisii town and used the KIRDI Premises. Their main challenges are on management of power and an important resource.

**G. Star Ltd**



The MSME is owned by a youth group of more than 20 persons, it is located in Nyeri and specializes on production of dried fruits and cereals-mainly bananas that is used as an ingredient in different local cuisines. The premises well maintained but need improvement on power management.

**Kambiti Farmers Group**



Specializes on mango drying and has 2 key challenges of power and waste management. The company is owned by a group of farmers and is located in Kambiti region.

### **Karurumo Farmers Group**



Consists of farmers who produce and process bananas, mangoes and other fruits and vegetables. They extensively use solar for drying and coolbot/charcoal coolers and hence have made good strides in reducing power consumption.

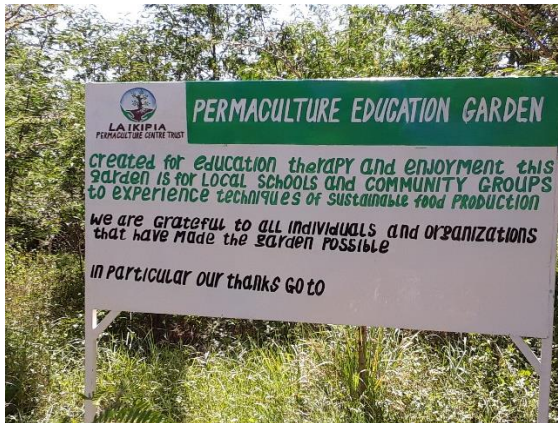
### **Mace Foods**



The company is located in Eldoret town and is specializes on processing and exporting pepper and other vegetables.



## Laikipia Permaculture Centre



The MSME is located in Nanyuki region and has taken great strides in environment conservation. It uses solar power to drive its processing of cactus fruits.

### GAEA Foods



Located in Kahawa sukari, the company specializes on processing peeled and ready to cook potato chips that is supplied to many local chip processors. They had challenges with wastes management, but after capacity building on Importance of EMS, they embarked on recycling of most of their wastes into animal feeds.

## Midrow Kenya Ltd



This sole proprietorship company is located in Ruiru area and specializes in processing of tomato sauce. The main challenge is on reduction of power consumption.

## Meru Greens

Located at Export Processing Zone a few kilometres from the capital city of Kenya, Meru greens is an established exporter of French beans and other horticultural vegetables. It has well established systems but require monitoring on reduction of power usage and waste management.

## UON Pilot Plant



This is owned by the University of Nairobi and has traditionally processed milk and meat products. There is, however, an additional fruit processing line (Hub) that is manufacturing fruit and vegetables and also trying to find ways of utilizing waste while minimizing power usage.

## Tensenses

The MSMSE is located at the EPZ Zones, Athi River and deals mainly on Macademia nuts acquisition and processing. It has well equipped units but grapples with huge power consumption.

## Appendix III: Field Activities

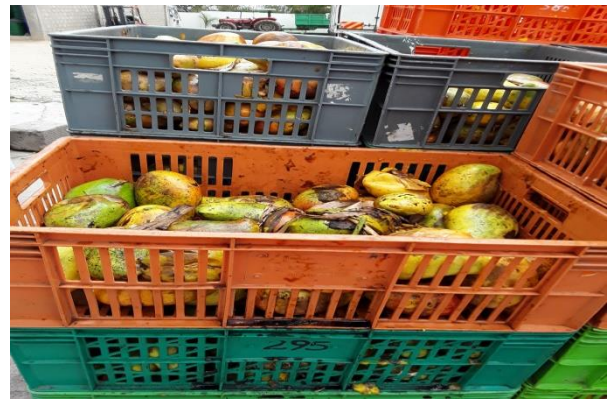
### a) Knowledge, Attitude and Practices of Waste Management



### Researcher in the field ( Benson )







**Mangoes being sorted and below are the dry-husks used as firewood for the Boiler.**





**b) Quantities of Waste Generated by MSMEs**



**c) Capacity Building on Waste Management**



## Capacity Building on Waste Management cont.d





**Prof. Okoth and Prof. Muthama Issuing an EMS Certificates to the MSME Trainee**



**d) Legal and Regulatory Frameworks on Waste Management**



*Benson (Researcher) in the Field Conducting a Routine Waste Management and Capacity Building follow-ups at GAEA Foods*

## **Appendix IV: Titles of Policy Frameworks Addressing Solid Waste Management in Kenya**

1. 1948 The Penal Code, Chapter 63 (Section 191 and 192), makes it an offence for anyone to voluntarily vitiate the atmosphere in any place, to make it noxious to the health of persons (Kenya)
2. 1950 The City of Nairobi (Nursing Homes and Maternity Homes) By-Laws.
3. 1960 The City of Nairobi (General Nuisance) By-Laws
4. 1961 Part II of the City Council of Nairobi Conservancy By-Laws the City of Nairobi (Restaurants, Eating House and Snack Bar) By-Laws
5. 1963 Local Government Act 265 deals with kinds of refuse and effluent, and where such service is established, compels its use by persons to whom the services is available
6. 1977 The Factories Act – every factory owner is to ensure that the factory environment is kept in a clean state, and free from effluvia arising from any drain, sanitary convenience or nuisance
7. 1985 The Radiation Protection Act – prohibits manufacturing, possessing, selling, disposing of, importing or exporting any irradiating device or radioactive material
8. 1986 Public Health Act (Chapter 242) makes provision for securing and maintaining health, including disposing of wastes appropriately
9. 1987 Building Code (Section 239(1)) dealing with the depositing of debris on streets
10. 1992 Food, Drugs and Chemical Substances Act
11. 1995 Building Code 1995 as an enhanced framework and Revised Building Regulation–Draft
12. 1996 Physical Planning Act (PPA) (Chapter 286), making provision for development control and as such allowing waste disposal at designated sites only
13. 1999 Environmental Management and Coordination Act (EMCA), providing a structured approach to environmental management in Kenya
14. 2003 The Environmental (Impact Assessment and Audit) Regulations, Legal Notice No 101 ENVIRONMENT & URBANIZATION Vol 29 No 2 October 2017 532
15. 2006 The Environmental Management and Coordination (Waste Management) Regulations, Legal Notice No 121 The Environmental Management and Coordination (Water Quality) Regulations, Legal Notice No 120 City of Nairobi (Medical Facilities) By-Laws
16. 2007 The Environmental Management and Coordination (Controlled Substances) Regulations, Legal Notice No 73 The Occupational Safety and Health Act Hazardous Substances Rules, Legal Notice No 60 Vision 2030 City of Nairobi (Ban on Polythene Carry Bags) By-Laws City Council of Nairobi (Waste Water Conservancy) By-Laws City Council of Nairobi (Solid Waste Management) By-Laws City of Nairobi (General Nuisance) By-Laws City of Nairobi Outlook
17. 2008 Municipal Council of Mombasa Environmental Management By-Laws Nairobi Metro 2030 Strategy Environmental Management By-Laws
18. 2009 The Environmental Management and Coordination (Noise and Excessive

Vibration Pollution) (Control) Regulations, Legal Notice No 61 Environmental Management and Coordination (Air Quality) Regulations

19. 2010 The Constitution of Kenya – Articles 42 and 70 address the right to a clean and healthy environment Republic of Kenya, National Land Policy Nairobi Integrated Solid Waste Management Plan 2011 Urban Areas and Cities Act,
20. 2011 2012 Republic of Kenya, National Environment Policy Republic of Kenya, Draft National Urban Development Policy Birth and Death Registration Act
21. 2013 Country Government Act – assigns the specific task of implementing nationwide policies within their jurisdiction
22. 2014 The SWM 2014 Bill – formulated to operationalize the Nairobi Integrated Solid Waste Management Plan. The National Solid Waste Management Strategy.

**Appendix V: Paired Samples Test on Before and After Capacity Building**

**Table 6.3: Paired Samples Test**

	Mea n	Std. Dev	Std. Error Mean	Paired Differences		t	df	Sig. (2- tailed )
				95% Confidence Interval of the Difference Lower	Uppe r			
The extent to which changes After capacity building Before capacity building	7.567	9.460	1.727	4.034	11.09 9	4.38 1	29	0.000

**Appendix VI: Pearson Correlation Analysis.**

**( a)Correlation; effects of Knowledge on waste management**

		<b>a) Education Level</b>	<b>b) Impacts of Poor waste management on human health</b>	<b>c)Zero waste management</b>	<b>d) awareness of waste management practices used</b>	<b>e) Implementation of knowledge on waste management acquired during the training</b>	<b>f) Awareness of penalties for violation of laws and regulations on improper waste disposal in Kenya</b>
a) Education Level	Pearson Correlation	1	-.106	.033	-.280	-.280	-.280
	Sig. (2-tailed)		.558	.853	.114	.114	.114
	N	33	33	33	33	33	33
b) Impacts of Poor waste management on human health	Pearson Correlation	-.106	1	-.317	-.031	-.031	-.031
	Sig. (2-tailed)	.558		.072	.863	.863	.863
	N	33	33	33	33	33	33
c) Zero waste management	Pearson Correlation	.033	-.317	1	.119	.119	.119
	Sig. (2-tailed)	.853	.072		.510	.510	.510
	N	33	33	33	33	33	33
d) Awareness of waste management practices used	Pearson Correlation	-.280	-.031	.119	1	1.000**	1.000**
	Sig. (2-tailed)	.114	.863	.510		.000	.000
	N	33	33	33	33	33	33
e) Implementation of knowledge on waste management acquired during training	Pearson Correlation	-.280	-.031	.119	1.000**	1	1.000**
	Sig. (2-tailed)	.114	.863	.510	.000		.000
	N	33	33	33	33	33	33
f) Awareness of penalties for violation of laws and regulations of improper waste disposal in Kenya	Pearson Correlation	-.280	-.031	.119	1.000**	1.000**	1
	Sig. (2-tailed)	.114	.863	.510	.000	.000	
	N=	33	33	33	33	33	33

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



( b ) Correlation; Influence of Capacity Building on Waste Management

		Gender	Education Level	Ownership of the processing plant land/building	Implementation of the knowledge acquired on waste management during the training been implemented in the firm	Adoption of new knowledge on waste management after training
a. Gender	Pearson Correlation	1	.092	-.314	-.152	-.152
	Sig. (2-tailed)		.612	.075	.399	.399
	N	33	33	33	33	33
b. Education Level	Pearson Correlation	.092	1	-.219	-.280	-.280
	Sig. (2-tailed)	.612		.221	.114	.114
	N	33	33	33	33	33
c. Ownership of the processing plant land/building	Pearson Correlation	-.314	-.219	1	.129	.129
	Sig. (2-tailed)	.075	.221		.473	.473
	N	33	33	33	33	33
d. Implementation of knowledge acquired on waste management during the training in the firm	Pearson Correlation	-.152	-.280	.129	1	1.000**
	Sig. (2-tailed)	.399	.114	.473		.000
	N	33	33	33	33	33
e. adoption of new knowledge on waste management after training	Pearson Correlation	-.152	-.280	.129	1.000**	1
	Sig. (2-tailed)	.399	.114	.473	.000	
	N =	33	33	33	33	33

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

**(c) Correlations; Effects of Legal and Regulatory Frameworks on Waste Management**

		Gender	Education Level	Ownership of the processing plant land/building	Awareness of the laws and regulations governing waste management in Kenya	Documentation of laws and regulations on waste management documented for reference by employees in the firm.	Awareness of penalties for violation of laws and regulations regarding improper wastes disposal in Kenya	challenges in conforming to these laws and regulations on waste management in your firm
a. Gender	Pearson Correlation	1	.092	-.314	-.058	-.008	-.152	-.025
	Sig. (2-tailed)		.612	.075	.748	.967	.399	.890
	N	33	33	33	33	33	33	33
b. Education Level	Pearson Correlation	.092	1	-.219	.019	.150	-.280	-.171
	Sig. (2-tailed)	.612		.221	.917	.404	.114	.342
	N	33	33	33	33	33	33	33
b. Ownership of the processing plant land/building	Pearson Correlation	-.314	-.219	1	.116	-.090	.129	.000
	Sig. (2-tailed)	.075	.221		.521	.619	.473	1.000
	N	33	33	33	33	33	33	33
c. Awareness of the laws and regulations governing waste management in Kenya	Pearson Correlation	-.058	.019	.116	1	.271	.559**	-.043
	Sig. (2-tailed)	.748	.917	.521		.126	.001	.812
	N	33	33	33	33	33	33	33
d.. Documentation of laws and regulations on waste management for reference by employees in the firm	Pearson Correlation	-.008	.150	-.090	.271	1	.152	.025
	Sig. (2-tailed)	.967	.404	.619	.126		.399	.890
	N	33	33	33	33	33	33	33
e. Awareness of penalties for violation of laws and regulations regarding improper wastes disposal in Kenya.	Pearson Correlation	-.152	-.280	.129	.559**	.152	1	.108
	Sig. (2-tailed)	.399	.114	.473	.001	.399		.549
	N	33	33	33	33	33	33	33
f. Challenges in conforming to these laws and regulations on waste management in the firm.	Pearson Correlation	-.025	-.171	.000	-.043	.025	.108	1
	Sig. (2-tailed)	.890	.342	1.000	.812	.890	.549	
	N=	33	33	33	33	33	33	33

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

(d) Correlations; Influence of Waste Practices on Waste Management

		Gender	Education Level	Ownership of the processing plant land/building	Awareness of waste management practices in your firm	Separation of firm's wastes according to their components	Practice used on solid waste storage	Adoption and implantation of Environmental Management System	Availability of a competent employee to implement an EMS Policy	Frequency of waste disposal in your firm
a. Gender	Pearson Correlation	1	.092	-.314	-.152	-.021	-.291	-.342	.039	-.193
	Sig. (2-tailed)		.612	.075	.399	.909	.100	.051	.830	.282
	N	33	33	33	33	33	33	33	33	33
b. Education Level	Pearson Correlation	.092	1	-.219	-.280	-.003	-.306	.078	-.027	.282
	Sig. (2-tailed)	.612		.221	.114	.989	.084	.666	.883	.111
	N	33	33	33	33	33	33	33	33	33
c. Ownership of the processing plant land/building	Pearson Correlation	-.314	-.219	1	.129	.031	.067	-.022	.047	.070
	Sig. (2-tailed)	.075	.221		.473	.864	.712	.902	.797	.699
	N	33	33	33	33	33	33	33	33	33
d. Awareness of waste management practices in your firm	Pearson Correlation	-.152	-.280	.129	1	.418*	.194	.182	-.045	.185
	Sig. (2-tailed)	.399	.114	.473		.015	.280	.310	.804	.302
	N	33	33	33	33	33	33	33	33	33
e. Separation of the firm's wastes according to their components	Pearson Correlation	-.021	-.003	.031	.418*	1	.293	.097	-.107	-.089
	Sig. (2-tailed)	.909	.989	.864	.015		.098	.590	.552	.624
	N	33	33	33	33	33	33	33	33	33
f. Practices used on solid waste storage	Pearson Correlation	-.291	-.306	.067	.194	.293	1	.210	.023	.000
	Sig. (2-tailed)	.100	.084	.712	.280	.098		.240	.898	1.000
	N	33	33	33	33	33	33	33	33	33
g. Adoption and implementation of Environmental Management System	Pearson Correlation	-.342	.078	-.022	.182	.097	.210	1	.262	.127
	Sig. (2-tailed)	.051	.666	.902	.310	.590	.240		.141	.481
	N	33	33	33	33	33	33	33	33	33
h. Availability of a competent employee to implement an EMS Policy	Pearson Correlation	.039	-.027	.047	-.045	-.107	.023	.262	1	.000
	Sig. (2-tailed)	.830	.883	.797	.804	.552	.898	.141		1.000
	N	33	33	33	33	33	33	33	33	33
i. Frequency of waste disposal in your firm	Pearson Correlation	-.193	.282	.070	.185	-.089	.000	.127	.000	1
	Sig. (2-tailed)	.282	.111	.699	.302	.624	1.000	.481	1.000	
	N=	33	33	33	33	33	33	33	33	33

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

The first criteria, supported the number of workers, defines SMEs as those enterprises below a specific range of employees (i.e. will vary from however ten to however fifty employees). The second criterion defines the SMEs as a result of the degree of legal formality, and has been used to distinguish between the formal and informal sectors.

## Appendix VII: Abstract of Published Papers

EISSN: 2707-0425

*East African Journal of Science, Technology and Innovation, Vol. 2 (Special issue): May 2021*

This article is licensed under a Creative Commons license, Attribution 4.0 International  
(CC BY NC SA 4.0)



### Knowledge, attitudes and practices synthesis of waste management among horticultural processing MSMEs in Kenya

<sup>1</sup>\*OUMA B N., <sup>2</sup>OKOTH M W., <sup>1</sup>MUTHAMA J N., <sup>2</sup>ABONG' G O., <sup>3</sup>VILLACAMPA M

<sup>1</sup>Wangari Maathai Institute for Peace and Environmental Studies, College of Agriculture and Veterinary Sciences, University of Nairobi, P.O. Box 29053-00625, Nairobi, Kenya.

<sup>2</sup>Department of Food Science, Nutrition and Technology, College of Agriculture and Veterinary Sciences, University of Nairobi, P.O. Box 29053-00625, Nairobi, Kenya.

<sup>3</sup>FUNDACION, SUSTALDE, Ribera de Axpe 11 Edificio D1Dpto.208 48950 Erandio, SPAIN.

\*Corresponding author's contact: [beny2@ymail.com](mailto:beny2@ymail.com)

#### Abstract

Horticultural processing Micro, Small and Medium Enterprises (MSMEs) in Kenya utilize raw agricultural produce and generate large quantities of solid and liquid wastes. However, there is limited information on knowledge, attitude and current waste management practices among horticultural processing MSMEs in Kenya. This study sought to establish the current knowledge, attitude and practices on waste management among horticultural processing MSMEs in Kenya. The survey adopted quantitative and qualitative data collection method, thirty-one (31) Certified MSMEs from Nairobi, Central and Western regions were surveyed. using a structured questionnaire. The MSMEs indicated that improper waste disposal has adverse effects on the environment, reuse/reduce/recycle were the core principles of waste management and wastes pollutes the environment. Segregation of wastes was considered good practice while improper waste disposal compromises quality of the environment. Improper waste disposal is harmful to their environment, their work place and neighborhoods ought to be clean (71%) each respectively while different waste management practices were used (6.8%). About 83.9% segregated their waste while 93.5% were not ISO 14001 compliant thereby indicating need for the MSMEs to work towards certification for productivity and external competitiveness. The respondent-s knowledge on wastes reduction showed that majority of the MSMEs employ the principles of reuse and waste minimization to manage wastes at 52% and 45% respectively. This was followed by recycling at 19% and energy recovery at 16%. The standardized beta coefficient on knowledge, attitude and practice on waste management indicated; values of 0.097(t=0.526), 0.628 (t=4.349) and 0.739 (t=5.913) respectively. Thus, no significant (p=0.603) relationship of knowledge on waste management. There was a significant relationship (p=0.000) between attitude and practices on waste management among Horticultural processing MSMEs. There is need to enhance knowledge through training towards a sustainable consumption production and practices in MSMEs.

**Keywords:** SCP; Waste Management; KAP; Horticultural Processing; MSME

**Cite as:** Ouma et al., (2021). Knowledge, attitudes and practices synthesis of waste management among horticultural processing MSMEs in Kenya. *East African Journal of Science, Technology and Innovation 2(Special Issue)*.  
Received: 24/04/21  
Accepted: 13/05/21  
Published: 25/05/21

#### Introduction

Waste can be considered as a resource because it could be managed to realize economic, social and

environmental benefits. Effective management of solid and liquid waste is critical in delivering Kenya's constitutional right to a clean and healthy environment for all (GOK, 2013b). Also, waste management is important in advancing the

1

**Capacity building influence on waste management among horticultural processing Micro, Small and Medium Enterprises in Kenya**1<sup>\*</sup>OUMA B N., 2<sup>\*</sup>OKOTH M W., 1MUTHAMA J N., 2ABONG G.O., 3VILLACAMPA M.<sup>1</sup>Wangari Maathai Institute for Peace and Environmental Studies, College of Agriculture and Veterinary Sciences, University of Nairobi, P.O Box 29053-00625, Nairobi, Kenya.<sup>2</sup>Department of Food Science, Nutrition and Technology, College of Agriculture and Veterinary Sciences, University of Nairobi, P.O Box 29053-00625 Nairobi, Kenya.<sup>3</sup>FUNDACION, SUSTALDE, Ribera de Axpe 11 Edificio D1Dpto.208 48950 Erandio, SPAIN.<sup>\*</sup>Corresponding author: [brvankun@crack.ac.ke](mailto:brvankun@crack.ac.ke)**Abstract**

Waste management includes those activities and actions required to manage wastes from inception to its final disposal. These include collection, transport, treatment and disposal of waste together with monitoring and regulation of waste management process. Inadequate and inappropriate knowledge of handling of horticultural wastes may have serious health implications and a significant impact on the environment as well. This is so because, if people possess good knowledge towards waste management, they can protect themselves from infectious diseases and keep the environment clean. This affects people's attitude and most people due to lack of capacity or training on how to handle wastes, do not bother to dispose wastes appropriately. This study therefore, assesses the influence of capacity building on waste management amongst horticultural processing Micro, Small and Medium Enterprises (MSMEs) in Kenya. Using descriptive research design, the data were collected using structured questionnaires from 31 Certified Horticultural processing MSMEs in Kenya derived from Nairobi, Central and Western regions after undergoing various trainings on waste management. The results indicated that the majority of those engaged in horticultural processing MSMEs business are married (90.3%), affirming the family-oriented business tier. Further, the results showed that, before conducting training to the MSMEs, their level of knowledge on reduction in quantity of waste, waste management was at 58% and 68%, respectively. After training the result showed a high level of improvement at 87% and 83.9% on the same variables. The results further showed changes on waste management before and after capacity building with a mean of 9.29 and 16.70 respectively. Therefore, the study established a significant relationship with a p-value of 0.000 between capacity building and waste management in horticultural processing MSMEs in Kenya.

**Keywords:** Capacity building; horticultural processing; MSMEs waste management

**Cite as:** Ouma et al., (2021). Capacity building influence on waste management among horticultural processing Micro, Small and Medium Enterprises in Kenya. *East African Journal of Science, Technology and Innovation 2(Special Issue)*.  
Received: 24/04/21  
Accepted: 13/05/21  
Published: 25/05/21

**Introduction**

The horticultural sub-sector is the fastest growing industry within the Kenyan sector. The sub-sector

employs approximately 4.5 million people directly in production, processing and marketing and value addition chains, while over 3.5 million people benefit indirectly (FAO, 2015).