



**BUSITEMA
UNIVERSITY**
Pursuing excellence

**FACULTY OF NATURAL RESOURCES AND
ENVIRONMENTAL SCIENCES**

DEPARTMENT OF NATURAL RESOURCE ECONOMICS

**ASSESSMENT OF CLEAN DEVELOPMENT MECHANISM
CONTRIBUTION TO METHANE EMISSIONS REDUCTION AND
WASTE MANAGEMENT, JINJA MUNICIPAL WASTE
COMPOSTING PROJECT, UGANDA**

By

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OCTOBER, 2021

CERTIFICATION

This is to confirm that this dissertation has been submitted with my approval as a research supervisor.



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Date: 04/10/2021.....

DECLARATION

I, **Irene Chekwoti** do hereby declare that this research work has been through my own efforts and never has it been submitted to any Institution of higher learning for any award.



Date: 4th/10/2021

IRENE CHEKWOTI



DEDICATION

This work is dedicated to my special family “**the Ikhuret**”; Peter, Jeremy, Ryan, Owen, Adrian and Philip. I also wish to dedicate this work to my dear sister Linet Chebet for standing by me when I needed such support the most.

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LIST OF ACRONYMS

°C	Degrees centigrade
CH ₄	Methane
CDM	Clean Development Mechanism
CERs	Certified Emission Reductions
CO ₂	Carbon dioxide
CO _{2eq}	Carbon dioxide equivalents
COP	Conference of Parties
DNA	Designated National Authority
EU	European Union
GDP	Gross Domestic Product
GHG	Greenhouse gas
GWP	Global Warming Potential
IPCC	Intergovernmental Panel on Climate Change
Km	Kilometre
KP	Kyoto Protocol
LDCs	Least Developed Countries
MSW	Municipal Solid Waste
MWE	Ministry of Water and Environment
N ₂ O	Nitrous Oxide
NCCP	National Climate Change Policy
NEMA	National Environment Management Authority
PoA	Programmes of Activities
UBOS	Uganda Bureau of Statistics
UNFCCC	United Nations Framework Convention on Climate Change
US \$	United States dollars

DEFINITION OF TERMS

Composting: The process of collecting, grinding, mixing, piling, and supplying sufficient moisture and air to organic materials to speed natural decay. The finished product of a composting operation is compost, a soil amendment suitable for incorporating into top soil and for growing plants.

Additionally: One of the criteria for CDM project developers to demonstrate in their registration documentation that the project activities are additional to what would have occurred without the CDM.

Anthropogenic Climate Change: Changes in the global climate brought about by the emissions of greenhouse gases by human activity.

Baseline: The amount of greenhouse gas emissions expected without CDM project activities. Emission reductions from projects are estimated against baseline scenarios.

Carbon Revenue: Revenues from CDM project activities that result from the direct creation and sale of Certified Emissions Reductions (CER).

Certified Emissions Reductions (CER): The crediting metric for emission reductions created by CDM projects. Each CER represents one metric ton of CO₂ equivalent reduced.

Clean Development Mechanism (CDM): One of the three flexibility mechanisms of the Kyoto Protocol that allows developed countries to receive credit for emission reductions that take place in developing countries.

Designated National Authority (DNA): Host country government office in charge of overseeing and approving potential CDM projects. Approval by the DNA is seen as proof that CDM projects create significant sustainable development benefits.

Designated Operational Entity (DOE): An independent, third-party organization that validates the CDM project activities during the registration phase of project development and once the project is operational.

Emissions Trading: One of the three flexibility mechanisms of the Kyoto Protocol that allows Annex I parties to trade emissions permits that they do not use to other parties in need of additional permits.

Emissions Reduction Purchase Agreement (ERPA): A contract between CDM project developers and CER purchasers in which the purchasers agree to buy a specific amount of

CERs at a set price at some future date. In return, the project developers receive payment at an earlier date than would otherwise be possible.

Global Warming Potential (GWP): A common metric to assess the climate change impacts of different greenhouse gases based upon their lifetime and climate forcing. Global warming potentials are often used to convert other gases to Carbon Dioxide equivalence.

Greenhouse Gases (GHG): Heat trapping gases that have begun to change the global climate. The Kyoto Protocol aims to reduce emission of these gases including carbon dioxide, methane, nitrous oxide, chlorofluorocarbons, hydrofluorocarbons, and sulphur hexafluoride.

Least Developed Countries (LDC): A group of countries that receive low development scores based upon metrics that combine economic, health, and education measures (see Human Development Index). Most of the countries are located in sub-Saharan Africa
Mitigation - Actions and policies aimed at reducing the impacts of climate change by decreasing the concentration of greenhouse gases in the atmosphere.

Mitigative Capacity: The ability to reduce anthropogenic greenhouse gas emissions or enhance natural sinks

Project Design Document (PDD): A lengthy document required as part of the CDM registration process that describes the project activities and pre-project baseline emissions, employs approved methodologies to estimate greenhouse gas impacts and leakage, proves the additionality of project activities, and describes the expected sustainable development impacts.

Project Idea Note (PIN): A smaller document required by some host country DNA that is a precursor to the PDD and describes the proposed CDM project activities.

Waste: All type of wastes, regulated or not regulated, hazardous or non-hazardous and generated by citizens under the municipal umbrella Municipal Solid Waste (MSW) or by others sources such as an Industrial, Commercial and Institutional (ICI) business unit.

ABSTRACT

Solid waste composting is being carried out in 12 municipalities in Uganda, Jinja inclusive with ambition of contributing to reduced Greenhouse Gas emissions (GHG) under the CDM Programme of Activities. The Composting project under study is located at Masese-Jinja Municipality. The main objective of the study was to assess the Jinja Municipality solid waste composting project's contribution to Low Carbon Development and Waste Management. The specific objectives were to identify the different waste forms deposited; estimate and project methane emissions reductions by composting at the plant and to assess the different socio-economic and environment benefits derived from the Municipal waste compost plant. Both primary data and secondary data were used. Secondary data on wastes was sourced from UNFCCC website for use. Journal articles on waste management and the state of environment reports were reviewed. Key Informant Interviews and site visits were also conducted. Data validation was done using the Focused Group Discussions. The methane emissions avoided and emissions reductions estimations were done using both the 2006 IPCC Waste Model spreadsheet and the default emissions estimate approach presented in the 1996 IPCC Good Practice Guidelines. In data management and analysis, Ms Excel and STATA MP 14 statistical packages were used to generate frequency tables, graphs and came up with other statistical conclusions. The study shows that a variety of wastes are deposited with most of the wastes sourced from domestic use including organic waste (32%), polythene and plastics (18%) as most dominant in composition. It was realized that of the deposited wastes, waste forms such as broken plastics, bottles and metal scrap were extracted by scavengers for sale to other parties. In the assumed scenarios of management, it was noticed that a big percentage of the respondents (76%) perceived that the waste levels would be low if the current waste management was improved.

The study also revealed that the estimated methane emissions avoided and Net Emissions Reductions from solid waste composted for years 2009-2019 and also predicted future emissions throughout the project life up to 2030 demonstrated an increasing trend with time variations. This is a good illustration of composting as a good waste management strategy for climate change mitigation and a low carbon economy development. It was recommended that community members need to engage in waste segregation and separation practices at the waste generation source. The Municipality needs to enhance public-private partnerships for improved and timely handling, transportation and management of the Municipal Solid

Waste. Enforcement of Waste management by-laws for controlled indiscriminate dumping of wastes. Jinja Municipality has already enacted waste management by-law that awaits implementation. The policy makers need to come up with policy measures that enhance integrated waste management for increased resource recoveries, optimizing annual budgeting and expenses for waste management.

Key words: *Municipal Solid Waste Management, Composting, Emission Reductions*

CHAPTER ONE: INTRODUCTION

1.0 Introduction

In this chapter, I examined the study's background, the major and specific objectives, research questions, the statement of the problem, the study's justification and importance, and the conceptual framework.

1.1 Background

Globally, there are increasing cases of climate change vulnerabilities especially facing the least Developing Countries (Angela and Ngonzi, 2019). The countries capacities to mitigate climate change are very low due to financial, technical and technological lapses. Most countries continue to suffer a variety of environmental stress including waste management challenges, a one driver to climate change due to its Green House Gases emissions it contributes to the atmosphere (EPA, 2016). The waste management sector contributes to the anthropogenic greenhouse effect primarily through emissions of carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O) mainly due to emissions from waste disposal. In the last decade, anthropogenic contributions to global methane emissions have been estimated to go from 48% to 78% of the total (Kirschke, et al., 2013;EPA, 2019). The IPCC's Fourth Assessment Report places the contribution made by the waste management sector to global Green House Gas (GHG) emissions on a level of 2.7 % (IPCC, 2007). According Uganda's First Biannual Report, Uganda's waste disposal contributes 1487.8046 Gigatonnes of Carbon dioxide equivalents (MWE, 2019).

Solid waste management strategies like composting play a significant role in reducing greenhouse gas (GHG) emissions by recovering materials, compost and emissions reductions from the mixed municipal solid waste stream (ISWA, 2009); (Kong, Shan, & Lacobini, 2012); (Weitz, Thorneloe, & Nishtala, 2002). The mitigation of GHGs from the waste sector is relatively simple as compared with mitigation from other sectors. In addition, there is still a possibility for potential reduction in carbon foot print of the solid waste, as the carbon reduction is not fully exploited, where the sector can be the opportunity to change from a net emitter into a net reducer of GHG emissions (ISWA, 2009).

The year 2009 saw the drafting of the Copenhagen Accord at the UN Climate Change Conference (COP15). The Kyoto protocol of the UN Framework Convention on Climate Change (UNFCCC) was born with the aim of developed countries supporting developing

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