INFLUENCE OF HOUSEHOLD CHARACTERISTICS ON SOLID WASTE MANAGEMENT PRACTICES AT HOUSEHOLD LEVEL IN MUKONO TOWN, UGANDA

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A Thesis Submitted in Partial Fulfilment of the Requirements for the Award of the Degree of Master of Science Degree in Environment and Natural Resources in the Department of Environment and Natural Resources and the School of Science and Technology of Africa Nazarene University

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DECLARATION

I declare that this document and the research that it describes are my original work and that they have not been presented in any other University for academic work.

…….. ……

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18S01DMEV002

This research was conducted under our supervision and is submitted with our approval as University supervisors.

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DEDICATION

I lovingly dedicate this thesis to my immediate family members, which include: Abud Andrew Marial (my wife), Roben Makuei Jacob (my son), Majak Acuoth Kuen (my father), Atoch Garang Malual (my mother), Konj Acouth Kuen (my uncle) for their tireless support they offered to me during the period of coming up with the thesis.

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ABSTRACT

To protect human health and for successful environmental protection in a given area, there must be effective waste management practices in place. There have been problems with household solid waste management which is one of the root causes of pollution. This study assessed the influence of household characteristics on solid waste management in Mukono town, Uganda. The specific objectives of the study were; to determine the influence of formal education level of household head, income levels of household heads, amount of solid wastes generated by the household, household size (number of people) and the waste collection system influence solid waste management practices at household level in Mukono. The study employed a descriptive research design with a target population of 11,000 households in Mukono municipality. A stratified random sampling technique was used to select a sample size of 245 households. A structured questionnaire was used to solicit information form the household heads. Data were analyzed using descriptive statistics (means, frequency distribution tables) and inferential statistics (regression and ANOVA) in a Statistical Package for the Social Sciences (SPSS version 25). The results of the study indicated that formal education level (β= 0.251, $p < 0.001$), income levels (β= 0.306, $p < 0.001$), amount of waste generated (β=.354, $p < 0.004$), and household size (β=0.261, $p < 0.001$) significantly influenced the level of solid waste management practices undertaken at the household level in Mukono town. The private system of solid waste collection method was found to significantly ($F(4,240) = 7.243$, $p < 0.001$) influence the level of solid waste management practices compared to the communal waste collection system. Creation of a strong partnership between the municipal council (the regulator) service providers (waste collectors) and the members of the households will enhance proper waste management in the town. A policy needs to be put in place, where the municipal council will provide land for composting and land fill and the NGOs will provide the much needed training to the households and service providers. The study provides information on the household characteristics that are important in formulating the much needed policy of solid waste management in Mukono town to ensure a clean environment.

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LIST OF ABBREVIATION/ACRONYMS

AAAS - American Association for the Advancement of Science

BC- Before Christ

CBO - Community Based Organizations

GDP- Growth Domestic Product

E-WASTE - Electronic Waste

IMF- International Monetary Fund

MSEs- Micro & Small Enterprises

MRF- Material Recovery Facility

NEMA - National Environmental Management Agency

NCC - National County Council

NGO - Non-Governmental Organization

SWM - Solid Waste Management

SPSS - Statistical Package for Social Science

UNEP - United Nations Environmental Program

OPERATIONAL DEFINITION OF TERMS

City Is a large and usually densely populated urban area. In our case, we will be referring to major cities.

Environment Is the natural, as a whole or in particular geographical area, the area in which something exists or lives.

Waste Management Refers to the generation, prevention, characterization, monitoring, treatment, handling, reuse and residual disposition of solid wastes.

Factors Refer to a circumstance, fact, or even influence that contributes causally to a result.

Garbage The amount of waste from various sources including households and market places.

Recycling Refers to the act of processing used or abandoned materials already used in order to produce new products

Stakeholder A stakeholder is an individual or an organization with a stake or even interest in something (for this case – household head in solid waste management).

Technology Is practical application of the science discipline which deals with making, modification and knowledge of tools, machines, techniques to commerce or industry

E-waste Refers to electronic waste, for example, cable, old television sets, and computers etc. Waste -Refers to any materials unused or/and rejected as worthless or unwanted.

Domestic Solid Waste All materials emanating from households whose use is no longer required.

Regulation Legal restrictions promulgated by a government authority to manage waste.

Sustainability The ability of the earth's various systems, including human cultural systems and economies, to survive and adapt to changing environmental conditions indefinitely

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Waste management is the process of collecting, separating, storing, transporting, disposing, monitoring and managing of waste materials on acceptable manner that does not pose health and environmental problems (Banga, 2013). The term waste management always relates to materials generated by human activities and the process is undertaken purposely to reduce waste effects on human health and the environment. The major focus of this research study was to assess the influence of household characteristics on waste management in Mukono Township. Generally, waste includes all materials and items that people can no longer put in to use and therefore intend to discard. These include: kitchen wastes, garden wastes (vegetables), metals, old clothes, food wastes, and wood.

The expansion of urban, industrial and farming activities accelerated by rapid population growth has led to production of huge amount of solid wastes at household levels and municipality, thus causing pollution to the environment (Rana, 2007). Poor solid waste management has been a big problem to human health affecting both rural and urban households. According to Modebe (2011), a clean environment influences good health which further affects man's productivity. Hence, a good and clean environment invariably affects the health, economic and wealth status of every household or a nation in general term. There are many methods of waste disposal used at household levels (Enete, 2010) and they include; composting which is an aerobic biological degradation of organic matter. Hog feeding, which involves feeding of

domestic animals such as pigs cows chickens and goats with leftovers food material of plant peels or leafs.

Landfill is also another method of waste disposal method which involves burying of wastes in borrow pits and covering it with layers of soil (Eggen, Moender & Arakwe, 2010; Krook, Swensson, Eklund, 2012). Incineration: the combusting of solid organic wastes at a very high heat to convert it in to residue or gaseous products (Tonini & Astrup, 2012). Open dumping: the dumping of wastes in an open land, river, street or sewage channel. Recycling is another method which means turning waste materials and transforming them in to useful products which can help reduce costs, save money, reduce disposal and reduce harmful emissions to air and water.

Trankler (2006) reported that a relationship exists between household characteristics and waste management. Richer households consume more than the lower-income ones which results in a higher waste generation rate for the former. Solid waste management is influenced by Household characteristics as pointed out by Adogu & Nkwocha (2015). It is shown that proper solid waste management at household level depends on the level of people's knowledge, awareness, attitudes, income level, education level, wastes generated and waste collection methods.

Tayler (2013) conducted a research study about waste management awareness knowledge and practices of secondary school teachers in their state and the result showed that teachers were aware and knowledgeable about waste management even though they possessed negative waste management practices. Therefore, there seems to be a great awareness and knowledge about waste disposal among people in some parts

of Uganda, but most of them especially in the rural areas are only aware of the traditional methods of waste disposal and not very aware about the modern methods such as incineration and recycling. It also indicated that the attitude of people towards waste management at household level can be affected by their level of knowledge and awareness and it has been reported that household with waste bins engage more in proper way of storing wastes that those households without waste bins. The same study showed no significant effects of gender, employment and the level of education on willingness to pay to recycle.

About 5.5 million tons of wastes are generated in Uganda with about 0.5% being generated in Mukono district and about 60% of the Ugandan waste is generated by households (Uganda Ministry of Environment, 2014). It is estimated that an average Ugandan in rural or urban areas generate about 0.3kg of solid waste per day with household and business centres contributing about 12% of the total urban wastes problem. Out of this, about two thirds of the wastes are dumped indiscriminately on the streets and in sewage drainage channels, thereby posing serious environmental pollution.

The improper waste management at household level may be due to lack of knowledge on how to collect wastes and dispose them in good manner (Allen, 2016). Low income per household may not be enough to buy waste bins and pay for the services rendered by a private company that help in the collection of wastes. The household might be using wrong dumping methods such as open dumping due to lack of landfill nearby or far distance. The amount of wastes generated per household might be huge enough that it is unable to handle. Therefore, poor waste disposal at household level in Mukono

could lead to breakout of infectious diseases, diarrhoea, typhoid, cholera, malaria, yellow fever etc.

Against the background of these issues identified, this research study assessed the household characteristics such as people's knowledge, income level, amount of wastes generated, and waste collection and disposal methods influence the management of wastes in Mukono town.

1.2 Problem Statement

Mukono Township is facing serious problems brought about by poor solid waste management at households' level. The rapid population growth with increase in agricultural, industrial and commercial activities in the area has created a huge generation of solid wastes that have become a public health and environmental concern. Despite local government and NGOs commitment to address the issue of waste management in the area, solid wastes continue to be found scattered all over the area in the market centres and household estates.

Many households' occupants seem to have low level of knowledge about proper solid waste management practices. There seem to be low income level per household making them not to afford service payment. Poor waste collection and disposal methods undertaken at household seem to be a factor. There is limited collection of solid wastes from the households and public containers by authorities on a regular basis. As a result, most household heads resort to open dumping of solid wastes which later decompose and become breeding ground for rats, flies, and mosquitoes, contributing to unhealthy environment that produce diseases such as whooping cough, Tuberculosis, cholera, diarrhoea, typhoid, yellow fever, hepatitis and malaria.

Some academic and scholarly works have been done on the Municipal solid waste collection and management, and the factors that affect waste recycling in Uganda. Most of these studies attempted to explain the established standards on waste management and laws of municipal council on solid waste management and waste recycling. There are rare studies to understand how household characteristics influence solid waste management in Mukono Township. Therefore, this study aimed at assessing the influence of household characteristics on solid waste management in Mukono Township.

1.3 Purpose of the Study

The purpose of this study was to assess the influence of household characteristics on solid waste management in Mukono Township with the aim of enhancing understanding of the problem so that decision makers can address the problem.

1.4 General Objective

To assess the influence of household characteristics on solid wastes management in Mukono township.

1.5 Specific Objectives

(i) To assess the influence of household head formal educational level on household solid waste management in Mukono township.

(ii) To assess the influence of household head income level on household solid waste management practices in Mukono township

(iii) To determine the influence of household head knowledge in handling solid waste on solid waste management.

(iv) To examine the influence of the amount of waste generated by the household on solid waste management practices at household level

(v) To investigate how household size (number of people) influence solid waste management.

(vi) To determine the waste collection methods used at household level and how they influence solid waste management in Mukono Township.

1.6 Research Questions

(i) What is the influence of household's head educational level on the level of household solid waste management practices?

(ii) How does household income levels influence household solid waste management practices in Mukono town?

(iii) How does household head knowledge in handling solid waste influence solid waste management practices at household level?

(iv) Does the amount of waste generated by the household influence solid waste management practices at household level?

(v) Does household size influence solid waste management practices at household level?

(vi) What are the methods of solid wastes collection used and how the waste collection methods in households influence waste management?

1.7 Significance of the Study

The findings of this research will be important to the households and residents of Mukono town who have been struggling with waste management issues in the estates which have posed a health and environmental concerns.

The municipal council will also gain from the study in that it can know the factors that influence waste disposal in the town and the challenge so as to deal with the factors as

well as the challenges in order to ensure that the environment is clean, and the health of its residents is protected.

1.8 Theoretical Framework

Two related concepts, social justice and environmental justice were employed in this study to assess the influence of household characteristics on Solid Waste Management in Mukono Township. There are other theoretical frameworks that could also be used such as political ecology for instance, it could have been used to study how political, economic and social factors affect the organization of waste while the concept of good governance (frequently employed by the World Bank/IMF in its surveillance over the transparency of government accounts, the effectiveness of public resource management and the transparency of the regulatory environment for private sector activity). (IMF, 1997) could be a useful framework for examining aspects of the waste management system in Uganda such as the management of financial and other resources for waste management and the regulatory framework for private sector involvement in waste management.

Within the broader framework of sustainable development, the concept of sustainable waste management is also an appropriate framework for studying not only the effects of improper waste management on human health and the natural environment but also the implications of current waste management practices for resource conservation and environmental sustainability (Watson, 2004). However, one single study cannot easily be embedded within all these theoretical frameworks, so a choice had to be made among them, thus, environmental justice. Furthermore, existing studies on household and municipal solid waste management in developing cities show that social justice and environmental justice have received less attention than the other concepts in the

investigation of environmental issues. Following these concepts in the current study, therefore, was seen as an opportunity to examine an important environmental problem from a different perspective.

1.8.1 Environmental Justice Theory on Household Solid Waste Management

Generally, the environmental and health problems related to waste affect to the highest extent those inhabitants who have the least resources and therefore, very little power to change their situation, as they do not affect policy-making (Forseyth, 2002). The environmental justice discourse started in the United States in the 1980s founded an anthropocentric view on nature stressing the rights of those affected by pollution rather than the rights of nature (Hannigan, 2006). In contrast, in the title of this research project, I refer to the rights of nature and by "social justice" to the rights of people. It was the result of the growing frustration of the African-Americans in the US with the placement of toxic landfills and garbage incinerators in the neighbourhood or communities of predominantly minority population (Hannigan, 2006). Therefore, environmental equity was presented as a fight against environmental racism. It argues that all people have a right to clean air, land, water and food, and the right to live and work in a clean and safe environment regardless of their degree of wealth.

As Clapp (2002) points out, waste often takes advantage of economic inequalities making their ways to disadvantaged communities. As the powerful communities externalize their environmental impacts, wastes will end up in remote rural areas and in the least fashionable urban neighbourhood (Ackerman & Mirza 2001). This is definitely the case in Mukono, where waste is generally dumped where poor groups live, poor communities suffer most from improper waste collection services, and the workers involved in the waste recycling and reprocessing, often informally performed

and leading to grave health hazards, come from the most marginalized social groups - the very picture of deeply embedded social inequality. In sum, making waste management a priority makes sense regardless of the environmental ethical position assumed. However, for anthropocentric, it makes sense because it safeguards human health, whereas for ecocentrics because it safeguards the environment as a whole.

In view of the above observations, there is now recognition and increased effort, especially in developing countries to develop systems and processes aimed at empowering communities especially the poor people, to address environmental issues that have direct implications on their wellbeing (Simatele, 2015). It is assumed that when the poor people are empowered to take responsibility of their own affairs, they will be able to influence processes that affect them and trigger the identification of strategies that are suited to their needs (Simatele, 2012).

1.9 Conceptual Framework

Conceptual framework is defined as the researcher's understanding of how the particular variables in the study connect with each other (Regoniel, 2015). Thus, conceptual framework identifies the variables required in a research investigation.

Therefore, to assess the influence of household characteristics on Solid Waste Management in this Framework, Solid Waste Management was the dependent variable and household characteristics such as people's knowledge, number of people in the household, amount of waste produced, and collection method used were the independent variables.

1.9.1 Dependent Variable

This is a variable which will be the effect of some cause. In this study, Waste Management is the dependent variable. So now, Mukono Township is facing serious challenges in household solid waste management. Transportation, collection, disposal and storage need to be handled keeping in view of the existing resources. Therefore, it is critical to establish some model to exercise best practices for effective Household Solid Waste Management.

1.9.2 Independent Variables

These are variables that create a cause of some effect to happen. In this project, the independent variables such as people's knowledge, number of people in the household, income levels, amount of waste generated, and collection method used were being taken to evaluate the cause.

1.9.3 Moderating Variable

Government intervention was used as a mediator in this project with an aim to investigate its intermediary role in relationship between the independent variables and the dependent variable.

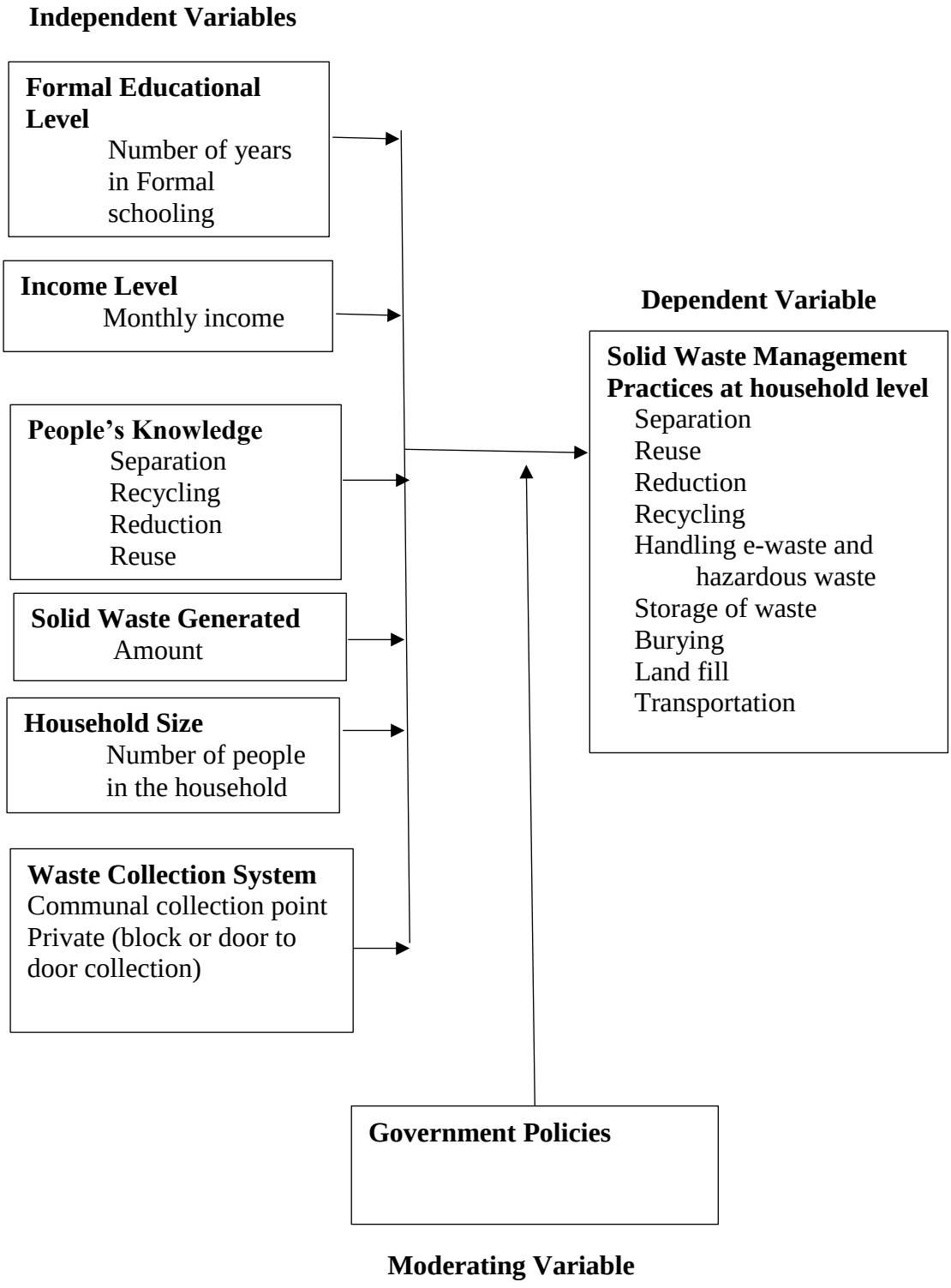


Figure 1.1: Conceptual Framework showing the influence of household characteristics on waste management in Mukono Township

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter covers a review of literature that is relevant to the study. The review is based mainly on the objectives of the study. Every human activity produces waste. Anywhere that is inhabited by humans, there is waste. Humankind has always produced waste in one form or another (Vega, 2008). Generally, Household waste constitutes what one consumes or makes use of and then disposes of everyday. The household characteristics that influence Solid waste management include: household head income, household head knowledge, household size (number of people living in a household), and amount of waste generated, and collection method used.

To solve the issue of household and municipal solid waste is an important policy objective and one which is becoming increasingly difficult to handle (Saat, 2013). Since the awareness of the external effects of waste generation is increasing, there is resistance by society to the development of new landfills and incineration facilities. Meanwhile on the other hand, household and municipal solid waste generation has grown significantly over the last decades as a result of higher incomes, more intensive use of packaging materials and disposable goods, and increased purchases of durable material goods (Abdul, 2010). This problem is being projected to continue escalating despite current efforts to reduce the material content of products and to stimulate the reuse of products and packaging and the recycling of materials and substances.

Household and municipal solid waste management constitutes one of the most crucial health and environmental problems facing governments of every city in low developed

countries in Africa. This is because even though these cities are using 20-50 percent of their budget in solid waste management, only 20-30 percent of the waste is collected (Orodho, 2009). The uncollected or illegally dumped wastes constitute a disaster for human health and the environmental degradation (Achangken, 2003).

To develop an effective Solid waste management strategy for a given area, it is always imperative to know the amount of waste generated and the composition of the waste stream and this has direct effect on the socio-economic factors. Early on, economists highlighted and talked about the socio-economic factors that influence household waste generation. Viewed from an economic perspective, (Seng, 2014) analyzed the household behavior on waste generation in terms of changes in income, price of refuse service, frequency of service, site of refuse collection and packaging. Households' size, cultural patterns, education and personal attitudes (Abdul & Grossmann et al., 2008) are said to influence solid waste generation as well.

Economists also compared the composition and quantity of waste in terms of income level, household size and age structure of the household as these affect the quantity and composition of solid waste. For instance, Richardson et al. (1978) study shows that grass, yard wastes and newspaper were positively correlated with the level of income. This project considers education, income, household size and extra land as important components that affect the solid waste generation. Various authors have shown that the amount of waste generated by a country is proportional to its population and the mean living standards of the people (Goldman et al. 2005).

Kreith (2002) relates waste generation rates to income levels of people. However, it has been shown that these are not the only governing factors. Amongst other socioeconomic factors that have been said to influence household waste generation are persons per dwelling, cultural patterns, education, and personal attitudes (Karbassi et al. 2012). In recognition of the importance of a reliable tool to predict the household characteristics, various researchers have attempted to construct models to predict these parameters. They found that relationships obtained between various parameters vary by country. This has been attributed to variations in consumer behavior and lifestyles.

2.2 Solid Waste Management

Solid-waste management is the collecting, treating, and disposing of solid material that is discarded because it is no longer useful (Nathanson, 2015). Improper disposal of municipal solid waste can create unsanitary conditions, and these conditions in turn can lead to pollution of the environment and to outbreaks of vector-borne disease- that is, diseases spread by rodents and insects. The tasks of solid-waste management present complex technical challenges. They also pose a wide variety of administrative, economic, and social problems that must be managed and solved.

The Historical Background of solid waste management started in the ancient cities when wastes were thrown onto unpaved streets and roadways, where they were left to accumulate (Nathanson, 2015). It was not until 320 BC in Athens that the first known law forbidding this practice was established at that time a system for waste removal began to evolve in Greece and in the Greek-dominated cities of the eastern Mediterranean. In ancient Rome, property owners were responsible for cleaning the streets fronting their property. But organized waste collection was associated only with state-sponsored events such as parades (Sinha, 2014). Disposal methods were very

crude, involving open pits located just outside the city walls. As populations increased, efforts were made to transport waste farther out from the cities.

After the fall of Rome, waste collection and municipal sanitation began a decline that lasted throughout the middle Ages. Near the end of the 14th century, scavengers were given the task of carting waste to dumps outside city walls. But this was not the case in smaller towns, where most people still threw waste into the streets (Nathanson, 2015). It was not until 1714 that every city in England was required to have an official scavenger. Toward the end of the 18th century in America, municipal collection of garbage was begun in Boston, New York City and Philadelphia (Tikkanen, 2015). Waste disposal methods were still very crude, however. Garbage collected in Philadelphia, for example, was simply dumped into the Delaware River downstream from the city.

2.2.1 Composition of Household Solid Waste

The sources of solid waste include residential, commercial, institutional, and industrial activities. Certain types of wastes that cause immediate danger to exposed individuals or environments are classified as hazardous (Feng, 2011). All non-hazardous solid waste from a community that requires collection and transport to a processing or disposal site is called refuse or municipal solid waste (MSW). Refuse includes garbage and rubbish. Garbage is mostly decomposable food waste; rubbish is mostly dry material such as glass, paper, cloth, or wood (Modebe, 2011). Trash is rubbish that includes bulky items such as old refrigerators, couches, or large tree stumps. Trash requires special collection and handling.

Construction and demolition (C&D) waste (or debris) is a significant component of total solid waste quantities (about 20 percent in the United States), although it is not considered to be part of the MSW stream (Davis, 2008). However, because C&D waste is inert and non-hazardous, it is usually disposed of in municipal sanitary landfills.

Another type of solid waste, perhaps the fastest-growing component in many developed countries, is electronic waste, or e-waste, which includes discarded computer equipment, televisions, telephones, and a variety of other electronic devices. According to UNEP (2006), e-waste made up five percent of the total solid waste stream, and the United Nations Environment Programme estimated that developed countries would triple their output of e-waste by 2010. Concern over this type of waste is escalating. Lead, mercury, and cadmium are among the materials of concern in electronic devices, and governmental policies may be required to regulate their recycling and disposal.

Solid-waste characteristics vary considerably among communities and nations (Feng, 2011). In the United States, paper and paperboard products make up close to 40 percent of the total weight of MSW; food waste accounts for less than 10 percent (Davis, 2008). The rest is a mixture of yard trimmings, wood, glass, metal, plastic, leather, cloth, and other miscellaneous materials. In a loose or uncompact state, MSW of this type weighs approximately 120 kg per cubic metre (200 pounds per cubic yard). These figures vary with geographic location, economic conditions, season of the year, and many other factors. Waste characteristics from each community must be studied carefully before any treatment or disposal facility is designed and built (Matusi, 2010).

2.2.2 Recycling

Recycling is the process of converting waste products into new products to prevent energy usage and consumption of fresh raw materials (Abdul, 2010). Recycling is the third component of Reduce, Reuse and Recycle waste hierarchy. The idea behind

recycling is to reduce energy usage, reduce volume of landfills, reduce air and water pollution, reduce greenhouse gas emissions and preserve natural resources for future use.

2.2.3 Solid Waste Collection Methods

Proper solid-waste collection is important for the protection of public health, safety, and environmental quality. It is a labour-intensive activity, accounting for approximately three-quarters of the total cost of solid-waste management. Public employees are often assigned to the task, but sometimes it is more economical for private companies to do the work under contract to the municipality or for private collectors to be paid by individual home owners (Ogawa, 2002). A driver and one or two loaders serve each collection vehicle. These are typically trucks of the enclosed, compacting type, with capacities up to 30 cubic metres (40 cubic yards). Loading can be done from the front, rear, or side (Mshelia, 2015). Compaction reduces the volume of refuse in the truck to less than half of its loose volume.

The task of selecting an optimal collection route is a complex problem, especially for large and densely populated cities. An optimal route is one that results in the most efficient use of labour and equipment and selecting such a route requires the application of computer analyses that account for all the many design variables in a large and complex network (Saat, 2013). Variables include frequency of collection, haulage distance, type of service, and climate. Collection of refuse in rural areas can present a special problem, since the population densities are low, leading to high unit costs.

Refuse collection usually occurs at least once per week because of the rapid decomposition of food waste (Abdul, 2010). The amount of garbage in the refuse of an

individual home can be reduced by garbage grinders, or garbage disposals. Ground garbage puts an extra load on sewerage systems, but this can usually be accommodated. Many communities now conduct source separation and recycling programs, in which homeowners and businesses separate recyclable materials from garbage and place them in separate containers for collection (Sinha, 2014). In addition, some communities have drop-off centre.

2.2.4 Landfill

Land disposal is the most common management strategy for Household and municipal solid waste (Memon, 2010).Refuse can be safely deposited in a sanitary landfill, a disposal site that is carefully selected, designed, constructed, and operated to protect the environment and public health (One of the most important factors relating to landfilling is that the buried waste never comes in contact with surface water or groundwater. Engineering design requirements include a minimum distance between the bottom of the landfill and the seasonally high groundwater table. Most new landfills are required to have an impermeable liner or barrier at the bottom, as well as a system of groundwater-monitoring wells. Completed landfill sections must be capped with an impermeable cover to keep precipitation or surface runoff away from the buried waste. Bottom and cap liners may be made of flexible plastic membranes, layers of clay soil, or a combination of both.

Landfills were developed to replace the practice of open dumping and to reduce the reliance on waste incineration. In many countries waste was divided into two categories, hazardous and non-hazardous, and separate regulations were developed for their disposal (Memon, 2010). Landfills were designed and operated in a manner that minimized risks to public health and the environment.

2.2.5 Separation

Before any material can be recycled, it must be separated from the raw waste and sorted. Separation can be accomplished at the source of the waste or at a central processing facility. Source separation, also called curb side separation, is done by individual citizens who collect newspapers, bottles, cans, and garbage separately and place them at the curb for collection (Saat, 2013). Many communities allow commingling of non-paper recyclables (glass, metal, and plastic). In either case, municipal collection of source-separated refuse is more expensive than ordinary refuse collection.

Instead of source separation, recyclable materials can be separated from garbage at centralized mechanical processing plants. Experience has shown that the quality of recyclables recovered from such facilities is lowered by contamination with moist garbage and broken glass (Nathanson, 2015). The best practice, as now recognized, is to have citizens separate refuse into a limited number of categories, including newspaper; magazines and other wastepaper; commingled metals, glass, and plastics; and garbage and other non-recyclables. The newspaper, other paper wastes, and commingled recyclables are collected separately from the other refuse and are processed at a centralized material recycling facility.

At a typical Material Recovery Facility (MRF), commingled recyclables are loaded onto a conveyor. Steel cans are removed by an electromagnetic separator, and the remaining material passes over a vibrating screen in order to remove broken glass (Sinha, 2014). Next, the conveyor passes through an air classifier, which separates aluminium and plastic containers from heavier glass containers. Glass is manually

sorted by colour, and aluminium cans are separated from plastics by an eddy-current separator, which repels the aluminium from the conveyor belt.

2.3 Amount of Household Waste Generated and its Influence on Solid Waste Management

The increase in household and municipal solid waste (MSW) generation can be attributed to several factors, namely the exponential human population boom, rapid development, increased consumer buying power and a plethora of other causes (Bruyoll, 2001). This situation is particularly acute in developing countries such as Uganda, where the fast pace of development has brought along rapid urbanization and increased rural-urban migration patterns.

It has been estimated by Mansor (2009) that MSW generation in Kuala Lumpur increased from 3070 tons per day in 2000 to 5080 tons in 2005. Murad et al. (2007) the year 2000, Kuala Lumpur's actual MSW generation stood much higher at 5000 tons per day. On a smaller scale, the national average for per capita waste generation in Malaysia was 0.68 kg/capita/day in 2001 (UNEP 2010). That figure has increased in 2006 to roughly 0.85 kg/capita/day resulting in a total of 7.34 million tons of MSW generated in the nation as a whole for that year (Siraj 2006). So far, other studies have been unable to come up with a definitive and consistent figure for waste generation in any given area that is under study. This is primarily due to several factors such as the varying definition of waste from area to area, the method of analysis and problems during measurement (Watanabe 2010).

2.4 Household Size Influence on Solid Waste Management and Disposal

The waste generating potential of households is dependent on several factors. The most important is household size, i.e. the number of persons present in the household. This

influences the rate of generation of several categories of waste, including packaging wastes, kitchen waste, plastic waste and combustible waste. Its effect is the same in each case; as the number of persons in the household increased, so the amount of such waste produced by the household increased (Alan, 2008). Logically, large households would be expected to generate much more solid waste than small households. This is because they consume more in terms of food and other items (Naing, 2009).

The household size and income are the most significant factors that affect the quantity of solid waste generated from household consumption and as such, a study on the relationship among these is vital in the decision making on waste management strategies (Seng, 2014). Concerns about the environmental impacts of consumption and production, such as loss of natural resources, climate change and other environmental damage caused by emissions and waste, have been addressed at the global level by the United Nations since the 1992 Earth Summit, in Rio de Janeiro. The World Summit on Sustainable Development held in Johannesburg 2002, called for the development of a decade framework of programs to promote sustainable consumption and production patterns (UNEP, 2003). This challenging task is coordinated under the UN-led Marrakech process.

2.5 Level of Household Knowledge Influences Solid Waste Management

Ling & Isaac (1996) conducted a research in China and they claimed that a national awareness relating to environmental protection needs to be stimulated by education. In many circumstances, level of education can determine how much salary or income a person is entitles to in a given job. Evolving from this, income will determine what individual buys, when he/she buys, where he/she buys and how frequent he/she buys the products. The individual normally stays in a flat or a house and the size of the

household is associated to the population of a country. As the household size increases, the country's population will directly multiplies.

Various authors have shown that the amount of waste generated by a country is proportional to its population and the mean living standards of the people (Medina, 1997) relate to income levels of people hence individual household's waste generation are correlated. As a city grows in population and physical size, so does its land use become more complex (Gobo, 2004). Such as, with the cultivation of land came the negative effects of extensive deforestation (Haden, Oyler, & Humphreys, 2009). On the other hand, extra land can also be used as storage or warehouse to store unused or waste products.

2.6 influence of Education on Household Solid Waste Management

Education is an important factor in the disposal of solid waste at the household level. A person who has had some knowledge regarding the importance of natural environment will not throw away garbage in an unsustainable manner. The most important landmark for environmental education at an international level was without a doubt the International Conference on Environmental Education organized by UNESCO and UNEP at Tbilisi in former USSR in 1977. The goals of environmental education were defined as creating environmental awareness; impart general knowledge for a basic understanding of environment, acquiring environmentally friendly attitudes and values and to generate new patterns of behavior towards environment.

The more recently held United Nations Conference on Environment and Development in Rio de Janeiro, Brazil in 1992, popularly known as the Earth Summit, adopted an action plan for Sustainable Development, Agenda 21. Chapter 36 which is devoted to education states that "Education is critical for promoting sustainable development and

improving the capacity of people to address environment and development issues "Education without communication is simply impossible. Communication in turn will only work with an appropriate medium. In the case of environmental education at educational establishments classes at school, college or universities level serve as this medium.

2.7 Household Income Influence on Solid Waste Management

One of the most influential factors thought to play a major role in determining waste generation rates is the affluence or income level of a particular household or person. A positive correlation between affluence and waste generation rate means that the more affluent a person is, the more waste he will produce due to his possession of expendable income that is used to buy and consume more products. Low income earner will most likely buy necessity items in contrast to a higher income earner who will probably buy luxury and possibly unnecessary items.

There is a positive relation between income and waste generation (Nilanthi et al., 2006). On the other hand, a negative correlation could denote that the more money a person earns, then they are more apt to eat out and be more aware of environmental concerns, thus producing less waste per capita. Hitherto, prior researchers have found conflicting indications showing the correlation between waste generation rates and affluence. Jenkins Journal of Asian Scientific Research (2003), found there is a direct positive correlation. The relationship between affluence and municipal waste generation is very close. American Association of Advanced Science (AAAS) (2000) found that a 40 percent increase in the growth domestic product (GDP) of countries belonging to Organization for Economic Cooperation and Development (OECD) since 1980 has been accompanied by the same percentage increase in municipal waste generated.

Even more troubling is the fact that the OECD predicts there will be a further 70 to 100 percent increase in GDP in its region by 2020. Unless the link between waste generation and GDP is severed totally, there could be a corresponding and commensurate increase in waste arising in these countries. This is further exacerbated by certain social trends, such as the increase in single person households due to higher divorce rates, lesser desire to raise a family and the aging population, particularly in the developed world. As the developing world industrializes and grows more affluent, it too can expect an increase in waste generation, unless an absolute decoupling of waste generation from GDP occurs. Other factors thought to have an influence on the rate of MSW generation are spatial in nature, such as neighbourhood area and housing type. Preceding researchers have found that the number of persons per household has a negative effect on amount of waste generated (Jenkins 2003).

2.8 Household Solid Waste Collection and Disposal Methods Influence on Solid Waste Management

Municipal solid waste collection schemes of cities in the developing world generally serve only a limited part of the urban population. The people remaining without waste collection services are usually the low-income population living in periphery-urban areas. One of the main reasons is the lack of financial resources to cope with the increasing amount of generated waste produced by the rapid growing cities (Memon, 2010). Always inadequate fees charged and insufficient funds from a central municipal budget cannot finance adequate levels of service. However, not only financial problems affect the availability or sustainability of a waste collection service.

Operational inefficiencies of solid waste services operated by municipalities can be due to inefficient institutional structures, inefficient organizational procedures, or

deficient management capacity of the institutions involved as well as the use of inappropriate technologies. Adeyemo (2013) with regard to the technical system, often the "conventional" collection approach, as developed and used in the industrialized countries, is applied in developing countries. The wastes collection trucks are sometimes sophisticated, expensive and difficult to operate and maintain, thereby often inadequate for the conditions in developing countries. After a short time of operation usually only a small part of the vehicle fleet remains in operation. In many cities or municipalities there is currently great interest in involving private companies in solid waste management. Sometimes this is driven by the failures of municipal systems to provide adequate services, and sometimes by pressure from national governments and international agencies.

Arrangements with private companies have not all been successful, and as a result some opposition to private sector involvement is now in evidence. An important factor in the success private sector participation is the ability of the client or grantor - usually a municipal Ministration to write and enforce an effective contract. Many municipalities do not know what has been costing them to provide a service, so they cannot judge if bids from the private sector reasonable. The contract document must be well written to describe in quantitative terms services are requited and to specify penalties and other sanctions that will be applied in case of shortcomings.

Monitoring and enforcement should be effective. It is also important that the rights of both parties are upheld by the courts. Three key components of successful arrangements are competition, transparency and accountability (Adeyemo, 2013). As an alternative to large (often international) companies that can provide most or all of the solid waste

services in a city, micro enterprises or small enterprises or Community-based Organizations (CBO) can be involved for services at the community level (households or the small city administrative zones). They often use simple equipment and labor-intensive methods, and therefore can collect waste in places where the conventional trucks of large companies cannot enter.

The MSEs may be started as a business to create income and employment, or they may be initiated by community members who wish to improve the immediate environment of their homes. A recusing problem with collection schemes that operate at the community level is that these systems generally collect and transport the waste a relatively short distance up to a transfer point, from where the waste should be collected by another organization - often a municipality. Problems of co-ordination and payment often result in the waste being left at transfer points for a long time creating a hygienic unsatisfactory condition. Another approach is to recycle as much of the waste locally (decentralized) so that there is very little need for on-going transport of collected waste (Adeyemo, 2013).

Disposal of solid wastes on land is by far the most common method in Uganda and probably accounts for more than 85% percent of the nation's municipal refuse (Huda, 2008). Incineration accounts for most of the remainder, whereas composting of solid wastes accounts for only an insignificant amount. Selecting a disposal method depends almost entirely on costs, which in turn are likely to reflect local circumstances (Goldman, 2005). The most common solid waste disposal methods include the following: landfill, incinerators, composting, and backyard burning of solid waste as discussed in section 2.8.1, 2.8.2, 2.8.3, and 2.8.4.

2.8.1 Landfill

Sanitary landfill is the cheapest satisfactory means of disposal, but only if suitable land is within economic range of the source of the wastes; typically, collection and transportation account for 75 percent of the total cost of solid waste management (Matsui, 2010). In a modern landfill, refuse is spread in thin layers, each of which is compacted by a bulldozer before the next is spread. When about 3m (about 10 ft) of refuse has been laid down, it is covered by a thin layer of clean earth, which also is compacted (Sinha, 2014). Pollution of surface and groundwater is minimized by lining and contouring the fill, compacting and planting the cover, selecting proper soil, diverting upland drainage, and placing wastes in sites not subject to flooding or high groundwater levels. Gases are generated in landfills through anaerobic decomposition of organic solid waste. If a significant amount of methane is present, it may be explosive; proper venting eliminates this problem.

2.8.2 Incinerators

In incinerators of conventional design, refuse is burned on moving grates in refractory-lined chambers; combustible gases and the solids they carry are burned in secondary chambers. Combustion is 85 to 90 percent complete for the combustible materials (Kreith, 2002). In addition to heat, the Products of incineration include the normal primary products of combustion—carbon dioxide and water as well as oxides of sulfur and nitrogen and other gaseous pollutants; nongaseous Products are fly ash and unburned solid residue. Emissions of fly ash and other particles are often stored by wet scrubbers, electrostatic precipitators, and bag filters.

2.8.3 Composting

Composting operations of solid wastes include preparing refuse and degrading organic matter by aerobic microorganisms. Refuse is pre-sorted, to remove materials that might have salvage value or cannot be composted, and is ground up to improve the efficiency of the decomposition process. The refuse is placed in long piles on the ground or deposited in mechanical systems, where it is degraded biologically to humus with total nitrogen, phosphorus, and potassium content of 1 to 3 percent, depending on the material being composted (Huda, 2008). After about three weeks, the product is ready for curing, blending with additives, bagging, and marketing. The use of open dumps for MSW in Kenya makes environmental pollution highly probable. Both surface water and groundwater remain vulnerable to MSW pollution because disposal dumps were chosen for convenience rather than based on environmental safety considerations.

The extent of groundwater pollution in and around the dumpsites still is unknown because adequate pollution assessment studies have not been done conducted on the groundwater. Based on the degree of surface water pollution, it is possible to identify when pollution is taking place in the groundwater. An investigation into the extent of pollution of groundwater urgently needs to be carried out within the vicinities of the MSW dumpsites. When solid waste is disposed into land sites, it decomposes and generates methane. Most of this methane is released into the air, despite the presence of methane capturing systems at landfills, meaning additional local and national environmental issues arise. Global methane emissions from landfill sites are estimated to be between 30 and 70 million tons each year, according to Green House Gas (Goldman, 2005). Improper storage can also cause an increased risk of fire and explosion if improper methods are used. To be successful, a large-scale composting program must be located carefully and odors must be controlled, because people do not

want to live near a giant compost pile or plant. Composting programs must also exclude toxic materials that can contaminate the compost and make it unsafe for fertilizing crops and lawns (Miller, 2007).

2.8.4 Backyard Burning of Household Solid Wastes

Backyard burning refers to the burning of household trash by residents on their own property (Matsui, 2010). Trash typically burned can include paper, cardboard, food scraps, plastics, and yard trimmings-essentially any materials that would otherwise be recycled or sent to a landfill. Burning usually occurs in a burn barrel, homemade burn box, wood stove, outdoor boiler, or open pit. Air emissions from backyard burning are released directly to the atmosphere without being treated or filtered. People burn trash for various reasons, either because it is easier than hauling it to the local disposal site or to avoid paying for regular waste collection service. In the past, backyard burning may have been the only way that many rural communities could get rid of their waste (Vega, 2008). Today, however, almost everyone can obtain reasonably priced waste collection or take their waste to conveniently located drop-off centres as alternatives to backyard burning.

Many states, and local governments prohibit or restrict backyard burning of waste. Even where restrictions exist, however, many people continue to burn. Most people who burn their waste do not realize how harmful this practice is to their health and to the environment. Current research indicates that backyard burning is far more harmful to our health than previously thought. It can increase the risk of heart disease; aggravate respiratory ailments such as asthma and emphysema, and cause rashes, nausea, or headaches (Karbassi, el al. 2012). Backyard burning also produces harmful quantities

of dioxins, a group of highly toxic chemicals that settle on crops and in our waterways where they eventually wind up in our food and affect our health.

2.9 Research Gap

Kothari (2004) asserts that inadequate knowledge about solid waste leads to improper solid waste management practices. To ensure effective solid waste management practices, it is critical to set aside adequate educational resources at municipal level to institute proper public education on solid waste management. The required commitment to educate the public should be considered within the overall costs of delivering the intended outcomes and not as additional costs. However, the author did not document how people's knowledge at household level influence solid waste management in urban estates hence, creating a research gap that this study aims to fulfil.

Palmer (2009) claims that income affect waste management at the municipal levels. Municipalities with big financial power improves the standard of waste management. It is not clear whether the financial power of a municipality can as well bring about proper management practice at the household levels. Private companies are mostly considered very important especially in achieving sustainable waste management, from the collection to financial burdens (World Bank, 2000). Cannella (2009) points out that proper solid waste management practices do not only concern money but the author did not bring out how income level influences solid waste management in urban households, and this create a gap that this study will want to find out.

Every household in an urban setting generates solid wastes daily and has its own way of treating them based on the volume and the method of disposal available. Others generate more waste and thrown in open places. Others manage to deliver the waste to

site like landfill for proper treatment (Saleemi, 2010). However, the author failed to link how amount of waste generated at household influence solid waste management in urban areas. Therefore, this created a research gap that this study focused to fill.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter describes the research methodology, chiefly: research design, study location, target population, sampling procedure and sample size, research instruments, validity and reliability of the instruments, data collection procedure and data analysis procedure.

3.2 Research Design

A descriptive survey was used in the description of the current status of the variables in the study. The study employed descriptive because it reports summary data and correlation between variables establishing opinions and knowledge about the household characteristics influencing the disposal of household waste in Mukono Township. The research design constitutes the blue print for the collection, measurement and analysis of data (Kothari, 2003).

3.3 Study Location

Mukono Town is within Mukono district 25km from the centre of Kampala city in the Eastern part of the city. The inhabitants practice business, agriculture and production industry. The different subsections of the town are shown on the map of Mukono in Appendix H on page 81 of this thesis.

3.4 Target Population

The target population was Mukono Township households head affected by unsustainable disposal of solid waste. Key informants facilitated access to data relating to the volume and type of solid waste generated and the available means of disposal at household levels. Key informant household heads were studied. In this particular study,

target population was 1100 household heads. This population for Mukono Township was derived from the Uganda Population and Housing Census (2002).

3.5 Sampling Procedure

The study used a stratified random sampling method which aims to get equal representation of different sectors of the study population. Simple random sampling was used to select the sample size because it reduced costs and time in interviewing the whole population.

3.6 Sample Size

Sample size in this study was a representation of all household heads from Mukono Township who faced problems with household solid waste management. The accuracy of the results dictates the level of generalization to be applied so as to demonstrate the whole target population (Kothari, 2014). For this particular study the sample size was mainly based on household heads since they were the best suited population. A sample size of 285 household heads (from a target population of 1100) was calculated using the Krejcie and Morgan (1970) formula stated below:

$$n = \frac{X^2 \times N \times P \times (1-P)}{(ME^2 \times (N-1)) + (X^2 \times P \times (1-P))}$$

Where:

n = Sample size

X^2 =Chi-square for the specified confidence level at 1 degree of freedom

N = Population size

P =Population proportion (.50 in this table)

ME=Desired Margin of Error (expressed as a proportion)

3.7 Data Collection Tools

Questionnaires were used as the research data collection tool in this study. The use of questionnaires was selected because it was appropriate when dealing with a large population of respondents. Questionnaires promote a quick way of deriving data in a short time span.

Structured and unstructured interviews were employed in order to get more extensive responses from the sample chosen. The structured questions ensured uniformity and they were easy to process. The structured questionnaires incorporated a list of the alternatives which allowed the respondents to choose the suitable answer that described their current situation well.

3.8 Actual Data Collection Procedure

The research questionnaire was structured as per the research questions which were refined before being administered to the respondents. A pilot test was carried out to identify the weaknesses in design. Five respondents were pilot tested to determine the accuracy of the questionnaires. The study assumed a rule of thumb that 5% of the sample size constitutes a pilot test (Cooper & Schindler, 2010). In this study data was collected on the following: gender distribution, age structure, education level, household income, solid waste generated, and on waste disposal methods.

3.9 Data Analysis

Primary data collected in this study was analysed using a Statistical Package for the Social Sciences (SPSS version 25). Data was analysed using both descriptive and inferential statistics. The descriptive statistics included frequency distribution tables, and the inferential statistics included regression analysis using simple and multiple

linear regression to establish the influence between the household characteristics and solid waste management.

This model is used in modelling the relationship between a dependent variable and two or more independent variables by fitting a linear equation to observed data. The model for multiple linear regression is thus defined as:

$$Y = b_0 + b_1 x_1 + b_2 x_2 + ... + b_n x_n + \varepsilon$$

From this equation it is described how Y changes with the independent variables x_n.

Where:

Y is the dependent variable solid waste management

b is the coefficient's

χ the independent variables.

n number of observations

ε error term which is the model deviation.

The summary of the analytical procedures are shown in Table 3.2.

3.10 Reliability of the Research Instruments

To ascertain reliability of the research instruments Cronbach's alpha was used. Cronbach's alpha is used to measure the internal consistent reliability of the instrument. Using this test, coefficients lie between 0-1, and different researchers argue that values ranging between 0.70-0.95 generally indicate enough internal consistency reliability.

3.10.1 Reliability of the Instrument

Cronbach's alpha coefficient was used to test the reliability of the responses and the results were as shown in Table 3.1.

Table 3.1: Reliability Statistics for Variables

Pilot Study			**Final Study**		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	No of Items	Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	No of Items
.711	**.754**	**16**	**.789**	**.795**	**26**

From Table 3.1, the items used in the study achieved high reliability coefficient both from pilot tests of 0.754 and in final study 0.795 which is ≥ 0.70. This is enough internal consistency reliability of the instrument demonstrated. (Zalma, Safiah, Ajau & Anuar, 2013).

3.11 Validity of the Research Instrument

According to Joppe (2000), the validity of findings is the degree to which results obtained from the analysis of data represents the phenomenon under study. By including questions on the different variables, the researcher ensured that this quality was achieved. Questions were formulated in a simple language for clarity and ease of understanding for the respondents. Conducting a pre-test ahead of the research also heightened the probability of achieving this quality.

3.12 Ethical Consideration

The researcher fully adhered to the necessary ethical limits of confidentiality and anonymity disclosing full information to respondents, ensuring the privacy of participants and informed consent for giving information voluntarily and not out of

coercion**.** In addition, the researcher obtained a letter from the University requesting for a permission to carry out the study.

Table 3.2: Summary of Data Analysis Procedure

Study Objectives	Independent Variables Involved	Dependent Variables Involved	Statistical Methods to be used
(i) To assess the influence of household head formal educational level on household solid waste management practices at household level.	Education level	Solid waste management	Descriptive statistics, linear regression analysis
(ii) To assess the influence of household head income level on household solid waste management practices at household level	Income level	Solid waste management	Descriptive statistics, linear regression analysis.
(iii)To determine the influence of household head knowledge in handling solid waste on solid waste management practices	Knowledge on waste	Solid waste management	Descriptive statistics, linear regression analysis.
(iv)To examine the influence of the amount of waste generated by the household on solid waste management practices at household level	Amount of waste generated	Solid waste management	Descriptive statistics, linear regression.
(v) To investigate how household size (number of people) influence solid waste management.	Household size	Solid waste management	Descriptive statistics, Multiple regression
(vi)To determine the waste collection methods used at household level and how they influence solid waste management	Waste collection method		

CHAPTER FOUR

DATA ANALYSIS AND FINDINGS

4.1 Introduction

This section presents the results and findings of this study and is divided in the following sub sections: characteristics of the household heads, solid waste characteristics in Mukono, Solid waste management practices at household level, influence of household head formal education level on solid waste management, influence of household head income on solid waste management, influence of the amount of solid waste generated at household level on solid waste management, influence of household size on solid waste management, and influence of waste collection method on solid waste management.

4.2 Characteristics of the Household Heads

The characteristics of household heads under this study included sex, age, and education level. This gave a view of Mukono residents' area of study.

4.2.1 Sex of the Household Heads

The sex of the household heads were noted and the data was analysed and presented in Table 4.1.

Table 4.1: Sex of Household Heads

Gender	Frequency	Percent
Female	136	55.5
Male	109	44.5
Total	**245**	**100**

The results shows that the majority (55.5 %) of the population of Mukono town consists of females, while the males form 44.5%. the results compare well with the national

average where the females were found to be 50.78 % of the total population of the country (UBOS, 2017).

4.2.2 Age Structure of the Household Heads

The distribution of the respondents in terms of age group is illustrated in Table 4.2

Table 4.2: Age Structure of the Households

Age Categories in Years	Frequency	Percent
25 – 35	105	42.9
36 – 45	83	33.9
46 – 55	43	17.6
Above 56	14	5.7
Total	**245**	**100.0**

According to Table 4.2, the majority of the respondents were in the age bracket of 25 - 35 years. Of the remaining, 33.9% were aged 36 - 45 years, 17.6% were aged 46 - 55 years, and the remaining 5.7% were aged 56 years and above.

4.2.3 Number Years Lived in Mukono

Table 4.3: Number of Years Lived in Mukono

Years Lived in Mukono Town	Frequency	Percent
1 to 3	19	7.8
4 to 7	59	24.1
8 to 11	65	26.5
11 to 14	24	9.8
15 to 18	22	9.0
Above 19	56	22.9
Total	**245**	**100.0**

Mean 12.1±.468, median 10, mode 10, standard deviation 7.3, min 1, max 40.

4.3 Characteristics of Solid Waste in Mukono Town

The characteristics of the solid wastes generated by households in Mukono town are discussed under the following sub-headings: types of solid wastes and their relative amounts and solid wastes disposal methods.

4.3.1 Types and Relative Amounts of Solid Wastes Generated by Households in Mukono

The respondents were also asked to rate the most abundant solid waste generated at their households. A rating scale of 1-5 was used where 1 was very low and 5 was very high. Table 4.3 illustrates the findings.

Table 4.3: Types of Solid Waste Generated in Mukono Township

Type of Waste		VL	L	M	H	VH	Means
	F	-	2	16	41	186	
Kitchen wastes	%	-	.8	6.5	16.7	75.9	4.68
	F	24	24	38	124	35	
Garden wastes	%	9.8	9.8	15.5	50.6	14.3	3.50
	F	17	73	87	37	31	
Plastic	%	6.9	29.8	35.5	15.1	12.7	2.97
	F	19	51	140	28	7	
Wood	%	7.8	20.8	57.1	11.4	2.9	2.81
	F	3	32	63	79	68	
Paper	%	1.2	13.1	25.7	32.2	27.8	3.72
	F	150	85	9	1	0	
Glass	%	61.2	34.7	3.7	.4	0	1.43
	F	197	43	4	1	0	
Scrap metals	%	80.4	17.6	1.6	.4	0	1.22
Weighted Means							**3.30**

F=Frequency %=Percent

From the summary in Table 4.3, the researcher sought to know among these wastes; kitchen, garden, plastic, wood, paper, glass, and scrap metal which one was highly and lowly generated in Mukono Township. Kitchen waste had a mean of 4.68 showing that the respondents generated very high amounts of this type of waste. On the other hand, finding on scrap metal waste had a mean of 1.22, meaning the waste was generated in very low amounts. From these summaries, kitchen wastes were the most highly generated waste types, compared to the other wastes generated with scrap metals being the least generated waste in this town.

4.3.2 Solid Waste Disposal Methods in Mukono

In this study the researcher was determined to know methods used in disposing of solid waste in the respondent's household and the results were as in the Table 4.4.

Table 4.4: Methods of Solid Waste Disposal

Method of Solid Waste Disposal	Frequency	Percent
Open dumping	66	26.9
Landfill	63	25.7
Burning	56	22.9
Composting	43	17.6
Burying in the soil	17	6.9
Total	**245**	**100**

From the result in Table 4.4, it is shown that 26.9% of the respondents used open dumping to dispose their wastes, while 25.7% of respondents used landfill in disposing their solid waste and 22.9% of respondents disposed their solid waste through burning, 6.9% of respondents disposed their solid waste by burying in the soil, 17.6% used composting method for disposing waste. From this analysis, it can be clearly seen that

majority of the household heads use open dumping as a method of disposing their household solid waste.

4.4 Solid Waste Management Practices in Mukono Households

The dependent variable for this study was the level of solid waste management practices at household level in Mukono town. The variable was operationalized as an index that consisted of the following activities or practices undertaken at the household: (i) separation of waste, (ii) recycling of wastes, (iii) waste reduction, (iv) coordination of wastes collection, and (v) storage.

The researcher sought to find out the level of agreement with a set of statements on practices undertaken about solid waste management at household level in Mukono. A 5-point scale semantic differential scale was used to gauge the level of household heads activities, where 1 indicated very low level and 5 indicated very high level. The responses were then added together to create an index of solid waste management practices at the household level and a grand mean was then calculated, which was used in subsequent analysis.

4.4.1 Separation of Wastes at household level in Mukono Township

Informants were to rate their level of waste separation of various solid wastes as a way of solid management in Mukono township and the results were as shown in Table 4.5.

Table 4.5: Separation of Wastes in Mukono Township

Solid Waste		VL	L	M	H	VH	Weighted Means
	F	33	35	66	93	18	
Organic waste	%	13.5	14.3	26.9	38.0	7.3	3.11
	F	42	72	67	42	22	
Plastic waste	%	17.1	29.4	27.3	17.1	9.0	2.71
	F	50	73	61	34	27	
Metals waste	%	20.4	29.8	24.9	13.9	11.0	2.65
	F	57	73	46	47	22	
Glass	%	23.3	29.8	18.8	19.2	9.0	2.61
Electronic waste	F	58	93	55	30	9	
(e-waste)	%	23.7	38.0	22.4	12.2	3.7	2.34
	F	47	112	58	24	4	
Toxic waste	%	19.2	45.7	23.7	9.8	1.6	2.29
	F	76	85	48	28	8	
Hazardous chemical	%	31.0	34.7	19.6	11.4	3.3	2.21
Weighted Means							**2.56**

F= Frequency % = Percent

From Table 4.5, shows the results on people's separation of solid waste. The waste were separated in to organic, plastic, glass, metal, electronic, toxic, and hazardous chemical wastes. In this town people had different levels of separation of solid waste. The statement on organic waste had a weighted mean of 3.11, which indicated that the respondents moderately separated this waste. On the other hand, findings on hazardous chemical had a weighted mean of 2.21, meaning the respondent's level of separation of this waste was low. This shows the separation of organic solid wastes was higher compared to the other wastes.

4.4.2 Recycling of Wastes in Mukono Township

Informants were also asked to rate their level of recycling of solid waste and the findings were as shown in Table 4.6.

Table 4.6: Recycling of waste in Mukono Township

Statements		**VL**	**L**	**M**	**H**	**VH**	**Weighted Means**
	F	53	71	66	44	11	
Burning and ash use	%	21.6	29.0	26.9	18.0	4.5	2.55
	F	37	87	84	33	4	
Use ash in composting	%	15.1	35.5	34.3	13.5	1.6	2.51
	F	50	92	67	30	6	
Composting	%	20.4	37.6	27.3	12.2	2.4	2.39
Weighted Means							**2.48**

F=Frequency %=Percent

Table 4.6 shows the extent of respondents' level of burning and ash use, using ash in composting and composting as methods of solid waste management. Responses on burning and ash use statement had a weighted mean of 2.55, indicating moderate level on people's knowledge on waste management while composting had 2.39, meaning low. This clearly indicated that people's recycling of solid waste in Mukono Township was moderate on burning and ash use compared to others with composting being low.

4.5 Influence of Education Level on Solid Waste Management

The first objective of this study was to assess the influence of household head formal educational level on solid waste management in Mukono township.

4.5.1 Educational level of the Household Heads

The level of education of the household heads was determined by asking the respondents to state the number of years they had attended the formal education system. The responses were then categorised into four groups or levels that included: no formal schooling (0 years), primary (1-8 years), secondary (9-13) years, and tertiary (above 14 years). The descriptive statistics on the levels of education attained by respondents were as shown in Table 4.7.

Table 4.7: Level of Formal Education Attained by Respondents

Formal Education Levels	Frequency	Percent
No Formal Schooling	38	15.5
Primary (1 to 8 years)	39	15.9
Secondary (9 to 13 years)	102	41.6
Tertiary (above 14 years)	66	26.9
Total	**245**	**100.0**

From Table 4.7, 15.5% of the respondents had not attained any level of education, 15.9% had attained primary level of education, 41.6% attained secondary level of education, and 26.9% had attained a tertiary level. From the study, majority of the respondents attained secondary school level.

4.5.2 Assessment of the Influence of Education Level on Solid Waste Management

The influence of education level on the solid waste management practices was determined using the bivariate linear regression analysis. The independent variable was

the education level, while the index of household solid waste management was the dependent variable. The results of the regression model are presented in Table 4.8.

Table 4.8: Regression Model Summary for education Level and Solid Waste Management

R	***R* Square**	**Adjusted *R* Square**	**Std. Error of the Estimate**
.321[a]	.623	.519	2.318

a. Predictors: (Constant), Household head education level
b. Dependent: Solid waste management

From this model summary, the coefficient of determination, R^2 = 0.623, indicates that 62.3% of the variation in solid waste management is influenced by household heads education level. The regression coefficients of the model showing the *beta, t* statistics and the tolerance level are shown in Table 4.9.

Table 4.9: Coefficients of Variations Showing Influence of Education Level on Solid Waste Management

	Unstandardized Coefficients		**Standardized Coefficients**		
	B	**Std. Error**	***Beta***	***t***	***p***
(Constant)	4.402	.399		8.035	.001
Education Level	2.016	.146	.251	1.038	.001

a. Dependent Variable: Solid waste management

From Table 4.9 above, it shows that the parameters are statistically significantly (p<.001). This clearly indicates that education level of household heads significantly influenced (β= .251, t=1.038 p<.001) solid waste management practices at the household level in Mukono township. It was concluded that household heads that had high educational level tended to have high levels of solid waste management practices.

4.6 Influence of Household Income Level on Solid Waste Management Practices

The second objective of this study was to assess the influence of household head income level on solid waste management practices.

4.6.1 Household Monthly Income

The household head monthly income was operationalized as the income the household earned per month in Uganda shillings. The respondent's earnings were categorized into four groups to signify different levels of earning, which included: less than 300,000; 300,001-600,000; 600,001-900,000; above 900,001 UGX. The frequency distribution of the levels of household earning are shown in Table 4.10.

Table 4.10: Categories of Household Income Levels

Household Level of Income in Ugandan Shilling (UGX)	**Frequency**	**Percent**
Less than UGX. 300,000	61	24.9
UGX 300,001 - 600,000	60	24.5
UGX 600,001 - 900,000	69	28.2
More than UGX 900,001	55	22.4
Total	**245**	**100.0**

Table 4.10 shows that 24.9% of respondents in the town had income of less than UGX. 300,000, 24.5% of respondents in the town had income of between UGX. 300,000 - 600,000 and 28.2% of respondents in the town had income between UGX. 600,001 - 900,000 while 22.4% of respondents in the town had income of more than UGX. 900,000. From this statistics, majority of the respondent have monthly income between UGX. 600,000 - 900,000.

4.6.2 Assessment of the Influence of Household Income on Solid Waste Management Practices

The influence of household income levels on the household level of solid waste management was determined by use of linear regression analysis. The dependent variable was the index of solid waste management at household level and the independent variable was the level of household income. The results of the regression model are presented in Table 4.11.

Table 4.11: Regression Model Summary for Household Income and Solid Waste Management

Model	*R*	*R* Square	Adjusted *R* Square	Std. Error of the Estimate
1	.501[a]	.517	.321	1.201

a. Predictors: (Constant), Household income level
b. Dependent: Solid waste management

From findings shown in Table 4.11, the R square value of 0.517 indicates that 51.7% of variance in solid waste management (dependent variable) can be predicted from the independent variable. Table 4.12 shows coefficients of variations of the model, the *t* value and *beta*.

Table 4.12: Coefficients of Variations Showing Influence of Income Level on Solid Waste Management

	Unstandardized Coefficients		Standardized Coefficients		
	B	*Std. Error*	*Beta*	*t*	*p*
(Constant)	.935	.474		3.248	.001
Household Income Level	.369	.202	.306	1.581	.001

a. Dependent Variable: Solid waste management

As shown in Table 4.12, it clearly states that the parameters are statistically significant ($p<.001$). The regression analysis indicates that income levels significantly influence

(β=.306, t=1.581, p< .001) the solid waste management practices in Mukono. This explains that the levels of household income influences solid waste management practices at household level in Mukono. Households with lower income have poor solid waste management practices compared to the higher income households.

4.7 Influence of Amount of Solid Waste Generated by Households on the Solid Waste Management Practices in Mukono

The third objective of this study was to determine the influence of type and amount of solid waste generated on the level of solid waste management practices in households in Mukono Town.

4.7.1 Amount of Solid Waste Generated by the Household

The amount of wastes generated by the household was determined by estimating the volume of waste generated by the household using the level of waste in kilogram per week. Findings were as shown in Table 4.13.

Table 4.13: Amount of Solid Waste Generated by the Household

Amount of Solid Waste Generated	Frequency	Percent
Below 5 kgs	127	51.9
6 - 10kgs	66	26.9
11 - 15kgs	49	20.0
More than 15 kgs	3	1.2
Total	**245**	**100.0**

From Table 4.13 it clearly shows that 51.4% of respondents generated between 0 - 5kgs of solid waste per week, 26.9% of respondents generated between 6 - 10kgs of solid wastes per week, 20.0% of respondents generated between 11 - 15kgs of solid waste per week while 1.2% of respondents generated more than 15kgs of solid waste per week, while 0.5% were not sure of the amount of solid waste they generated per week.

From this summary, majority of the respondents generated between 0 - 5kgs of solid waste per week.

4.7.2 Influence of Amount of Solid Waste Generated on the Level of Solid Waste Management at Household Level in Mukono Town

The influence amount of solid waste generated by the household on the household level of solid waste management practices was determined by use of bivariate linear regression analysis. The dependent variable was the index of solid waste management practices at household level and the independent variable was the amount of solid waste generated by the household. The results of the regression model are presented in Table 4.14.

Table 4.14: Regression Model Summary for Amount of Waste Generated and Solid Waste Management

R	*R Square*	*Adjusted R Square*	*Std. Error of the Estimate*
.516[a]	.700	.771	1.039

a. Predictors: (Constant), Amount of solid waste generated by household
b. Dependent: Solid waste management practices at household level

From findings shown in Table 4.14, the R square value of 0.51700 indicates that 70 % of variance in solid waste management (dependent variable) can be predicted from the independent variable. Table 4.15 shows coefficients of variations of the model, the *t* value and *beta*.

Table 4.15: Coefficients of Variations Showing Influence of Amount of Waste Generated on Solid Waste Management Practices

	Unstandardized Coefficients		**Standardized Coefficients**		
	B	***Std. Error***	***Beta***	***t***	***p***
(Constant)	1.0446	.355		2.946	.004
Amount of waste generated by households	.444	.047	.354	1.581	.004

a. Dependent Variable: Solid waste management practices

As shown in Table 4.15, it clearly states that the parameters are statistically significant (p<.001). The regression analysis indicates that amount of solid waste generated by households significantly influence (β=.354, t=1.581 p< .004) the solid waste management practices at household level in Mukono town. This explains that the amount of solid waste generated by households influence the solid waste management practices undertaken at household level in Mukono town. Households generating low amount of solid waste tend to undertake few or low solid waste management practices compared to households producing more solid wastes.

4.7.3. Amount of Waste Generated at the Household and Disposal Method

To determine the relationship between the amount of solid waste generated by the household and the disposal method used, a cross-tabulation between the two variables was conducted and the results are shown in Table 4.16.

Table 4.16: Cross-Tabulation between Amount of Waste and Disposal Methods

Amount of Waste	Disposal Methods Used by Households					
	Burning	Burying in the Soil	Composting	Land fill	Open Dumping	Total
0-5kgs	34	12	16	26	38	126
11-15kgs	7	1	10	20	11	49
6-10kgs	15	4	15	16	15	65
6kgs	0	0	1	0	0	1
> 15kgs	0	0	1	1	2	4
Total	**56**	**17**	**43**	**63**	**66**	**245**

Table 4.16 shows the frequency distribution of the houses, it can clearly be seen open dumping was the most used method by the households that generated the less than 5kgs of solid waste. The results are clearly demonstrated in Figure 4.1.

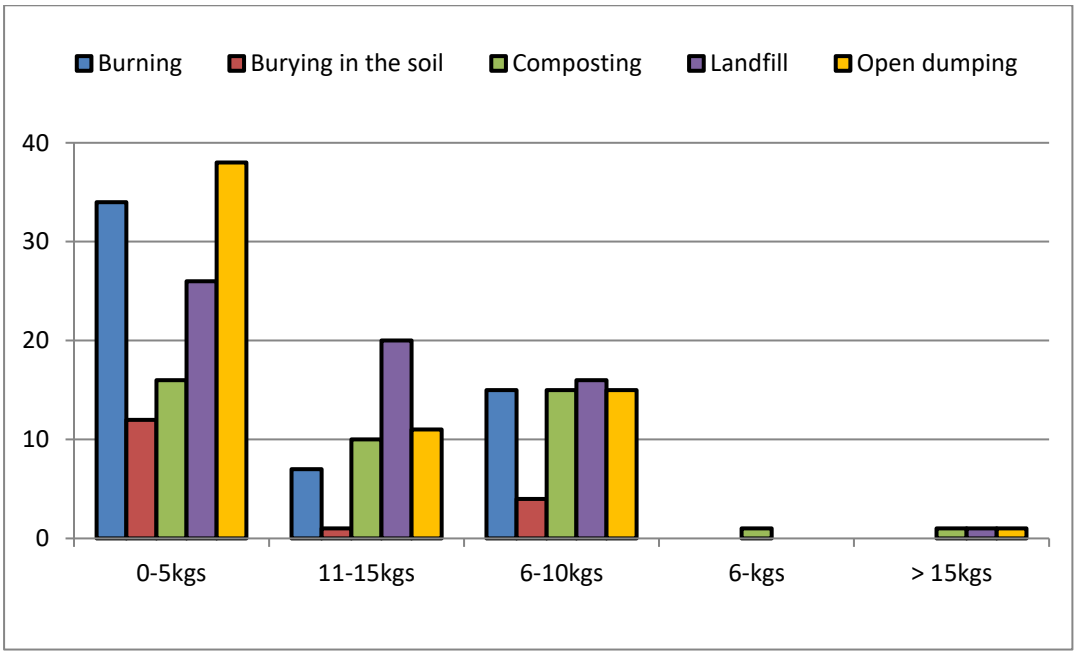


Figure 4.1: Amount of solid waste generated and method of disposal

4.8 Influence of Household Size on the Level of Solid Waste Management

The fourth objective of this study was to investigate how household size (number of people living in the household) influence solid waste management practices in Mukono.

4.8.1 Household Size in Mukono Town

The household size was determined as the number of people living in the same household and ate their food together. The household heads were asked to state their household numbers and the descriptive statistics and frequency distribution are given in Table 4.16.

Table 4.16: Descriptive Statistics and Frequency Distributions of the Household Size

Household Size	Frequency	Percent
1	1	.4
2	9	3.7
3	20	8.2
4	47	19.2
5	48	19.6
6	39	15.9
7	33	13.5
8	23	9.4
9	12	4.9
10	6	2.4
11	3	1.2
12	3	1.2
16	1	.4
Total	**245**	**100.0**

Mean 6±.14, median 5, mode 5, standard deviation 2.20, minimum 1, maximum 16

The number in the households averaged 6, with a range of 15 and a standard deviation of 2.20.

4.8.2 Influence of Household Size on the Solid Waste Management Practices

The influence of household size on the level of solid waste management practices was determined using bivariate linear regression. The household size formed the independent variable, while the level of solid waste activities at the household was the dependent variable. The results of the regression model are presented in Table 4.17.

Table 4.17: Regression Model Summary for Household Size and Solid Waste Management

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.251[a]	.663	.359	1.688

a. Predictors: (Constant), Household size

From Table 4.17, model summary *R* square value indicated that 66.3% of variance in the dependent variable; solid waste management can be predicted from the independent variable. The coefficients of variations of the regression model, the *t* value and *beta* statistics are shown in Table 4.18

Table 4.18: Coefficients of Variations Showing Influence of Household Size on Solid Waste Management

	Unstandardized Coefficients		Standardized Coefficients		
	B	***Std. Error***	***Beta***	***t***	***p***
(Constant)	.320	.302		2.066	.008
Household size	.199	.049	.261	4.048	.001

a. Dependent Variable: Solid waste management

As illustrated in Table 4.18, it shows that the parameters are statistically significant ($p<.001$). The regression analysis indicates that household size significantly influence ($\beta=.261$, $t= 4.048$, $p<.001$) the level of solid waste management activities at household level in Mukono. It therefore means that the number of people in a household do

influence the level of solid waste management activities at the household level in Mukono town.

4.9 Waste Collection Methods at Household Level and their Influence to Solid Waste Management Activities

The fifth objective of this study was to determine the waste collection methods used at household level and how they influence solid waste management practices at household level in Mukono Township.

4.9.1 Methods of Solid Waste Collection at Household Level

Respondents were asked the method they used in collecting solid waste from their house households and findings were as illustrated in Table 4.19.

Table 4.19: Solid Waste Collection Method

Solid Waste Collection Method	Frequency	Percent
Private waste collection from door to door	90	36.7
Collection from blocks of houses	86	35.1
Collection from communal bin	69	28.2

Table 4.xx shows responses on household method used in collecting their solid wastes where door-to-door had 36.7% showing that this was the method mostly used by the respondents while communal bin had 28.2%. Thus, communal bin was the least method used in collecting of wastes.

4.9.2 Influence of the Method of Solid Waste Collection on the Management of Solid Wastes in Mukono

The influence of methods of solid waste collection methods on the management of the solid wastes in Mukono was analysed using the ANOVA to compare the mean

differences. The means for the different methods were determined and the results are given in Table 4.20.

Table 4.20: Means of the Private, Block Houses and Communal Collection Methods

Collection Methods	*n*	Mean	Std. Deviation
Private waste collection from door to door	90	4.160	.256
Collection from blocks of houses	86	3.921	.580
Collection from communal bin	69	2.612	.361

The level of waste management practices for households using the private waste collection methods were higher (mean 4.16) followed by the collection from the block houses (mean 3.92) and finally the communal collection bins (mean 2.61) on a scale of 1 to 5. The *ANOVA* test for the mean comparisons is provided in Table 4.21.

Table 4.21: Mean Comparisons Using *ANOVA*

	Sum of Squares	*df*	Mean Square	*F*	*p.*
Between Groups	21.984	4	5.496	7.243	.000
Within Groups	182.114	240	.759		
Total	**204.098**	**244**			

The level of solid waste management for the private and blocks were significantly higher statistically ($F_{4, 240} = 7.24$; $p < .001$) than the communal collection methods.

This meant that the activities of private waste collection methods enhanced solid waste collection management in Mukono than the communal collection methods. This can be attributed to funding (money spent on waste activities), hiring of manpower, desire to have beautiful clean compounds

CHAPTER FIVE

DISCUSSION, CONCLUSION AND RECOMMENDATION

5.1 Introduction

The study investigated the influence of household characteristics on solid waste management in Mukono Township, Uganda. A sample size of 285 respondents was taken which comprised of only household heads where questionnaires were administered for data collection. Analyses were done in SPSS version 25 for 245 returned respondent questionnaires.

From the analysis, the findings indicated that the population of Mukono Township consisted of female as majority and male as shown in the Table 4.1. The researcher also sought to know their age distribution which was framed in terms of age brackets levels which indicated that majority of them were in the age bracket of 25 - 35 years from Table 4.2.

In regard to the respondent's education level attained, majority of them had attained secondary school level from Table 4.3. It is also notable that some of the respondents had not attained any level of education in Mukono Township. In addition to these demographic characteristics, respondents were also asked about their household income level with the researcher using different salary slabs. From the findings in Table 4.4, majority of the respondent earned a monthly income of between UGX. 600,000 - 900,000 with few earning an income of more than UGX. 900,000.

5.2 Solid Waste Management Practices at Household Level

Knowledge is seen as a key variable that affects environmental action (Dhokhikah, et al., 2015). From other studies done, it has been asserted that higher levels of environmentally relevant knowledge play an important role in modifying

environmental behavior (Oskamp, et al., 1991). Schahn and Holzer (1990) describes two definitions of knowledge in their research on recycling: abstract knowledge, which focuses on awareness of general environmental issues; and concrete knowledge which evaluates awareness of local services, for example, recycling services (Barr, & Gilg, 2005).

In this research, abstract knowledge refers to general knowledge regarding issues on solid waste management and concrete knowledge regarding specific issues specific on solid waste management in Mukono Township. Knowledge is thus a significant predictor of behavior since lack of knowledge will lead to a decline in self-efficacy, making an individual feel he/she cannot participate as they lack the knowledge required in order take part (Barr, & Gilg, 2005). Also lack of knowledge of environmental effects of littering, lack of social pressure to prevent littering, and absence of realistic penalties or consistent enforcement can contribute to an increase in public littering rates, (Al-Khatib et al., 2009).

5.3 Influence of Education Level on Solid Waste Management

Education plays a significant role to a nation and thus people are enlightened on various aspects or issues. In the area of environmental conservation, a person acquires knowledge on various aspects about wastes management through collection, transportation and disposal among other ways. For any person who has had acquired this knowledge through environmental education values the natural environment thus reduces the tendency of littering to keep the environment clean. From this study Education level influences solid waste management as illustrated in the regression model Table 4.8. However, compared to all other household characteristics under this

study, education level influences solid waste management at a moderate extent Table 4.17.

5.4 Influence of Household Income Level on Solid Waste Management

Income is an important factor considered in this study. Household income affected the amount of solid waste generated from household level consumption and impact on waste management process used to being effective and efficient. This includes waste management systems like collection, transportation, and even disposal. In a study, the researcher asserted that people remaining without waste collection services are usually the low-income population living in urban and rural areas (Zhu et al., 2008). In addition, household with low income used a range of organic waste with traditional packages for some of their meals, whereas household that had high income level consumed foods and different kinds of meat which were industrial packed which includes plastic materials. In this study the findings in the regression model Table 4.10 and Table 4.21 affirms that income level of household significantly influences solid waste management to a high extent in Table 4.17. From the literature review in a study done there is a positive relation between income and waste generation (Nilanthi et al., 2006). Thus, this study also clearly indicates that household income influences solid waste management systems.

5.5 Influence of Amount of Wastes Generated on Solid Waste Management

The researcher asked the respondent to state the most generated type of waste from their households in Mukono Township. This waste included kitchen, garden, plastic, wood, paper, glass, and scrap metal where kitchen wastes was highly generated compared with others with scrap metal least generated from Table 4.11. Different households generated different types of wastes and had different methods of management.

However, increase in household solid waste generation can be attributed to several factors, namely the household population, rapid development in the cities, increased consumer buying power among other causes (Bruyoll, 2001). In addition, the composition of these of wastes can dictate the technology used before disposing it, thus the amount and composition of wastes generated influence the process of waste management. In this study majority of the respondents generated between 0 - 5kgs of solid waste per week. In addition, the amount of wastes generated had a strong positive correlation with solid waste management Table 4.18. This clearly indicates that the amount of solid waste generated has influence on solid waste management evident from the regression model Table 4.21 at high extent Table 4.17.

5.6 Influence of Household Size on Solid Waste Management

This refers to the number of people in the household. Households with more occupants generate larger quantities of wastes. This influences the rate of generation of different types of waste, including packaging wastes, kitchen waste, plastic waste and combustible waste generated from household consumption (Seng, 2014). This implies that the outcome of big household size can lead to non-participation in solid waste management which is manifested in irresponsible and careless disposal of waste in their various compounds, public streets, highways, roads and around communal bins for residential waste. Thus, this can affect methods of waste collection and disposal which influences solid waste management. In this study household size had a strong positive correlation with solid waste management Table 4.18, and also from the regression model Table 4.14 the findings indicated that it influences solid waste management at high extent Table 4.17.

5.7 Influence of Waste Collection Methods on Solid Waste Management

Waste collection is associated with periodic collection of household solid waste. Solid waste as a general term encompasses all waste materials except atmospheric emissions, hazardous waste, and liquid waste. Solid waste is further divided into residential and commercial where residential category refers to the waste that is designated as 'garbage' a class that can be described as waste gathered by the community services. Commercial category describes wastes from industrial and agricultural customers.

Wastes collection services are done by the government through Municipals and also private sectors offer. This is majorly done in urban areas which are limited in the rural areas. However, these services are mostly done at a fee which now depends on the household income levels. In other words, people remaining without waste collection services are usually the low-income population living in periphery-urban areas. One of the main reasons is the lack of financial resources thus, increasing amount of generated waste produced by the rapid growing cities (Memon, 2010). Always inadequate fees charged and insufficient funds from a central municipal budget cannot finance adequate levels of service. However, not only financial problems affect the availability or sustainability of a waste collection service, there is also operational inefficiencies due to inefficient institutional structures, inefficient organizational procedures, or deficient management capacity of the institutions involved as well as the use of inappropriate technologies.

Other research work done earlier on solid wastes includes a study on socio-economic factors that influence household waste generation. Viewed from an economic perspective, (Seng, 2014) analyzed the household behavior on waste generation in

terms of changes in income, price of refuse service, frequency of service, site of refuse collection and packaging. In the findings it was recorded that these factors influenced waste generation. Also, in another study, households' size, cultural patterns, education and personal attitudes (Abdul & Grossmann et al., 2008) are said to influence solid waste generation as well.

However, in this study the researcher concentrated on finding out an assessment of household characteristics influencing solid wastes management in Mukono Township, Uganda. From the analysis people's knowledge on solid waste management, household income level, amount of waste generated, number of people in the household, and wastes collection system or method used do influence solid waste management.

5.8 Conclusion

The following conclusions were made from this study:

(i) The level of education of the household heads significantly influenced the level of solid waste management practices at household level in Mukono town.

(ii) The higher levels of household monthly income significantly increased the level of solid waste management activities at household level in Mukono town.

(iii) The high amount of waste generated by the households significantly increased the level of solid waste management practices at household level in Mukono town.

(iv) The higher the number of people living in a household the better was their level of solid waste management practices at household level in Mukono.

(v) Private waste collection methods enhanced the level of solid waste management practices at household level in Mukono town.

5.9 Recommendations

Based on the findings from this study the researcher made the following recommendations:

The municipal councils should provide enough land for composting and landfill projects and adequately manage the solid waste at the sites.

The government should work with the household heads in dealing with solid waste management. The partnership should be at three levels in training members of the households and in providing services such as transport that the households can pay for.

A proper solid waste management policy should be formulated and implemented by the Mukono Township. The policy should promote healthy methods of solid waste disposal such as recycling, incineration while phasing out the old methods open dumping and burning.

The results from this study are significant to the municipal council as it will provide them with knowledge of the households and the factors they need to address in dealing with the issue of waste management.

The researcher recommends this work to some non-governmental organization who would wish to step in educating the residents on waste management. This will aid them on major areas in handling the entire process.

5.10 Areas for Further Studies

This study concentrated on assessment of household characteristics influence on solid waste management, the researcher recommends that further study to be carried out is to

determine the relationship between solid waste management practices and some health indices among the residents of Mukono Township households. The current study findings will serve as pilot, baseline and springboard for the proposed larger advanced research.

The results of this proposed future research will hopefully add to the evidence and justification for implementation of the fore-mentioned recommendations.

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APPENDICES

Appendix A: Letter of Introduction

To Whom It May Concern.

Dear Sir/Madam,

This is to kindly inform you that I am a student at Africa Nazarene University pursuing a

Master's Degree in Environment and Natural Resource Management and as part of course requirements, we are expected to carry out a research project work of which I am researching on "Assessment of influence of household characteristics on waste management. A case study of Mukono Township The purpose of this letter is to request you to assist me by responding to the questionnaire and returning them to me. You are further assured that any information given will be used for the purpose of the study only and will be treated with the confidentiality required.

I look forward to your assistance and co-operation.

Yours faithfully,

Jacob Mangar Majak

Appendix B: Questionnaire

Kindly take your valuable time to fill out this questionnaire. All the information provided will be treated confidentially, and will be used for the purpose of this study only. The results will be produced in the form of aggregated data. For any questions or clarification, do not hesitate to ask the researcher concerning this study. Please be free to contact the Head of Environment Department of Africa Nazarene University-Nairobi Kenya. Tel: +254721299114.

Consent: Please acknowledge below if you are willing to participate in the study.
Signature……
Date……
Signature…….

Questionnaire on an assessment of the influence of Household characteristics on the Solid Waste Management in Mukono Municipality, Uganda.

Questionnaire Number: _____ Date: / / 2019
Municipality_____ section _____

Please you are required to put a tick in the box [ ] for their appropriate response in questions below and Yes or NO where necessary.

Section A.Social Demographic characteristic and income of the household head or participant

Code	Question	Response
A1	What is your gender?	Male [ ] Female [ ]
A2	What is your age bracket?	a) Below 25yrs [ ] b) Between 26-35yrs [ ] c) Between 35-45yrs [ ] d) Between 46-55yrs [ ] e) Above 55yrs [ ]
A3	What is your level of education attained?	a) Primary [ ] b) Secondary [ ] c) Tertiary [ ] d) None [ ]
A4	How long have you been a resident of this area?	a) 1-5yrs [ ] b) 6-10yrs [ ]

		c) 11-15yrs [ ] d) Above 15yrs [ ]
A5	How many people stay in this household?	a) 2-4people [ ] b) 5-7people [ ] c) 8-10people [ ] d) Above 10people [ ]
A6	How much wastes does your household generate per a week?	a) 1bag [ ] b) 2bags [ ] c) 3 bags [ ] d) Above 3 bags [ ]
A7	How much is your household income per month?	a) Less than Ug Shs 300,000 [ ] b) UgShs 300,000- 500,000 [ ] c) Ugshs 600,000-900,000 [ ] d) Above Ugshs 900,000 [ ]

Section B. Household's current solid wastes generation and management

Code	Question	Response
B1	What are the most common solid wastes generated at your household per month? (Rank them according to their higher proportion in amount produced).	1 2 3 4 5 Paper Kitchen wastes Plastic Glass Scrap metals Garden wastes Wood Others specify…..
B3	How much of wastes does your household generate in Kilogram per week?	a) 0-5kgs [ ] b) 6-10kgs [ ] c) 11-15kgs [ ] d) Not sure [ ]

B4	Do you have a temporary waste storage container in your household	a) Yes [ ] b) No [ ]
B5	What type of waste storage container available in your household?	a) Plastic bag [ ] b) Empty drum [ ] c) Dust bin [ ] d) Bucket/carton [ ] e) Others specify ……..
B6	If no storage container available, where else do you put the wastes?	a) Throw it in the nearby channel [ ] b) Throw it in an open place [ ] c) Disposing it on the backyard of the house [ ] d) Private waste collectors take it [ ] e) Others specify……..
B7	How frequently do you dispose of your wastes in the dumping sites of your choice	a) Everyday [ ] b) Every week [ ] c) Every 2 -4 weeks d) Every month [ ]
B8	Does your area have a private company that collect solid wastes through door-to-door?	a) Yes [ ] b) No [ ]
B9	If No, go to question B14	
B10	For how long has this company been doing the service of wastes collection?	a) For one to two years [ ] b) For two to four years [ ] c) For long period of time [ ]
B11	How often does this company collect the wastes from your house?	a) Daily [ ] b) Weekly [ ] c) Monthly [ ] d) Others specify…….

B12	How much shillings to you pay for the services rendered by the wastes collection company?	Ug shs……
B13	Is the service rendered by this company satisfactory?	a) Yes [ ] b) No [ ] If No, what do you think is the problem? …… …… ……..
B14	What do you about the solid wastes at your house when the company's truck did not come at the right time?	a) I Keep the wastes until the truck come [ ] b) I burn the waste at the backyard of the house [ ] c) I dump it in the sewage channel [ ] d) I dump it at the round site [ ] e) Show if any other alternative…….

Section c. Household solid wastes collection and transportation methods

Code	Question	Response
C1	What method is being used in your household to collect the solid wastes?	a) Communal Bin [ ] b) Door-to-door [ ] c) Block [ ]
C2	What mean of transport is used in your household to take the wastes to the dumping sites?	a) Wheel barrow [ ] b) Truck [ ] c) Hand carrying & footing [ ] d) None [ ]
C3	What is the disposal method used to dispose of solid wastes in your household?	a) Burying in the soil [ ] b) Opening dumping [ ] c) Burning [ ] d) Composting [ ] e) Landfill [ ]

		f) Incineration [ ]
C4	Why do you dispose of your wastes using this this method?	a) I cannot afford service fees [ ] b) I do not have wastes collection service [ ] c) Any other reason, indicate ……
C5	How will you describe the wastes management status at your household?	a) Very satisfactory [ ] b) Satisfactory [ ] c) Poor [ ] d) Very poor [ ]

Section D. People's knowledge, awareness and attitude about wastes management at household level

Code	Question	Response
D1	Do you have any knowledge of information about household wastes management?	a) Yes [ ] b) No [ ]
D2	If yes, where is the source of knowledge or information about household wastes management?	a) Community meeting [ ] b) Mass Media (TV, Radio [ ] c) Poster and banners [ ] d) Wastes disposal agencies [ ] e) Neighbours [ ] f) Any other specify…….
D3	Does your household practice wastes separation at source?	a) Yes [ ] b) No [ ] c) Don't know [ ]
D4	If NO, what do you think is the reason?	a) I don't see the important of waste separation [ ] b) It is not my responsibility [ ] c) I do not understand wastes separation [ ]

		d) If any other, specify……
D5	Are you aware that wastes generation is related with consumption pattern?	a) Yes [ ] b) No [ ]
D6	Who do you think is responsible for solid waste management?	a) My household [ ] b) Municipality [ ] c) Private wastes collectors [ ] d) All of the above [ ] e) Any other, specify…….
D7	How do you evaluate the performance of solid wastes management by the body you tick in question D6 above?	a) Very good [ ] b) Good [ ] c) Fair [ ] d) Poor [ ] e) Very poor [ ]

Part Two: Measure of the Dependent variable

Do household characteristics influence solid wastes management? Yes [ ] or No [ ]

Indicate the extent to which the following household characteristics aspects influence solid wastes management in Mukono in scale of 1-5 where 1= strongly agree, 2 = Agree, 3 = Undecided, 4 = Disagree and 5 = strongly Disagree

No.	Question	Strongly agree	Agree	undecided	Disagree	Strongly disagree
		1	2	3	4	5
1	People's knowledge on waste management at household level influence solid wastes management					
2	Household income level influence wastes management					
3	Amount of wastes generated at household					

	influence waste management.					
4	The number of people in a household influence wastes management					
5	Wastes collection methods at household influence wastes management					
5	Government and private NGOs intervention influence wastes management					

Thank you very much for taking time to take part in this research survey

Appendix C: ANU Approval Letter for Data Collection



AFRICA NAZARENE
UNIVERSITY

12th ~~June~~ August, 2019

RE: TO WHOM IT MAY CONCERN

Jacob Mangar Majak (18SO1DMEV002) is a bonafide student at Africa Nazarene University. He has finished his course work and has defended his thesis proposal ***entitled "An Assessment of Household Characteristics Influencing Solid Waste Management in Mukono Township, Uganda.***

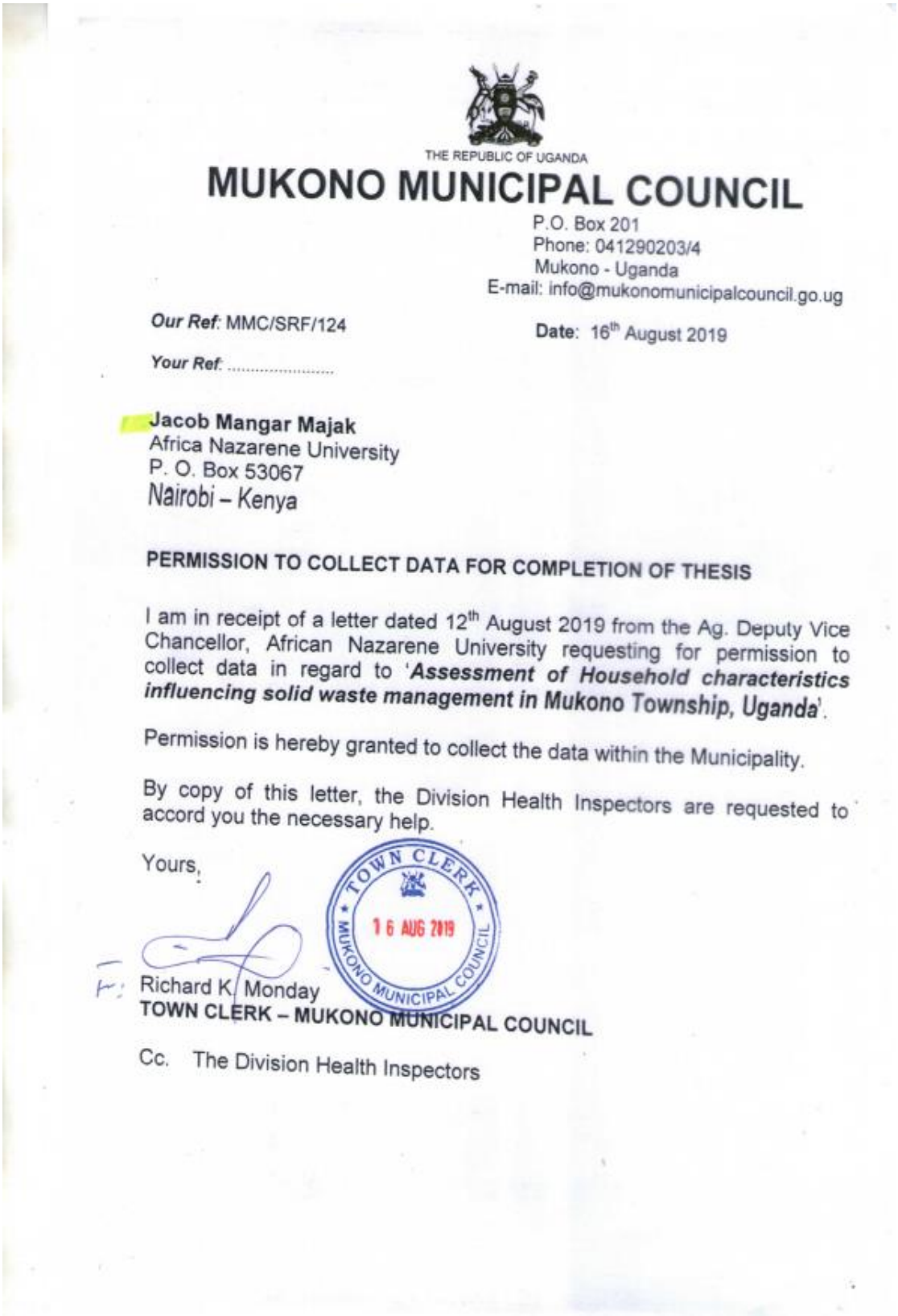
Any assistance accorded to him to facilitate data collection and finish his thesis is highly welcomed.

Prof. Orpha Ongiti
Ag. Deputy Vice Chancellor, Academic Affairs

D. V. C. ACADEMIC
AFRICA NAZARENE UNIVERSITY
P. O. Box 53067
Nairobi, Kenya.
Africa

P.O Box 53067 - 00200 Nairobi, Kenya • Tel: 020 252 7170/1 - 5 • Fax: 020 201 2233 • Cell: 0733 874 111 • Email: registrar@anu.ac.ke • www.anu.ac

Appendix D: Approval Letter from Mukono Municipal Council



THE REPUBLIC OF UGANDA

MUKONO MUNICIPAL COUNCIL

P.O. Box 201
Phone: 041290203/4
Mukono - Uganda
E-mail: info@mukonomunicipalcouncil.go.ug

Our Ref: MMC/SRF/124

Date: 16th August 2019

Your Ref: .....

Jacob Mangar Majak
Africa Nazarene University
P. O. Box 53067
Nairobi – Kenya

PERMISSION TO COLLECT DATA FOR COMPLETION OF THESIS

I am in receipt of a letter dated 12th August 2019 from the Ag. Deputy Vice Chancellor, African Nazarene University requesting for permission to collect data in regard to '***Assessment of Household characteristics influencing solid waste management in Mukono Township, Uganda***'.

Permission is hereby granted to collect the data within the Municipality.

By copy of this letter, the Division Health Inspectors are requested to accord you the necessary help.

Yours,

TOWN CLERK
16 AUG 2019
MUKONO MUNICIPAL COUNCIL

Richard K. Monday
TOWN CLERK – MUKONO MUNICIPAL COUNCIL

Cc. The Division Health Inspectors

Appendix E: Solid Waste Management Practices in Mukono (Sorting)



Man sorting waste at Mukono dump site. (photo taken by researcher)



Sorted waste at Mukono dump site (photo taken by researcher)

Appendix F: Solid Waste Management Practices in Mukono (Land fill)



Tractor moving materials at a Land fill in Mukono (photo taken by researcher)



People removing plastics from a Land fill in Mukono (photo taken by researcher)

Appendix G: Solid Waste Management Practices in Mukono (Composting)

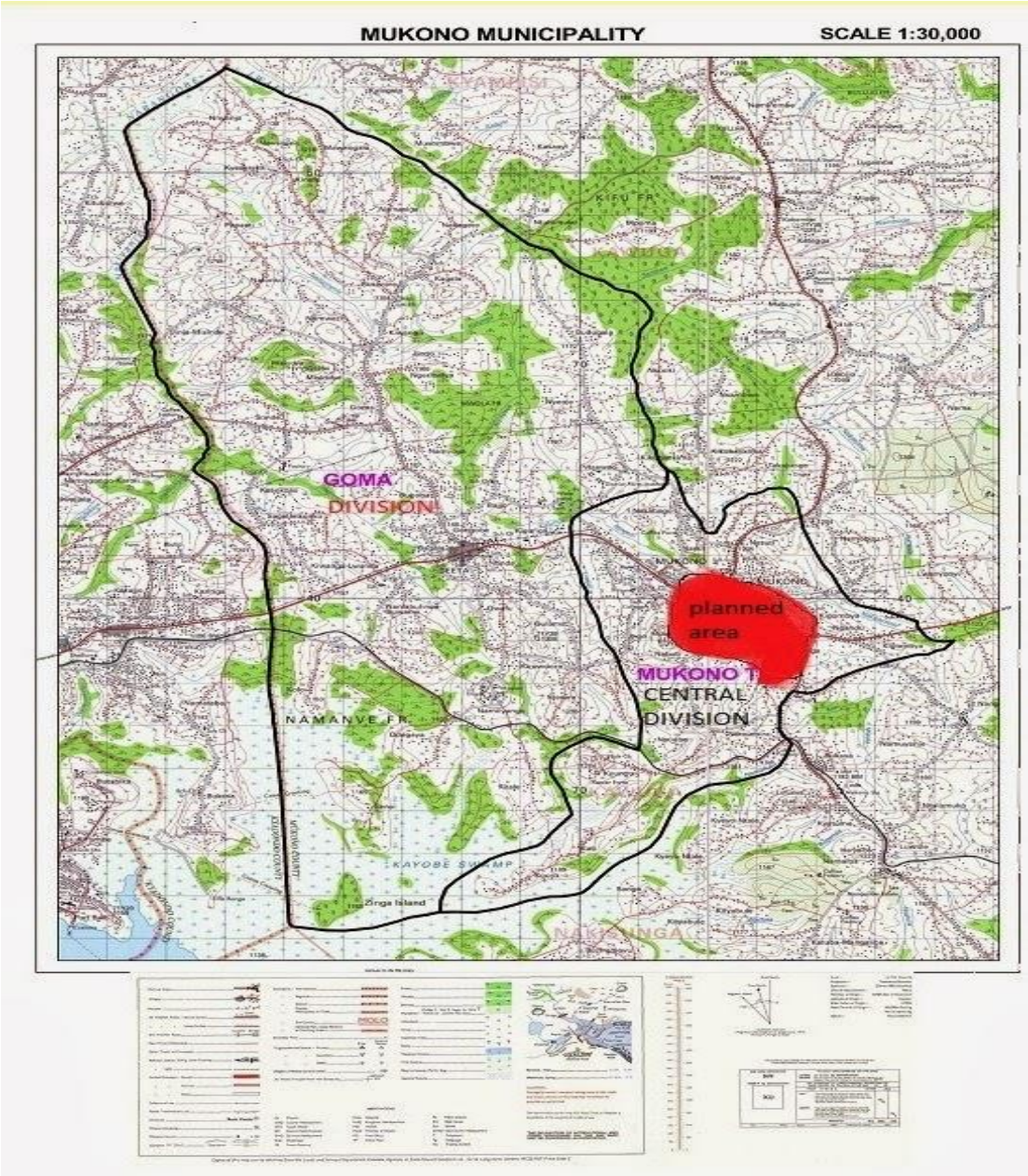


Composting tunnels at Mukono. (Photo taken by researcher)



Compost heap inside the composting tunnels. A chelate is added to enhance the process (photo taken by researcher)

Appendix H: Map of Mukono Town in Uganda



Map of Mukono Town in Uganda