

# Solid Waste Management Practices and Sustainable Environmental Management: A Case of Lira City

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## Abstract

The purpose of this study was to examine the effect of effect of commercial waste management practices. Specifically, the study sought to: explore commercial solid waste management practices in Lira City, assess the level of environmental sustainability of Lira City and to examine the effect of commercial solid waste management practices on environmental sustainability of Lira City. The study employed cross sectional research design; employed both quantitative and qualitative approaches from sample size of 103 respondents that was drawn using Krejcie & Morgan (1970). The study used questionnaires and interview guide as research techniques to collect quantitative and qualitative data from primary and secondary sources. Quantitative data analysis was done using SPSS package version 23 while thematic and content analysis was employed to analyse qualitative data. The findings of the study revealed that waste compositing was the main way of managing solid waste by hotels and restaurants in Lira City. The study revealed that the level of environmental sustainability in Lira City was still below average as indicated by a Likert scale of 1-5 used by the researcher. Finally, the study indicated that the use of waste compositing and waste recycling to manage waste had a significant effect in Lira City. Based on the above findings, the study concluded that commercial solid waste in Lira City was being best managed by the use of compositing. The study therefore recommended that commercial waste management in Lira City should be managed at the local government, company, and community levels so that everybody can be in position to manage.

**Keywords:** Commercial waste management, Environmental sustainability, Lira City, Waste compositing

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## 1. Background to the Study

Solid waste management is a global concern which affects every individual and government (Nyampundu et al., 2020). Historically, human advancement has been intrinsically linked to the management of solid waste due to its effect on both public and environmental health (McAllister, 2015). According to Havlíček & Morcinek (2016), interest in environmental problems is not just a modern phenomenon but people were concerned with similar issues in the past, including the pre-industrial era. The industrial revolution of the 16th century attracted many people to settle in urban centres which had better amenities and good employment prospect. This migration of people to cities led to population explosion that in turn led to a surge in the volume and variety in composition of wastes generated in cities (Amasuomo & Baird, 2016). Unhygienic urban sanitation resulting from population explosion and mismanagement of waste is believed to have caused the plagues that affected Europe at that time (Nathanson, 2015). It was about this time that waste management techniques were developed to combat the spread of disease but the political and social problems of the time did not see great strides in waste management (Nathanson, 2015).

In the United States of America, before 1800s, some cities were still faced with the challenges of organised public works for street cleaning, refuse collection, water treatment, and human waste removal but it was until the early 1800s when George Waring of New York City organized solid waste management around engineering unit operations; including street sweeping, refuse collection, transportation, resource recovery and disposal (Magazzino, Mele & Schneider, 2020). This approach was adopted nationwide, and was managed by City Departments of Sanitation. In Japan, it was until the 19th century when waste collection was private venture (Magazzino, Mele & Schneider, 2020). The government involvement was minimal and waste was treated by waste generators themselves or by private waste treatment operators. Waste was often discarded by waste treatment operators on roadsides or vacant lots and was piled up in unsanitary conditions which led to wide spread of various infectious diseases. This necessitated the enactment of The Waste Cleaning Act of 1900. The Act defined the collection and disposal of waste as the obligation of municipalities and placed waste treatment operators under the supervision of government organizations to establish a waste administration system.

According to the United Nations data collected between 2010 and 2018, there were 2 billion people without access to waste collection services globally and 3 billion people who lacked controlled waste disposal facilities (SDG report 2019). The world generates 2.01 billion tons of municipal solid waste annually, with at least 33 percent of that not managed in an environmentally safe manner. In Sub-Saharan Africa more than half of waste generated is openly dumped and this practice is inflicting vast implications on the environment, health, and

prosperity (Kaza, 2018). Proper waste disposal methods and treatment is of great concern with respect to the quality of life and the environment we live in (Fakere et al., 2012).

In East Africa, solid Waste management (SWM) system has changed from the colonial days in the 40s, 50s, 60s when it was efficient because of the lower Urban population and adequate resources to the current status that displays those inefficiencies (Okot-Okumu and Nyeenje, 2011). The centralized Waste Management System has evolved in to the current management mixtures that include decentralised as well as the involvement in the private sector. In Uganda before the advent of colonialism, waste management was considered the responsibility of the individual households. Urban settlements were nonexistent and each household had places for dumping waste generated. The waste was either poured in pits dug outside the homestead or just deposited in the nearby bush.

### 1.1 Statement of the Problem

Effective management of commercial solid waste still remains a challenge to many urban areas in Uganda (Aryampa, Maheshwari, Sabiiti, Bateganya, Bukenya, 2019). Most solid wastes are poorly burnt, dumped indiscriminately in within the community leading to pollution of the air, soil and water bodies, posing health and livelihood risks to many urban dwellers (Danso, Drechsel, Fialor, Giordano, 2017). The annual agricultural survey carried out in 2018 (UBOS 2018) indicate that 77% of the households in Uganda use organic fertilizers like livestock manure, crop residues and ash to improve agricultural production. The use of the derived organic compost represents an appropriate win-win waste management strategy and sustainable soil fertility management practice (Kumar, Takeshima, Thapa, Adhikari, Saroj, Karkee, Joshi, 2020). Although Lira City enacted a law of waste management in 2006, the daily monitor of 25 September 2019 reported that waste management still remains a big challenge in the City. The report further revealed that leaders and experts were concerned that there were no strategies in place to deal with the waste problem. The National Environment Management Authority (NEMA) with financial support from the World Bank established Municipal Solid Waste (MSW) composting plants in Lira Municipality which is currently Lira City (NEMA, 2016) to manage solid waste but a study conducted by Adong (2022) and published on repository of Makerere University indicated that food and/or crop waste and inorganic solid waste (commercial waste) especially in markets areas still remains the biggest challenge. This study therefore examined the effect of commercial solid waste management practices on environmental sustainability in Lira City.

### 1.2 Purpose of the Study

To examine the effect of commercial solid waste management practices on environmental sustainability in Lira City.

#### 1.2.1 Objectives of the Study

1. To examine the commercial solid waste management practices used by hotels and restaurants in Lira City.
2. To assess the level in which hotels and restaurants are sustaining Lira City.
3. To assess the effect of commercial solid waste management practices on environmental sustainability in Lira City.

### 1.3 Significance of the Study

It is hoped that this study is expected to be useful as a source of reference for further researches. This is especially true since there are very few studies linking solid waste management to environmental sustainability in Uganda. This is expected to be among the few studies that have focused on this area

The study shall be able to reduce knowledge gap in this important area of waste management as service delivery in urban centers. It also documents all that that was not previously known about waste management practices in Lira City.

Findings and recommendations from this study is expected to help policy makers in Lira City in designing appropriate solid waste management policies and bylaws that will improve the practice of solid waste management and promotes attainment of environmental sustainability of the city.

Findings from this study shall help the political and technical heads of Lira City to make informed decisions when selecting solid waste management practices to be used in such a way that they will ensure sustainability economically, socially and environmentally

The study is expected to yield data and information that will be useful for proper planning and decision-making in Lira city and other agencies like NEMA in developing a framework for actions that reduces the adverse effects of solid waste and promotes environmental and public health for the benefit of the residence in Lira city.

### 1.4 Theoretical Underpinning

The study is guided by the Theory of Reasoned Action (TRA) and the Triple Bottom Line (TBL) model (Ajzen 1985, 1991). TRA suggests that behavior is best predicted by an individual's intention, influenced by attitude and subjective norms. While TRA has been studied extensively, its predictability has been questioned due to factors such as gaps between intention and behavior and external influences on behavior.

The Triple Bottom Line model, coined by John Elkington in 1994, emphasizes that businesses should measure social and environmental impacts alongside financial performance. It consists of three pillars: profit, people, and the planet. This approach promotes sustainability and considers ecological and social aspects that traditional reporting frameworks often overlook.

In the context of the study, TRA helps individuals make reasoned decisions to avoid indiscriminate waste dumping. The TBL model encourages businesses to consider social and environmental impacts in addition to profit, aiming for holistic improvement across all sectors.

## 2. Review of Related Literature

### 2.1 Commercial Solid Waste Management Practices

Solid waste management refers to the collection, transport, recovery and disposal of waste, including the supervision of such operations and after-care of disposal sites (Elagroudy et al 2016). Solid waste can be classified based on their source, such as; municipal solid waste, industrial solid waste and agricultural solid waste, commercial solid waste.

The importance of environmental sustainability to development has been captured in MDG 7. Despite some progress towards meeting this goal, there is still substantial unfinished business and new global and local challenges endanger the development and environmental gains achieved so far (Organisation for Economic Co-operation and Development (OECD) Post-2015, 2018). Recent developments in the various OECD peer reviews have seen the strengthening of the treatment of the level of environmental sustainability. Economic Surveys recommend policy initiatives to improve economic performance so as to reduce the level of waste and this would lead of the improvement of the level of environmental sustainability. These include a separate section on green growth and climate change policies, institutions and targets. These have been conducted for member countries, as well as interested non-OECD countries, such as Brazil, China or South Africa to date.

Environmental Performance Reviews provide independent assessments of members and interested non-member countries (most recently Colombia and South Africa) on their progress in achieving domestic and international environmental policy commitments which can culminate into improved level of environmental sustainability (OECD, 2018). Development Assistance Committee (DAC) peer reviews provide in-depth examinations of the development systems and policies of all DAC member countries (DAC, 2017). They include an assessment on how development co-operation is addressing environmental challenges, their priorities and approaches to achieve these priorities. They include a review of the amount and type of official development finance aimed at achieving the Rio convention, and other environmental policy, objectives within the broader portfolio of development co-operation and finance.

#### Landfilling

Landfilling is currently the most common method of waste disposal (Kaza *et al.* 2018). A landfill is a large area of land or excavated site specifically designed and built as the final disposal site of solid waste (Abdel-Shafy & Mansour 2018). It's an engineered pit, in which layers of solid waste are filled, compacted and covered for final disposal (NEMA, 2020). After decades of environmental management and specifically, waste management in Uganda, the focus has shifted to ensuring that waste is no longer just disposed in dumpsites but is well managed in engineered landfills (NEMA, 2020). An Engineered landfill consist of a lined bottom; a leachate collection and treatment system; groundwater monitoring; gas extraction (the gas is flared or used for energy production) and a cap system.

A good landfill and waste composting plant ensures safe and sound disposal and utilization of municipal solid waste, and when handled effectively. It will turn into an income generating activity for the Municipal council while ensuring availability of rich compost manure. Globally ,approximately 37% of waste is disposed in landfills (Kaza et al.2018),with approximately 52.6% of waste landfilled in the United states of America,59.1% in Brazil, 94.5% in Malaysia,79%in China (Vaverkova ,2019) and 42%in Bangladesh(Amin 2017).The commercial solid waste deposited in the landfills may cause adverse effects on the surrounding environment and people living close to landfill sites(Njoku et al.2019).In Bangladesh a study conducted by Ume et al ,2021 revealed that Mosquitoes breeding is higher within and around landfills and contribute to the spread of various vector-borne diseases among nearby dwellers.

Lira city has one land fill constructed at Aler. The waste site, which is part of Aler district farm, is located in Aler Village, Anyomore Parish, Adekokwok Subcounty, Lira city under secondary vegetation characterised by shrubs. To the East and north is Aler Hill, while to the south and west is Aler farmland. A low-lying area is to the south of the proposed site approximately 200 metres away and this is where area water is drawn. The site, which measures approximately 15 acres, is well isolated from homesteads has secondary vegetation as the current land cover and is intended to receive municipal solid waste only. Much of the generated waste from Lira City and the immediate catchment is composed of vegetable matter (70%), glass, clinical waste, waste paper, plastics especially low-density polyethylene, worn out tyres and wood shaving

### **Composting of waste**

Managing waste at source is more important than the conventional way of handling waste. Composting is one of the methods to manage the waste at source (Vanlalmawii & Awasthi, 2016). Composting is the most appropriate economical solution to overcome the problem due to municipal waste (Saini et al 2017). A study conducted in 2016 in central Uganda revealed that majority (91.2%) of the households did not carry out composting and the reasons were as follows: not having a need for manure (60%), having little land on which to compost wastes (42.8%), and not having enough compostable wastes (5.3%) for those that could have use for it.

Organic waste accounts for the bulk of urban waste in middle and low-income countries, and most Asia-Pacific countries fall into this group (Luchsinger, 2016). According to UNEP (2018) out of the municipal solid waste generated in sub-Saharan Africa, 57% is organic waste, the bulk of which is currently dumped but which could provide significant socio-economic opportunities for countries. Composting help to significantly reduces the volume of wastes in the country, eco-friendly, hygienic, economical and toxic free and also provide nutrients that are suitable for agriculture and can be used as fertilizer to replace chemical fertilizer (Kadir et al, 2016). Composting is an environmentally friendly, wealth creating and sustainable method rather than directly dumped into earth and is useful to convert organic waste to useful products (Atalia, 2015)

### **Recycling of waste**

According to The National Environment (Waste Management) Regulations, 2020 recycling” means any recovery operation by which waste materials are re-processed into products, materials or substances whether for the original or other purposes, and includes the reprocessing of organic material. Recycling is considered as one of the best options in the solid waste management hierarchy to reduce the impacts presented by end of life (EoL) and end of use (EoU) post-consumer packaging plastic wastes. (Bupe, Mwanzaa, & Mbohwb, 2016) Recycling as secondary material resources is the most common method of commercial waste management in Germany (45 %) and Belgium .A study conducted by Troschinetz & Mihelcic 2009, on sustainable recycling of municipal solid waste in developing countries, identified twelve factors that influence sustainable recycling of MSW in developing countries as; government policies, government finances, waste characterization, waste collection and segregation, household education, household economies, MSWM administration, MSWM personal education, MSWM plan, local recycled material, technological and human resources and land availability.

## **2.2 Environmental Sustainability**

Environmental sustainability refers to how the actions of individuals affect the ecosystem, subsystem, and super system upon which human beings and other organisms live (Ferdig, 2017). Environmental sustainability can be compatible with decent work, especially when the institutional and policy tools adopted to promote decent work complement measures to advance a sustainable, low-carbon and resource-efficient growth. The ILO (2018) identifies 46 countries that have been able to grow economically in the 20 years between 1995 and 2014 while at the same time reducing their production-based GHG emissions. Of these, 23 decoupled growths from their carbon footprint, meaning that the emissions embedded in their consumption also declined; these 23 countries were able to achieve decoupled growth without exporting their emissions.

## **2.3 Effects of Commercial Solid Waste Management Practices and Environment Sustainability**

Abdulfatah, Onu, Abdurrahman, Lawal, Oyagbola, Mundu and Danjuma, (2019) carried out a study on the effect of solid waste management of sustainability development in Mukono municipality. The study was both quantitative and qualitative in nature and employed cross sectional study design. Data was collected with the help of questionnaires. The finding indicated that environmental and social impact worsens as world population increases and solid waste is not well managed. The study also found that in the community, there are challenges of lean assets to administer their solid wastes, leading to unrestrained dumping, also poor management of wastes, thereby contributing to environmental pollution, and the spread of diseases, land degradation, and unhealthy living. The study concluded generating waste is one thing, the type of waste generated is another, and yet also the way it is generated, managed or disposed-off, entirely a different issue.

According to Al-Khatib, Monou, Abdul, Hafez & Despo (2018), commercial Solid waste generation (SWG) is a problematic and is an issue of concern everywhere in the world, particularly in all urban centers. Such SWG is considered one of the most challenging issues faced by most developing countries that suffer from sever environmental pollution problems caused by the large quantities of SWG. According Brems, Baeyens, Dewil, (2017), plastics waste disposal is a major global environmental problem. Amount of 50 million tons of post-consumer plastic waste are generated annually by Europe, USA and Japan. Disposal of these plastic wastes in landfill is considered a non-sustainable from the environmental point of view. Moreover, landfill sites and their capacity are decreasing rapidly. On the other hand, legislation is stringent worldwide. USA legislation and several European directives are concern with plastic wastes disposal and management

It has been estimated that solid waste management contributes for the greenhouse gases emission between 3 and 5%. This is mainly due to the emission of methane, carbondioxide, and nitrite gas that escapes from the open



dumps. Additional gas emissions of carbon dioxide are from the upstream processes such as transportation and waste collection (UNEP, 2018). Sewage water that is mixed with industrial and domestic Waste water may be contaminated with heavy metals and chemicals. It was reported that the presence of heavy metals in the municipal sludge decreased the efficiency of the anaerobic digestion process (Nagpure, 2019). These studies indicated that a significant amount solid waste increased and organic matter was recorded to have increased in industrialised nations (Da Paz, Lafayette, & Holanda, 2020). Accumulation of organic acid intermediates was also recorded that is referred to methanogenic bacteria inhibition. Such inhibition is due to the toxicity of heavy metals. It was reported that the toxicity of the heavy metals to the anaerobic digestion of the sludge can be arranged according to the following decreasing order (Dissanayaka & Vasanthapriyan, 2019)

The large amount of solid waste has become a serious threat to the city and its surrounding ecological environment, which causes many issues, such as illegal dumping and pollution (Da Paz et al., 2020; Santos, 2019). Solid waste is considered a major global environmental problem, especially in developing countries (Haraguchi et al., 2019; Nguyen et al., 2020). Therefore, developing efficient MSW management (MSWM) is crucial for protecting resources, the environment, and public health (Ceylan, 2020). A study by Magazzino, Mele and Schneider (2020) indicated that solid waste management practice has a significant effect of environmental sustainability. According to the study, proper management of solid waste help in reducing the quantity of solid waste which goes into the environment and this in turn help in enhancing the sustainability of the environment.

A study which has been conducted by Nagpure (2019) on the effect of solid waste management of environmental sustainability indicated that solid waste management had a significant effect on environmental sustainability. According to World Bank, the world generates 2.01 billion solid wastes annually, with at least 33% of that conservatively not managed in safest environmental manner and likewise waste is generated per person per day worldwide is averagely 0.74 kilogram but ranging from 0.11 to 4.54 kilograms (World Bank, 2020). These quantities of solid waste have a negative effect on the sustainability of the environmental. The utilization of solid waste as an energy resource can reduce the drastic environmental impacts of improper waste management practices and fossil-based electric power generation (Ayeleru, Fajimi, & Oboirien, 2021). Uncontrolled, open dumping on the peripheries of many of the region's cities has resulting in the degradation of valuable land resources and the creation of long-term environmental and human health problems (Duan, Li, & Wang, 2020).

According to Sahar, Israr Ahmad (2019), waste management is beneficial from the economic, social and environmental perspective. This study investigated the general public and informal garbage collector's perception from social, environmental, and economic aspects. A total of 300 respondents were interviewed (125 households and 125 informal garbage collectors) from seven districts of Faisalabad. The results reported that the majority of the residents blamed themselves for poor management of solid waste which leads to different environmental issues. Lack of awareness among the general public about waste management practices is one of the key factors for environmental issues. Further, solid waste collection by informal garbage collectors would not only improve the social and environmental sustainability but would also serve as a source of income (economic value). Ordinary least square (OLS) method was also used to check the impact of different factors affecting the income level of garbage collectors. Working hours was the only variable which has a significant impact on income. The policy makers should increase the awareness among masses regarding the improvements of the environment by better management. There should also be an awareness program for garbage collectors regarding health hazards by involving NGOs and other volunteers.

According to Suthar and Rayal (2016), informal waste management sector may help in resources recycling, generating earning and employment opportunities. Poorly managed waste streams are causing adverse economic and environmental impact. This may result in health hazards creating further difficulties for low-income families especially. Sandhu, Burton, & Dedekorkut-Howes, (2016) conducted a study of the relationship between solid waste management and economic sustainability. The study was descriptive in its design and employed both questionnaires and interview guide in collection of data from primary source. The result of the study revealed that solid waste management (SWM) practices and informal garbage collectors greatly help to address both economic and environmental issues. This results into the enhancement of economic and sustainable development.

Nguyen, Chuang, Chen (2020) carried out a study to examine the effect of solid waste management practices on sustainable development. The study focused on the effect of solid waste management on economic, social and environment sustainability. The study employed which was both quantitative and qualitative in nature employed descriptive study design. Data was collected from both primary sources with the help of questionnaires, interview guide and documentary review checklist. The analysis of quantitative data collected was done with the help of descriptive and inferential statistics while qualitative data analysis was done using thematic and content analysis. The finding of the study indicated that solid waste composition is influenced by socioeconomic factors including the average family size, number of room(s), monthly income, and employment status.

#### 2.4 Gap in Literature

This review covered a theoretical review and an actual review of literature on each of the study objectives. The

theoretical review explored the theory that attempt to explain the relevance of solid waste management practices on sustainable environmental management and in that context, theory of reasoned action has been reviewed to shed light to the study. The empirical analysis of the literature also covers the effect of commercial solid waste management practices on environmental sustainability, All the studies conducted on the effect of commercial solid waste management practices and environmental sustainability yielded significant positive relationships. However, none of the studies that have been reviewed was conducted in Lira City. This therefore leaves a gap in terms of the geographical that this study will address. In a nutshell therefore, a reasonable conclusion based on prior studies is that, an effective commercial solid waste management practices have a positive effect on health of the people, create good image on business, reduce pollution and many others.

### 3. Method

This study adopted cross-sectional survey design. The choice of the design was to enable the researcher to data from the respondents at only one point in time.

#### 3.1 Study Population and Sample Selection

The study population was 138 comprising of the technical staff, scarp dealers both at the City council and local levels, management of hotels and restaurant in the Lira City and leaders of Lira main market The sample size of the study was determined using Krejcie & Morgan (1970). The population of the study comprised 103 respondents.

#### 3.2 Data Collection and Analysis

In this study the researcher employed the use of questionnaire, and guided interviews to collect primary data from all the respondents. Through questionnaires, the researcher administered preset questions to the intended target respondents. The questionnaire was self-administered; where the researcher distributed the questionnaires by herself and waits for the respondents to fill the questionnaires. interview was used to collect detail information about waste management practices and sustainable environmental management in Lira city.

Quantitative Data checked for completeness, entered on spreadsheet after which, statistical package for social sciences (SPSS) Version 23, was employed to analyse the data collected. Univariate analysis was carried out using descriptive statistic. This was done with the help of percentages, mean, standard deviation. It helped to test the waste management practices ad level of environmental sustainability of Lira City. To examine the effect of commercial solid waste management practices of environmental sustainability, the researcher employed regression analysis. This also helped the research to test the variation in environmental sustainability which is as a result of commercial solid waste management practices in Lira City. Qualitative data was processed and analysed using thematic and content analysis.

### 4. Findings and Discussion

#### 4.1 Commercial Solid Waste Management

Descriptive statistics were used to examine commercial solid waste management practices specifically in terms of percentages, means and standard deviation. Commercial solid waste management practices were examined in terms of landfills, waste compositing, and waste recycling. The findings are indicated in (Table 1).

The result of descriptive statistic in table 1 indicated that waste compositing is the main way of managing commercial waste in Lira City. This is indicated by its highest average mean (Mean=3.175, SD=1.068). This is followed by waste recycling (Mean=2.996, SD=1.048) while the use of landfills (Mean=2.871, SD=1.122) is the least way of managing commercial solid waste in Lira City since it had the lowest average mean. However, the result indicated that most of the indicators the main way of managing commercial solid waste in Lira City is the use of waste compositing. This is revealed by its average means which is above average on a Likert scale used by the researcher to explore commercial solid waste in Lira City. However, the result indicated that the responses from the respondents were all heterogeneous. This is indicated by the value of their standard deviation which ranges from 1.048 to 1.122.

##### 4.1.1 Landfills

As shown in Table 2, the majority of respondents have disagreed that they have a pit in place for dumping waste (33.3% and 19%) for those who disagreed and strongly disagreed. The result also revealed that majority of the respondents disagreed that decomposable and non-decomposable wastes are always deposited separately (59.5% and 15.5%) for those who disagreed and strongly disagreed. Most of the respondents expressed disagreement on the statement that waste are always disposed after a specific period (58.3% and 9.5%) for those who disagreed and strongly disagreed, majority of respondents expressed in support to the statement that they have a mean in place for transporting waste to the pit (72.6% and 20.2%) for these who agreed and strongly agreed. Lastly, on the question as to whether dumping waste to landfills (open pit) is the main way of managing waste here, majority of the respondents expressed disagreement (56% and 16.7%) for those who were not in support. The overall mean of landfills is 2.871, which indicated below average performance of the use of land to manage commercial solid waste

in Lira City. The standard deviation of 1.1218 suggested heterogeneity in views of the respondents in regards to the use of landfills to manage commercial solid waste in Lira City.

The finding agrees with that of Kaza et al. (2018) who indicated that landfilling is currently the most common method of waste disposal mostly in households. The finding also concurs with Vaverkova (2019) who indicated in his study that globally, larger percentage of commercial solid waste are disposed in landfills.

#### 4.1.2 Waste composting

The descriptive of waste composting indicated in Table 3 revealed that, the majority of respondents have agreed that waste composting generates money for the firm (42.9% and 4.8%) for those who agreed and strongly agreed. The result also revealed that majority of the respondents disagreed that is a place for composting waste (51.2% and 7.1%) for those who agreed and strongly agreed. Most of the respondents expressed support on the statement that composting waste is a source of manure sold to farmers (67.9% and 9.5%) for those who agreed and strongly agreed, majority of respondents expressed in disagreement to the statement all forms of waste are always managed through composting (54.8% and 17.8%) for these who disagreed and strongly disagreed. On the statement that there is a specific person for transporting waste to the composting pit, majority of the respondents were in support (59.5% and 19%) for those who agreed and strongly agreed. Lastly, on the question as to whether composting waste is the main way of managing waste here, majority of the respondents expressed support (50% and 2.4%) for those who were not in support. The overall mean of waste composting is 3.175, which indicated above average performance of the use of composting to manage commercial solid waste in Lira City. The standard deviation of 1.068 suggested heterogeneity in views of the respondents in regards to the use of waste composting to manage commercial solid waste in Lira City.

The finding concurs with Saini et al (2017) who indicated that composting is the most appropriate economical solution to overcome the problem due to municipal waste. The finding also agrees with Kadir et al. (2016) who revealed that Composting help to significantly reduces the volume of wastes in the country, eco-friendly, hygienic, economical and toxic free and also provide nutrients that are suitable for agriculture and can be used as fertilizer to replace chemical fertilizer. The study is consistent with that of Atalia (2015) who indicated that composting is an environmentally friendly, wealth creating and sustainable method rather than directly dumped into earth and is useful to convert organic waste to useful products.

#### 4.1.3 Waste recycling

The descriptive of waste recycling shown in Table 4 revealed that, the majority of respondents have disagreed that all waste generated are recycled (83.4%). The result also revealed that majority of the respondents agreed that there are people who collect the waste that can be recycled (70.2% and 16.7%) for those who agreed and strongly agreed. Most of the respondents expressed support to the statement that there is a specific place for storing waste that can be recycled (60.7% and 16.7%) for those who agreed and strongly agreed, majority of respondents expressed in disagreement to the statement that there are specific days that waste that can be recycled are always collected (47.6% and 6%) for these who disagreed and strongly disagreed. Lastly, on the question as to whether waste recycling in the main way of managing waste in Lira City, majority of the respondents expressed disagreement (33.3% and 17.9%) for those who were not in support. The overall mean of landfills is 2.996, which indicated below average performance of the use of waste recycling to manage commercial solid waste in Lira City. The standard deviation of 1.048 suggested heterogeneity in views of the respondents in regards to the use of waste recycling to manage commercial solid waste in Lira City.

The finding agrees with Suthar and Rayal (2016), who revealed that informal waste management sector may help in resources recycling, generating earning and employment opportunities. Poorly managed waste streams are causing adverse economic and environmental impact. This may result in health hazards creating further difficulties for low-income families especially. The finding also concurs with Bupe, Mwanzaa, & Mbohwb, (2016) who indicated that recycling is considered as one of the best options in the solid waste management hierarchy to reduce the impacts presented by end of life (EoL) and end of use (EoU) post-consumer packaging plastic wastes. The finding also agrees with Troschinetz & Mihelcic 2009, on sustainable recycling of municipal solid waste in developing countries help to enhance environmental sustainability.

#### 4.2 Level of Environmental Sustainability

The finding indicated in table 5 revealed that out of the ten items which were used to assess the level of environmental sustainability in Lira City only five items had their means above average on a Likert scale used by the researcher to measure the items. This meant that the respondents were in agreement that commercial waste management has; helped to minimise cases of disease outbreak in Lira City (3.13), helped to make the business premises in Lira City attractive (Mean=3.09), helped to maintain the productivity of Lira City for future generation (Mean=3.19), helped to enhance sustainable use of resources (Mean=3.08). They disagreed that commercial solid waste management has; helped to eliminate garbage in Lira City therefore improving business performance (Mean=3.86), helped to maintain Lira City clean (Mean=2.63), helped to sustain markets in Lira City (Mean=2.78), helped to reduce the level of pollution in Lira City (Mean=2.94), and helped to increase the number of businesses

in Lira City (Mean=2.84). The overall mean for environmental sustainability of Lira City was 2.981 which is below average on a Likert scale used by the researcher to assess the level of environmental sustainability of Lira City. This indicated that the respondents expressed that the level of environmental sustainability of Lira City is still low. However, their standard deviations have revealed heterogeneity in the opinion of the respondents in regards to the items used to assess the level of environmental sustainability of Lira City. However, the most heterogeneous response was sustainable use of resources (SD=0.921), making business places in Lira City attractive (SD=0.857) and making Lira City promising for the future generation (SD=0.700).

#### 4.3 Waste Management Practices and Sustainability

The result of regression analysis carried out with the result presented in table 6 produced an adjusted R Square of 0.419. This indicated that jointly, landfills, waste compositing and waste recycling account for 41.9% change in environmental sustainability of Lira City while 59.1% is contributed to by others factors not in the scope of this study.

The finding of the qualitative aspect of the study on the effect of solid waste management on environmental sustainability revealed that;

*'if the solid wastes are not properly managed, it can lead to problems like blockage of drainage channels and this can spoil the smooth running of business in the City. In cases where the blockages have led to serious flooding, it can force people to relocate their businesses to places that may not be very good as compared to where they were doing business from'*

Another qualitative finding on the effect of waste management practices of sustainability revealed that; *'if Lira City can adopt proper methods of managing waste, it will make the City to be clean and good for doing business. This can also be by enforcing by-laws of waste management in the City'*

Another qualitative finding on the effect of waste management practices of sustainability revealed that;

*'Many businesses in Lira City are not doing well simply because they are not located in good places. Waste littered all over the business premises tend to deter customers from going to the shop to buy goods from there because sometimes people fears that they might contract diseases'*

The finding agrees with Abdulfatah, Onu, Abdurrahman, Lawal, Oyagbola, Mundu and Danjuma, (2019) carried out a study on the effect of solid waste management of sustainable development in Mukono municipality in which the finding indicated that environmental and social impact worsens as world population increases and solid waste is not well managed. The finding also concurs with that of Nagpure (2019) on the effect of solid waste management of environmental sustainability indicated that solid waste management had a significant effect on environmental sustainability. In a similar way, the finding is consistent with Sahar, Israr Ahmad (2019), who indicated that waste management is beneficial from the economic, social and environmental perspective. The study is also in line with Sandhu, Burton, & Dedekorkut-Howes, (2016) whose study on the effect of solid waste management on environmental sustainability revealed that solid waste management (SWM) practices and informal garbage collectors greatly help to address both economic and environmental issues. This results into the enhancement of economic and sustainable development. The finding is consistent with Nguyen, Chuang, Chen (2020) carried out a study to examine the effect of solid waste management practices on sustainable development in which the finding indicated that solid waste management had a significant effect on environmental sustainability.

#### 5. Recommendations

The study results indicate that waste management is an activity that involves multiple stakeholders such as government, waste companies, and the community playing effective roles. The study therefore made the following recommendation.

In order to address the challenge multidimensional and multilevel interventions are required. However, further research is necessary for understanding the most appropriate strategy for the involvement of urban residents in solid waste management in poor-resourced settings like Ghana. For effective and efficient solid waste management, the study recommends interventions by Lira Council Authority.

The authorities of Lira City need to enforce sanitation and solid waste management by-laws on solid waste management for the waste companies to follow the standard procedure in solid waste management. At the community level, there is a need for the local government authorities to enforce sanitation and waste management regulations in households for the sanitary disposal of waste. The study recommends financial support from the central government to the waste management companies for effective solid waste management practices. There is also a need for training and capacity building for regulatory agencies in order to strengthen them to enable them to strictly enforce legislation and by-laws on sanitation and solid waste management in communities. The local government authorities should provide appropriate and engineered landfill sites for waste companies to dump waste in the appropriate way in order to avoid environmental pollution and flooding.

With regards to the company level, the study recommends that waste companies should follow the standard protocol in waste management. The study also recommends that managers and supervisors of waste companies



should intensify awareness raising and education on environmental sensitization to the various target groups such as urban residents and the community.

In order to promote hygienic way of solid waste management, Lira City Council should provide adequate logistics, solid waste bins, and facilities at vantage points for easy access and dumping of waste. There is a need for waste companies to provide motivation and attractive terms and conditions of service for the staff. This will ensure that waste companies will recruit staff with the requisite skills and qualifications for effective and efficient solid waste delivery service.

At the community level, there is a need to promote community involvement and participation in decision-making processes on sanitation issues in order to help improve on effective solid waste management. In particular, improving waste collection coverage of municipal areas, introducing mass community awareness raising and information campaigns will help to address negative community attitudes towards waste management. Also, it could encourage community members to pay for sanitation levies towards waste management. The implication is that if the various stakeholders follow these recommendations it could lead to effective and efficient solid waste management in the study setting.

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**Tables**

**Table 1: Descriptive Statistics of Commercial Solid Waste Management**

	N	Mean	Std. Deviation
	Statistic	Statistic	Statistic
Landfills	96	2.871	1.122
Waste compositing	96	3.175	1.068
Waste recycling	96	2.996	1.048
Valid N (list wise)	96		

Source: Primary Data, 2022

**Table 2: Descriptives Statistics on Landfills**

No	Items	Responses (%)					Statistics	
		SD	D	NS	A	SA	M	SD
1	There is a pit in place for dumping waste	19	33.3	4.8	32.1	10.7	2.855	1.355
2	Decomposable and non-decomposable waste are always deposited separately	15.5	59.5	16.7	8.3	22.7	2.43	1.185
3	Waste is always disposed after a specific period	9.5	58.3	2.4	22.6	7.1	2.60	1.152
4	There is a mean in place for transporting waste to the pit	1.2	6.0	00	72.6	20.2	4.05	.743
5	Dumping waste to landfills (open pit) is the main way of managing waste here	16.7	56	4.8	14.3	8.3	2.42	1.174
<b>Overall Aggregated Statistics</b>							<b>2.871</b>	<b>1.122</b>

**Note:** D – disagree, SD- strongly disagree; NS - not sure; A – agree, SA- strongly agree; M - mean; and, SD – standard deviation.

Source: Primary Data (2022)

**Table 3: Descriptives Statistics on Waste compositing**

No	Items	Responses (%)					Statistics	
		SD	D	NS	A	SA	M	SD
1	Waste compositing generates money for the firm	11.9	33.3	7.1	42.9	4.8	2.95	1.201
2	There is a place for compositing waste here	11.9	23.8	6.0	51.2	7.1	3.18	1.224
3	Compositing waste is a source of manure sold to farmers	2.4	13.1	7.1	67.9	9.5	3.69	.905
4	All forms of waste are always managed through compositing	17.9	54.8	10.7	15.5	1.2	2.27	.974
5	There is a specific person for transporting waste to the compositing pit	8.3	11.9	1.2	59.5	19.0	3.69	1.161
6	Compositing waste is the main way of managing waste here	14.3	50.0	2.4	31.0	2.4	2.57	1.144
<b>Overall Aggregated Statistics</b>							<b>3.175</b>	<b>1.068</b>

**Note:** D – disagree, SD- strongly disagree; NS - not sure; A – agree, SA- strongly agree; M - mean; and, SD – standard deviation.

Source: Primary Data (2021)

**Table 4: Descriptives on Waste recycling**

No	Items	Responses (%)					Statistics	
		SD	D	UD	A	SA	M	SD
1	All the waste generated are recycled	41.7	41.7	6.0	8.3	2.4	1.88	1.011
2	There are people who collect the waste that can be recycled	6.0	4.8	2.4	70.2	16.7	3.87	.954
3	There is a specific place for storing waste that can be recycled	3.6	13.1	6.0	60.7	16.7	3.74	1.007
4	There are specific days that waste that can be recycled are always collected	6.0	47.6	10.7	31.0	4.8	2.81	1.092
5	Waste recycling is the main way of managing waste here	17.9	33.3	14.3	32.1	2.4	2.68	1.174
<b>Overall Aggregated Statistics</b>							<b>2.996</b>	<b>1.068</b>

**Note:** D – disagree, SD- strongly disagree; NS - not sure; A – agree, SA- strongly agree; M - mean; and, SD – standard deviation.

Source: Primary Data (2022)

**Table 5: Descriptive Statistics of Environmental Sustainability**

Constructs	Mean	Std Dev	Vari
Commercial waste management eliminated garbage improving business performance	2.86	.569	.324
Commercial waste management-maintained Lira City clean good for doing business	2.63	.544	.296
Waste management sustaining the markets in the City to improve business performance	2.78	.579	.335
Proper waste management minimizing cases of disease outbreak at the business premises	3.13	.645	.417
Proper waste management made business places attractive	3.09	.621	.386
Proper waste management made Lira City productive for doing business	3.19	.857	.735
Proper waste management helps us to use our resources sustainably leading to improvement in profits	3.08	.921	.848
Proper waste management made Lira City to continue to feed the future generation	3.27	.700	.490
Proper waste management reducing the level of pollution in Lira City	2.94	.525	.276
Proper waste management help the environment to increase the numbers of the business	2.84	.685	.469
<b>Overall mean</b>	<b>2.981</b>	<b>.665</b>	<b>.458</b>

Source: Primary Data, 2022

**Table 6: Model Summary for regression analysis**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.651	.423	.419	.77062	.423	47.990	1	96	.000

a. Predictors: (Constant), Land filling, waste compositing and waste recycling

b. Dependent Variable: Environmental sustainability