Household Solid Waste Management In Urban Areas: A Focus On Mityana Municipality In Uganda

Yasin Bbira

Nkumba University, Natural Resources Manager, Mityana District, Uganda

Nabukonde Ameria

Head of Department, Natural Resources Management, Nkumba University, Uganda

I.   INTRODUCTION

Solid waste management is a universal issue that matters to every single household (UN Habitat, 2016). However, providing waste management services is a major challenge for many urban areas in Uganda due to the increasing domestic waste volume and deficiency of the local government system. In response, this study will be done to identify the types of solid wastes emitted by households in Mityana municipality and then examine the household solid waste management practices in order to ascertain the challenges that arise as a result of poor household solid waste disposal. For purposes of this research, this chapter will cover the background to the study; Theoretical framework; Problem statement; Purpose and Objectives of the study; Research questions; Justification and significance of the study; Scope in terms of contextual, spatial and temporal frame; and finally definitions of key terms.

A.   BACKGROUND

Household solid waste management is one of the most serious urban neighborhood threats to environmental health in sub-Saharan African countries including Uganda (Tumelo et al, 2016). The major challenge is the increasing amount of household waste and the large quantity of different types of wastes generated by households (Kellman, 1995). In Mityana municipality, household solid waste is at the core of municipal environmental problems (Municipal Development Plan, 2015) which has been exacerbated by the rapid and often unauthorized growth of the informal settlements outpacing the ability of the municipal authorities to provide adequate domestic waste management services (UNDP, 2018).

Solid waste management in Mityana municipality is the responsibility of the health Department. They are charged with the collection, transport and disposition of all solid waste including household waste. However, inadequate collection and disposal of household solid waste is a persistent problem (UN Habitat, 2016). The uncollected waste ends up in neighborhood dumps where disease-carrying insect vectors and rodents proliferate and also in street drains where they have caused localized flooding and subsequent road damage, and traffic obstructions. Wastes disposed off in open dumps have also contributed to surface and ground water contamination as well as air pollution as highlighted in the Municipal Development Plan (2015). The unsatisfactory management of household waste prompted residents in Mityana municipality to strike in 2019 but to date, there is no significant change in management of domestic solid waste in the area (New Vision, 2019).

Praveenkumar &Mohan (2017) highlight that effective solid waste management depends on public participation and involvement in waste management services. The rationale of effective public participation is clearly based on the fact that every household generates waste and can be affected directly and indirectly if household waste is not well managed. Managing household waste materials at their sources therefore requires the active participation of the waste generating households since the community does not like to see waste in the immediate vicinity (USAID, 2017). This implies that, households as waste generators are key stakeholders in solid waste management and their participation is essential for the successful implementation of solid waste management programmes (Kumara, 2018).

Households in Mityana municipality can also play a range of roles, such as, waste prevention, separation at source, placing waste outside for collection, reuse, making compost using organic materials, participating in design of a waste service, participating in clean-ups, paying for waste management services, and monitoring and supervising the operation of services. UN-HABITAT (2010) indicates that municipal authorities could not successfully collect and remove household waste without the active cooperation from the service users-householders. It is in this light that the current study aimed to describe the household solid waste management practices and the types of solid wastes emitted by

households as well as the challenges arising from poor waste management in Mityana municipality.

Figure 1: Household waste dumped along a drainage channel and roadside

a. THEORETICAL FRAMEWORK

The theoretical framework for this study focused on a five-tiered waste management hierarchy to guide domestic waste management decision-making. Smith and Scott (2005) theorize that the waste management hierarchy is a protocol to maximize the recovery options and to minimize disposal through open dumping, limiting negative impact on the environment and natural resources as much as possible in order to achieve sustainable domestic solid waste management. The hierarchy ranks the most preferable ways to address solid waste. It consists of a pyramid, with source reduction or waste prevention at the very top of the pyramid, which means this, is the most preferred method in the domestic waste management cycle. The next middle levels of the pyramid include reuse, recycling and recovery. The lowest level of the hierarchy is the use of a disposal site. During any household activity, an important goal of waste management should be to reduce the amount of disposable waste and preserve the environment.
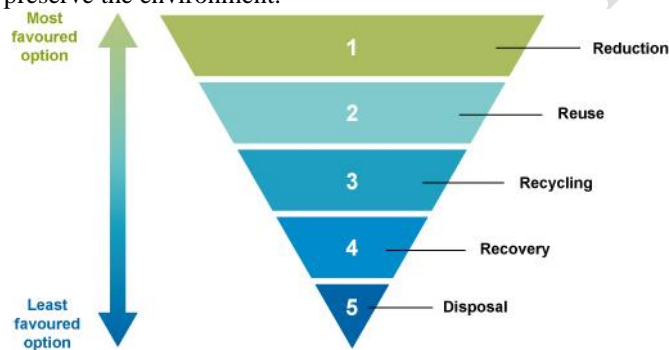
Source: Adopted from UNEP, 2015
Figure 2: The waste management hierarchy

B. PROBLEM STATEMENT

Many household activities emit domestic waste and these are major causes of environmental and health challenges including infectious diseases such as malaria, cholera, dysentery, respiratory complications and injuries among others. Unfortunately, current household waste management practices in Mityana municipality are crude and not sufficient to promote sustainable management of domestic waste (Sobi, 2016). In addition, some residents seem to be accustomed to dirt since they indiscriminately discharge domestic waste into open spaces, drains and at times on streets of Mityana town. This has made Mityana one of the dirtiest, unsanitary and anesthetically pleasing municipalities in Uganda (Ministry of Housing Report, 2018). If not urgently addressed, the problem of domestic waste will exacerbate the already strained environmental health conditions of many households in Mityana municipality. In order to improve the household sanitation conditions, it is therefore necessary to identify the different types of solid wastes emitted by households and the waste management practices at household level. Equally important are the challenges that arise as a result of poor waste disposal.

C. OBJECTIVES

a. THE MAIN OBJECTIVE

✓ To improve household solid waste management for better sanitation in Mityana municipality.

b. SPECIFIC OBJECTIVES

✓ To identify the different types of household solid wastes in Mityana municipality.
✓ To determine the different household solid waste management practices in Mityana municipality.
✓ To identify the challenges that arise out of the different household solid waste management practices in Mityana municipality.

D. RESEARCH QUESTIONS

✓ What are the different types of household solid wastes in Mityana municipality?
✓ What are the different household solid waste management practices in Mityana Municipality?
✓ What are the challenges that arise out of the different household solid waste practices in Mityana Municipality?

E. JUSTIFICATION OF THE STUDY

Effective management of household waste has emerged as one of the greatest challenges being faced by Mityana municipal authorities. Within the existing scenario, there is no proper and effective household solid waste management system in Mityana municipality as haphazard depositing and open burning of piles of domestic solid waste along the roads, open spaces and wetlands is common sight causing health hazards and environmental problems to residents (Ministry of Housing Report, 2018). This appalling sanitation condition demands proactive action ahead of time. However, lack of reliable data on household solid waste management practices remains one of the major drawbacks for deciding on effective domestic solid waste management options. This study attempted to fill this gap by describing the household solid waste management practices in Mityana municipality. The study area is selected because it is one of the new municipalities in Uganda that was created in 2015 with aim of bringing services closer to people including solid waste management services which are currently under researched in

the proposed study area. It is expected that the findings of this study will enable policy makers make wise decisions regarding domestic solid waste management that will benefit local communities.

F. SIGNIFICANCE OF THE STUDY

The study will assist the researcher to enhance his research skills. It will also act as a reference for further research in related studies by acting as an eye opener. The recommendations of the study may be adopted by environment managers and policy makers in order to improve domestic waste management in the country thereby providing solutions to the real world. The findings will also contribute to the body of knowledge on domestic solid waste management by environmental health professionals.

G. SCOPE

The research was confined to the description of household solid waste management practices in regard to the types of wastes emitted, waste management hierarchy and the challenges associated with improper solid waste management. The study was conducted in Mityana municipal council within the three divisions of the municipality which include: Central, Busimbi, and Ttamu. The time scope for this study was the period from July 2020 up to August, 2020. Data collection instruments included questionnaires and interview guides. The study focused on households because they are the major solid waste generators in Uganda (Okot-Okum & Nyenje, 2011). However, 5 key stakeholders/purposive respondents especially; technical staff were interviewed to obtain information on policy, legal, institutional framework and technical issues. The five (5) purposive respondents were: Mityana Municipal Environmental Officer, Health Officer, and mayors from each of the 3 divisions.

H. DEFINITIONS

a. HOUSEHOLD SOLID WASTE

Household solid waste, also known as domestic solid waste or residential waste is disposable solid material generated by households or any dwelling unit (Keilman, 1995).

b. SOLID WASTE MANAGEMENT

Solid waste management is a mechanism associated with the control of generation, storage, collection, transport, processing and disposal of solid wastes in a way that favors the best interests of public health and takes into considerations environmental concerns (Mungure, 2008)

c. HOUSEHOLD

According to the UN Framework (1990:4), 'a household is either (a) one person residence-a person who makes provision for his/her own food and other essentials for living without combining with any other person to form a part of a multi-person household or a multi-person settlement-involving a group of two or more persons living together who make a common provision for food and other essentials for living.' Thus, in the context of this study, a household involves any form of settlement whether involving single rental units or permanently owned dwelling units that accommodate a person or persons for a shared socioeconomic livelihood goal.

II. LITERATURE REVIEW

A. INTRODUCTION

This chapter presents the state of the art that relates to the study topic and its objectives i.e. types of household solid wastes emitted by households, household solid waste management practices and challenges arising from improper solid waste management. The review of related literature is as follows: the first section presented a general literature related to types of domestic solid wastes, then literature related to household solid waste management practices and then challenges arising from improper waste disposal and the Conceptual framework. The literature was compared globally and in developing countries including Africa and Uganda in particular with inclination to the research questions.

B. TYPES OF DOMESTIC SOLID WASTES EMITTED BY HOUSEHOLDS

A clear appreciation of the types of household waste being emitted is a key component in the development of robust and cost-effective household solid waste management practices. Hussein et al., (2018) explains that the types of household solid wastes are critical for the determination of the appropriate handling and management of household wastes. NEMA (2007) categorizes household waste into two major groups: organic and inorganic. The organic solid waste can further be divided into three categories: putrescible, fermentable, and non-fermentable (Ziraba et al., 2016). Putrescible wastes include products such as foodstuff, and vegetables that decompose fast. Fermentable wastes decompose rapidly, but without the unpleasant accompaniments of putrefaction while non-fermentable wastes tend to resist decomposition and, therefore, break down very slowly. Inorganic solid waste includes articles like metals, plastics, rubber and other non-biodegradable materials (UN-Habitat, 2010). Conversely, UNEP (2005) categorizes household wastes as: putrescibles, paper, plastics, textiles, metal, glass, ceramics and some hazardous wastes such as electric bulbs, batteries, discarded medicines and automotive parts. This implies that household waste also contains hazardous material such as batteries, electronics, and discarded medicine (UNEP: 2005).

Bobeck (2010) critically analyzes that the household waste categories in developing countries are similar to those in industrialized, high-income countries. However, Al-Khatib et al (2010) showed that, the quantity and magnitude of waste varies at both temporal and spatial scales. In developing countries like Uganda, a large part of household solid waste involves organic, biodegradable wastes, including peelings

from fruits and vegetables, food remnants and leaves (Cointreau, 2006). This correlates with a research by Okot-Okum and Nyenje (2011) in Kampala that concluded that waste in Uganda is predominantly biodegradable (78%). A related study done in Indonesia by Aretha et al (2013) categorizes that kitchen waste was the highest fraction of household waste, followed by recyclable inorganic wastes such as plastic, paper and card board and this is consistent with the previous studies by the World Bank. These findings relate with the World Bank Report (2018) which highlights that, middle and low income countries generate 53% and 57% food and green waste, respectively, with the fraction of organic waste increasing as economic development levels decrease.

The type of household waste emitted also depends on factors like standards of living, consumption patterns and geographical location (Bobeck, 2010). Lifestyle, economic situation, and waste management regulations are other causes of variation in the types of wastes emitted (Leander, 2015). A study by Hoornweg & Bhada (2012) on the main drivers of household waste concludes that: culture, climate, energy sources, as well as frequency of waste collection and how it is disposed of as other factors determining waste composition. This finding is supported by a research by Philippe and Culot (2009) that emphasizes the importance of climate in determining the type and density of household waste. This is indicative of the fact that, the types of wastes emitted are influenced by a range of factors which differ from one household to another over space and time.

C. HOUSEHOLD SOLID WASTE MANAGEMENT PRACTICES

Effective household solid waste management practices can help to improve the health and environmental quality of the households (UN-Habitat, 2018). However, knowledge about appropriate practices for household solid waste management in low-income countries such as Uganda is poor among local communities (Veronica&Mentore, 2015). This leads to poor household waste management resulting in environmental degradation (Savage, 2019). Many attempts to solve this problem by municipal authorities, private sector and households in Mityana have not yet yielded desired results. The public has not taken positive steps in solid waste management practices like source reduction, sorting, re-using, recycling or properly disposing of the portion that cannot be reclaimed. Instead the public has for the most part maintained an "I don't care" attitude of generating as much garbage as possible unconscious of the implications (UBOS, 2014). In this section, a discussion of the major household solid waste management practices that make up the waste management hierarchy was done. The practices discussed include: reduction, reuse, recycling, recovery/composting and disposal/land filling. The most preferred practice in household solid waste management system is to minimize the amount of waste generated while the least option is land filling. The intermediate options depend on the type of waste that can be treated in the other steps of the hierarchy (Rousta, 2018). However, all steps within the waste management hierarchy fulfill an important function.

a. HOUSEHOLD SOLID WASTE REDUCTION

In the hierarchy of household solid waste management, the first focus is on reduction (reduce), and then reuse and recycle. However, it is difficult to underscore the specific measures that should be taken in reducing and preventing household waste. Fahzy (2014) points out that the most significant option of household solid waste management is reducing the amount you buy. This explains why source reduction is at the top of the waste management hierarchy. The key is to only purchase goods that we need and in the right amount because a better way to reduce waste is by not creating it (World Bank, 2018). In developing countries, compounding evidence alludes that each household adds to the household solid waste management problem (Ali et al., 2016). Thus, in case each household reduces its solid waste, the problem will be reduced. It can start by analyzing what is thrown away and what goods are needed at home. Other steps of reducing waste include: Shopping for high-quality items which are durable such as clothes, electronic, shoes, reusable cups, and reusable water bottles; using minimum packaging by carrying your own shopping bags instead of using plastic bags and reducing food wastage by improving post harvest handling to minimize losses and cooking what is just enough for the householders (World Bank, 2018).

Konstantinos (2017) concurrently explains that, the most sustainable household solid waste management practices are those aimed at reducing food waste quantities. He based his argument on the fact that organic fraction is the largest part of household waste worldwide. His argument is consistent with that of Ozcan et al (2016). This can also be applied in Uganda and particularly in Mityana municipality since the largest fraction of household waste in this area is organic food waste. Konstantinos (2017) also contends that better on-site individual management of organic household waste can result in decreasing and then possibly minimizing the disposal of waste in landfills and the off-site cost of management, along with increasing environmental performance through the decrease of emissions and the lessening of resource use. Based on the above, it is important to explore innovative ways of integrating household waste reduction in everyday life. Our focus should be on trying to reduce the amount of domestic waste generation at source rather than later at the end-of-pipe. However, relatively few efforts have been made in Mityana to regulate domestic organic materials that usually comprise a big fraction of the total waste generation in the study area.

b. HOUSEHOLD SOLID WASTE REUSE

The idea of being wasteful makes many people uncomfortable but most people continue to waste resources (Fahzy, 2014).The process of reusing starts with the assumption that the used materials that flow through our lives can be a resource rather than refuse. Waste, after all, is in the eye of the beholder. One person's trash is another person's treasure. If we really look at things we are throwing away, we can learn to see them as materials that can be reused to solve everyday problems and satisfy everyday needs (Institute of Sustainable Development, 2017). Most households in Uganda, however, haven't even begun to exploit the resources in their

trash yet reusing saves money, conserve resources, and satisfy the human urge to be creative (Ngan, 2009). Items that can be reused at home include: containers, paper, bags, bottles, boxes, clothes, furniture, shoes, old towels and bed sheets, books, magazines, and old tires. Reusing items by repairing them, giving used items to needy groups or selling them will also reduce waste (Brown, 2011). Reusing products, when possible, is even better than recycling because the item does not need to be reprocessed before it can be used again. Bjerkli (2005) argues that the informal waste management sector does a lot to promote reuse as they buy reusable items like furniture, clothes (known as emivumba in Luganda), old phones, news paper bottles, cans and other reusable materials from householders and sell them on to small shopkeepers and merchants.

Reuse can be very helpful for disadvantaged people who cannot afford to buy new goods (Environment Investigation Agency Report, 2018). These could include clothing, furniture, phones and other domestic items. Reuse centers that collect and distribute reusable goods can also provide community benefits by engaging in job-training programmes and general training for the long-term unemployed, disabled people and young people. Reuse is also an economical way for many people to acquire the items they need (Harvey, 2017). It is almost always less expensive to buy a used item than a new one. As well as these benefits, reuse eliminates the environmental damage that would have been caused if the item had been disposed of, rather than reused. In contrast, manufacturing a product from raw materials (and, to a lesser extent, recycling) consumes resources, causes pollution and generates wastes. Gertsakis and Lewis (2004) document that true sustainability will require significant increases in the efficiency of resource use by reusing more valuable products from the municipal waste stream. It is therefore apparent that the practice of reuse is an important step in household solid waste management.

c. HOUSEHOLD SOLID WASTE SORTING

UN-Habitat (2010) underscores that for effective waste management, an ideal situation hypothesizes that those who generate waste will segregate it, because waste segregated at source has a higher value. Rousta (2019) expounds that, sorting the waste at the source, the place where it is generated, is a crucial task to promote recycling and circular economy. A reported by Taherzadeh & Richards (2015) guides that the more and the better the waste is sorted at the household level, by the people who generate the waste, the more products can be reduced and reused, materials recycled and resources recovered. Segregation at source therefore reduces the cost of segregating, cleaning, and handling recyclable material and protects the health of waste handlers. This system, however, needs to be adaptive and responsive to the needs of the people that contribute to it. Petit & Leipold (2018) agree that relying on household waste sorting enhances recovery of resources from waste and can even reach its fullest efficiency. This encourages everyone in household to participate in sorting thereby contributing to sustainability of the waste management system. Waste sorting thus emerges as a link that connects people's choices of everyday actions with sustainability. In

fact, Rousta & Ekström (2013) highlight that one way for people to contribute to sustainable development is by sorting household waste as part of their daily routine. This can enable waste management systems to recycle the waste material and avoid depleting the planet's resources (Abraham and Guilder, 2018).

According to Tucker (2002), behavioral aspects such as intentions, are crucial triggers for engagement in waste sorting. Similar findings were also documented by Barr (2002). These researchers also identified barriers and enablers which can prevent or encourage waste sorting and engagement. These can be psychological variables such as motivation, intention, subjective norms and environmental threat; and situational variables such as space to accommodate separate bins for separate fractions of the waste, knowledge, socio demographics and experience. This indicates that waste sorting behavior is partly subject to how well a person is acquainted with cultural aspects that underpin norms and impact how societies tend to act; how knowledge is distributed; and whether intention and motivation are focused on the individual or on collective causes. People may also engage in waste sorting for various reasons including employment or for work, environmental sanitation and even for its own sake during leisure. Kielhofner (2002) demonstrates that sorting can be done as an activity of daily living that needs to be done as part of daily life task. Whether people perceive waste sorting as an activity that they engage in as part of leisure, productivity or because it is an activity of their daily repertoire shapes the pattern of their engagement in it. Socioeconomic factors, such as gender, age, income and culture are also sought to impact the waste sorting engagement (Ando &Gosselin, 2005).

A study by Strydom (2018) in South Africa found that aspects such as time, space, knowledge and inconvenient waste management schemes most prominently deter the participation in household waste sorting. This is in concurs with similar findings in the study by Omran &Schiopu (2015). In addition, Rousta et al (2015) found that lengthy distances to recycling stations commonly determine whether or not household waste is properly sorted. Similarly, Gonzalez-Torre and Adenso-Diaz (2005) established that as the distance to the recycling stations decreases, the number of fractions that people sort at the household level increases. This indicates that the way waste sorting and recycling systems are set up can both positively and negatively impact the engagement in waste sorting among households. In addition, the recycling and waste sorting system needs to be adapted to the target group in order to encourage households to take part in it.

However, policies and responsibilities may require people to engage in the waste sorting schemes making it mandatory rather than voluntary (Coralie Hellwig et al, 2019). Due to the reason that voluntary engagement in sustainable waste practices seems hard to achieve, the Ugandan government introduced the National Environment (waste management) Regulations (1999) with section 44 which obliges households to sort household waste. However, enforcement of this regulation is a constant challenge for environmental managers. Furthermore, there is a stigma surrounding waste sorting in that sorting and recycling is often thought to be dirty and unhygienic. Waste sorting is also perceived as labor that is

predominantly done by poor and underprivileged parts of society. This implies that people should be motivated to engage in waste sorting in a bid to contribute towards environmental and social sustainability, but also to improve household health and well being.

d. HOUSEHOLD SOLID WASTE STORAGE

Waste storage is under the direct responsibility of the waste producer (Russ, 2008). Households are the main producers of solid waste and are therefore the first responsible actors for short term storage of domestic waste (Oberlin, 2011). The UN Habitat (2010) categorizes household solid waste storage facilities as: household storage facilities including; household bins or bags, sometimes known as primary storage and community storage facilities such as; containers or bunkers, each used by many households, known as secondary storage. The storage volume required for household wastes is a function of the number of people served, the daily rate of waste generation per capita, and the number of days between successive collections. A variety of facilities are used for household storage of solid wastes. In Uganda temporary containers, such as boxes, plastic bags, plastic containers such as broken basins, old tins and a range of different types of containers are often used. Okot-Okumu (2012) documents that most household wastes in Uganda are stored in bins by the affluent and in sacks, plastic bags, cut jerry cans, cardboard boxes by low income households and a large percentage of household waste storage containers such as sacks, polythene bags and boxes used by the poorer urban community are dumped with waste. Similarly, Oberlin (2011) shows that household waste is stored in different types of containers, such as plastic bags, old plastic buckets, baskets, boxes, open piles, but invariably some people discharge waste indiscriminately in open spaces, storm water drains, valleys and along the roads. Oberlin (2011) agrees that the old containers such as buckets and boxes are dumped together with the waste since they cannot be used for any other purpose.

The choice of container depends on several factors, including the wealth of the household, collection system and the amount of waste to be collected (Russ, 2018). Plastic and galvanized steel bins with lids are commonly used in middle-income and high-income areas, but they are relatively expensive and so they may be stolen. Those without containers might be burning, burying the waste around their premises or taking away the waste to be dumped somewhere else. Trasias et al., (2016) discovered that households without waste storage containers in Central Uganda kept their wastes outside the house in the open. The provision of permanent containers may be the responsibility of the collection agency or the householder, or it may be encouraged by a public education campaign. Standardization of primary storage is only suitable when waste generation rates are high, and only in high-income areas.

There are many problems associated with storage of household waste (UNDP, 2018). Due to the nature of the containers, households do not cover them, thus exposing the waste to flies, insects and rain (WHO, 2018). Moreover, most households keep these containers outside the house. Majority of households in Uganda are also poor and cannot therefore purchase sub-standard solid waste bins and those who manage to purchase them face the problems of theft. Waste storage containers are furthermore vandalized by domestic animals, especially dogs and cats, which tear them while looking for food; hence they spread the waste around the premises (Ministry of Finance, Planning, Economic Development, 2016). The best practice is therefore to store household waste in covered plastic bins. However, this is not common in Uganda. The use of covered plastic bins protects the waste from direct exposure to flies, vermin, and scavengers, and they also prevent odor nuisances and unsightliness (Yusof, et al., 2002). This is supported by Azeez (2006) who categorically concludes that durable storage bins help reduce the direct effect of household waste by 75%.

e. HOUSEHOLD SOLID WASTE RECYCLING

Effective recycling starts with households where waste is created. In many countries, municipal authorities help households with waste bins with labels on them (Danya, 2015). Households then sort out the waste themselves and place them in right bins for easy collection and recycling. Almost every material can be recycled; however, the value of the recycled material can vary significantly depending on the demand and uses for it (UNDP, 2018). Recycling is most common for valuable materials or materials that are costlier if produced from virgin raw materials (Da Zhu, et al, 2008). Household waste items that are usually recycled include: organic waste, paper, plastics, glasses, batteries, electronic waste and metals.

The old tradition of households and small businesses selling reusable and recyclable materials such as newspaper, plastic bags, bottles, clothes, tins, and glass to waste purchasers at the doorstep is well known. However, Da Zhu, et al (2008) reveal that household incomes increase, people abandon the behavior of segregating waste at home and tend to throw away all such materials with other domestic (organic and inorganic) waste. Although the households in the lower-income societies generate the least quantity of waste per day, they keep the greatest number of types of material such as plastics, glass, iron scraps, milk sachets, and so on) separate to sell to the recyclers (Pooja, 2018). Middle- and high-income groups, which generate higher quantities of waste, keep a very limited range of materials (generally only newspapers) to sell and dump the rest of the materials along with other types of waste, which are subsequently sorted and sold by the waste collectors.

Recycling at home has been well-studied, and is influenced by both individual and contextual factors (Thomas, 2000). Specifically, attitudes, knowledge, norms, demographics, habits and situational factors such as collection frequency and recycling bin provision have been shown to predict recycling behavior (Barr et al, 2003). A related study was done by Lorraine E. et al (2018) discovered that recycling at home is more common than in the workplace. Qualitative interviews by Lorraine E. et al, (2018) show that attitudes to recycling are largely positive, though there are barriers such as lack of facilities/information, and contamination risk to translating intentions into action. Recycling therefore requires

different forms of intervention or support such as, recycling bin, regular collection, information (Whitmarsh et al., 2017). Waste recycling is often undertaken as a survival strategy when the urban poor are unable to obtain formal employment, and when non-waste resources are scarce or unaffordable. ADB (2002) states that solid waste recovery and recycling is carried out by many of the African poor who engage in waste picking as a means of income generation. In addition, recycling cooperatives have contributed to living conditions improvement and poverty reduction in Asia (Squires, 2006).

In Mityana municipality, recycling is practiced by several stakeholders at different points in the solid waste management chain. However, at present there is a lack of coordination among the stakeholders and there is still large scope for improvement. Currently, municipal authorities do not play a major role in recycling because they concentrate mainly on waste collection, transport, and disposal. They allow informal workers to act as intermediaries that fill the gap but with no legal basis (Ministry of Local Government, 2018).

Despite the environmentally and socially beneficial aspects of waste recycling, it is not without its negative impacts, such as exploitation by waste buyers and poor health and living conditions for the urban poor who deal in waste picking. Lorraine et al (2018) arguments that the negative impacts of waste recycling deter local households from effective waste recycling. In addition, the traditional recycling methods consume high energy and generate waste again (Jassim, 2017). This is consistent with Mackaness (2005) who stated that recycling consumes energy and thus imposing costs on the environment. Recycling cannot therefore do much because in the end the recycled material is going to turn into trash. Furthermore, Tsai & Bekin et al (2007) argue that there are other environmentally friendly ways that can be adopted to manage waste. They do not wholesomely buy the idea that recycling is an environmentally sound way of managing waste because of the shortcomings leveled against it.

f. HOUSEHOLD SOLID WASTE COMPOSTING

The household solid waste stream composition of many developing countries including Uganda is largely biodegradable in nature and thus composting provides the most suitable solid waste management option for these wastes (Nsimbe et al, 2018). This is consistent with findings by World Bank (2018) and UNEP (2015) on the use of compost as a waste reduction strategy. The promotion of urban farming in Uganda has reignited interest in the adoption of composting as a strategy for managing household solid waste in urban areas. Compost provides an environmentally friendly method which not only mitigates problems of atmospheric pollution but also conserves soil fertility and biodiversity (Misra et al, 2003). Compost therefore replaces chemical fertilizers thereby avoiding emissions associated with their production (FAO, 2017). The organic fraction of domestic waste can therefore be exploited through composting, thus returning vital nutrients to the soil. This provides great potential for nutrient recycling, especially to urban farms, which often require large amounts of nutrients to replace the losses from intensive farming. Chrysargyris et al (2013) observed that, compost is used by many small scale farmers in

low income countries as soil conditioner because it is relatively cheaper compared to commercial mineral fertilizers and is more readily available than animal manure.

Composting of organic wastes in developing countries is however, still small scale and insignificant, often practiced by few households and mostly for individual household gardens (Okot-Okum & Nyenje, 2011). A study Nsimbe et al (2018) in Masaka municipality, central Uganda revealed the same information of low engagement in composting. Similar studies conducted by Jack et al (2016) in urban centers of Kenya, Ethiopia and the Caribbean islands also gave similar results. All these researches attributed the low engagement in household compositing to lack of knowledge on technical aspects of compositing process and urban space constraints (Hoornweg et al., 2016).

Nsimbe et al (2018) further points out that, households who segregated waste were more likely to engage in compositing. This is consistent with findings of European Union, EU (2002) and African Development Bank, ADB (2002) that show a positive correlation between segregation and composting. These findings show that waste segregation is a precursor step for successful compositing. It is therefore vital to promote waste segregation at the household level for effective compositing.

g. HOUSEHOLD SOLID WASTE DISPOSAL

Disposal is the ultimate stage in solid waste management system for those wastes that have no further use to society. It therefore falls at the lowest level of the waste management hierarchy (Russ, 2018). Waste disposal processes aim to isolate the waste from people and the environment in a manner that causes no harm. The best option for dealing with any particular household waste depends on the nature of the waste itself and the income status of the household. Financing of safe disposal of solid waste poses a difficult problem as most people are willing to pay for the removal of the refuse from their immediate environment but are generally not concerned with waste ultimate disposal (UNEP, 2018). In Uganda, two main waste disposal processes are widely used: landfill, including burial in pit and open dumping, and thermal processing, which includes burning and incineration (Kabagambe et al., 2015). There has never been a designed sanitary landfill for disposing solid waste in an environmentally acceptable way in Mityana municipality. Disposal of waste most of the time takes the form of crude dumping. However, Mbuligwe (2002) comments that, minimizing waste generation by focusing on management practices at the source can help to save disposal sites space, reduce illegal dumping, and therefore, cut down on pollution potential from solid waste.

Waste poses a threat to public health and the environment if it is not disposed of properly (Truman, 2006). Environmental degradation caused by inadequate disposal of waste can be expressed by the contamination of surface and ground water through leachate, soil contamination through direct waste contact or leachate, air pollution by burning of wastes, and the spreading of diseases by different vectors like birds, insects and rodents. Okot-Okum(2012) reveals that household waste generated in most households is often

disposed indiscriminately without concern for human health impacts and environmental degradation that include soil surface and ground water pollution. Kaseva & Mbuligwe (2005) also documented similar findings. Household waste disposal is therefore an issue that is important to the management of any urban area. However, the perception of waste as an unwanted material with no intrinsic value has dominated attitudes towards disposal (Ramatta et al., 2014).

D. CHALLENGES ARISING FROM POOR HOUSEHOLD SOLID WASTE DISPOSAL

The increase in solid waste generated per household in Africa has not been accompanied by a commensurate growth in the capacity and funding to manage it (Ziraba et al, 2016). In fact, that less than 30% of household waste in developing countries including Uganda is collected and disposed appropriately (Streetman, 2017). The implications of poorly managed household waste on health and environment are numerous and depend on the nature of the waste, individuals exposed, duration of exposure and availability of interventions for those exposed. This is one of the major reasons why solid waste management is a top environmental and public health issue which was not stopped during the country lock down that started in March 2020 in a bid to control Corvid-19. However, while several causal linkages between exposure to waste and environmental health outcomes for particular types of waste are well established, those affecting households in Mityana municipality remain unclear or not prioritized as public health issues. A review of evolution of policies, show that, Uganda, has made numerous efforts supported by policies, to manage domestic solid waste in a sustainable way but in most cases implementation has been haphazard and fallen short. The potential consequences of this failure to manage domestic solid waste forms the heart of this study as illustrated in the framework, with particular focus on the environmental health impacts.

a. EXPOSURE TO HOUSEHOLD SOLID WASTE

Exposure to household solid waste is normally associated with observable and invisible impacts (Ziraba et al, 2016). These may take the form of bodily contact, penetrating injuries, inhalation, or ingestion. Categories of people exposed to solid waste range from the households who generate the waste, those who collect it, such as the municipal workers, those who pick waste for a living and those living or working near disposal sites such as landfills or dumpsites and incinerators.

b. ENVIRONMENTAL AND HEALTH IMPACTS OF EXPOSURE TO HOUSEHOLD SOLID WASTE

The impact of household solid waste on health is varied and may depend on numerous factors including the nature of the waste, duration of exposure, the population exposed, and availability of prevention and mitigation interventions (Wahab et al, 2014).The impacts may range from mild psychological effects to severe morbidity, disability or death (Boadi & Kuitunen, 2005). While certain health impacts might be

immediate, and directly linkable to the solid waste exposure, others may be indirect and long term (Vrijheid, 2000). In fact, Adelowo (2012) clarifies that it is not easy to detect certain impacts of household solid waste on environment and health. This makes establishing the burden of disease attributable to solid waste and full epidemiologic spectrum of diseases emanating from the exposure a difficult undertaking. Furthermore, the environmental effects and the extent of pollution present depend on the properties and conditions of the environment in which the solid waste is disposed. It is therefore not certain that inadequate management of domestic solid waste will have the same implications in all areas.

The impacts of improper domestic waste disposal include the following;

INJURY TO PEOPLE AND PROPERTY

In Uganda, the practice of sorting household waste at source is almost non-existent even for high risk waste such as sharps and broken glass generated from households. Wahab et al (2014) notes that the presence of sharp objects in waste poses a high risk of injury to both those who generate the waste, the handlers and pickers. This is positively correlates with a research done by Rauf et al (2013) in Karachi, Pakistan on the impact of household waste. Domestic workers and waste handlers are therefore at high risk of injuries from unsorted household waste. Where waste is disposed of in open dumpsite accessible to pickers, the risk of injury from sharp objects is ever present (Rauf et al., 2013). In addition, fires from open burning of waste can destroy homes in shanty households or slums and injure or kill residents.

FLOODING

Floods are common in many urban centers (NEMA, 2013). While poor urban physical planning may be largely to blame for the increasing phenomenon of urban floods, the problem can partly be attributed to rampant blockage of drainage systems by solid waste (Lamond et al, 2012). In fact, inappropriate disposal of waste, especially the non-biodegradable plastics results in the blockage of drainage systems (UNDP, 2015). Floods not only destroy property, they have claimed lives both on roads, homes, and damage sewerage systems leading to wide spread environmental contamination with human waste and associated risk of infection transmission (Cointreau, 2006). Blocked drainage systems are also breeding sites for diseases transmitting vectors such as mosquitoes (WHO, 2016).

INFECTIONS/DISEASES

Poorly managed household solid waste, is a major source of infection for domestic workers, waste handlers and general public (Brown, 2017). Decomposing organic waste is a rich medium or culture for growth of numerous micro-organisms many of which are disease causing if passed on to humans. There is always a risk of transmission through vectors such as houseflies and rodents but also through human contacts as is the case with waste handlers who do not use protective wear and waste pickers who most of the time use bare hands

(Achudume & Olawale, 2007). This was also documented by Boadi & Kuitunen (2005). Additionally, articles retrieved from waste may be sold to unsuspecting public without undergoing thorough cleaning hence posing a risk of infection transmission. Gastro-intestinal infections such as typhoid fever, polio virus infection, hepatitis E infection, and cholera are often transmitted through contaminated food or water (Cabral, 2010, Boadi & Kuitunen (2005).

Using water polluted by household waste for bathing, crop irrigation and drinking water can also expose individuals to disease organisms and other contaminants (Brown, 2017). However, many poor urban residents of Mityana municipality do not get their water supply from the main municipal sources (UBOS, 2014). Water from shallow unprotected wells is often contaminated by leachate from dumpsites. Still even those who draw water from the municipal sources may get it from illegal connections that are susceptible to breakage and contamination (WHO, 2018). Other common sources of water include protected or unprotected springs. Worse still, children living near open dump sites are exposed to a triple risk infectious diseases, injury and inhalation of dangerous fumes from the continuous burning of waste. Cointreau (2006) reveals that, in developing countries one of the most common causes of death among children fewer than 5 years is diarrheal disease caused by contamination of water supplies. Contamination of surface-waters is most likely to occur during floods in the rain season (Boadi, 2005).

Cointreau (2006) and Ladu et al (2011) critically examine that the more commonly noticed health and injury issues related to household solid waste management are: Back and joint injuries, respiratory illness, infections from direct contact with contaminated material, dog and rodent bites, or eating of waste-fed animals, puncture wounds leading to tetanus, hepatitis and HIV infection, injuries at dumps due to surface subsidence, underground fires and slides, headaches and nausea from anoxic conditions where disposal sites have high methane, carbon dioxide and carbon monoxide concentrations and lead poisoning from burning of materials with lead containing batteries, paints and solders. Furthermore, garbage is often burned in residential areas to reduce volume and uncover metals. Burning creates thick smoke that contains carbon monoxide, soot and nitrogen oxides, all of which are hazardous to human health and degrade urban air quality. Combustion of polyvinyl chlorides (PVCs) generates highly carcinogenic dioxins (WHO, 2018).

LOSS OF AESTHETICS AND PSYCHOLOGICAL/ EMOTIONAL IMPACTS

Residents living next to dumpsites are usually affected by stench/pungent smell, the unpleasant sight of marauding scavenging animals and social stigma (MoH, 2015). In extreme cases, household waste has been reported to contain human body parts or aborted fetuses which may be distressing and could affect the mental well-being of the residents and those involved in waste picking. Vrijheid (2000) correlates emotional and psychological health damage to closeness to dumpsites. A study by Linzalone & Bianchi (2005) on risks associated with disposal sites also revealed similar results. The situation is worse in slums where open dumping near

households is common practice. Dumping of household waste along streets and other open places therefore has a negative impact on the spatial and temporal state of the human and physical landscape.

### *BREEDING GROUNDS FOR MICROORGANISMS AND ATTRACTION OF VECTORS AND RODENTS*

Open dumping sites serve as a feeding ground for disease carrying pathogens, as well as attracting disease-carrying vectors and rodents. Of concern is for example the anopheles mosquito, which is one type of the mosquitoes that transmits malaria (WHO, 2017). In Uganda, malaria is today one of the leading causes of death. UNICEF (2017) estimates that malaria is responsible for 13% of under-five mortality in Uganda. This high perseverance of malaria in Uganda may have a correlation with poor management of domestic solid waste.

Another problem in developing countries like Uganda is the improper storage, such as open containers, for organic household wastes. Open containers attract for example vectors like flies, which may be carriers of diseases through food contamination, either by direct contact with food or through their droppings (MoH. 2018). Food contamination by flies has for example resulted in a high incidence of diarrhea among young children in Uganda (Omaswa, 2006). This is worsened by the increasing consumption of waste by animals; increasing the risk of infection transfer (Cointreau, 2006).

E. CONCEPTUAL FRAME WORK

Being a mixture of many several items including kitchen waste, plastics, metals, glass, paper, cardboard, textiles, wood, yard waste, batteries and electronics, an increase in quantity and composition of household solid waste poses serious environmental problems and hence needs to be managed properly so as to reduce its negative impacts. Proper waste management involves many hierarchical steps and sustainable practices which include waste minimization, sorting, re-using, recycling, composting, and land filling (Scott, 2006). Unsustainable practices include open dumping and open burning leading to environmental pollution. The central aim of managing waste is to reduce its volume, composition and adverse effects (Metkel & Wassie, 2019). The study presented a framework to aid understanding the linkages between household solid waste composition, waste management practices, and environmental health, and gives the rationale for maintaining proper solid waste management as an investment in preventing environmental degradation and ill health as well as promoting household wellbeing. The negative impacts of improper solid waste disposal may include: attraction of vectors, injuries, infections/diseases, floods, psychological stress and loss of aesthetics (Brown, 2017).

CONCEPTUAL FRAME WORK

(Modified from Scott et al., 2018)
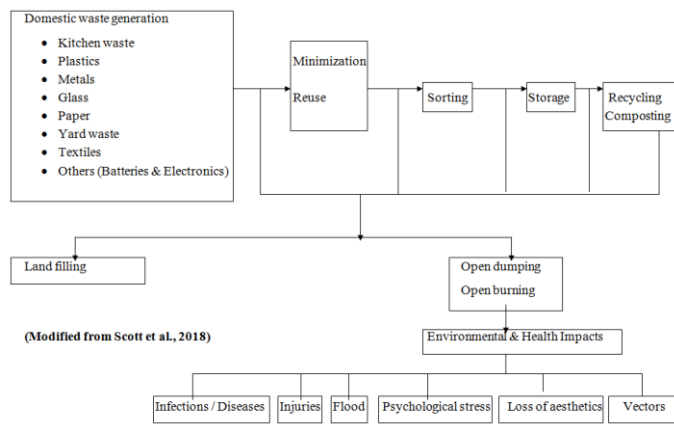
III. METHODOLOGY

A. INTRODUCTION

This chapter indicates how data for the study was collected, analyzed, and interpreted in order to achieve the main objective of the study. The chapter comprised of the research design, research location, research population, sample population, data collection instruments, data collection methods, data analysis, quality assurance, ethical considerations and limitations.

B. RESEARCH DESIGN

A research design is the overall blue print of and/ strategy for the research (Amin, 2005). It is a master plan specifying the nature, and pattern the research intends to follow while carrying out the research study (Oso and Onen, 2008).

This study used a cross-sectional survey design. A researcher adopted a cross –sectional research design due to the intent of collecting data from different respondents aimed at making different inferences about the entire population at a point in time (Etyang, 2018). The aim of using a cross – sectional survey design was to investigate, explain, and describe the phenomenon of interest through obtaining different viewpoints relating to objectives. Oso and Onen (2008) assert that such a design involves the use of questionnaires, making it feasible to carry out the research within a short period of time and give accurate results.

In this study, numerical figures and descriptive information were obtained, giving it both a qualitative and quantitative research dimension. The study hence used both quantitative and qualitative research approaches. A Qualitative research method was used in order to generalize the findings of the study in relation to the objectives (Blanche et al, 2006) while a quantitative research method was used to provide the factual figures by quantifying the findings.

At the data collection stage, qualitative design involved administering 5 open ended interviews to the Municipal Environment Officer, Health Officer, and a division mayor in each of the divisions in the municipality, and 300 questionnaires to respondents, while the quantitative design involved administering closed ended questionnaire questions.

C. RESEARCH AREA

The research was done in Mityana Municipality located about 77 kilometers west o Kampala. Mityana Municipality is located between 00^024' north of the Equator and 32^032'east of the Greenwich in Mityana district in Central Uganda (www.en.m.wikipedia.org). The municipality covers an urban area of 8 square miles ($21Kms^2$) with an average elevation of 3,967 feet (Uganda Districts' Handbook, 2018). The Urban Population density is 4,847 persons/square miles; with an urban population of 95,428 persons and about 24,000 households (UBOS Projection, 2020, www.city.population.de). Mityana Municipality has 15 wards/parishes and 144 villages (Mityana Municipal Council Statistics, 2020). Ttamu division has 6 parishes/wards and 59 villages, Central division has 4 parishes and 36 villages, and Busimbi has 5 parishes/wards and 49 villages (UBOS, 2019). However, Central division is the most urbanized and densely populated division (Mityana Municipal Council Statistics, 2020).

D. RESEARCH POPULATION

The study focused on 300 households because they are the major solid waste generators in urban areas of Uganda (Okot-Okumu& Nyenje, 2011). 10 key stakeholders including the municipal health officer, municipal environmental officer, senior municipal physical planner, municipal councilor-Central Division, Local chairperson (Bukanaga cell), Division councilor (Ttamu), domestic waste contractor (MAVI), Busimbi division Town Clerk, and Busimbi Community Development Officer (CDO), and Central division mayor were interviewed to obtain information on household waste management, policy, legal, institutional framework and technical issues.

Number	Population Type/Category	Targeted Population	Accessible Population
1.	Permanent Households	200	100
2	Small housing units	300	200
3	Division mayors	3	1
4	Town Clerks	3	1
5	Private waste contractor	1	1
6	Division Councilors	3	1
7	Municipal Councilors	3	1
8	Local Chairpersons	3	1
9	Municipal Environment Officer	1	1
10	Municipal Physical Planner	1	1
11	Municipal Health Officer	1	1
12	Municipal CDOs	3	1
	TOTAL	522	310

Table1: Study Population specifics and breakdown

E. SAMPLE POPULATION

Cohen et al (2000) argue that a sample size is determined by the style of the research. In a survey study, there would be need for a representative sample of the population to

generalize the study findings. In this study, the sample size was determined using the Slovin's formula as:

$$n = N/(1+Ne^2)$$

n=number of samples
N=Total Population of households (24000)
e=Error tolerance (level) (at 80% level of significance).

Data was collected from 300 households sampled from the three divisions of the municipality.

F. SAMPLING TECHNIQUES

The study used both probabilistic and non-probabilistic sampling techniques.

a. PROBABILISTIC SAMPLING TECHNIQUES

The study used simple random sampling and cluster sampling in congested areas to select the permanent and small unit households. This technique was chosen because households had a large population size and as such warranted simple random sampling to minimize sampling bias.

b. NON-PROBABILISTIC SAMPLING TECHNIQUES

Purposive sampling was employed to select the 5 technical staff that was being targeted due to their perceived knowledge arising out of known experience that they have in waste management. This technique was employed following the postulate that if sampling has to be done from smaller groups of key informants, there is need to collect very informative data, and thus the researcher needed to select the sample purposively at one's own discretion.

G. DATA COLLECTION INSTRUMENTS

a. QUESTIONNAIRE

Questionnaires were used to collect data from households. The questionnaires were directly administered by the researcher himself or 2 research assistants in order to support the respondents who may need clarification of the questions. The questionnaires were structured, and designed with both open and closed ended questions (Amin, 2005). The questionnaires were used because they were appropriate for large samples and for collecting a wide range of information (Sekaran, 2003).

b. INTERVIEW GUIDE

The researcher prepared and used a semi-structured interview guide to conduct direct personal interviews with technical staff involved in waste management. The guide had open ended questions where the respondents were free to elicit whatever they had to say about a given topic (Etyang, 2018). According to Mugenda and Mugenda (2003) interviews are advantageous in that they provide in-depth data which is not possible to get using questionnaires. Interviews also made it easy to fully understand someone's impression or experience.

c. DOCUMENTARY REVIEW CHECKLIST

This consisted of a review of documents particularly concerning solid waste management practices. Most of these documents were obtained from online libraries and internet websites. Also, text books, journals, magazines, theses, conference papers, newspaper articles, government reports, dissertations related to solid waste management were also reviewed.

d. DATA COLLECTION

The researcher got authorization from town clerk of Mityana municipality. Data on types of solid waste generated, waste management practices and associated challenges was collected and shared with Nkumba University and Mityana Municipality authorities.

e. DATA COLLECTION METHODS

QUESTIONNAIRE SURVEY

This was used to collect primary data from households and it involved the use of a semi-structured questionnaire. According to Etyang (2018) a questionnaire survey is mainly aimed at collecting quantitative data where the researcher designs questions related to study objectives.

INTERVIEW

This was used to collect primary data from technical staff including the municipal health officer, environmental officer, and 3 division mayors. This method was deemed appropriate since the aforementioned category of staff had vital information yet had no time to fill in questionnaires. An interview guide was used to collect qualitative data.

DOCUMENTARY REVIEW

This was used to collect secondary data and was be guided by a documentary review checklist. Documents with literature relevant to solid waste management were analyzed as secondary sources of data to supplement primary data from survey and interview.

H. DATA ANALYSIS

a. QUANTITATIVE DATA ANALYSIS

Quantitative data analysis involved the use of both descriptive and inferential statistics in the statistical package for Social Scientists (SPSS). Descriptive statistics entailed the determination of measures of central tendency such as mean, mode, median; measures of dispersion such as range, variance, standard deviation, frequency distributions and percentages. Data was processed by editing, coding, entering and then presented in comprehensive pivot tables showing the responses of each category of variables. Pivot tables were used to show relationships amongst household solid waste practices.

b. QUALITATIVE DATA ANALYSIS

This involved both thematic and content analysis and was based on how the findings related to the research objectives.

I. QUALITY ASSURANCE

Quality control was done through validity and reliability of the instruments. Validity is the appropriateness and the extent to which a research instrument measures what it is intended to measure (Oso and Onen, 2008). Therefore validity was about credibility or trustworthiness/accuracy or correctness of the research instrument (Etyang, 2018). The researcher used expert judgment of his supervisors to verify the validity of instruments. Validity was determined using content validity index (C.V.I).

Reliability is the consistency of an instrument to produce the same results each time it is measured under the same conditions with the same subjects (Barifaijo, and Oonyu, 2010). To ensure reliability of quantitative data, the Cronbach's Alpha Reliability Coeficient for Likert-Type scales test was performed. According to Sekaran (2003) some professionals as a rule of thumb, require a reliability of 0.70 or higher before they use an instrument. Upon performing the test, the results that were 0.70 and above were considered reliable.

J. ETHICAL CONSIDERATIONS

Participation was voluntary with informed consent. The researcher also ensured confidentiality of the information obtained from respondents and anonymity of the respondents by ignoring names of respondents and exact ages. Instead, codes/numbers for each respondent were used.

LIMITATIONS

The major limitation was that some of the practices on waste management were self reported and the researcher did not directly observe or prove some practices as the respondents gave responses which they thought were legally acceptable since solid waste management is viewed as a politically sensitive issue in Mityana municipality.

IV. DATA ANALYSIS AND INTERPRETATION OF RESULTS

This chapter presents the findings of the study. Initial emphasis is on the percentage of response(s) in each division, bio-data of the households/respondents, the state of solid waste and waste management, magnitude of solid waste management, main household solid waste management practices, responsibility for collection of solid waste, and the main challenges arising from improper solid waste disposal/management.

A. DEMOGRAPHIC CHARACTERISTICS OF HOUSEHOLDS

a. DISTRIBUTION OF RESPONDENTS BY DIVISION

During the study, the research identified respondents in the municipality correlated with the municipal statistics. As seen in figure 4.1, a significant number of respondents (38%) were from Central division-the most densely populated division, and 33% from Busimbi-the largest division per area.
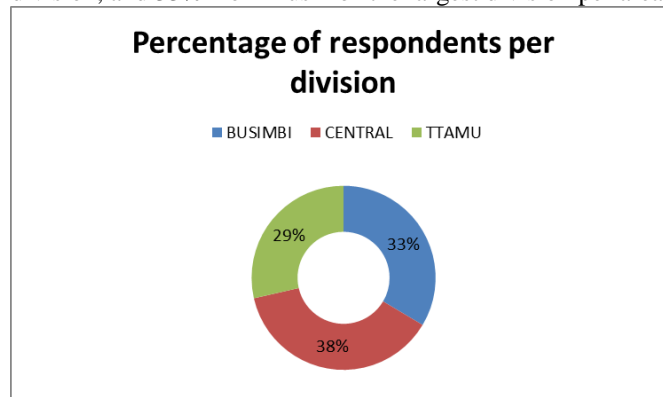

Figure 4.1: Distribution of Respondents per division

b. HOUSEHOLD LEVEL OF EDUCATION AND KNOWLEDGE ON SOLID WASTE MANAGEMENT

There is a great correlation between the level of education with basic knowledge on what solid waste means and management practices. In central division for instance, most respondents with a higher level of education have knowledge on solid waste management. The literacy level of respondents has improved especially in rural divisions; however, central division has the largest number of respondents with ordinary level education up to tertiary institutions (40% of the sample).

DIVISION	% of literate households (above primary level)	Knowledge of Solid Waste Management Practices (Number of households)	
		YES	NO
Central	40%	95	15
Busimbi	32%	75	25
Ttamu	28%	70	20
Total	100%	240	60

Source: Primary data

Table 4.1: Respondents' level of education and solid waste management knowledge

c. DISTRIBUTION OF SETTLEMENT TYPE BY DIVISION

Furthermore, the high concentration of businesses and people in central division shows that most slums (65%) are found in Central division with an increasing proportion of middle income settlements in threshold divisions of Ttamu and Busimbi respectively. This clearly relates to the level of tenancy/occupancy. In slums, most of the people are tenants who rent houses/rooms such as in Mizigo and Buswabulongo. In high and middle income zones, most households are landlords or permanent owners. This analysis corresponded with information provided by the Municipal Physical Planner who acknowledged that; 'Central division is the most

urbanized division in the municipality though most settlements are unplanned.'

Division	Number of households depending on settlement type		
	Slum household	Middle Income household	High Income household
Central	65	40	14
Busimbi	58	35	09
Ttamu	43	40	06
TOTAL	166	105	29

Source: Field data

Table 4.2: Distribution of settlement type by division

d. AGE AND SEX DISTRIBUTION OF RESPONDENTS PER DIVISION

Most of the respondents were youth accounting for 2/3 of the total sample. Basing on the sample, Central division has 55% of the inhabitants as youth and the least percentage of youth is in Ttamu division accounting for 45% of the sample.
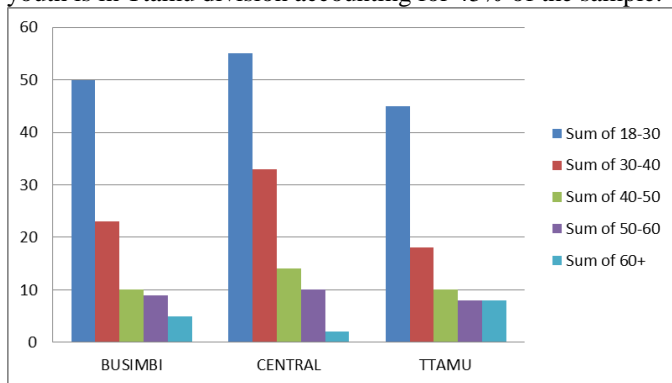
Figure 4.2: Distribution of the age of respondents per division (Source: Primary data).

In relation to the gender dimension of respondents, a large proportion of the respondents were female (54%) to males (46%). According to the UBOS Report (2017), women are the major social group in Mityana municipality and are directly impacted by the generation of waste at household level. The study considered a relatively higher percentage of women because they were the readily available group during the administering of household questionnaires. The largest percentage of female respondents was in Central division.

Division	Distribution of gender of respondents per division	
	Male	Female
Central	54	60
Busimbi	44	55
Ttamu	40	47
TOTAL	138	162

Source: Primary data

Table 4.3: Distribution of gender per division

B. MAIN TYPE OF WASTE GENERATED BY HOUSEHOLDS

The characterization of waste generated by households indicated that the commonest waste generated is kitchen waste (degradable waste) mainly in Busimbi division. However, plastic waste is greatly increasing especially in Central division with over 45% of total waste in the division. Most

organic waste is found in the divisions of Busimbi and Ttamu with Central division mainly generating non-organic waste. Slum zones mainly generate food and plastic waste. However, there is an increase in plastic waste in areas dominated by high income settlements. This correlates with interview data provided by the Municipal Environmental Officer that; '*most households generate organic waste, though inorganic waste mainly plastic waste is increasing due to overuse of polythene bags to carry foodstuffs and household items.*' However, the Town Clerk of Busimbi Division, when asked about which division generates most organic waste, the response was inconclusive; '*for now it's hard to quantify where most organic waste comes from since most households consume food that generates organic waste.*'
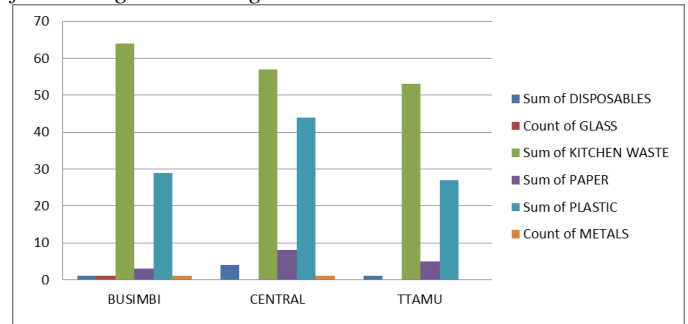
Figure 4.3 Types of waste generated per division (Source: Primary data).

Plate 4.1: Example of kitchen, paper, and plastic waste dumped along a road (Field data)

a. HOUSEHOLD PRACTICES OF SOLID WASTE MANAGEMENT

The commonest solid waste management practice is burning especially in Central and Busimbi divisions, while in Ttamu division; most households use farmlands and open spaces as waste burning and collection points. Generally, 30 percent of the households use burning as the main household solid waste management practice. However, there is an increase in innovative practices for proper solid waste management such as waste reuse, picking of waste, and composting in some households-especially in Central and Ttamu divisions respectively.

Field data highlighted that the type of waste varies per division. For instance in Ttamu division, a cumulative sample of 24 respondents reported that garbage collection is the commonest solid waste management practice well as in Busimbi and Central division, the main practice is burning. This observation rightly relates to a confession by the Central

Division Councilor to Mityana Municipality that; '*most people in areas such as Hospital Area illicitly dump garbage along roads and in drainage channels.*' Furthermore, a Councilor of Busubizi in Ttamu division confessed that, '*most people mainly use generated waste as 'nakavundira' that is used as organic manure in gardens and polythene bags are burnt.*'

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Sorting	10	3.3	3.3	3.3
	Burning	90	30.0	30.0	33.3
	Composting	41	13.7	13.7	47.0
	Open Dumping	59	19.7	19.7	66.7
	Collection	72	24.0	24.0	90.7
	Picking waste	24	8.0	8.0	98.7
	Reuse	4	1.3	1.3	100.0
	Total	300	100.0	100.0	

Table 4.4.1: Household solid waste management practice in Mityana Municipality

Division	Household Waste management practice							
	Sorting	Burning	Composting	Open dumping	Collection	Picking waste	Reuse	Total
Central	5	33	14	26	23	11	2	14
Busimbi	4	34	12	18	25	5	1	9
Ttamu	1	23	15	15	24	8	1	7
Total	10	90	41	59	72	24	4	00

Source: Primary data.

Table 4.4.2: Household solid waste management practice per division

Plate 4.2: Use of kitchen waste and ash as farm compost in Ttamu (Source: Field photo)

b. AVAILABILITY OF WASTE MANAGEMENT CONTAINERS

Most of the households lack containers for discarding waste and if existent, they are less durable. As a result, most people have discarded waste in open places and dumps especially in Central division.

Plate 4.3: Open space dumping (Source: Field Photo/ Primary data)

This is evident basing on the field data that showed that the distribution and presence of solid waste containers varies greatly in the municipality. Slum dwellings have inadequate solid waste containers and mainly use communal garbage sites or open dumpsites well as in middle income and high income areas, most households use relatively durable and modern solid waste containers such as plastic bags, buckets, and paper boxes. Qualitative interview data from the Mayor-Central division attests this fact that '*most households in central division lack proper waste collection containers as the Municipal authorities removed the big metallic waste containers and plastic containers after tendering waste collection services to MAVI-Mityana Agro-Vet Institute.*'
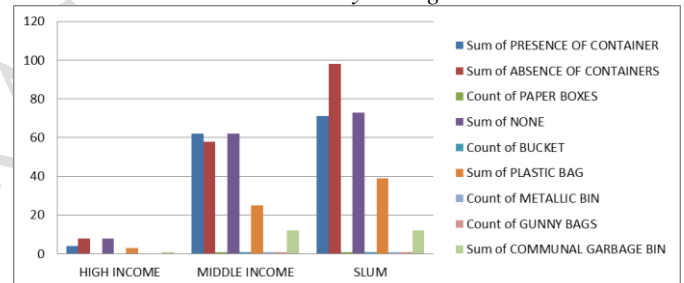

Figure 4.4: Distribution of the type of solid waste containers/household (Source: Field data).

c. PROBLEMS/CHALLENGES ASSOCIATED WITH IMPROPER SOLID WASTE DISPOSAL/MANAGEMENT

Most households highlighted that the main effect of improper solid waste disposal is health related. 49 percent of the sampled respondents especially in Central division acknowledged that increased waste has led to increased health risk with a standard deviation of 2.01797. On a micro-settlement level (in settlement zones), the magnitude of health complications is related to diseases such as constant diarrhea and cholera due to increased dumping of organic waste along settlements in parts of Mityana Central and Buswabulongo wards. Information from the Municipal Health Officer categorically shows that '*improper waste management and collection from households has increased unsanitary conditions leading to cholera, and diarrhea. The stench from the Namukozi dumpsite and the effluent is increasing respiratory infections and contaminating open wells, and underground water streams.*' Other prominent impacts include: untidy environment, and bad odor.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Health risks	146	48.7	48.7	48.7
	Attraction of vectors	20	6.7	6.7	55.3
	Bad odor	42	14.0	14.0	69.3
	Flooding and clogging	19	6.3	6.3	75.7
	Nothing wrong	8	2.7	2.7	78.3
	Untidy environment	65	21.7	21.7	100.0
	Total	300	100.0	100.0	

Effects_of_improper_solid_waste_disposal		
N	Valid	300
	Missing	0
Mean		2.7267
Std. Deviation		2.01797
Variance		4.072
Range		5.00

Source: Primary data

Table 4.5: Distribution of the impact of improper solid waste disposal

Plate 4.4: Drainage channels clogged by waste around Thorban area (Source: Field photo)
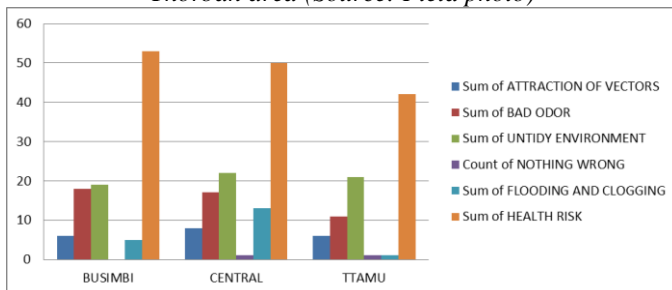
Figure 4.5: Impacts of improper solid waste disposal and management/division (Primary data)

Plate 4.5: Open space dumping and burning in Central division-a health hazard (Field photo)

The ranking of problems emanating from improper solid waste disposal varied in relation to settlement type. Generally, in all settlement zones, health risk is the main threat of improper solid waste disposal; however, the health risk is higher in slum and middle income settlement zones than in high income settlements. High income settlements further have low risks of clogging and flooding and are mainly tidy. Surprisingly, attraction of vectors is higher in middle income settlements especially in Businzigo than in some slum areas in Central division.

d. CAUSES OF SUCH INCREASED RISK/IMPROPER SOLID WASTE DISPOSAL

Research findings and field data highlighted the causes of increased risk of solid waste in Mityana municipality

Limited Training On Solid Waste Management

89%of the people have not received any form of training on proper solid waste management practices with the most affected zone being central division (39%). In areas where training has been done, it has been informal by local Community organizations and using local media leading to unsustainable waste management practices such as open space burning**.** Qualitative interview data from the Busimbi Community Development Officer acknowledges such quantitative findings. The CDO said that '*there is low initiative to train local households on measures being advanced to manage waste such as waste tax education that is meant to raise enough money to cater for garbage collection and payment of garbage sweepers in Busimbi division*.'
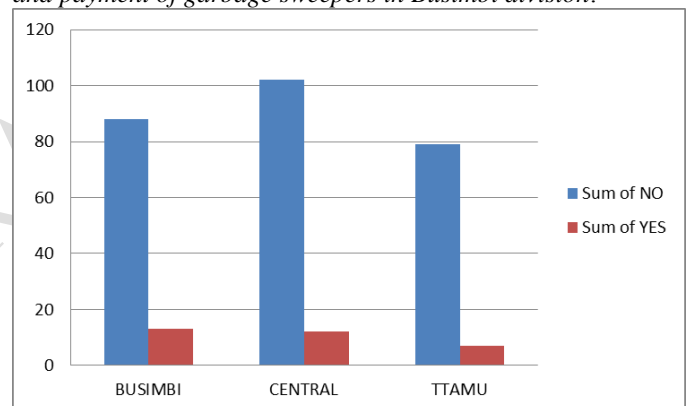

Figure 4.6: Training on solid waste management practices.

Improper Collection Of Household Waste

Most of the waste generated is not collected as 59% of the respondents are not aware of how/who is responsible to collect waste. However, 25% of respondents in Central division indicated that the municipality contracted a waste collecting company (Agro-vet) though there is limited cooperation on when/how to collect such household waste. Respondents further indicated that the frequency of waste collection is low. In Ttamu and Busimbi, the waste collection truck has never reached there or is seen after 3-4 weeks respectively. Thus, local households collect and manage their own waste; especially after there are large volumes of uncollected waste. This information is contrary to qualitative data obtained from MAVI-Domestic Waste Collection office during interview. MAVI explains that '*waste is properly collected daily using 2 garbage collection trucks. We also provide bags to collect in garbage to local areas but; the negative attitude and laziness of local households to bring waste to the waste collection trucks that increases the uncollected waste in some areas.*'

Plate 4.6: Household waste collection truck (Source: Field data)

Limited Knowledge On Who Is Responsible For Waste Collection

A sizeable number of the respondents hardly know who is responsible for collection of such waste. Some respondents believe that it is the responsibility of the municipality and waste contractor as they pay a waste collection fee but progress of collection is low. As a result, some households have developed initiatives such as burning and composting to manage waste or directly bring waste along roadsides for collection. There is generally little cooperation with the waste contractor or municipal authorities on the collection of household waste (See figure 4.7).
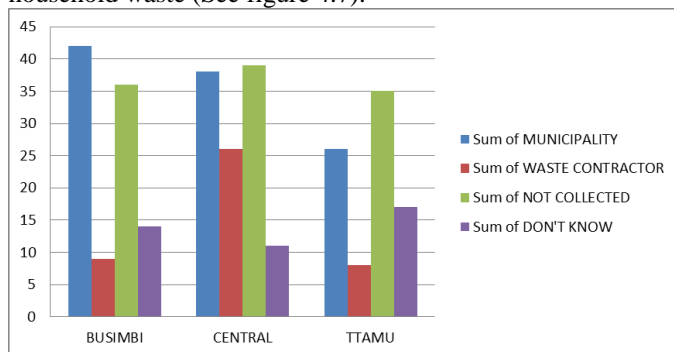

Figure 4.7: Responsibility on collection of waste (Source: Primary data)
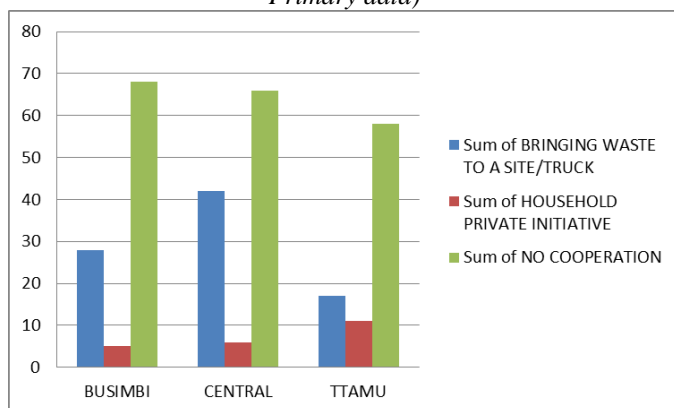

Figure 4.8: Household cooperation on collection and management of solid waste (Primary data)

V. SUMMARY, DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

A. INTRODUCTION

This chapter involves a summary of findings, conclusion and recommendations. The summary is based on the findings of the study objectives and the recommendations are based on the discussion of the findings and analyses of the data as well as interpretation of the findings addressing the research questions that the study aimed to explore and explain.

B. SUMMARY AND DISCUSSION OF RESEARCH FINDINGS

Solid waste management is an increasing paradox in municipal management globally that requires concerted, integrated, and robust strategies to minimize and manage. This has been evident through the myriad strategies and techniques that municipal authorities and households have cropped out to manage waste. Basing current research findings, it is evident that collection, disposal, and management of solid waste in emerging urban zones is a 'super wicked' challenge to individual households, and municipal authorities in Mityana Municipality-despite the gross target of promoting municipal hygiene, sanitation, and a clean environment. This calls for systematic development of scenarios, processes, and systems that aim at increasing efforts by the central government, local municipal authorities and different stakeholders at division level and local communities to increase knowledge, and willingness for proper solid waste management. However, despite the relatively clear framework in solid waste management at municipal level, the study identified gross disparity in the level of solid waste knowledge amongst households and limited cooperation with contracted waste collection contractors which has led to a sprawl in illicit dumping and disposal of solid waste. Hence, implementation and enforcing of proper solid waste management in the municipality is wanting.

a. STATE OF THE HOUSEHOLD SOLID WASTE COLLECTION, TRANSPORTATION AND DISPOSAL IN MITYANA MUNICIPALITY

The study identified various ways of household solid waste collection, transportation and disposal practices in Mityana municipality. It was established that the collection of household waste is irregular; and most predominant in the central business zone of Central division-where a domestic waste collection truck of Agro-Vet collects waste on a weekly basis. However, in threshold areas of Ttamu and Busimbi divisions such as Mbaliga and Naama respectively, waste collection is done individually despite the payment of solid waste collection fees. This finding correlates with a study by Upama and Karmacharya (2012) in Kathmandu-Nepal that found out that urban waste collection in central urban zones is twice higher than in slum and threshold zones. Furthermore, Hayal, and Aramde (2016) categorized that most sub-Saharan cities are experiencing increasing waste generation estimated at 0.5 kg per capita/day and collection is relatively done daily,

and most households in the urban centers accumulate waste solid that need collection to the disposable centers.

The study found out that most of the waste is organic and less hazardous in suburban zonesof the municipality. However, there is an increase in inorganic and hazardous waste in Central division in form of yard waste, and plastics. Unfortunately, most of the waste is unsorted and stored in less durable containers such as sacks are used by different households while commercial building in the central market area mainly dump waste along the roadside for prospective collection. This finding directly correlates with a study by Henry, and Jun (2016) in Seoul, that found out that there is a spatial variation in the frequent and type of waste collection systems even in similar urban zones such as door –door, the block collection system and the sweeping of street. However, these findings are in variance to the study by Elsa (2003) that concludes that in some urban zones, households and local authorities have systematic mechanisms to regularly and frequently collect waste. Although local authorities contend that there is a human resource gap in waste collection and management, households critically argued that less transparency and bureaucracy from the municipal authorities partly account for the unjust and irregular collection, and management of waste especially in Wabigalo in Ttamu division.

The study also established that transportation of solid waste in Mityana municipality is a preserve of the municipality which has contracted a private company. In this approach, it was found that a private company-Agro-Vet is contracted by the municipal authorities to keep the area clean. However, local households critically highlighted that waste collection by the contractor has been less effective with some zones of the municipality such as Naama, Busubizi, and Katiko never accessed for waste collection. This has left the service of waste collection to local households who normally adopt unsustainable practices to discard uncollected waste such as open dumping, and burning. This gap is clearly established by Finn (2013) in a study on waste collection in Kratovo-Macedonia that shows that there is uncoordinated waste transportation in most urban zones since private contractors seek profit from the waste collection and transportation service. This leads to communal dumping in any open and unprotected environmental zone such as along roads, behind buildings, and in valleys. This has been compounded by the absence of a municipal owned waste collection facility leading to unauthorized landfill dumping.

According to the findings of the study, the magnitude to the problem of solid waste management in Mityana municipality has been worsened by the shortage of expertise, constraints, and limited awareness, legal and administrative enforcement of environmental regulations. Thus, there is a general lack of public awareness and environmental ethics in solid waste disposal and management resulting in uncontrolled and illicit solid waste disposal especially in the slum zones of Central division. This lacuna has grossly led to a conclusion that collection of solid waste has been enforced by the households' themselves especially in the threshold zones-despite paying for waste collection services than the municipal authorities that legally have the mandate to enforce solid waste management. This observation relates with the findings from the study by Blaser and Schluep (2012) that indicated a variance in the quantity of waste between central and threshold urban zones-where outskirts have huge volumes of uncollected waste.

b. CHALLENGES OF IMPROPER SOLID WASTE DISPOSAL AND MANAGEMENT

The finding from the study highlight that there is a general consensus that illicit disposal of solid waste is a great livelihood and environmental hazard irrespective of the spatial and temporal extent of an urban zone. However, the extent of damage is more in congested and slum urban zones. For instance, in Mityana municipality, health risks emanating from improper solid waste disposal are higher in slum zones of Central division such as Buswabulongo than in relatively middle and high income settlements. The main health impacts were proliferation of flies, mosquitoes, and rodents; that, in turn, are disease transmitters that affect population. The study also established that there is increasing dirt and bad odor arising from the accumulation of solid waste-especially organic waste. Illicit and improper solid waste dumping was associated with incubation and proliferation of flies mosquitoes and rodents; in turn, transmit diseases that affect population's health such as malaria, diarrhea and cholera. However, a proportion of the households in less urban zones highlighted that there is less problem associated with solid waste. This could partly have been due to the fact that such households had safe waste storage and disposal facilities. This finding correlates with a study by Upama and Karmacharya (2012) in Bhaktapur municipality that sequentially concluded that improper solid waste management leads to a cycle of household ill health, environmental hazards, and bad odor from decomposing waste.

C. CONCLUSIONS

Study findings highlight that increasing waste is a great socioeconomic and environmental paradox and challenge in Mityana municipality. The expansion of the urban zone to relatively rural areas of Busimbi and Ttamu is projected to increase the multiplier effect of solid waste due to increased population and emergence of low cost housing units. This is presumed from a hypothesis that as an urban unit expands, there is likelihood in a sprawl of solid waste and housing units. Therefore, in an emerging urban unit like Mityana Municipality, there is need for the development of early warning systems and proactive mechanisms that integrate all households and local authorities towards sustainable and feasible solid waste management practices. Basing on field observations and interviews, the increasing plastic waste generated from polyolefin sources could be used as an economic incentive through the effective management of source and destination points such as re-extrusion that yields material analogous; secondary route which is the reduction of waste by compression (mechanical) and the tertiary route which is the thermo-chemical methods that yield fuel or petrochemical stock.

Furthermore, areas with high organic waste such as Ttamu and Busimbi could be harnessed through setting up

local initiatives to reuse and turn such waste into agricultural inputs or environmentally friendly energy sources such as briquettes. This could help reduce on the illicit encroachment on natural forests and vegetation to harvest local energy sources such as fuel wood that most people using for domestic services.

D. RECOMMENDATIONS

In order to reduce the amount of solid waste and improve solid waste management practices, there is need to increase community sensitization, capability, and capacity building on proper solid waste management. This can be done through radio programmes on local radio stations such as Mboona FM, and increasing grassroots support on waste usage and management such as in Naama, Ttamu, and Busubizi, This is because local people have the willingness to adapt to locally feasible waste management practices only hampered by lack of initiative, guidance, and support from local authorities.

There is need to set up an organic waste composting or value addition plant/program in suburban zones such as in Ttamu and Busimbi to explore the opportunities for reducing, reusing, recycling, and rethinking the waste management strategy. This should incorporate the management of plastic waste through setting up youth groups advocating for effective household management that is consistent with local household capacity and capability.

There is need to set up division waste collection zones/sites with clear sorting zones or waste sites. This could be done through stakeholder participation, and securing of support through local community based organizations. This would ease waste collection, transportation, and disposal and build local capacity to integrate and participate in waste management processes that they currently think is a preserve of the municipal authorities and a private contractor. Such a sustainable practice can help in mindset change on unsustainable waste disposal practices especially in Central division such as roadside dumping. This is envisioned from the fact that waste management is a cooperative and integrated process where households and local authorities in a given zone own up to the solid waste challenge.

.Municipal authorities need to frame an integrated waste management approach that employs decentralized community based systems involving NGOs/CBOs targeting the peri-urban poor and the more centralized urban council and private operator systems that target the central business areas and the rich and middle income settlement zones such as in Mizigo. Such systems can be promoted through community participation and education involving CBOs such as Kiyinda diocesan innovative projects on the use of plastic for home gardening in Katiko and the informal sector around Mityana Central Market area. This needs to be aided by political good will, support, and transparency in availing solid waste management services. For example, waste contractors can be re-distributed in each division or ward involving local community actors. Such actors can be trained on proper waste management processes from source to disposal points.

E. PROSPECTIVE AREAS FOR FURTHER RESEARCH ON SOLID WASTE MANAGEMENT

✓ Development of local capacity for sustainable organic Waste Management in Busimbi and Ttamu divisions.
✓ Assessing the willingness to pay for waste collection services in Mityana municipality
✓ Evaluating the impact of local households on effective solid waste management in Mityana municipality.

REFERENCES

[1] Abdhalah K. Ziraba, Tilahun Nigatu Haregu & Blessing Mberu (2016). A review and framework for understanding the potential impact of poor solid waste management on health in developing countries
[2] Abd El-Wahab EW, et al. Adverse health problems among municipality workers in alexandria (egypt). Int J Prev Med. 2014;5(5):545–56.
[3] A.Chrysargyris, C.Saridakis, & N.Tzortzakis (2013). Use of municipal solid waste compost as growing medium component for melon seedlings production.
[4] Adelowo OO, Akinlabi IA, Fagade OE. Environmental impact assessment of Attenda abattoir, Ogbomoso southwestern Nigeria on surface and groundwater quality using geo-electrical imaging and microbiological analysis. Environ Monit Assess. 2012;184(7):4565–74.
[5] African Development Bank(ADB) (2002). Study on Solid Waste Management options for Africa
[6] Ahmad K. Jassim (2017). Sustainable Solid Waste Recycling, Skills Development for Sustainable Manufacturing
[7] Achudume AC, Olawale JT. Microbial pathogens of public health significance in waste dumps and common sites. J Environ Biol. 2007;28(1):151–4.
[8] Al-Khatib I., Monou M., Abu Zahra A. S. F., Shaheen H. Q., Kassinos D., 2010. Solid waste characterization, quantification and management practices in developing countries. A case study: Nabulus district – Palestine. Journal of Environmental Management, 91, 1131-1138. Available from: http://www.sciencedirect.com
[9] Amin E. M. (2005). Social Science Research, Conception, Methodology and Analysis, Makerere University Press. Kampala.
[10] Ando, A.W.; Gosselin, A.Y. Recycling in multifamily dwellings: Does convinience matter? Econ. Inq. 2005, 43, 426–438. [CrossRef]
[11] Aretha Apriliaa,*, Tetsuo Tezukaa, Gert Spaargarenb (2013). Inorganic and hazardous solid waste management: Current status and challenges for Indonesia
[12] Aisa Oberlin Solomon (2011). The role of households in solid waste management in East Africa capital cities
[13] Azeez KK: Waste management practices in small scale mining communities in the Wassa West District of West Region. 2006, Ghana. MPH dissertation: School of Public Health, University of Ghana
[14] Barifaijo. M, Basheka. C.B. &Oonyu. J., (2010). How to write a good Dissertation. A guide to Graduate students. New Vision Printing and Publishing Company LTD

[15] Barr, S. Household Waste in Social Perspective: Values, Attitudes, Situation and Behaviour; Ashgate: Burlington, VT, USA, 2002.

[16] Barr, S., Ford, N. J., and Gilg, A. W. (2003). Attitudes towards recycling household waste in Exeter, Devon: quantitative and qualitative approaches. Local Environ. 8, 407–421.

[17] Bekin, C., Carrigan, M. & Szmigin, I. (2007) Beyond recycling: 'Commons-friendly' Waste reduction at new consumption communities. Journal of Consumer Behaviour, 6, 271-286.

[18] Blanchet, Martin, Durrheim, K. & Desmond, P. (Eds.) (2006) Research in Practice: Applied methods for the Social Sciences, Cape Town, and University of Cape Town Press.

[19] Boadi KO, Kuitunen M. Environmental and health impacts of household solid waste handling and disposal practices in third world cities: the case of the Accra Metropolitan Area, Ghana. J Environ Health. 2005;68(4):32–6.

[20] Camilla Louise Bjerkli (2005).The cycle of plastic waste: An analysis on the informal plastic recovery system in Addis Ababa, Ethopia

[21] Clairvair O. Squires (2006). Public participation in solid waste management in small island developing states. A Research Paper.The author is a member of staff of the Caribbean Development Bank (CDB). However, the views expressed are his own and not those of the CDB.

[22] Cohen, L., Manion, L. & Morrison, K. (2000). Research Methods in Education, London, Rutledge

[23] Cointreau S., 2006. Occupational and Environmental Health Issues of Solid Waste Management, Special Emphasis on Middle- and Lower-Income Countries. Available from: http://www.wiego.org/occupational_groups/pdfs/waste_collectors/Urban_Paper_Health_Solid_Waster_Mgt.pdf

[24] Coralie Hellwig , Greta Häggblom-Kronlöf , Kim Bolton and Kamran Rousta (2019). Household Waste Sorting andEngagement in Everyday Life Occupations AfterMigration—A ScopingReview

[25] Da Zhu P. U. Asnani Chris Zurbrügg Sebastian Anapolsky Shyamala Mani (2008). Improving Municipal Solid Waste Management in India. A Sourcebook for Policy Makers and Practitioners

[26] D. Hoornweg, T. Laura & L. Otten (2016). Composting and its applicability in developing countries

[27] Etyang .M. (2018). A step by Step Practical Guide to Mastering Research.

[28] European Union (2002). Stories on Composting and separate collection

[29] Fahzy Abdul-Rahman (2014). Reduce, Reuse, Recycle: Alternatives for Waste Management Guide G-314

[30] Gertsakis, J., Lewis, H., Sustainability and the Waste Management Hierarchy – A Discussion Paper, EcoRecycle: Victoria, 2004.

[31] Gonzalez-Torre, P.L.; Adenso-Diaz, B. Influence of distance on the motivation and frequency of household recycling. Waste Manag. 2005, 25, 15–23.

[32] Hoornweg, D.; Bhada-Tata, P. What a waste: A global review of solid waste management. Urban Dev. Ser. Knowl. Pap. 2012, 15, 1–98. [Google Scholar

[33] Hussein I.Abdel-ShafyaMona S.M.Mansourb (2018). Solid waste issue: Sources, composition, disposal, recycling, and valorization

[34] James Okot-Okum & Richard Nyenje (2011). Municipal solid waste management under decentralisation in Uganda

[35] Julianne M. (2008) Governance and Community Participation in Municipal Solid Waste Management, Case of Arusha and Dar es Salaam

[36] Kamran rousta (2018).Thesis for the degree of doctor of philosophy household waste sorting at the source a procedure for improvement

[37] Kielhofner, G. A Model of Human Occupation: Theory and Application; Lippincott Williams & Wilkins: Philadelphia, PA, USA, 2002.

[38] Konstantinos P. Tsagarakis (2017). Minimizing Onsite Organic Household Left-Over Waste: The Emission Benefits of Keeping Pet Rabbits

[39] Krejcie, R.V., & Morgan, D.W., (1970). Determining Sample Size for Research Activities. Educational and Psychological Measurement

[40] Leblanc R (2018). An over view of single stream recycling

[41] Ladu, J.L.C., X. Lu and M.A. Osman, 2011. Solid waste management and its Environmental impacts on human health in Juba town-South Sudan.

[42] Lamond J, Bhattacharya N, Bloch R. The role of solid waste management as a response to urban flood risk in developing countries, a case study analysis. In: Proverbs D, et al. editor. Flood Recovery Innovation and Response. Bristol: WIT Press; 2012. p. 193–205.

[43] Linzalone N, Bianchi F. Studying risks of waste landfill sites on human health: updates and perspectives. Epidemiol Prev. 2005;29(1):51–3.

[44] Lorraine E. Whitmarsh*, Paul Haggar and Merryn Thomas (2018): Waste reduction behaviors at home, at work, and on holiday What influences behavioral consistency across contexts? School of psychology, cardiff university, cardiff, united kingdom

[45] Mackaness, C. (2005) Funky style in shades of green. Telegraph Weekend. In Bekin, C., Carrigan, M. & Szmigin, I. (2007) Beyond recycling: 'Commons-friendly' Waste reduction at new consumption communities. Journal of Consumer Behaviour, 6, 271-286

[46] Metkel A & Wassie B (2019). Household's preferences for improved solid waste management options in Aksum city, North Ethopia: An application of choice modeling

[47] Mbuligwe, S.E., 2002. Institutional Solid Waste Management Practices in Developing Countries: A Case Study of Three Academic Institutions in Tanzania. Resource, Conservation and Recycling, 35, 131-146.

[48] Michaela Bobeck (2010). Organic Household Waste in Developing Countries An overview of environmental and health consequences, and appropriate decentralised technologies and strategies for sustainable management Mityana Municipal Development Plan (2015)

[49] Mugenda O. M and Mugenda A.G. (1999). Research Methods: Quantitative and Qualitative approaches.

African Centre for Technology studies (ACTS), Nairobi, Kenya.

[50] National Environment Management Authority (NEMA) - Uganda, (2007). State of the Environment Report - 2007 - Uganda

[51] National Environment (waste management) Regulations (1999)

[52] Omran, A.; Schiopu, A.-M. Reasons for non-participation in recycling of solid waste in northern Malaysia: A case study. Environ. Eng. Manag. J. EEMJ 2015, 14, 233–243

[53] Oso and Onen, D (2008). A general guide to writing Research Proposal and Report, Nairobi: The Jomo Kenyatta foundation

[54] Ozcan, H.K.; Guvenc, S.Y.; Guvenc, L.; Demir, G. Municipal solid waste characterization according to different income levels: A case study. Sustainability 2016, 8, 1044

[55] Petit-Boix, A.; Leipold, S. Circular economy in cities: Reviewing how environmental research aligns with local practices. J. Clean. Prod. 2018, 195, 1270–1281.

[56] Philippe F. and Culot M., 2009. Household solid waste generation and characteristics in Cape Haitian city, Republic of Haiti. Resources, Conservation and Recycling, 54, 73-78. Available from: http://www.sciencedirect.com

[57] Pius Nsimbe, Hilbert Mendoza, Solomon Tsebeni Wafula & Rawlence Ndejo (2018). Factors associated with composting of solid waste at household level in Masaka Municipality, Central Uganda

[58] P.Jack, J. Siera, F. Causeret, L. Guinde, and J-M. Blazy (2016). Factors affecting the adoption of compost use by farmers in small tropical Caribbean islands

[59] Praveenkumar Hiremath1, Mohan. I. Naik, 2017. Role of Public Participation for Management of Solid Waste, with Respect to Quantity of Waste Generation, Collection and Transportation in Kalaburagi City, Karnataka, India Praveenkumar Hiremath1 , Mohan. I. Naik2 Ph.D., Research Scholar, Department of Environmental Science, Gulbarga University, Kalaburagi, India1 Professor and Scheme Head, AINP on Rodent Control, University of Agricultural Sciences, GKVK, Bangalore, India

[60] Ramatta M, Dennis C and Philip B.A (2014). Domestic waste disposal practice and perceptions of private sector waste management in urban Accra

[61] Rauf MU, et al. HIV, hepatitis B and hepatitis C in garbage scavengers of Karachi. J Pak Med Assoc. 2013;63(6):798–802.

[62] Rousta, K.; Ekström, K. Assessing incorrect household waste sorting in a medium-sized Swedish city. Sustainability 2013, 5, 4349–4361.

[63] R.V. Misra, R.N. Roy, and Himoka (2003). On farm composting methods

[64] Sekaran U. (2003), Research Methods for business: A skill building Approach, Fourth Edition, Southern Illinois University of Carbondale

[65] Smith, P. G., Scott, J. S., Dictionary of Water and Waste Management, Elsevier: Butterworth and Heinemann, 2005.

[66] Strydom, W. Barriers to household waste recycling: Empirical evidence from South Africa. Recycling 2018, 3, 41.

[67] Tucker, P. Understanding recycling behaviour. Paper Technol. 2001, 42, 51–54. 12.

[68] Taherzadeh,M.J.;Richards,T.ResourceRecoverytoApproachZeroMunicipalWaste;CRCPress: BocaRaton,FL, USA, 2015.

[69] Trasias Mukama, Rawlance Ndejjo,David Musoke, Geofrey Musinguzi,Abdullah Ali Halage, David O. Carpenter, and John C. Ssempebwa (2016). Practices, Concerns, and Willingness to Participate in Solid Waste Management in Two Urban Slums in Central Uganda

[70] Tumelo T. Kwailane, Thando D. Gwebu &Wame L. Hambira (2016). Challenges of domestic solid waste management: a case study of Lobatse Botswana

[71] United Nations Environment Programme (UNEP). Global Waste Management Outlook. 2015. Available from: http://web.unep.org/ourplanet/september-2015/unep-publications/ global-waste-management-outlook

[72] UN-HABITAT. Solid Waste Management in the World's Cities, Earthscan Ltd: London and Washington, D.C., p. V, 2010.

[73] Veronica Di Bella & Mentore Vaccari (2015). Constraints for Solid waste management in Somaliland

[74] Vrijheid M. Health effects of residence near hazardous waste landfill sites: a review of epidemiologic literature. Environ Health Perspect. 2000;108 Suppl 1:101–12.

[75] Whitmarsh, L., Capstick, S., and Nash, N. (2017). Who is reducing their material consumption and why? A cross-cultural analysis of dematerialization behaviours

[76] World Bank (2018). What a waste 2.0 A global snapshot of solid waste Management to 2050 report

[77] Yusof MBM, Othman F, Nashim N, Nur CA: The role of socio-economic and cultural factors in municipal solid waste generation: A case study in Taman Berling, Johor Bahru. J Teknologi. 2002, 37: 55-64.

[78] Ziraba e A.K, Tilahun N.H& Blessing M (2016). A review and framework for understanding the potential impact of poor solid waste management on health in developing countries