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DEPARTMENT OF DEVELOPMENT STUDIES

ASSESSMENT OF COMMUNITY'S PERCEPTION OF MUNICIPAL SOLID WASTE MANAGEMENT STRATEGIES AND CHALLENGES IN THE BUEA MUNICIPALITY VERSUS KANIFING MUNICIPAL COUNCIL (KMC) IN THE GAMBIA

Thesis submitted to the Department of Development Studies in Partial Fulfilment of the Requirements for the Award of a Master's of Science (MSc) degree in
Regional Planning and Project Management

By

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BUEA, NOVEMBER 2015

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We hereby certify that this thesis entitled "**Assessment of Community's Perception of Municipal Solid Waste Management Strategies and Challenges in Buea Municipality versus Kanifing Municipal Council (KMC) in the Gambia**" was prepared by Baboucarr S. M. Gaye under our supervision.

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Dedication

I wish to dedicate this piece of work to my late nephew Bukary Gaye a former employee of the Customs and Excise Department in the Gambia.

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List of Acronyms

AEO …….African Environment Outlook
BBO ……...……..Buy, Build and Operate
BOO …….…..…… Build, Own and Operate
BOOT …….……..Build, Own, Operate and Transfer
BOT ……..Build, Operate, and Transfer
DAT ……. Department of Environment and Tourism Affairs
CBO ……..……....Community Based Organisation
CDM …….……Clean Development Mechanism
EPR …….. Extended Producer Responsibility
EU ……European Union
FGD …….…….Focus Group Discussion
GMC …….....Gwalior Municipal Corporation
HSWA ……..Hazardous and Solid Waste Amendment
HYSACAM …….……...Hygiene and Sanitation Company of Cameroon
IETC ……...Environmental Technology Centre
IFC ……..International Finance Corporation
KMC…….Kanifing Municipal Council
KII …….……...Key Informant Interview
LMG …….……...Local Municipal Government
MCECs…….…….. .Multifunctional Clean Energy Centres
MCECs ……Multifunctional Clean Energy Centres
MDG …….……...Millennium Development Goal
MSW……Municipal Solid Waste
NGO ……Non-governmental Organisation
PCBs…… Polychlorinated biphenyls
PCTs ……Polychlorinated terphenys
NPM ……New Public Management
PPP ……..Public Private Partnership
RCRA …….…….Resource Conservation and Recovery Act
SOEs ……..… State-owned Enterprises
SPSS ……..….Software Package for Social Sciences
SWM ……. Solid Waste Management
UNEP ……..United Nations Environmental Programme

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Abstract

Waste is an inevitable consequence of industrialization and urbanization. Like in all other rapidly urbanising municipalities in the developing world, municipal solid waste and its management is a major challenge to the sustainable development, of which Buea and Kanifing Municipalities are no exception. The study was aimed at assessing the community's perception of Municipal solid waste management strategies and challenges in Buea Municipality and Kanifing Municipal Council in the Gambia. Data was collected through detailed structured questionnaires administered to 200 residents of the Buea municipality. This was complemented by key informant interviews, field observation and a desktop review of related literature for both areas. The study found that organic waste was the most generated (35%) and 41%} forms of waste in both Buea and Kanifing municipalities respectively. There was a statistically significant variations ($p<0.05$) across the study locations. Also, the study found that waste collection dustbins were not evenly distributed. Most people resorted to the use of bags, plastic buckets among others for the storage of waste. Waste was not totally disposed of at the officially designated collection points. Waste was collected at least once a week, but collection frequency varied. Collected wastes were deposited at open dump in Musaka and Bakoteh dump sites. Most of the respondents did not know how waste was treated but a few indicated incineration and burying as the common methods used. Challenges of municipal solid waste management in Buea municipality were ascribed mostly to inadequate dustbins and non-sorting of waste at origin. Conversely, challenges reported in Kanifing Municipal Council (KMC) in the Gambia were the indiscriminate dumping and disposal of waste. Finally, the study found out that poor waste management was associated with outbreak of diseases such as malaria in both areas. The study concluded that significant strides have been made in the context of the partnership between the Buea council and Hygiene and Sanitation Company of Cameroon (HYSACAM) but more still remains to be done. The study recommends provision of more dustbins and community sensitisation on hygiene and sanitation norms and on the importance waste sorting at point of origin in both municipalities.

Keywords: *Waste, Municipal Solid Waste, Waste Management, Public Private Partnership.*

CHAPTER ONE

INTRODUCTION

1.1 Background

Throughout the world, all human activities results in the generation of waste. According to the United Nations Populations Fund, UNFPA, (2008), about 3.3 billion human populations live in towns and cities and this number is expected to increase to about 5 billion by 2030 (UNFPA, 2008). Literally, more people in a specific geographic location would imply higher level of waste generation, hence more waste to manage within that area. Poorly managed wastes are perceived to have negative effects to the environment. However many societies are unable to effectively manage such wastes. This inabilities of societies to manage waste generation effectively play great role in increasing extant environmental pressures (Alam *et al.*, 2007).The challenge that such potential population growth thus presents to decision makers and planners in meeting corresponding needs for food, shelter and waste management is complex. How this may be efficiently done poses a problem in many societies today.

Countries with fast growing urban populations face serious waste disposal problems mainly because the rate of waste generation is often not matched by improvement in management and disposal of the waste materials. According to Boadi and Kuitunen (2002), large amounts of garbage generated in urban settlements mostly come from households, schools, medical facilities and industrial activities. In developing countries, the problems associated with solid waste management are more acute than in developed countries (Zerboc, 2003). These countries are characterised by lack of financial resources and infrastructure to deal with solid waste creates a vicious cycle.

Lack of resources leads to low quality of service provision which may lead to fewer people willing to pay for said services, which in turn further erodes the resource base and so on Kuniyal *et al*. (1998). However, more often than not, an increase in population is not matched with an equal increase in revenue for the local municipalities for waste management (Zerboc, 2003). Another significant factor that contributes to the problem of solid wastes in a developing country scenario is the lack of proper collection and transportation facilities. Improper planning coupled with rapid growth of population and urbanization serves to add congestion in streets, and as a result the waste collection vehicles cannot reach such places, thus allowing filth to build up over time. Lack of monetary resources, at times, results in improper or no

transportation vehicles for waste disposal adding another dimension to the ever rising cycle of problems (Jain 1994, Zerboc 2003).

Besides this, rapid urbanization means rapid growth of shanty dwelling units that are largely unplanned for, and add to the waste, health, and hygiene problems.

In fragile ecological zones such as in mountainous environment, solid waste is the number one threat (Jain, 1994). Here, tourist inflow adds significantly to the demands on resource base and contributes considerably to the amount of wastes generated. Often regulations fail to encapsulate the waste generated by the tourists and fees to be paid there of (Jain, Kuniyal *et al.* 2002).

In fact, the challenges stemming from the generation of waste is not just coping with the volume, but also its composition and having the ability to design and accomplish its management in an efficient and sustainable manner. Waste should be disposed of in a safe way which takes into cognizance the health of environment and that of the public, while ensuring non-detrimental effects on generations to come (Ali *et al.*, 1999). While in developed parts of the world, sustainability encompasses ensuring that future generations are not negatively affected by environmental choices made today; for most developing countries, attention rather lies on what can be currently gained from such choices, especially from the socio- economic standpoint (Khatib, 2011).

A typical solid waste management system in a developing country displays an array of problems, including low collection coverage and irregular collection services, crude open dumping and burning. These public health, environmental, and management problems are caused by various factors which constrain the development of effective solid waste management systems. They can be categorized into technical, financial, institutional, economic, and social constraints.

The Cameroonian and the Gambian governments are gradually emerging from a hygienist vision of municipal solid waste management and are adopting a more environmentalist, sustainable approach. Although in Cameroon no legislation to this effect is currently in place, the Ministry of Environment and Sustainable Development has incorporated the concept of sustainable development in its waste management strategy document. This official strategy is

clearly structured around three priorities. The first is to prevent and reduce the production and harmfulness of waste by developing clean and more resource-efficient technologies.

The second priority is to ensure that more waste is recovered and recycled, and the third is to dispose of non-valuable waste in a sustainable way. Implementing this kind of policy, however, runs into the obstacle of the sector's funding problems.

1.1 Study Area

1.1.1 Background of Buea

Buea (Fig. 1.1 and 1.2), the regional headquarter of the South West Region of Cameroon was created on the 29th of June 1977 by presidential decree No. 77/203. The Buea Municipality has a surface area of 870 sq. km, 67 villages, four distinct identified urban spaces as per outlined criteria (Buea station, Soppo, Molyko, Mile 17 and Muea). It is highly complex community caught between a blend of urban, rural and traditional settings.

Buea Municipality is bounded to the north by tropical forest on the slope of mount Cameroon (4100m above level). The mountain range extends to the beautiful sandy beaches of the Atlantic Ocean. The town also share boundary with other major towns like the city of Limbe to the South West, Buea Municipality to the South East, Muyuka Municipality to the East and Idenau district to the West. With an Equatorial climate, temperatures are moderate with a slight seasonal variation (rainy and dry seasons) Buea has moderate economy with agricultural, administrative, business, tourism and the financial sector taking the central stage of the town.

Buea has an estimated population of above 200,000 inhabitants Business and job creating programme and sustaining them (BUCREP, 2005) and annual growth rate of 5% as per United Nations projections for urban population growth rate for Africa; constituting essentially of the Bakweris (the indigenes) in the villages and a highly cosmopolitan population within the urban space putting the indigenes at a minority. The Bakweri language spoken by the natives is equally written and documented. English and French are two official languages used for general interaction while pidgin is the lingua franca. According to a 2004 survey carried out by the Ministry of Public health in Cameroon, about 40% of the population do not have access to quality health care while close to 60% have financial difficulties to afford basic health care services. The citation is currently true for rural areas of the municipality and much less realistic for the urban zones, (Ministry of Public health, Cameroon, 2004)

Like the rest of the country, Buea enjoys tropical climate with two distinct seasons- dry and rainy season. The rainy season last from around March to October, while the dry season last from November to February. The rainy season is marked by relatively low temperatures (about 15 degrees Centigrade) during which moisture-laden and predominantly South West Monsoon originates from the Atlantic ocean and blow over the whole country. The peak of the rainy season falls between late June and early September when heavy down pours of tropical rains are experienced. On the other hand, the dry season is marked by abundant sunshine accompanied by high temperature (about 30 degrees centigrade) especially during the day. Predominant winds from the Sahara desert blow into the country, bringing along dry conditions.

Because of its location at the foot of Mount Cameroon, Buea enjoys a considerably more temperate climate than the rest of the country which is generally cool but dry and humid, with maximum temperature ranging between 25 to 35 degrees centigrade. Humidity levels in the area often range between 75% and 80% during the months of November through February. Thunderstorms and fogs are common, rolling of the mountain into the city below.

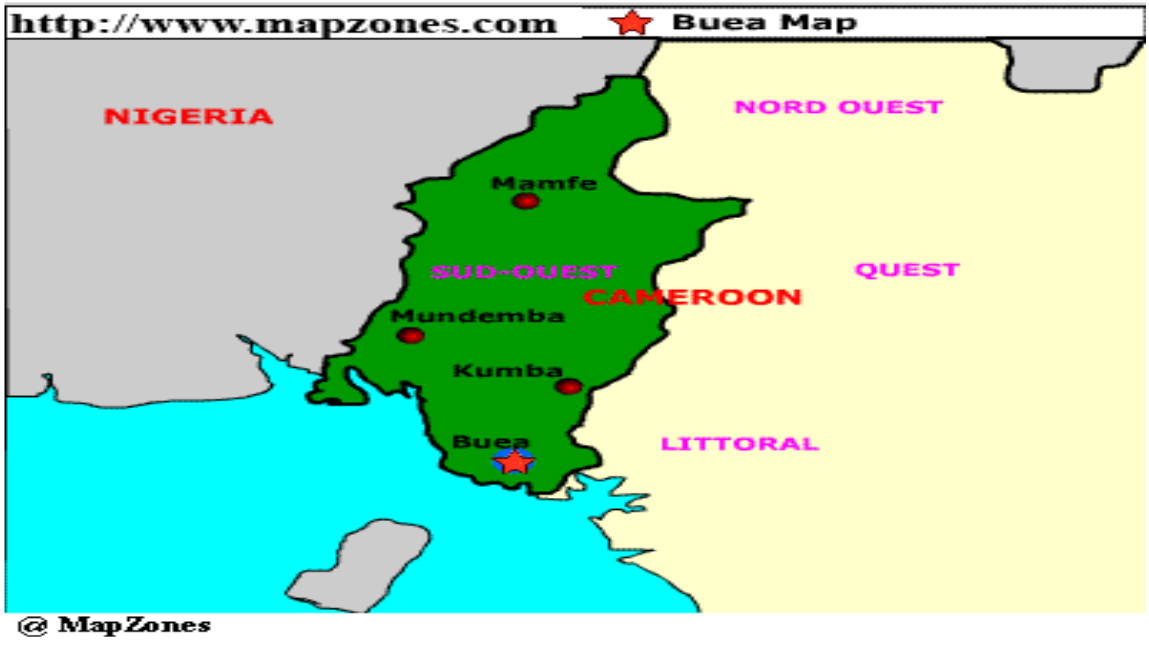

Figure 1.1: The map of the South West region of Cameroon showing the major towns including
Source: cf. www.weather-forecast.com

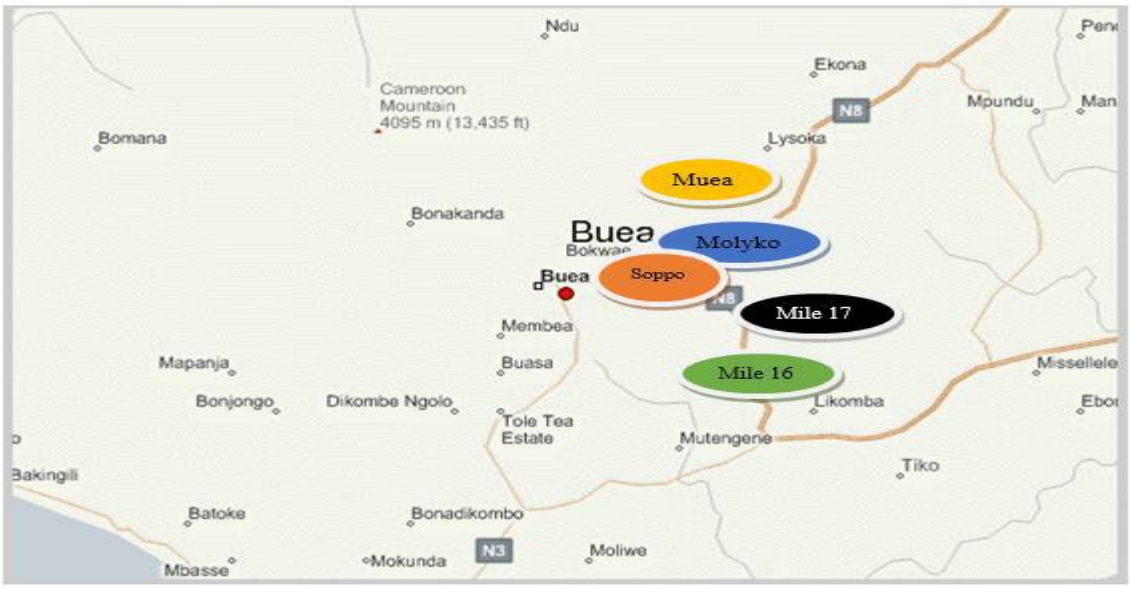

Figure 1.2*:* Buea Location Map (South-West Region) showing in yellow, blue, orange, and green circles the settlements that were targeted by the study.

Source: cf. www.weather-forecast.com

1.1.2 Background of The Gambia

The Gambia is a tiny country located in West Africa and is divided into the South and North bank by the river Gambia. The country covers a total area of 11,300 km², and at its widest point, it is not more than 48-km wide. 1,300 km² of the Gambia's territory is covered by water. With the exception of an 80-km border on the North Atlantic Ocean, the Gambia is almost entirely surrounded by neighboring Senegal.

The climate is like that of some countries in West Africa with two seasons – dry and rain. Unlike Cameroon, the rainy season starts from mid-June to November and the dry season from November to May. The Gambia has a liberal, market-based economy characterized by traditional subsistence agriculture, a historic reliance on groundnuts (peanuts) for export earnings, a re-export trade built up around its ocean port, low import duties, minimal administrative procedures, a fluctuating exchange rate with no exchange controls, and a significant tourism industry.

Figure 1.3: Map of the Gambia showing major towns

Source: www.accessgambia,com/country.html (2010).

Agriculture accounts for roughly 24% of Gross Domestic Product (GDP) and employs about 70% of the labour force. Within the agricultural sector, peanut production accounts for 6.9% of GDP, other crops 8.3%, livestock 5.3%, fishing 4%, and forestry 0.5%. Industry accounts for approximately 12% of GDP and services about 59%. The limited amount of manufacturing is primarily agricultural-based activities include soap, soft drinks, and clothing (Anadre Van Zandbergen, 2014).

Figure 1.4: Map of KMC

Source:www.accessgambia.com/country.html (2014).

1.2 Statement of the Problem

Open dumping of waste presents a real threat to the environment and to human health and is commonplace in developing countries like Cameroon and the Gambia. Constrained by budget pressures, towns and cities in the southern hemisphere are struggling to deal with the proliferation of municipal solid waste. Global production has practically doubled over the past ten years and is expected to reach 2.5 billion tons per year in 2025 as a result of the combined effect of urban development and changes in consumption patterns.

However, prospects for the private sector are still largely dependent on the establishment of a strict, secure regulatory framework, good public governance and better access to finance. They are also constrained by the local authorities' limited financial resources. To some extent, recycling and recovery activities are not affected by budgetary limitations.

On the one hand, the failure in municipal service delivery by national and local governments in many Municipalities like Buea and Kanifing in developing countries has often been attributed to inequitable resource allocation, low revenue collection, low service coverage, mismanagement, low institutional capacities, corruption and lack of transparency and accountability. The mentioned problems coupled with the increasing urban growth and waste generation in most of the cities in developing world have overwhelmed the capacity of the municipalities to provide adequate and efficient waste management services resulting in gross urban environmental decay and an increased involvement by informal sector who are in most cases not recognized by the authorities and other actors other than municipalities in solid waste management.

On the other hand, unplanned and rapid urbanization and population growth automatically increases the demand for waste services and this is due to the fact that people moving to the cities and the majority are likely to be migrants from rural areas in search for better life and employment (Khajuria, 2010, Zerbock 2003). Municipal tax and fee revenues, however, are not likely to rise as quickly as the population and in this situation public sector in many cities in developing world are unable to deliver services effectively.

The reason behind this is that, solid waste management in these countries receives less attention from governments and policy makers than that paid to other urban environmental problems, such as air pollution and wastewater treatment Schübeler et al (1996), lack of financial resources is another problem to cope with the increasing amount of generated waste produced by the rapid growing cities, insufficient funds from a central municipal budget cannot finance adequate

levels of service Zurbrugg, (2003). Thus, the formal sector which is administrated by the municipalities tends to be costly and inefficient (Medina, 2010).

However not only financial problems affect the efficiency and sustainability of a waste collection service, other factors like operational inefficiencies by municipalities, inefficient organizational procedures, or deficient management capacity of the institutions involved as well as the use of inappropriate technologies also results in inefficient waste management (Schübeler 1996, Zurbrugg 2003).

Urban environments generate various types of waste, with serious implications for human health and environmental sustainability. The types of waste generated include municipal solid waste, waste water from various sources (including households and industries), and sludge from human excreta. A key indicator of the challenge to manage some of these waste streams is reflected in the difficulty by most Africa countries to meet the Millennium Development Goals, especially that on sanitation and slums.

Indeed, efforts to improve the situation have been outpaced by rapid population growth and urbanization. Public authorities are ultimately responsible for ensuring the provision of adequate waste management services. However, the private sector's role is vital in complementing the efforts of Government. The waste management "value chain", which includes the collection, treatment, reuse, disposal and recycling of various waste streams, provides economic incentives that allow for the private sector to be an effective partner in environmental management, given an enabling environment for private sector investment in waste management activities.

Like most cities and Municipalities in Africa, Buea and Kanifing Municipalities are also faced with some challenges in managing the growing waste. Waste collection and disposal has been and still a major problem in these Municipalities. Before the partnership with HYSACAM, a private company the Buea Council could not and is still grappling with the volume of waste generated on daily basis. According to the Regional Manager of HYSACAM, Michel Ngapani (2010) during the commissioning ceremony of the partnership with Buea Council he said "For over 10 years now, the hygiene and sanitation situation in the Buea Municipality has been unbefitting. In the past in the Gambia the Department of Public Health was responsible for waste collection and disposal. Currently this responsibility has been handed to the local

authorities. In the Greater Banjul area, services are also contracted to private companies (Department for International Development UK, 2010).

The hygiene and sanitation Department of the Buea Municipal Council with one rubbish skip only, has battled to no avail with waste management in the municipality. Most often, the streets of Buea are transformed into waste parks accompanied negative environmental impacts with adverse environmental and health risks if waste are improperly disposed or stored with disgusting odour when the lone rubbish-truck gets a breakdown. Inhabitants too sometimes fail to respect using the waste containers the council has allocated. Other challenges faced by HYSACAM include limited equipment, people's negative attitude, and poor access to neighbourhoods. Sometimes they dump their waste into the draining system without knowing the health implications of it. It is against this background that this study was conducted.

1.3 Objective of the Study

The overall objective of this study is to assess comparatively the existing Municipal solid waste management strategies and possible challenges within Buea and Kanifing Municipality in the Gambia. Specifically it aims to:

- To identify the types of waste generated most in the Buea Municipality and KMC in the Gambia
- Examine the strategies used by households and HYSACAM for effective waste management in the Buea Municipality?
- Assess the effectiveness of the partnership in waste management between HYSACAM and Buea Council.
- Identify and analyze the major challenges associated with waste within the Buea Municipality versus Kanifing Municipal Council (KMC) in the Gambia?

1.4 Research Questions

1. What are the type of waste mostly generated in the Buea Municipality and KMC in the Gambia?
2. What are the current waste management strategies employed by households and HYSACAM for effective waste management in Buea Municipality and KMC?
3. How effective is the partnership between HYSACAM and Buea council in waste management?
4. What are the possible challenges associated with Municipal solid waste management within the Buea Municipality and KMC in the Gambia?

1.5 Significance of the Study

This study is significant because it addresses some critical developmental issues that affect the society at large. Public Private Partnership (PPP) in waste management between Buea Council and HYSACAM would bring several benefits to community members, the Buea Council and HYSACAM and the government at large.

Waste management more generally is often viewed primarily as an environmental concern; given its adverse health-related impacts. Despite of this, it is envisaged that effective waste management can provide important employment and income-generating opportunities especially to poor community members. As stated in a study on Informal Waste Recovery and Recycling: Alleviating Poverty, Environmental Pollution and Unemployment in Douala, "that the growing interest at the landfill is on scrap metals, plastics, glass, paper and cardboards. More than 90% of the waste pickers interviewed indicated that they earn a daily income of 1000 FCFA–1500 FCFA (US$2.90–US$3.33) from the sales of usable waste materials (Mbeng, 2008).

Moreover, because waste management is typically managed by municipalities, improvements in this sector are often associated with local governance reform, decentralization, and community engagement. The expansion of recycling and improvements in waste management can therefore deliver important benefits in terms of the economic and social, as well as environmental dimensions of sustainable development. Therefore proper waste management in this context can help in reforming the activities of Municipal Councils.

By working in partnership with the private sector, governments will benefit from the strong incentives for private firms to cut down costs associated on waste management as well as use disposables as a means of generating meaningful jobs. Often, private firms will avoid the bureaucratic problems that plague national and municipal governments, and they can experiment with new technology and procedures. Public Private Partnerships allow government to extend services without increasing the number of public employees and without making large capital investments in facilities and equipment.

Private sector will often obtain a higher level of productivity from their work forces than can civil service systems, for instance they can use part-time labour where appropriate. Partnering with the private sector gives local governments the ability to take advantage of economies of scale. By contracting with several suppliers, the governments can assure continuity of services. In addition by contracting competitively for services, they can determine the true costs of production and thereby eliminate waste (Gerrard, 2001).

1.6 Scope of the Study

The study was conducted in five settlements in the Buea Municipality in the South West region of Cameroon namely: Mile 16, Mile 17, Muea, Great Soppo and Molyko. The Kanifing Municipal Council (KMC) was also targeted for comparison reason. The main focus of the study was on Municipal solid waste management in both Buea and Kanifing Municipality in the Gambia.

1.7 Organization of the Study

The study is organized into five chapters. Chapter one gives the introduction of the study which features the background, problem statement, objective of the study, research questions, significance of the study and definition of key terms. Chapter two includes the literature review, the theoretical framework, and gaps identified in the literature and how the work shall attempt to fill them. The methodology to be used in the data collection and data analysis of the study are highlighted in chapter three. Chapter four presents and gives detailed analysis of the findings which tries to answer the formulated research questions. In the same chapter, the implications of the findings and limitations of the study are also discussed. The last chapter of the report is the summary of findings, conclusion and recommendations.

A list of references which is the list of all documents consulted and information used in the study and appendices are also found at the last pages of the report.

1.8 Definition of Terms

Municipal Solid Waste

Municipal solid waste commonly known as trash or garbage in the US, and as refuse or rubbish in the UK, is a waste type consisting of everyday items that are discarded by the public.

Public Private Partnership

This is an arrangement where parties, known as partners, agree to cooperate to advance their mutual interests.

Perception

The ability to understand the nature of something or the way you notice things.

Waste

Waste or refuse is an unwanted left over substance that have been discarded or thrown away after domestic use.

Waste management

The collection, transportation, and disposal of garbage, sewage, and other waste products.

CHAPTER TWO

LITERATURE REVIEW

2.1 Definition of Waste

Waste can be defined differently because it depends on the individual and his or her background. According to Gourlay (1992), waste is matter thrown away or something that is no longer useful, and it has been discarded. Refuse is mainly solid waste disposed from either residential areas or work places. Refuse normally comes from domestic, workplaces, street cleaning, hospitals and other institutions. Waste from heavy manufacturing is collected, processed and disposed by the companies or other contractors who are into such business. Failure by the local authorities to collect refuse results in urban dwellers dumping it at open sites as well as peri-urban areas which are health hazards and cause pollution (Coad, 2006). It is the duty of the city fathers to collect waste.

According to Thomas-Hope (1998), uncollected refuse is posing a great challenge to cities mainly in the developing countries. According to United Nations-Habitat (2006), less than 20% of urban solid waste is collected and disposed of properly. In an effort to solve the problem of refuse, communities had been empowered through the Community Based Organisations (CBO) to manage waste in their areas. Furthermore, (Gourlay, 1992), defined waste or refuse as an unwanted left over substance that have been discarded or thrown away after domestic use.
Waste is material that is not a prime product, for which the initial user has no further use, in terms of his or her own purpose of production, transformation or consumption, and of which he or she wants to dispose; hence, waste is every one's business. Waste may be generated during the extraction of raw materials, the processing of raw materials in to immediate and final products, the consumption of final products and also from other human and economic activities (United Nations Environmental Programme, 2002).

2.2 Types of Waste

Wastes which arise from virtually all man's activities can be classifies conveniently with respect to their source. Major categories include household and consumer's wastes i.e. Municipal wastes, industrial wastes, agricultural wastes, extraction wastes, energy production wastes and also sewage sludges. Wastes can also be classified by hazard and by composition.

2.2.1 Municipal Wastes: The term ‘’ Municipal wastes’ applies to those wastes generated from household and to wastes of similar characters derived from shops, offices and other commercial units. Levels of municipal wastes production are related to levels of industrialisation and levels of income. Per capita wastes generation varies between 2.75 and 4.0 kg per high income countries but is as low as 0. 5kg per day in those countries with lowest income, (Miller, 1988).

2.2.2 Agricultural Wastes: Wastes produced by agricultural activities comprise animal slurries, silage effluent end of spray residues and tank washing following pesticides use, and empty plastic packaging ground, trees, tree branches. Sewage sludge are produced as a result of the treatment of industrial and domestic wastes. Animal manures and silage effluents are the main components of agricultural wastes. Like sewage sludge, these comprise the slurry of fine-grain, organic -rich particles. Sewage particles may be contaminated with heavy metals, water-soluble organic chemicals, grease and oil depending on the source of effluent and efficiency of treatment, (Saunders, 2013).

2.2.3 Industrial Waste: Industrial process encompasses a very wide range of materials and may include general factory rubbish, packaging materials, organic wastes, acids alkalis and metal. Mining wastes arise as by-products of the extraction process and may include top soil, rock and dirt, and may be contaminated with small quantities of such materials and as metal and coal. The most important feature of industrial and mining wastes is that a significant proportion is regarded as hazardous and as such, requires special treatment and disposal. Industrial wastes are considered briefly because they are not a major problem to rural communities, though as industrial processes grow and move to country side, those responsible for the health of the people need to think and plan ahead for the coming industrial problem which will be generated. With the case of Buea, industrial waste is relatively small in quantity, which includes; cartons, papers, parts of old electronics, (Saunders, 2013).

2.2.4 Hazardous Wastes: It is generally accepted that the bulk of hazardous wastes are generated by process industry, the main source being the chemical sector, minerals and metal processing industries and engineering industries. Estimates of hazardous wastes arising are uncertain because of difficulties in providing a concise definition of hazardous wastes arising in the European Economic Community(EEC) Vary from 17% to 50% of all industrial wastes arising depending on the interpretation of the EEC definition(Haines 1989). Hazardous wastes

arise not only as by-products of industrial processes, but also when consumers discard empty chemical packages and other items at the end of their useful life. Many countries are concerned about the increasing quantities of hazardous materials in, for example aerosol cans, "empty" chemical packages and batteries that find their ways in to the municipal waste stream. In addition, many "white goods" (i.e., washing machines, refrigerators, etc.). Contain small quantities of chemicals such as polychlorinated biphenyls (PCBs) and chlorofluorocarbons, (Haines, 1989).

2.2.5 Radioactive Wastes: Radioactive wastes arise primarily from nuclear power generation; smaller quantities are derived from military force and a variety of uses in medical, industrial and university establishment. There are many types of radioactive wastes which can be classified either according to their radioactive properties or according to the source in which they are originated. Low –level radioactive wastes generally consists of contaminated laboratory debris, biological materials, building materials and uranium mine tailings. Spent fuels from nuclear power reactors, together with liquid and solid reduce from reprocessing of spent fuels are classified as high-level radioactive wastes (Saunders, 2013).

2.2.6 Biomedical Wastes: Biomedical wastes refers to any waste that includes anatomical, pathological wastes, infectious wastes, hazardous wastes and others generated in health care facilities and medical laboratories that require special handling.

2.3 Characteristics of Waste

The wastes include kitchen waste, papers, construction materials, old tyres, medical wastes, etc. In order to understand the severity of the problem and to work towards a solution, one must understand the types of wastes being generated.

2.4 Classification of Solid Waste

Wastes can be classified into:

- **Biodegradable Wastes** - The biodegradable wastes are those that can be decomposed by the natural processes and converted into the elemental form. For example, kitchen garbage, animal dung, etc.
- **Non-biodegradable Wastes** - The non-biodegradable wastes are those that cannot be decomposed and remain as such in the environment. They are persistent and can cause various problems. For example, plastics, nuclear wastes, glass, etc.

- **Hazardous Wastes** - Hazardous wastes arise not only as by-products of industrial processes, but also when consumers discard empty chemical packages and other items at the end of their useful life. Many countries are concerned about the increasing quantities of hazardous materials in, for example, aerosol cans, "empty" chemical packages and batteries that find their ways into to the municipal waste stream. Also, many "white goods" (i.e., washing machines, refrigerators, e.t.c.). Contain small quantities of chemicals such as polychlorinated biphenyls (PCBs) and chlorofluorocarbons (NCS Pearson, 2015).

2.5 Municipal Solid Waste

Municipal solid wastes are wasted that result from economic productivity and consumption. This includes wastes from households, commercial establishments, institutions, markets and industries, and its handling and disposal is a growing concern to all nations Rechard, (1995). Municipal Solid Waste (MSW) is defined by Cointein (2006) as a non-air and sewage emissions created within and disposed of a municipality, including household garbage, commercial refuse, construction and demolition debris, dead animals, and abandoned vehicles. Municipal waste is generally made up of paper, vegetable matter, plastics, metals, textiles, rubber, and glass United States Environment Agency, (2002)

2.6 Waste Generation

According to Rakesh Gir et al. (2010) waste generation is an inevitable consequence of industrialization and urbanization. With increasing world population and standards of living, it is not amazing that the quantities of wastes have grown rapidly worldwide in recent decades. The explosive growth in population and sustained drive for economic progress and development has resulted in a remarkable increase in the quantity of solid wastes from different processes viz., domestic process, industrial processes in our country over the last couple of decades. With an urban population of about 27.8 per cent of the country's total population, Urban Solid Waste Management in India today represents a formidable challenge. While the country's overall annual population growth rate is about 2 per cent, the estimated urban population growth rate is much higher - around 3.5 per cent per annum (World Bank, 1998).

Also, the per capita income of the urban population has increased resulting in a rise of approximately 1.3 per cent of urban waste generation per head in the last five years. These two factors have led to a yearly increase of the overall burden of solid waste in Indian cities by

almost 5 per cent. At present, the total MSW generation in India is approximately 100,000 tonnage per day, most of which is disposed of unscientifically creating an environmental hazard. Drawing lessons from the national scenario, the Ministry of Environment and Forests, Govt. of India brought out Municipal Solid Waste (MSW) (Management and Handling) Rules 2000 and then entrusted the following responsibilities to the municipal authorities for the management and handling of municipal solid waste in an urban:

- Setting up of waste processing and disposal facilities on their own or through an operator of a facility as per specified;
- Organizing house-to-house collection of municipal solid wastes through any of the methods, like community bin collection (central bin), house-to-house collection, collection on regular pre-informed timings and scheduling by using bell ringing of musical vehicle (without exceeding permissible noise levels);
- Devising collection of waste from slums and squatter areas or localities including hotels, restaurants, office complexes and commercial areas;
- Making use of wastes, which are biodegradable in nature, such as wastes from slaughter houses, meat and fish markets, fruits and vegetable markets, etc.
- Prohibition of mixing of bio-medical and industrial wastes with municipal solid wastes and such wastes; and
- Transfer of collected waste from residential and other areas to the community bins by the hand driven containerized carts or other small vehicles (World Bank, 1998).

2.7 Municipal Solid Waste Management

Municipal Solid Waste Management (MSWM) refers to the collection, transfer, treatment, recycling, resource recovery, and disposal of solid waste generated in urban areas. MSWM is a major responsibility of local government and a complex service involving appropriate organizational, technical, and managerial capacity and cooperation between numerous stakeholders in both the private and public sectors. MSWM encompasses refuse storage and collection, street and drain cleaning, solid waste transfer and transport, solid waste disposal and resource recovery (Bernstein, 2004).

Furthermore, Tanaka (1999) stated that waste management nowadays is about waste reduction and recycling. Items valued as useless are processed and find their way back to the market, and

this practice is encouraged as it is helpful in waste management. In developing countries, including Zimbabwe, the problem of Solid Waste Management is becoming complicated and requires long-term and sustainable programmes for its solution.

2.8 Management of Waste at the point of Generation (source)

The trend is to manage the waste cycle from cradle-to-grave, beginning with separation at source. Separation at source is an action whereby waste is separated into different waste types at the source of generation. The aim is to separate recyclables from non-recyclables, hazardous from non-hazardous into different waste fractions, which can then be taken directly to a suitable facility keeping in mind the waste hierarchy as mentioned above.

According to Gourlay (1992 the first consideration should be given to the proper storage of refuse while awaiting collection. The galvanized steel dust bin with close fitting cover is a suitable receptacle for storing refuse. The capacity of a bin will depend upon the number of users and frequency of collection. The stored refuses should be disposed of daily. In natural systems, there is no such thing as waste. Everything flows in a natural cycle of use and reuse.

Living organisms consume materials and eventually return them to the environment, usually in a different form, for reuse. Solid waste (or trash) is a human concept. It refers to a variety of discarded materials, not liquid or gas that is deemed useless or worthless.
However, what is worthless to one person may be of value to someone else, and solid wastes can be considered to be misplaced resources. Learning effective ways to reduce the amount of wastes produced and to recycle valuable resources contained in the wastes is important if humans wish to maintain a liveable and sustainable environment.

Solid waste management is the process of collecting, storing, treatment and disposal of solid wastes in such a way that they are harmless to humans, plants, animals, the ecology and the environment generally. The unhealthy disposal of solid waste is one of the greatest challenges facing developing countries Kofoworola, (2007). It is a problem recognized by all nations at the 1992 Conference on Environment and Development and regarded as a major barrier in the path towards sustainability (United Nations Conference on Environment and Development, 1992).

2.9 Waste Management Concepts

2.9.1 Waste hierarchy: this refers to the "three R's"; Reduce, Reuse and Recycle. It classifies waste management strategies according to their desirability regarding of waste minimization (figure 2.1). It aims at extracting the maximum practical benefits from products and to generate the minimum amount of waste.

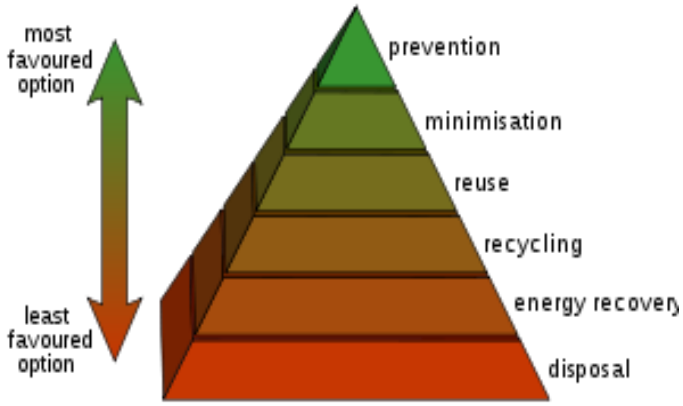

Figure 2.1 Waste hierarchy model

Source: Zorica Bacinschi, 2015

2.9.2 Extended producer responsibility (EPR): a strategy designed to promote the integration of environmental costs associated with products throughout their life cycle into the price of the product.

2.9.3 Polluter pays principle (PPP): a principle where a polluting party pays for the damage done to the natural environment (Zorica Bacinschi, 2015).

2.10 Waste Management Methods

2.11.1 Unconventional Method

2.10.1.1 Open Dumps: Open dumps are illegally dumped, abandoned piles of garbage and debris in large quantities and are mostly found in developing countries (plate 2.1). Open dump always breeds pest and vectors that cause diseases to those living nearby. The waste of an open dump always decays and its remains form part of the soil as organic manure. However, the complex mixture and diversity of the waste types found in open dump sites make it present potential threats the environment on humans (United States Environment Protection Agency, 2002).

2.11 Conventional Methods

2.11.1 Land filling: Land filling is the most widely used method of disposal in developed countries though there are means to adapting to small communities with minimum mechanical equipment. The waste is covered daily with rare exceptions, with 15cm of soil to control insects and rodents, to prevent fire and to discourage scavengers. The landfill is a process of controlled burial.

The requirements for it begin with the collection of a site. It should be within a short haul from the collection area, but distant from the human dwelling. A land area that will be improved by solid waste fill is desirable. The cover material must be readily available, with the best way of obtaining it being the excavation of a trench out of an area. The site opened is then filled with wastes, compacted by the best possible means at hand, and excavated material is used to cover the waste. A stable well-weathered road to the site is necessary so that waste disposal is not interrupted for more than two or three days during the rainy season (Jeff Davis, 2013).

Ownership and future use of the site and surrounding 200m zone should be controlled. Upon completion, access to the use of site must be limited. The site are opened to rainfall, surface drainage, and in poorly chosen locations, penetration by ground water. Water leaving the fill or dump site will carry dissolved mixed and suspended pollutants into to the surrounding soil and rock formation is called leachate. The process also converts some solid organic materials to liquids which are carried by the water leaving the fill. However, the landfills have become modern and it is called the 'Sanitary landfill'. The site is selected so that the wastes and their products are controlled and so that the method can be applied economically. That have structures like vent pipe sand leachate removal standpipes, to collect methane gas and to prevent groundwater contamination by leachates, respectively.

Uses of a modern landfill site are limited. Other than open sheds, no building should be placed on completed landfills since they will settle rapidly during the first few years and since there is danger from methane gas. Methane gasses are inflammable and explosive and the accompanying gases are extremely odorous. It should be planted with grass as it is completed to avoid drainage and erosion problems and prepare the site for further us Landfill sites are frequently used as playing fields (United States Environment Protection Agency, 2002).

2.11.2 Incineration: Incineration is more than open burning, and it is not easily adopted by developing countries since it is very expensive to manage (see figure 2.2). To have self-sustained burning, the waste must contain a minimum of 50 per cent by weight of combustible material and a maximum of 50 per cent moisture. These criteria are equally rarely met in rural villages where the only waste may be combustible leaves and branches that may be valuable as wood, fuel or manure. With burnable wastes, an incinerator is needed. Locally made devices are rarely satisfactory. When insufficient air is produced, the result is incomplete that is, burning with odour and smoke. The ash must be well handled, and a means provided for its disposal. The usual method is to use it as fill material on site. Incineration is not a satisfactory method for rural villages in developing countries Hsiue et al. (1991).

2.11.3 Recycling and Composting: According to the United States Environmental Protection Agency United States Environment Protection Agency, (2002), recycling is a process that involves collecting, reprocessing, and recovering certain waste materials (e.g. glass, metal, and plastics, paper) to make new materials or products. Some recycled organic materials are rich in nutrients and can be used to improve soils. The conversion of waste materials into soil additives is called composting. Recycling and composting generate many environmental land economic benefits. For example, they create jobs and income, supply valuable raw materials to industry, produce soil-enhancing compost, and reduce greenhouse gas emissions and the number of landfills and combustion facilities (United States Environment Protection Agency, 2002).

2.11.4 Source Reduction: Source reduction is sometimes called waste minimization. This should be the first option, in reducing the amount of waste produces. This can be accomplished through changes in design or technology. Waste source reduction is part of a pollution prevention strategy. Waste prevention strategies include using less packaging, designing products to last longer, and reusing products and materials. Waste prevention helps reduce handling, treatment, and disposal costs and ultimately reduces the generation of methane, (United States Environment Protection Agency, 2002).

2.12 Waste Management Practices

According to Graham (1999) one significant change started some years back and is now accelerated in all major western countries and is the proactive reduction and management of waste. In Africa, there are few formal systems of material recovery but however, there is a wide

reuse of plastics, bottles, papers, cans, for domestic purposes. This practice is highly common among the poor in the cities. Nevertheless, few items are converted into new products for local use. For example, melting of aluminium cans and scraps metals into household utensils, transforming old cars tires into shoes, ropes, and flower pots. All these activities have led to the growth of the informal sector in most developing countries and especially in Cameroon and her city of Buea in particular.

Ayang (2000) reported that in most developing countries, a lot of paper and glass recycling is going on, both in the private as well as the public sectors of the economy. Scrap metals are being recycled for motor arks; auto parts are generally sold from junk yards.

According to Taylor (2007) there is essentially no waste because one organism becomes nutrients for other organisms. Humans, on the other hand, produce huge amounts of waste that go unused and pollute the environment. He identified two approaches to solid waste management. In the first place, waste can be burnt, buried, or shipped to other countries. The second approach is waste reduction that entails recycling the waste for future use or sustainability. About 70% to 90% of the solid waste we produce can be eliminated by reusing and recycling materials and also by redesigning manufacturing processes and buildings to produce waste.

Households, formal and informal industries, commercial enterprises and other institutions generate waste. Their current practices point to their needs, to behaviour patterns that require change, and constraints within which new MSWM system will need to be designed or improved. Important questions to be answered are: Where do households and other stakeholders store their garbage? What products get recycled? What wastes are sold and then recycled? If the government is not providing an effective service, to whom do they turn to for help? What are current payment levels for MSWM? Who is paying for MSWM? How much do the different stakeholder groups participate in solid waste reduction, and through what participation forum? What motivates their participation?

Waste collection implies gathering of waste and transport to either the processing facility (WTS) transfer facility or disposed site EPA, (2010). This process has taken firstly in high-income nations like America, Portugal, Germany, and Canada and some high- income states like Russia and part of South Africa, colour code bins are placed in convenient location,

permitting waste holders and producers of a given area to dump it in the respective bins (United Nations-HABITAT, 2010).

2.13 Best Practices of Solid Waste Management

Waste management practices are not uniform among countries (developed and developing nations), regions (urban and rural), and sectors (residential and industrial).The Latin American model for integration of small-scale waste collection enterprises with the formal waste collection system is an example of sound collection practice. These systems were developed in the Andean countries and were increasingly being copied in some Central American countries and can be applied to African cities like Buea and KMC. The enterprises are paid by the municipal government or by a community organization to provide collection using muscle-powered or semi-motorized carts. They serve marginal or hilly areas that are not currently served and which collection trucks cannot reach (United Nations Environment Programme, 2012).

Due in part to the low cost of the equipment used, collection tends to cost approximately two-thirds as much as standard motorized collection methods. Administrative costs are minimal, particularly because members of the enterprise take part in its administration as well as in its operation.

Finally, operation and maintenance of the equipment is quite simple and inexpensive and can usually be done by a member of the Enterprise (United Nations Environment Program 2012).
What qualifies this model as a sound practice is its wide reach regarding creating benefit. The community benefits since it gets waste removal service. The city benefits, since it secures collection service at 65% of the "normal" cost and satisfies its mandate to maintain public cleanliness. Local individuals, especially single mothers, are often the first to respond to a call for the formation of such an enterprise, and benefit through creating jobs for themselves (United Nations Environment Programme 2012).

Another good example of best practices can be cited in Bhaktapur city in Nepal. Bhaktapur composting facility was commissioned in 1984 with support from German Technical Cooperation (GTZ) and it has been operating for almost 20 years. Now the Community Development Section is responsible for waste management in the municipality.

Most of the municipalities in Nepal have community development sections that are responsible for all aspects of waste management. Local community groups provide waste management services under an annual contract to the municipality in 12 of the 17 wards.

However, the municipality still has overall responsibility for waste management in the five remaining wards. The community contractors range in size from three to seven employees, are allocated to the wards according to the population of each ward. Each group is responsible for one ward to facilitate effective waste management. The municipality also allocates one waste inspector to each of the wards. Group contractors in all 12 wards are responsible for the household waste collection, street sweeping and the collection of municipal solid waste from various unofficial collection points.

The remuneration of each member of the group is same as the salary of a permanent sweeper of the municipality. Overtime is paid for work on public and national holidays. Residents have praised this system of waste management because it has not only provided a source of income to residents but has also made it easier to control and complain to the group workers since they are all known to the local community. The municipality is responsible for transporting and disposal of all the collected solid waste.

The main functions of the Community Development Section are street sweeping, cleaning of roadside drains, removal of dead animals, procurement and maintenance of waste collection vehicles, recruitment and training of waste management staff, and informing the public about the waste management system. This department is also actively engaged in waste minimization and segregation. It has also distributed almost 500 composting bins of 50 kilograms capacity, selling them for NRs10. 600 each (Bhaktapur municipality, 2008 data).

Exnora is a non-governmental organization based in Madras, which promoted the idea of forming neighbourhood associations for managing the primary waste collection. Civic Exnora units are formed by households from one or set of streets, and a small number of office bearers (either elected or, more commonly, filled by volunteers) form the Committee that manages the Civic Exnora. One person, responsible for collecting the wastes (called “street beautifier”), is appointed and trained; often a tricycle waste collection cart is purchased with a bank loan or funds from private sponsors. Wastes are collected from each household once daily and are taken to a Municipal bin or (increasingly) to a Municipal corporation transfer station. Each household contributes a monthly fee to the Civic Exnora. Based on the contributions, a monthly salary is

paid to the street beautifier and the remainder is used for repaying the loan for the purchase of the tricycle and undertaking any other programmes.

Surely mentioned that more than 60,000 people were receiving waste service from 500 roads in about 80 neighbourhoods, organized by 150 Civic Exnora units. A more recent estimate states that there are1, 500 Civic Exnora covering approximately 0.45 million people (Anand, 1999). In addition to these good practices of waste management, waste collection methods vary widely among different countries and regions. Domestic waste collection services are often provided by local government authorities, or by private companies for industrial and commercial waste. Some areas, especially those in less developed countries, do not have a formal waste-collection system. In some developed countries the following methods of waste management are adopted:

- In some areas such as Taipei, the city government charges its households and industries for the volume of rubbish they produce. Waste will only be collected by the city council if the waste is disposed of in government issued rubbish bags. This policy has successfully reduced the amount of waste the city produced and increased the recycling rate. A similar system operates in New Zealand where waste must be packed in specially identified bags (Crystal et al.2012).

- In some jurisdictions unsegregated waste is collected at the curb-side or from waste transfer stations and then sorted into recyclables and unusable waste. Such systems are capable of sorting large volumes of solid waste, salvaging recyclables, and turning the rest into bio-gas and soil conditioner.

- In San Francisco, the local government established its Mandatory Recycling and Composting Ordinance recyclables and compostable out of the landfill. The three streams are collected with the curbside "Fain support of its goal of zero waste by 2020, requiring everyone in the city to fantastic bin system - blue for recyclables, green for compostable, and black for landfill-bound materials - provided to residents and businesses and serviced by San Francisco's sole refuse hauler, Recology. The City's "Pay-As-You-Throw" system charges customers by the volume of landfill-bound materials, which provides a financial incentive to separate recyclables and compostable from other discards. The City's Department of the Environment's Zero Waste Program has led the City to achieve 80% diversion, the highest diversion rate in North America (Zurbrugg. 2003)’

For a given system to be sustainable it must be appropriate to the local conditions in which it operates, from a technical, social, economic, financial, institutional and environmental perspective and capable to maintain itself over time without reducing the resources it needs. Sustainable technology for waste management can be interpreted in two ways. First, waste management technology choices can be restricted to technical requirements like waste quantities and composition, area characteristics, haul distances to the disposal site and operational cost. Second, it may be interpreted in a broader perspective including economic conditions, the cost of labour and capital, maintenance and repair capacity, and skill levels of existing staff (Arnold Van de Klundert et al, 1999).

An appropriate technology is the simplest level of technology that can effectively achieve the intended purpose in a particular location. In poor third world cities, too often authorities seek to imitate the technology and equipment used in developed countries. This is misguided and often led to corruption. Households in many developing countries and cities like Buea do not sort their garbage as in industrialized countries and thus the adoption of technology will simply collect and dispose all wastes without recovery of reusable and recyclables (Hari S., www.gdrc.org).

2.14 Waste Management Problems in Africa

Waste management problems in Africa are varied and complex with infrastructure, political, technical, social/economic, and organizational/management, regulatory and legal issues and challenges to be addressed. Waste is typically disposed of without consideration for environmental and human health impacts, leading to its accumulation in cities, towns and uncontrolled dumpsites. Co-disposal of non-hazardous and hazardous waste without segregation is common practice. Municipal Solid Waste (MSW) management has continually been an intractable problem in recent times beyond the capacity of most municipal/state governments. This has resulted in refuse heaps being dumped in the urban landscape in heavily populated cities as typically only about 40 to 50% of waste is reportedly being collected.

The attractiveness of many cities in Africa is marred by the inefficient collection, management, disposal and reuse of municipal solid waste (MSW). Rectifying this requires a change in attitude towards how MSW is viewed. MSW needs to be viewed as a resource that should be incorporated into human development agenda and urban development. This has the potential for generating income for cities in Africa through the re-use of waste for purposes such as

energy generation. This, however, requires the adoption of appropriate technologies, most of which are not readily available in Africa. The inability of African countries to make efficient use of their waste through re-use suggests that as a future direction, African countries need to adopt a set of appropriate technologies that will assist them to convert waste into re-usable assets, (Africa Institute of South Africa AISA POLICY Brief Number 81 – September (2012).

Rates and quantities of solid-waste generation, composition and disposition vary across Africa, these being linked to local economies, levels of industrial development, waste management systems and lifestyles of the country concerned. The quality and availability of data on solid-waste generation and management in Africa are, however, scanty, and this impedes the development of programmes that will promote efficient use of solid waste in Africa. Developing a broader understanding of the types of solid waste that are generated by African cities, and researching how these can be used to advance development is now more than desirable, as solid waste is increasingly seen as an alternative source of renewable energy.

Devising better management options through reuse of waste in Africa will help the continent to achieve the Millennium Development Goal (MDG) number 7: to ensure environmental sustainability. However, there are factors that directly or indirectly influence MSW management in Africa. They include natural environmental concerns, social norms and associated concerns, economic factors, historical influences, political contexts, local, regional and national legislation, institutional factors, educational factors, technological developments, human resource deployment and financial constraints. These, combined, bring to the fore challenges associated with future directions of MSW management in Africa.

Africa has a varied historical and political background of waste management. There have been, for instance, allegations that some African countries serve as dumping grounds for toxic and hazardous waste, produced mostly in the developed world. To some extent this is directly linked to a culture of economic dependency on developed countries; the inherent belief that Africa can be used for any purpose; corrupt traditions and practices that are endemic to Africa and which ultimately affect all facets of lifestyles in Africa; and environmental management practices (Africa Institute of South Africa AISA POLICY Brief Number 81 – September (2012).

Some of the largest African cities like Nairobi, Dar es Salaam, Lagos, Cairo and Johannesburg are experiencing population growth trends that are primarily fuelled by high levels of migration.

This has led to the increased production of solid waste in these cities, with waste-collection systems as a result becoming inefficient, so that the cities lose their attractiveness.

Proper sanitary landfills are still lacking in most African cities and waste is often thrown around in heaps. This is the direct cause of most cities in Africa being perceived as unhealthy. By 2020 more than 50 per cent of the population in sub-Saharan Africa will be living in the cities. This is likely to raise the daily rate of production of waste by as much as 1,0 kg per capita. For instance, the African Environment Outlook (AEO) of the United Nations Environmental Programme (UNEP) estimates that the per capita generation of solid waste is an average of 0,7 kg/day in Zimbabwe and 1,0 kg/day in Tanzania.

Most of this waste contains large proportions of organic matter. Mauritius generates around 1. 1 kg/capita daily of mixed MSW, which has increased significantly from 0,8 kg per capita. South Africa has noted the impact of waste as a big challenge of the twenty-first century in its Integrated Pollution and Waste Management Policy, established by the Department of Environment Affairs and Tourism (DEAT).The policy outlined goals to be achieved through the National Waste Management Strategy, and highlighted the elements of integrated waste management planning, waste information systems, general waste collection, waste minimization, recycling, waste treatment and disposal, capacity building, education and awareness as key intervention measures needed to promote efficient use and management of waste in Africa.

According to 1999 State of Environmental Report, South Africa generates over 42 million m3 of solid waste every year. In 2001, the amount of waste produced was noted as increasing due to population growth, urbanization and economic growth.
What these dynamics of waste production and management demonstrate is that there are disparities between higher-income and lower-income countries in the volume of waste generation and management strategies.

Higher income countries generate more waste per capita (approximately (2.7 m3/capita per annum) than the lower-income countries (approximately 0.2 m3/ capita per annum). This is reflected a greater extent among African countries. For instance, Accra, Ibadan, Dakar, Abidjan and Lusaka generate waste in the range of 0.5 to 0.8 kg/capita per day, with a putrescible organic content of 35 to 80 per cent, and plastics, glass, and metals at less than 10 per cent. It is believed that because of improved standards of living and increased urbanization the amount of waste

generated by African cities will increase over the coming years. According to some studies, waste generated in most urban areas in Africa will quadruple by 2025.

In urban centres throughout Africa, less than half of the solid waste generated is collected, and 95 per cent of that is neither contained nor recycled. It is indiscriminately thrown away at dumping sites on the periphery of urban centres, or at temporary sites. These inefficient forms of solid-waste disposal have serious health and environmental impacts, which extend beyond their boundaries polluting nearby water sources and serving as breeding grounds for disease. Among the low-income countries, this is worse. For instance, in Lesotho only 7 per cent of urban households have garbage collection facilities, while, in Gaborone (Botswana) and Maputo (Mozambique), nearly all solid waste is disposed of in an open dump rather than a sanitary landfill.

Afon 20 reported in 2005 that in Lagos (Nigeria) heaps of garbage piled up at street corners and were often dumped indiscriminately. In spite of these challenges, it can be mentioned that some African countries have set themselves ambitious goals and targets that seek to implement effective waste management techniques and strategies to promote proper management and disposal of waste. These include recycling, composting and anaerobic digestion. Progress made so far on these areas and technologies and the methods adopted are encouraging

2.16 Future directions of solid-waste management in Africa

Solid-waste management is, therefore, a significant environmental challenge in Africa, especially in large cities. Thus alternative uses, such as composting, separation and recycling, which are capable of converting waste into assets and also assist in generating employment and income, are desirable if the continent is to catch up with the international trends and standards of managing MSW. For Africa to attain this, there are some hurdles that still need to be overcome. These include improving methods that are currently used to collect and dispose of waste, the most popular of which, in many African countries, is, as we have seen, use of unsanitary landfills or open dumping.

This has promoted scavenging, which renders low social status to those who promote recycling by re-using waste for various purposes. The lack of advanced methods that are supported by appropriate technologies means that in Africa there are very few alternative uses of solid waste. To change this situation, investment in solid waste management and technologies needs to be

promoted. This should be supported by extensive research on MSW management that should put emphasis on:

- Natural environmental analysis;
- Social norms and concerns analysis;
- Analysis of economic factors that promote waste production;
- Historical influences on waste disposal and management in Africa;
- Political contexts of waste management in Africa;
- Local, regional and national legislation on waste management in various countries of Africa;
- Institutional factors, including educational factors that would promote innovative uses of waste in Africa; and
- Technological developments for waste re-use and management that are suitable for African economies and the environment.

However, proper handling and disposal of waste are an indicator of how successfully and effectively the local government system is working. Among the developed nations, waste is no longer a burden to the state but a resource that has been integrated into energy-generating strategies. However, as reflected in this brief, it seems that in Africa waste management and its re-use require drastic improvement through the adoption of the latest appropriate technologies.

The increasing volume and complexity of waste associated with the modern economy are posing a serious risk to ecosystems and human health. Every year, an estimated 11.2 billion tons of solid waste is collected worldwide, and decay of the organic proportion of solid waste is contributing about 5 per cent of global greenhouse gas emissions. Every year, an estimated 11.2 billion tons of solid waste are collected worldwide. Of all the waste streams, waste from electrical and electronic equipment containing new and complex hazardous substances presents the fastest-growing challenge in both developed and developing countries (T. Simelane, 2012)

Poor waste management - ranging from non-existing collection systems to ineffective disposal -causes air pollution, water and soil contamination. Open and unsanitary landfills contribute to contamination of drinking water and can cause infection and transmit diseases. The dispersal of

debris pollutes ecosystems and dangerous substances from electronic waste, or industrial garbage puts a strain on the health of urban dwellers and the environment.

The solution, in the first place, is the minimization of waste. Where waste cannot be avoided, recovery of materials and energy from waste as well as remanufacturing and recycling waste into usable products should be the second option. Recycling leads to substantial resource savings. For example, for every tone of paper recycled, 17 trees and 50 per cent of water can be saved. Moreover, recycling creates jobs: the sector employs 12 million people in Brazil, China and United States alone (T. Simelane, 2012)

The UNEP International Environmental Technology Centre (IETC) in Japan supports the implementation of integrated solid waste management systems. Its work also focuses on the proper treatment of special wastes (electronics, agricultural biomass, plastics) in developing countries. IETC aims to optimize the management of solid waste by involving all stakeholders in the process through pilot projects at local level.

2.17 Theoretical Framework

2.17.1 Urban System Theories and Waste Management

Intensive human activities in cities often require imports of resources and transform raw materials, energy, and water into the built environment, air emissions, and waste. As early as 19th century, Marsh looked into the historical degradation of nature along with human development and asserted that humans had played a destructive role in the nature transformation. He contended that humans should respect the laws of nature and act as co-workers of nature, because man and nature shape each other Marsh, (1864) Wolman's (1969) analogy of city activities as a metabolism process represents pioneering research on system-wide impacts on resource consumption and waste generation in an urban environment (Decker et al., 2000).

Wolman argued that "the metabolic cycle is not competed until the wastes and residues of daily life have been removed and disposed of with a minimum of nuisance and hazard". Wolman further demonstrated the problem in the case of water use in a hypothetical city in the U.S. With a particular focus on waste materials, Bower (1977) introduced the concept of "residuals" and the model of Residuals-Environmental Quality Management (REQM), and the criteria to evaluate 36 REQM strategies. Since the first study by Wolman half a century ago, at least 20

comprehensive studies have been undertaken across the world (Kennedy et al. 2010). It is noteworthy that a majority of the current case studies are located in European or Asian regions.

It appears only two studies were conducted in the U.S.; one by Zucchett (1975) in Miami, and the other by Ngo and Pataki (2008) in the Los Angeles County. Researchers have found that material flow analysis, especially at a refined geographical scale, is rather constrained by data availability than by methodology Leigh et al., (2007). Data requirements are particularly a challenge for urban system analysis also because a uniform unit of measurement is typically needed. Three common types of measurements have been adopted by researchers in urban system models: (1) material masses (such as Niza, Rosado et al, (2009); (2) energy such as Odum, (1983); and (3) land area, which are associated with studies of carrying capacity and ecological footprint.

Carrying capacity refers to "the level of population or development that can be sustained in an area without adversely affecting that area beyond an acceptable level" Randolph, (2004). Even if technology innovations may increase the carrying capacity, researchers represented by Meadows argued that the current pace of population growth, industrialization, pollution, resource depletion may create the limits of growth on this planet in an abrupt way (Meadows et al. (1992). An ecological footprint measures the amount of biologically productive land area needed to sustain resource consumption and to assimilate residuals from a person, a region, or activity, such as manufacturing a computer (Wackernagel et al. 1996).

Embedded in life-cycle thinking, ecological footprint analysis can be used as an indicator for self-sufficiency and sustainability in an easily comprehensible way. Both theoretical and empirical studies on urban systems suggest that urban and environmental systems are interdependent and thus we must consider environmental processes as drivers of urban change Alberti, (1999). Urban systems cannot be sustainable if it requires more resources than it can produce and generates more waste than it can assimilate. The integration of urban system models and economic system analysis, although not always recorded in the same unit of measurement, represents a significant advancement in system analysis in that previously separated systems are finally considered as one unity. Based on the 37 regional economic input-output model that was developed by Leontief in 1936 to trace the flows of goods and services among sectors, Leontief et al (1972) extended the economic input-output model that originally developed to examine Air Pollution problems. (Pattern, et al. 1976) extended the framework of the economic system to ecological systems.

2.18 Gaps identified in the Literature and how the work shall attempt to fill them

Literature indicates varied perceptions in waste management in different areas. In the different areas collaboration of stakeholders in waste management is minimal. Knowledge on the types of waste generated, collection, treatment and disposal systems are not well known.

CHAPTER THREE

METHODS OF THE STUDY

3.1 Study Design

The study made use of a multistage sampling technique to collect the population perception on the waste management behaviour in the Buea Municipality. Being a cosmopolitan area with diverse activities, localities were initially purposive selected to cut across, agricultural, commercial, and student residential. Upon selection, the quarters were ranked concerning to their population densities. Those settlements with high population densities were chosen. In the quarters, respondents were chosen following availability and willingness to participate.

3.2. Study population

The study population consists of two hundred (200) residents of Mile 16, Mile 17, Muea, Great Soppo, and Molyko.

3.3 Data Collection

The study made use of primary and secondary data.

3.3.1 Primary data

Primary data was collected through the administration of 200 semi-structured questionnaires to respondents in the municipality. The questions were précised as much as possible so as to make the questionnaire more effective and efficient. In most cases, the respondents were simply expected to mark a tick "√" where they feel it corresponds with their view. The questionnaires contained information on bio data, types of wastes generated by households of the municipality, nature of collection treatment and disposal systems. Information was also collected on the environmental and health impacts about the waste management situation through observation.

Key Informant Interviews were also used to collect data and cross-check data from (10) officials of HYSACAM and Buea Council. This was guided by a checklist (see Appendix 2).
In the field, observations were made to appraise the nature of collected data, and management system put in place.

3.3.2 Secondary data

Secondary data was principally collected from already existing data in the area particularly for the Gambia from institutions, relevant books, journals, and the internet.

3.4. Analytical Approach

Data from the questionnaire were analysed using descriptive statistics such as counts, percentages, mean, standard deviation, median etc. Inferential statistics such as chi-square test was also used. The analyses were carried using Statistical Package for Social Sciences 20 SPSS and Microsoft Excel 2013. Charts (pie charts and bar charts) and tables were used to enhance illustration. The charts and Tables were developed using Microsoft Excel 2013.

3.5 Validation of Results

The validity of the results was enhanced in three major ways. Firstly, the questionnaire was pre-tested to ensure that the questions contained therein reliably measured the issued raised by the study objectives and research questions. Secondly, the information collected was triangulated to ensure correctness. Finally, cross reference questions were used. All calculations were done at the 95% confidence interval, to justify the generalization of the test results.

CHAPTER FOUR

PRESENTATION AND ANALYSIS OF FINDINGS

4.1 Socio-demographic Characteristics of Respondents

In the study, 40 (20%) of the respondents were from Mile 16, 42 (21%) were from Mile 17, 44 (22%) were from Muea, 34 (17%) were from Great Soppo and 40 (20%) were from Molyko (Table 4.1). Forty-five questionnaires were handed out in each location but the return rate two hundred (200) completed questionnaires (Mile 16, 40, Mile 17, 42, Muea, 44, Great Soppo 34, and Molyko 40).

Table 4.1: Socio-demographic profile of respondents

Characteristics	Count	Percent	Characteristics	Count	Percent
Location			**Gender**		
Mile 16	40	20	Female	113	56.5
Mile 17	42	21	Male	87	43.5
Muea	44	22			
Great Soppo	34	17	**Level of education**		
Molyko	40	20	Primary	74	37.0
			Secondary	31	15.5
Age group			High school	42	21.0
15-25 years	54	27.0	College	17	8.5
26-35 years	112	56.0	University	36	18.0
36-45 years	15	7.5			
46-55 year	13	6.5	**Occupation**		
≥ 56 years	6	3.0	Farming	28	14.0
			Civil servant	13	6.5
Income Level			Business	110	55.0
≤ 20,000CFA	64	32.0	Student	28	14.0
21,000 - 50,000CFA	87	43.5	Driver	6	3.0
51,000 - 100,000CFA	35	17.5	Masons	4	2.0
101,000 - 200,000CFA	12	6.0	Technicians	3	1.5
≥201,000CFA	2	1.0	Others	8	4

Source: Author's field work, 2015.

The majority (133 or 56.5%) of the respondents were female, and 87 (43.5%) were male. The gender distribution of the study population observed in the study is characteristic of the population structure in Cameroon, where women are slightly more than men (BUCREP, 2006). It was good to target more women than men for the simple reason that women are more involved in household waste management than men. And as such, more useful information would be obtained from them.

Most (74 or 37%) of the respondents had primary level education, 31 (15.5%) had secondary level education, 42 (21%) had high school education, 17 (8.5%) had college level education and 36 (18%) had university level education. The majority (63%) of the study population have at least secondary level education. This shows that the population is highly literate. With high literate population, it is expected that they will be more aware of and concerned with environmental sanitation.

Twenty-seven (27%) of the respondents were between the ages of 15 and 25 years, 112 (56%) were between the ages of 26 and 35 years, 15 (7.5%) were between the ages of 36 and 45 years, 13 (.5%) were between the ages of 46 and 55 years and 6 (3.0%) were above 55 years. This indicates that most respondents were within the youthful age bracket.

Fourteen (14%) of the respondents were involved in farming, 13 (6.5%) were in the civil service, 110 (55%) were into business, 28 (14%) were students, 6 (3%) were drivers, 4 (2%) were masons, 3 (1.5%) were technicians and the rest (8 or 4%) were hairdressers, electrician, cobbler, photographers etc. Since most respondents are engaged in business, there is the likelihood that this category of respondents would have a higher purchasing power, thus generate more waste.

From these activities, 64 (32%) earned less than 20 000 FRS a month, 87 (43.5%) earned between 21 000-50 000 FRS a month, 35 (17.5%) earned between 51000-100 000, 12 (6%) earned between 101 000-200 000 FRS and 2 (1%) earned above 200 000 FRS a month.

4.2 Research Question 1: What are the types of waste generated most in Buea Municipality?

In the study area, the most generated type of waste was organic waste (41.5%), followed by plastic (39%) and the least was solid waste (other waste types not in the two categories) (19.5%). The amount of organic waste (41.5%) generated in Buea are similar to that (35%) generated in urban dwellers in Gambia Hoornweg *et al.* (2012). This literally means that though Cameroon is classified as a low-medium income country as opposed to Gambia, which is a low income country, waste-wise, any strategy developed in municipalities in Cameroon could be extended to Gambia. In this study, there were statistically significant variations (x^2=20.076; $df_{(95)}$=8; p=0.01) in the types of waste generated across the various locations.

Comparatively, the population perceived that more solid waste was generated in Mile 17 and more organic waste was generated in Mile 16 and more plastics in Molyko.

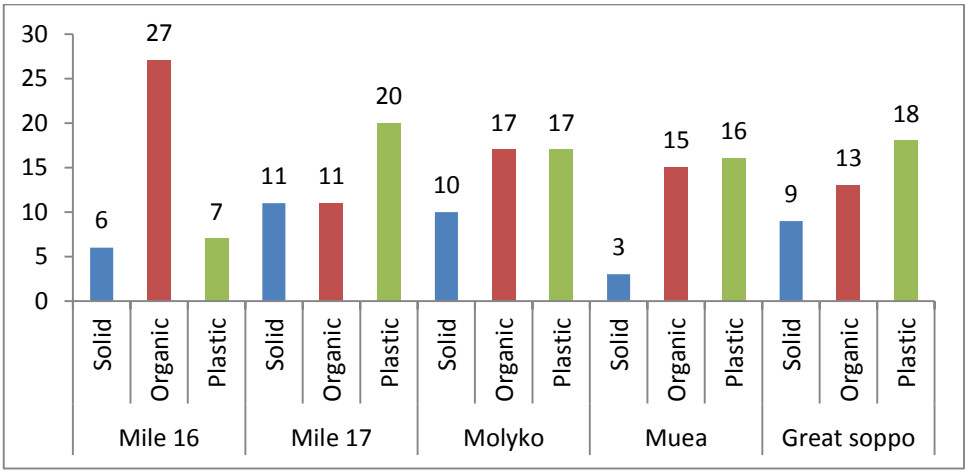

Figure 4.1: Comparison of types of waste generated in different localities
Source: Author's field work, 2015

The variation in perceived waste generated in the communities could be associated to the predominant activities in the environs. Mile 16, for example, is a peri-urban community with agriculture being the primary activity. In this area, organic waste dominated the wastes categories. Composting of such waste will play a vital role to the livelihood of the community. Similarly, the main economic activity in Mile 17 is the business with a high-level use of plastics for packaging that were dominant in the waste stream in the locality.

There were, statistically significant variations (x^2=20.076; $df_{(95)}$ = 8; p=0.01) in the types of waste generated between the various income groups (figure 4.2). Those who earn less than 20 000 FRS generated more organic waste than those who earned more than the other income groups. This indicates that as income level rises, consumer preferences and diversification of consumption also increases. These results agree with those of Sankoh et al. (2012) who reported that the amount of solid wastes generated in Freetown, Sierra Leone increased with the income level of the households.

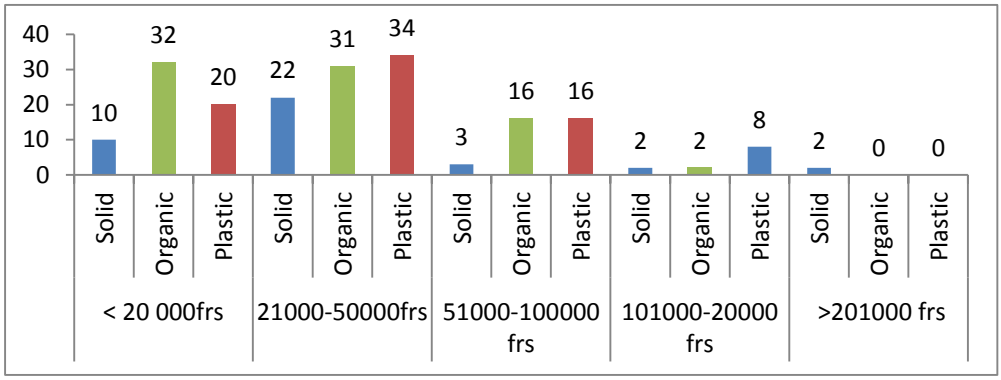

Figure 4.2: Comparison of types of waste generated with income earnings of respondents.
Source: Author's field work, 2015

Respondents that earned less than 20,000 CFA FRS generated more organic waste than solid and plastic waste (figure 4.2). Furthermore, it is interesting to note that respondents who earn 201,000 CFA FRS or more generated more solid waste than the other two types of waste.

No statistically significant variations were found between the types of waste generated and sex of respondents (p=0.827), occupation of respondents (p=0.188) and level of education (p=0.810).

4.3 Research Question 2: What are the current strategies for waste management in Buea Municipality?

4.3.1 Provision of dustbins

A majority (194 or 97%) of the respondents indicated that they do not have or are provided with unique household dustbins for waste collection. However, (6 or 3%) in Molyko reported being supplied with dustbins by HYSACAM. Those that were supplied with these waste collection containers were mainly top administrative authorities with preferential treatments. Responses did not vary significantly (p>0.05) across and within the socio-demographic characteristics of location, age group, gender, occupation, level of education and income levels.

4.3.2 Storage of waste

Most household members (147 or 73.5%) store the waste they generate in bags, 49 (24.5%) store in plastic buckets, 2 (1%) store on the ground and 2 (1%) in provided dustbins (Figure 4.3) near their houses. Similarly, in the Gambia, wastes in the Kanifing Municipal Council (KMC) are stored near houses and collection is scheduled to take place once per week although some areas do not receive a collection service for up to three weeks or more. In such areas, residents make use of unauthorized dumps that just as in Buea, are periodically cleared by the cleansing department.

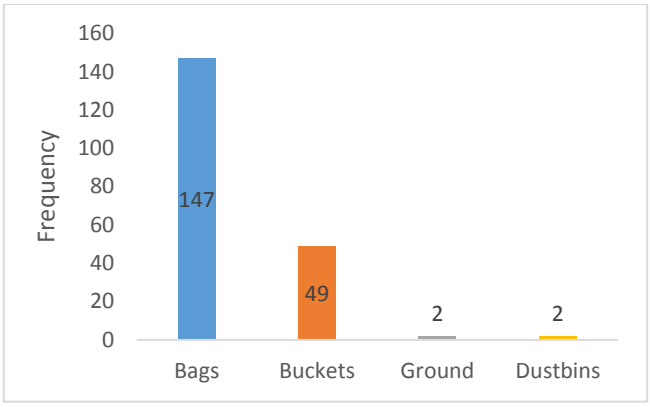

Figure 4.3: Waste storage in Buea municipality
Source: Author's field work, 2015

The limited number of dustbins provided by the waste management company, HYSACAM, can account for the high resort of community members to store waste mostly in bags, plastic buckets and on the ground. As a result of storing waste in these inappropriate containers, waste collection proves to be a very challenging task leading to unauthorized disposal of wastes on the streets (Department for International Development United Kingdom, 2010).

Plate 4.1: Heap of waste waiting to be collected and disposed in Molyko, Buea
Source; Fako News Center, 2010

4.3.3 Waste Sorting at place of Origin

Eighty six percent of the respondents did not sort their waste before disposal while 28 (14%) sorted their waste before disposal (Figure 4.4). Waste sorting plays a great role in waste management. When sorted probable treatment or disposal is easier. The probable reason most

respondents did not sort waste at source before disposal could be allied to lack of awareness. The non-sorting of waste at point of origin constitute a major impediment to subsequent waste treatment.

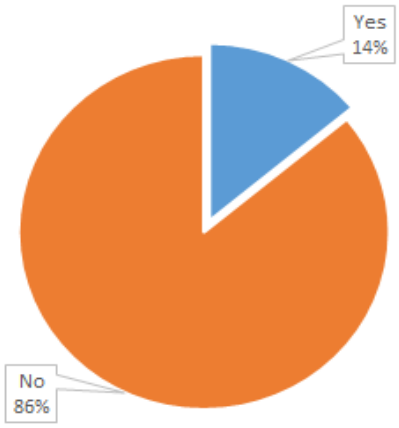

Figure 4.4: Sorting of waste at place of origins in Buea Municipality
Source: Author's field work, 2015

However, there was a statistically significant variations (x^2=13.248; $df_{(95)}$ =4; p=0.01) in waste sorting across educational levels. More of those with university education perceived waste sorting as something important. This was not practically observed given that the waste management company does not place emphasis on sorting.

4.3.4 Waste Disposal at HYSACAM Collection Points

A majority (124 or 62%) of the respondents did not use the officially designated waste collection points while 76 (38%) used the collection points for waste disposal.

The nearest distance from the house to the collection points was significantly ($p<0.05$) and positively correlated ($r=0.232$) with the usage of the collection points. Those who were less than 40 meters away from the waste collection points were more likely to dump their waste at the collection points than those who were above 60 meters from the collection points.

Equally, access to the waste collection points was significantly ($p<0.05$) and positively correlated ($r=0.379$) with usage of official waste collection points. Those with difficult access were less likely to use the collection points than those with easy access.

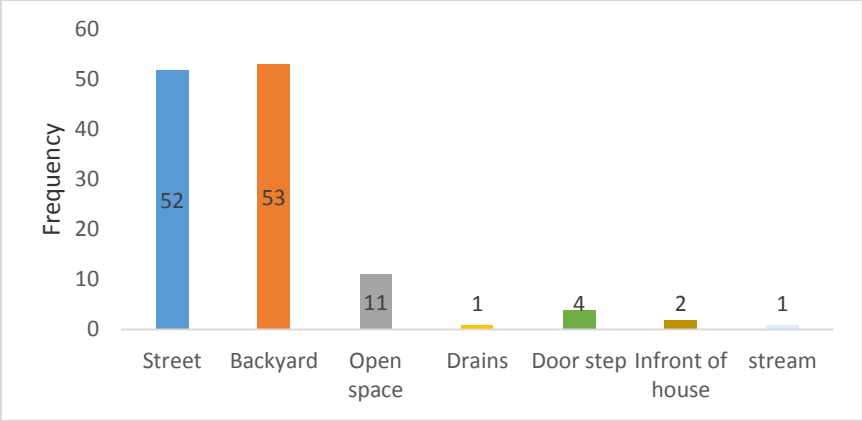

Figure 4.5: Points of waste disposal in Buea Municipality
Source: Author's field work, 2015

For the 124 respondents who did not use the officially designated collection points, 52 (41.9%) disposed their waste in the streets, 53 (42.7%) disposed their waste at the backyard, 11 (8.9%) in open space, 1 (0.8%) in water drains, 4 (3.2%) at door steps, 2 (1.6%) in front of the house and 1 (0.8%) in streams.

This response did not vary significantly ($p>0.05$) across and within the socio-demographic characteristics of location, age group, gender, occupation, the level of education and income levels. According to Marshal (1995), open disposal of waste is a major problem to the environment, especially on the air that the people inhale. Dumps emit obnoxious odours that cause illness to people. According to Wrensh (1990) open disposal may be sources of airborne chemical contamination via off-site migration of gases and the particles and chemicals adhering to dust. Wrensh (1990) further stated that in some sites, volatile organic chemicals have been detected in odour air of homes nearby dumpsites.

4.4 What is the effectiveness of the partnership between Buea Council and HYSACAM and what are the challenges faced in waste management?

4.4.1 Frequency of waste collection

With regards to the frequency of waste collection in the study area, 43 (21.5%) reported that waste is collected on daily basis, 65 (32.5%) reported once a week, 65 (32%) also reported twice a week and 26 (13.0%) reported that waste is collected occasionally (Figure 4.6)

From the statistics above, it is clear that HYSACAM collected waste at least once a week. Even though this is inadequate given the amount of waste generated in this municipality, it is evident that HYSACAM is making considerable efforts and the partnership is effective to a certain extent. However, the timing of collection is not known.

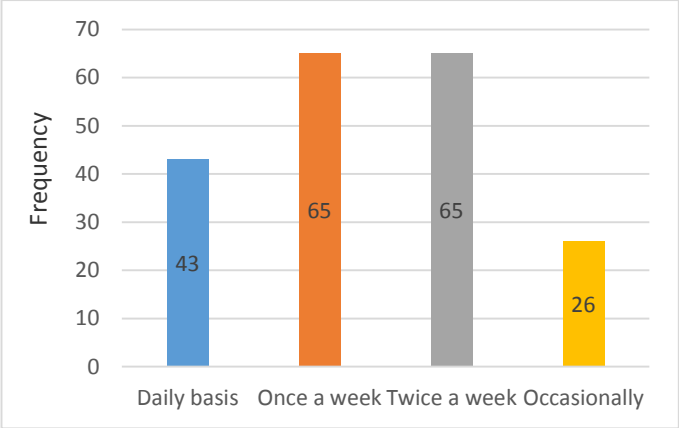

Figure 4.6: Perceptions on the frequency of waste collection by HYSACAM in Buea
Source: Author's field work, 2015

The frequency of waste collection by HYSACAM was found to vary statistically across the different locations. It was observed that in Molyko and Great Soppo, waste was collected by HYSACAM at most occasionally or twice a week whereas, in Mile 17, Mile 16 and Muea, waste was collected at least once a week. These variations can be explained by the degree of access to the various localities. Molyko and Great Soppo are known for lack of access roads within, the hilly topography and haphazard electricity connections that prevent the waste collection vehicles from accessing these localities. On the other hand Mile 17, Mile 16 and Muea are endowed with well-planned access roads which permit the vehicles to pass freely.

4.4.2 Awareness on final waste disposal form

Awareness on the method of waste disposal is important in assessing the sustainability of a waste management project and environmental consciousness of the stakeholders. Also the price paid for waste services is intricately linked to the disposal system. In the study, 52.5% of the respondents reported that HYSACAM disposed of the waste in an open dump, 3 (1.5%) in streams, 40 (20%) in a landfill and 52 (26%) did not know (Figure 4.7).

Perception of the method of final waste disposal by HYSAAM varied statistically ($p<0.05$) by location. These differences could be explained by the proximity of the location to the open dump the HYSACAM open dump at Musaka. Locations that were furthest away from the open dump such as Mile 16, Molyko and Great Soppo scored low in identifying the open dump as the final destination of HYSACAM waste than those closer to it namely Mile 17 and Muea.

This further strengthens the fact that there are limited sensitization and adequate information dissemination from the waste management authorities. A study conducted in Gambia revealed that, though there is a growing public concern about waste management, Local Councils suggest

that there is a growing public awareness about failure to give residents the services they expect though there are some evidence that certain householders were willing to pay for improved services. Sensitisation through public education programmes and the use of the media was suggested to be one way of raising public awareness about this important issue (Department for International Development United Kingdom, 2010).

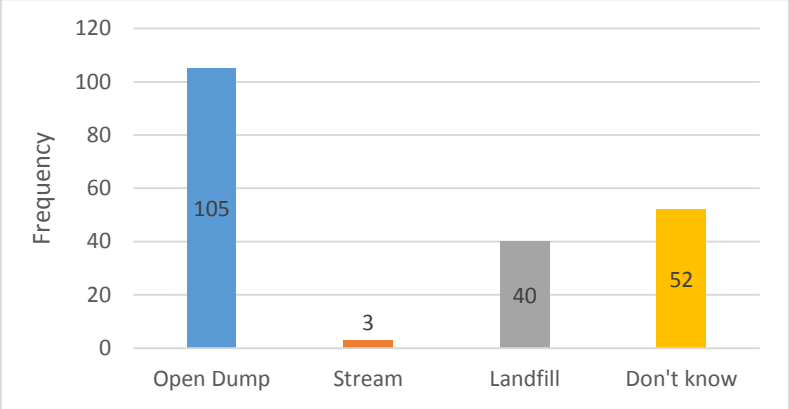

Figure 4.7: Perceptions about the area for final waste disposal
Source: Author's field work, 2015

4.4.3 Methods of waste treatment by HYSACAM

A majority of the respondents (78 or 39%) did not know how waste is treated by HYSACAM after collection. Twenty-six (13%) of the respondents believed that the waste is buried, 39 (19.5%) said it is incinerated, 31 (15.5%) said it is turned into compost and 25 (12.5 %) said it is recycled (Figure 4.8). Observation at the landfill showed that the collected wastes are covered with soils, which are allowed to decompose and are illegally collected by some farmers as manure. Often, during the dry season, the waste is burnt. The perceptions or respondent are thus related to the time they have visited or pass-by the dumpsite.

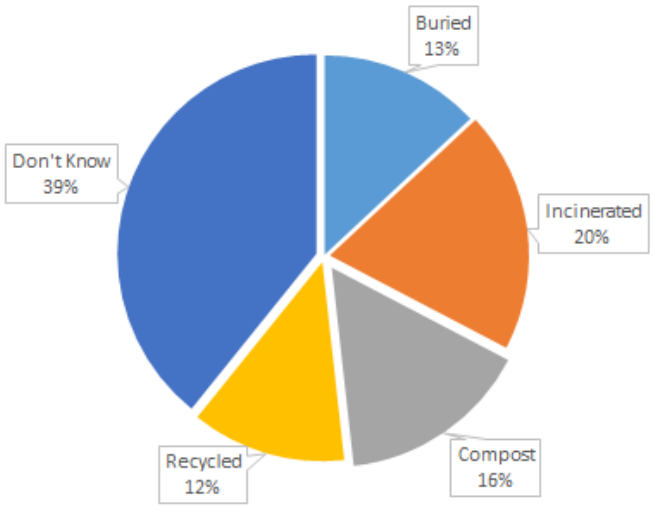

Figure 4.8: Perceptions about treatment of waste by HYSACAM in Buea
Source: Author's field work, 2015

Perceptions about treatment of waste by HYSACAM varied statistically significantly ($p<0.05$) by location. The proximity of the location to the open dump in Musaka determined the perception. Most of the respondents that were not aware of how waste collected is treated by HYSACAM were those furthest away from the Musaka open dump such as Mile 16, Molyko and Great Soppo than those closest to it such as Muea and Mile 17.

4.5 Challenges to waste management

Most (114 or 57%) of the respondents reported that the major challenges to waste management in Buea is the insufficient number of waste collection bins provided by HYSACAM. Twenty-three (23%) ascribed the challenges to the non-sorting of waste at the place of origin, 42 (21%) ascribed it to difficult access to waste collection points, 12 (6%) to the irregularity in the waste collection by HYSACAM, among others (Figure 4.9).

Waste management challenges in KMC in the Gambia tend to differ from those in Buea municipality. According to the African health observatory and WHO analytical summary (2014), major challenges are the indiscriminate dumping of wastes into waterways which leads to the flood of some urban areas poor collection and inappropriate disposal practices. Also in the Gambia's Daily Observer newspaper (October 2013) reported that huge waste dumps are scattered around some neighborhoods, highways, even public places like markets. The later also reported that during the monthly "Operation Clean the Nation" it is disheartening to see waste gathered on the streets for days without being collected by the municipal authority. This situation is equally seen in Buea.

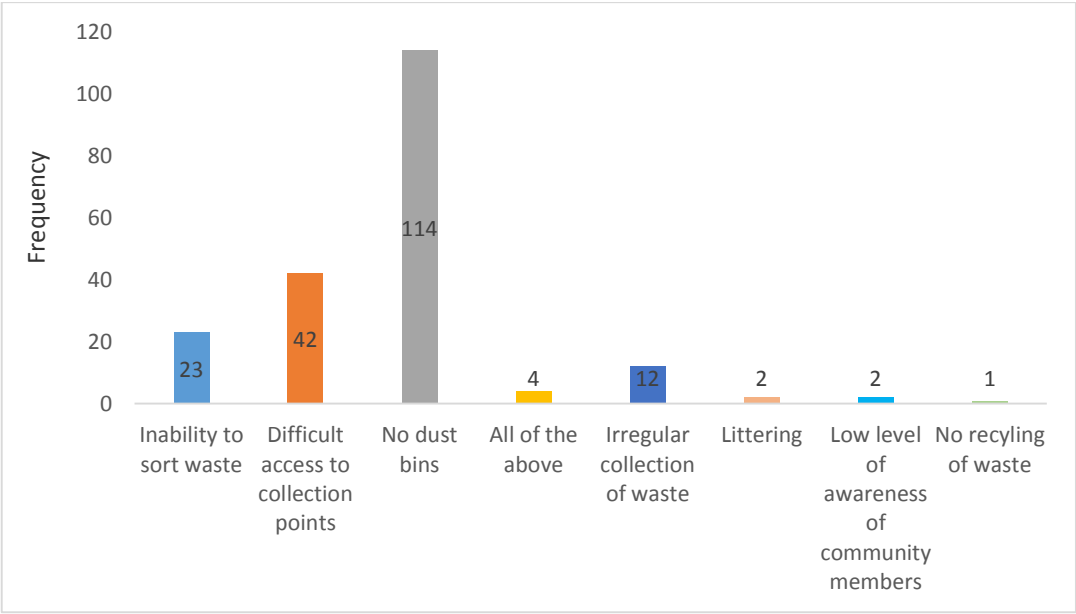

Figure 4.9: Perceptions of the challenges to waste management in Buea Municipality

Source: Author's field work, 2015

This response did not vary significantly ($p>0.05$) across the socio-demographic characteristics of location, gender, age group, occupation, level of education and level of income.

4.6 Effects of poor waste management

Forty-nine percent of the respondents indicated that the present status of waste management in the Buea municipality contributes significantly on disease outbreak such as malaria. The pilling of wastes especially in the rainy season serves as a breeding ground for mosquitoes. Apart from causing illnesses, 44% reported that air and water pollution issues are notorious. In some areas, wastes are dumped into water ways and gutters. This does not affect only drainages but equally affects the quality of water. In fact, most community members though aware of the consequences of poor waste management were not found to comply with the hygiene and sanitation regulation as stipulated. These respondents would have been expected to be more environmentally friendly or sensitive for the sake of protecting their own health.

Similarly in KMC in the Gambia, adverse effects as a consequence of poor waste management practices had also been reported. These effects included: pollution of ground water, an increase in wind-blown waste and visual intrusion, negative effects on tourism that employs a large number of coastal population, and inherent dangers posed to workers at landfill sites who do not have protective clothing as well as scavengers including children.

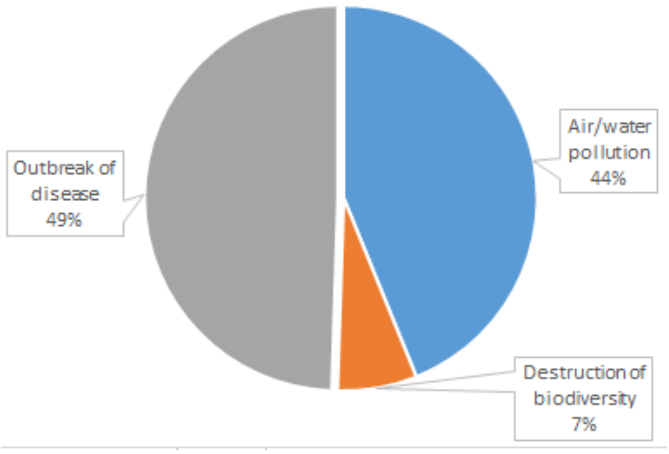

Figure 4.10: Effects of poor waste management in Buea
Source: Author's field work, 2015

These responses in the Buea municipality did not vary significantly ($p>0.05$) across the socio-demographic characteristics of location, gender, age group, occupation, the level of education and level of income.

4.7 Strategies for effective waste management in Buea

Suggested measures for improved waste management included provision of dustbin (63.5%), standard schedule for waste collection (24%), sorting of waste at point of origin (3%), regular collection of waste (3%), sensitization (1%), use of fine (0.5%), more personnel/equipment by HYSACAM (2%), composting (0.5%), increase in the number of waste collection points (2%) (Figure 4.10). In suggesting strategies for effective waste management, most respondents had the belief that provision of dust bins is the best option as indicated by the number of respondents. Though the availability of dust bins could help lot but I also believe that other options (sensitization, regular collection of waste by HYSACAM, more personnel and equipment for HYSACAM etc.) are better options that should not be ignored.

In a developing country like Malaysia, similar to the Gambia, different solid waste management strategies are suggested. These include the control the generation of solid waste, the enforcement of waste legislation, recycling, waste control at source, the design of an intelligent system for controlling the composition of solid waste, and a continuous awareness campaign on waste-related issues.

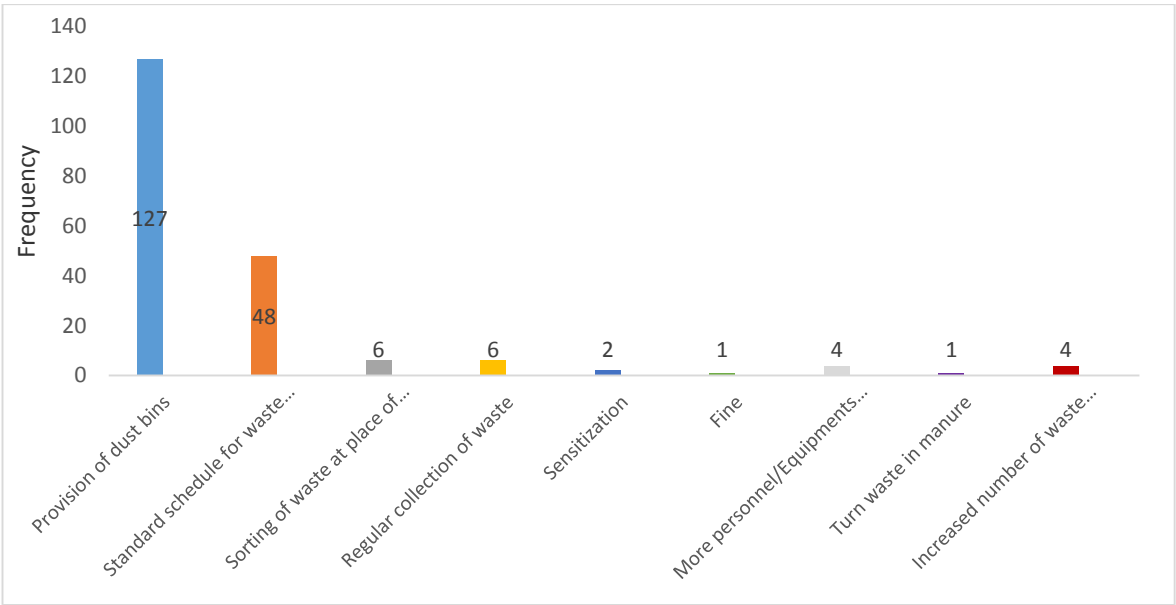

Figure 4.11: Possible measures for the improvement waste management in Buea.
Source: Author's field work, 2015

4.8 Implication of the Results

Given the problems identified, the results of this study have several implications for Buea Council and KMC in the Gambia. Since the bulk of the waste generated in households is organic in both Buea municipality and KMC, composting could be a very viable alternative. On the other hand solid and plastic waste consists mostly of materials that cannot be easily turned into manure and non-biodegradable and requires recycling that may be very expensive. The majority of households are not provided with dustbins, and this implies that waste management may be more difficult and expensive.

Also, the main challenge of HYSACAM is the insufficient equipment particularly trucks, hence suggesting more challenges to waste management.
Public awareness in solid wastes was not quite satisfactory in both Buea and KMC municipality. This low level of awareness implies that progress of waste management may be slow and will require intensive awareness campaign. This will also call for both the councils and Hysacam to give sensitization campaigns as a priority.

4.9 Limitations of the Study

It has been noted that this study has some limitations which are worthy of mentioning.
In some instances, some respondents were reluctant to give certain information that they considered very personal (income earning) or sensitive. There was also the fear from some respondents that information to be collected might be used for other purposes different from academic. This resulted in some respondents concealing or refusal to give information.

As the researcher was not a native of Cameroon, "Pigin" language that was the lingua-franca was not understood by him, and some of the respondents could not understand fully the questions asked in English. Therefore in such instances the researcher had no other option but to use an interpreter. Although the use of an interpreter helped to an extent there was the possibility of distortion of information.

Moreover, the researcher was not able to collect primary data in the KMC in the Gambia as he did in the study areas in Cameroon. This would have given uniform data from the two countries. Given the sampling technique that was used, any adult household member available was interviewed, and some of them probably may not necessarily be directly involved in managing the waste in the household and thus may not be in a position to give useful information to the

researcher. The number of women interviewed should have been far greater than men because they are more involved in waste management at the household level. But nonetheless, these limitations do not affect the validity and reliability of the results of the study in any way.

Last but not the least, communities, where this study was conducted, were not cities as such. Waste management is more of a problem in larger cities and therefore the information collected may not be very detail and rich as compared to information collected from bigger cities like Douala, Yaounde, etc.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

5.1 Summary of Findings

The main focus of this study is on the strategies of Municipal solid waste management, challenges in Buea Municipality and KMC in the Gambia. It has been clearly indicated by the findings that waste management in the municipalities is still a challenge even with partnerships. The following key findings were revealed by the study:

- In both Buea Municipality and KMC in the Gambia, organic waste represented the highest type of waste generated with percentage compositions of 35%, and 41.5%, respectively.
- In the Buea Municipality, 97% of the respondents use bags to store waste because they do not have or are provided with unique household dustbins for waste collection.
- Waste sorting was found not to be practiced by community members in both the Buea and Kanifing Municipality (KMC).
- In the Buea municipality, 43 (21.5%) reported that waste is collected on a daily basis, 65 (32.5%) reported once a week, 65 (32%) also reported twice a week and 26 (13.0%) reported that waste is collected occasionally.
- Most (114 or 57%) of the community members in Buea municipality reported that the major challenges to waste management are the insufficient number of waste collection bins provided by HYSACAM while in KMC reported by the Daily Observer newspaper, indicated indiscriminate dumping and disposal of waste as major challenges.
- Forty-nine per cent of the respondents indicated that the present status of waste management in the Buea municipality contributes significantly on disease outbreak such as malaria.

5.2 Conclusion

Due to rapid urbanization, urban solid waste has become a big challenge for developing countries including Africa especially Cameroon and the Gambia. Even with partnerships in Buea municipality, waste management is still a major challenge. The municipalities are

challenged of poor waste sorting practices, collection, and disposal. Apart of these challenges, the level of awareness on proper waste management practices is a major concern. For sustainable waste management, the participation of community members should be encouraged. Therefore, better waste management strategies like sorting and recycling should be encouraged and practiced. Therefore the intensification of sensitization campaign should be in the forefront for improving the sanitary conditions of Buea municipality and KMC of the Gambia. Finally, for a more effective partnership, for example, HYSACAM in Buea needs to improve its capacity regarding manpower and equipment.

5.3 Recommendations

1. Provision of dust bins to community members.
   Provision of dust bins to community members by HYSACAM will help in the proper management of waste at the household level.

2. Introduction of sorting waste at place of origin
   Community members do not sort waste at the place of origin because they do not have the knowhow and are not conscious of the importance. Training and enlightening them on this issue would minimize the associated problems.

3. Regular inspection of homes by the officials of the HYSACAM and Buea Council. This activity is important because it will help in compliance to sanitation norms and regulations. It is recommended that homes should be visited at least once a week.

4. Community members should participate fully in waste management activities for reasons of sustainability. Like in Madras in India, community members could come together and form Committees that would be responsible for waste management in their respective neighborhoods.

5. Intensification of sensitization of the public on sensitization and hygiene
   Given the fact that attitude change cannot be achieved in a short period, sensitization should be an on-going activity rather than periodically. This will contribute significantly in raising awareness level of the public on hygiene and sanitation issues. Community members should also be sensitized on scheduled time for waste collection.

6. Recycling of waste and composting.

HYSACAM and Municipal Councils should go beyond collection and transportation of waste to include recycling of waste. This will definitely reduce the burden of waste and even create employment.

7. There is the need for HYSACAM and the Municipal Councils to recruit more workers and provide more vehicles. Recruitment of more workers and the provision of more vehicles will improve capacity, thus better performance.

8. Three key components for successful waste arrangements: Competition, transparency, and accountability, thus an alternative to large companies that can provide appropriate solid waste management options will need the services of micro enterprises. Small enterprises or Community-Based Organizations can provide services at community level.

9. HYSACAM should introduce the use of simple equipment and labor intensive methods; thus they can collect waste in places where the conventional trucks of large companies cannot enter.

5.4 Suggested Areas for Further Research

The following areas have been suggested for further research:

1. Waste recycling as a sustainable option for waste management in cities in the Gambia and Cameroon.

2. The economic importance of waste: A case of waste scavenging in cities in The Gambia and Cameroon.

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Appendices

Appendix 1: Questionnaire to be completed by household members

Name of interviewer…… Date of interview…….

A. Personal Information

1. Age of respondent
   ☐15 to 25 ☐ 26 to 35 ☐ 36 to 45 ☐ 46 to 5555≥
2. Location

   ☐ Mile 16 ☐Mile 17 ☐ Muea ☐Great Soppo ☐Molyko

3. Sex: ☐ Male ☐ Female
4. Occupation

   ☐ Farming ☐ Civil servant ☐ Business ☐ Others (specify)……
5. Level of Education

   ☐ Primary ☐ Secondary ☐ High school ☐College ☐University
6. What is your average monthly income earnings?

   ☐≤20,000 FCFA ☐ 21,000 – 50,000 FCFA ☐ 51,000-100,000 ☐ 101,000 - 200,000FCFA ☐ ≥201,000FCFA
7. What kind of waste do you generate most in your household?
   ☐ Solid waste ☐ Organic ☐ Plastic
8. Is your house hold provided with dust bins?
   ☐Yes ☐No
9. Where do you store the waste you generate before it is collected?
   ☐Bags ☐ Plastic buckets ☐ On the ground others (specify)……..
10. Do you dispose waste at official collection points?
    ☐ Yes ☐ No
11. Where do you dump your waste before it is collected?

    ☐ Street ☐ Back yard ☐Open space ☐ Drains ☐ others (specify)……
12. Do you normally sort the waste generated in the house before disposing?
    ☐ Yes ☐No
13. How far is your household from the waste collection point?
    ☐≤ 20 meters ☐21 – 40 meters ☐41 – 60 meters ☐61 – 80 meters ☐≥81 meters
14. Do you have access to a waste collection point?
    Yes☐ No ☐

15. How regular HYSACAM does collect the waste from the collection point?
    Daily basis☐ once a week ☐ twice a week ☐ occasionally ☐
16. How long does it take before this waste is collected and disposed?
    ☐ Two days ☐ three days ☐ four days ☐ one week ☐ others (specify)…….

17. When this waste is collected where is it finally disposed?
    ☐Landfill ☐Stream ☐open space ☐ others (specify)……
18. How is the waste collected managed?
    ☐ Buried ☐ incinerated ☐ turned into compost ☐ recycled ☐others (specify)……..
19. What are the major challenges of waste management in your community?
    ☐ Inability to sort waste ☐difficult access to collection point ☐Far from collection ☐int ☐No dust bins All of the above others (specify)……
20. In your opinion, what do you think are the effects of poor waste management?
    ☐Air/water pollution ☐ destruction of biodiversity ☐outbreak of diseases ☐ others (specify)…….
21. Which of the following strategies can be used to improve waste management in your community?
    ☐ Provision of dust bins ☐ standard schedule for the collection of waste ☐ sorting of waste at place or origin ☐ others (specify……..

THANK YOU

Appendix 2: KII checklist for Buea Municipality and HYSACAM

1. Name of institution……
2. When did you sign the partnership with in waste management in the Buea Municipality?
   …….

3. What necessitated this partnership?
   ……
   ……
   ……
   ……

4. What are the responsibilities of both Buea council and HYSACAM in this partnership?
   ……
   ……
   ……..
   ……

5. What are the roles expected to be played by community members?
   ……
   ……
   ……
   ……

6. How effective is this partnership?
   ……
   ……
   ……
   ……

7. What are the associated challenges of this partnership?
   ……
   ……
   ……
   ……

8. What strategies have been put in place to mitigate these challenges?
   ……
   ……..
   ……
   ……..

9. What are the steps put in place to ensure proper waste management at household and community level?

   ……
   ……
   ……
   ……

10. Are there prospects for sustainable waste management under this partnership?

    ……
    ……
    ……
    ……

11. If you are given the opportunity to propose new strategies for sustainable waste management, what will be your best management options for Buea Municipality/HYSACAM?

    ……
    ……
    ……..

THANK YOU