UNIVERSITY OF CAPE COAST

HOUSEHOLDS' SOLID WASTE SEPARATION PRACTICES IN THE CAPE COAST METROPOLITAN AREA

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BY

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Thesis submitted to the Department of Geography and Regional Planning of the Faculty of Social Sciences, College of Humanities and Legal Studies, University of Cape Coast in partial fulfillment of the requirements for the award of Master of Philosophy Degree in Geography and Regional Planning

APRIL, 2018

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DECLARATION

Candidate's Declaration

I hereby declare that this thesis is the result of my own original research and that no part of it has been presented for another degree in this university or elsewhere.

Candidate's Signature: ..... Date: .....

Name: Peter Gyimah

Supervisors' Declaration

We hereby declare that the preparation and presentation of this thesis were supervised in accordance with the guidelines on supervision of thesis laid down by the University of Cape Coast.

Principal Supervisor's Name: Dr. Simon Mariwah

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Co Supervisor's Name: Prof. Kwabena Barima Antwi

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ABSTRACT

Source separation of solid waste, though rarely practiced in Ghana and Africa, holds great promise to usher the country and continent into the realm of integrated and sustainable solid waste management option. The study investigated households' solid waste separation practices in the Cape Coast Metropolis. Descriptive research design was employed and multi-stage sampling method was used to obtain data from 246 household respondents whereas 7 key informants were purposively selected. Data for the study were collected through the use of interviews, questionnaires, and observations across low, middle and high-income communities. The data process was done using the Statistical Product and Service Solutions (SPSS, version 21.10) software programme. Emphasis was placed on the existing solid waste disposal practices, waste separation practices, willingness of households to separate waste and challenges associated with households' separation of solid waste. The study found that most residents, regardless of their income status, rarely separate their waste. However, there were general indications of residents' willingness to separate waste at source. Unavailable waste recycling plant and inability to purchase waste separation bins constitute major challenges of waste separation in the study area. For incentives towards future source separation programmes, the study recommends that the central government and Cape Coast Metropolitan Assembly in conjunction with their development partners should assist in the provision of waste separation bins and waste recycling plant in the study area. The Cape Coast Metropolitan Assembly within its entrusted authority should also promulgate and enforce bye-laws to regulate the process.

KEY WORDS

Behavioural determinants

Solid waste

Source separation

Theory of planned behaviour (TPB)

Waste composition

Waste management practice

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DEDICATION

To my beloved mother,

Ama Saa

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LIST OF ACRONYMS

AAK	Abura-Asebu-Kwamankese
AfDB	African Development Bank
CCMA	Cape Coast Metropolitan Assembly
DESSAP	District Environmental Sanitation Strategy and Action Plan
EPA	Environmental Protection Agency
GNWPTA	Ghana Netherlands Water Programme and Technical Assistance
ISSWM	Integrated Sustainable Solid Waste Management
MLGRD	Ministry of Local Government Rural Development
MMDA	Metropolitan, Municipal and District Assembly
NESSAP	National Environmental Sanitation Strategy and Action Plan
NGOs	Non-Governmental Organizations
OLA	Our Ladies of Apostles
PPP	Public Private Partnership
SDGs	Sustainable Development Goals
SS	Source Separation
SWM	Solid Waste Management
TPB	Theory of Planned Behaviour
UCC	University of Cape Coast
UN-HABITAT	United Nations Centre for Human Settlements
WMD	Waste Management Department
WMH	Waste Management Hierarchy
WTE	Waste-To-Energy

CHAPTER ONE

INTRODUCTION

Background of the Study

Solid Waste Management (SWM) is recognized as one of the major challenges encountered by both developed and developing countries (United Nations Centre for Human Settlements, 2010). The challenge has to do with increasing quantity of solid waste generation due to the fast-growing population, rising production and high consumption rates in urban areas which has created an urgent need for solid waste disposal facilities (Henry, Yongsheng & Jun, 2006). Thus, solid waste has become a major consequence of modernization and economic development (Tsiboe & Marbell, 2004).

Indeed, postmodern societies have magnified consumption of materials for convenience, comfort, and luxury. With combined increasing consumer goods production and wasteful consumption, the landfilling of generated solid waste requires the use of land, competing with agricultural land and residential space (Shin, 2014). Indeed, waste in whatever form, is an inevitable by-product of man's socio-economic development process (Mariwah, 2012). Thus, waste generation is an unavoidable part of human activity and perhaps a person stops generating waste only when he or she is in a state to be disposed off as waste (Adogame, 2009). With anticipated population increase and associated waste generation, timely and effective SWM is one of the most critical challenges of sustainable development

that needs to meet the needs of the present without compromising the ability of future generations to meet their own needs (World Commission on Environment Development, 1987).

Waste constitutes scrap material or an effluent or other unwanted surplus substance arising from the application of a process, or any substance or article which requires to be disposed of as being broken, worn out, contaminated or otherwise spoiled (Department for Environment Food and Rural Affairs, 2004). Solid Wastes (SW) include product packaging, grass clippings, furniture, clothing, bottles, food scraps, newspapers, appliances, paint, and batteries, which come from homes, schools, hospitals, organic trash, street sweepings and businesses (Zerbock, 2003; United State Environmental Protection Agency, 2013).

Solid waste generation in the world over the years has continued to increase in line with growth in other socio-economic parameters such as growing population and high consumption levels (Sakurai, 1990; Achankeng, 2003). This is evident in several studies which have shown that, growing urban population leads to huge increase in waste generation (Schübeler, Wehrle & Christen, 1996; Rapten, 1998; Medina, 2002; Zerbock, 2003). In Africa, the generation of solid waste, both domestic and industrial, continues to increase in cycle with growth and consumption (Achankeng, 2003). According to African Development Bank [AFDB] (2002), waste generation in African nations is growing rapidly and may double in aggregate volume within a decade, driven largely by growth in population and improvements in living standards.

The composition of waste generated by most African urban centres is mainly decomposable organic materials based on the urban community consumption that generates much kitchen wastes, compound wastes and floor sweepings (Henry et al., 2006; Simon, 2008; Okot-Okumu, Nyenje, 2011). Couth and Trois (2010) reveal that the average organic content for urban municipal solid waste in Africa is around 56% and its degradation is a major contributor to greenhouse gas emissions.

In Ghana, the amount of solid waste generation in metropolitan cities is on the rise (Asase, 2011) and in some cases generated waste are more than available resource capacity for collection, transportation and disposal (Oteng-Ababio, 2011). In Kumasi and Accra for an instance, the rates of waste generated are 0.6 kg/person/day and 0.40 kg/perso/day respectively (Ketibuah, Asase, Yussif, Mensah & Fischer, 2009). The Ministry of Local Government and Rural Development [MLGRD]-EHSD (2010a) maintained that almost all the SW generated in the country are collected and sent to landfills of different forms. In the rural areas and smaller towns however, SW is disposed in natural depressions, sand pits, or on the beaches (Babanawo, 2006).

In the Cape Coast Metropolis, there is an increasing concern about rising volume and generation rate of SW. According to the Cape Coast Metropolitan Assembly (CCMA), huge piles of SW and overflowing waste containers are seen in the Metropolis. Table 1 depicts estimates of SW generation quantities and total population in the CCMA for the next twenty-five (25) years should the current status quo persists.

Table 1: Estimates of SW generation quantities in the Cape Coast Metropolis

Years	Estimated Population	Generation rate	Daily in tons	Annuallyin tons
2014	220,000	0.75 kg/day	165	60,225
2020	264,225	0.75 kg/day	198	72,332
2030	358,560	0.75 kg/day	269	98,156
2040	486,573	0.75 kg/day	365	133,199

Source: GNWPTA, based on Census 2010 population data and daily generation rates derived from NESSAP, 2009.

As things remained unchanged, with an estimated population of 220,000 and waste generation of 165 tonnes per day, the Metropolitan Assembly generated about 60,225 tonnes of solid waste in 2014. Should the situation persist, by the year 2040, an estimated population and annual generation of SW in the Metropolis will triple to 486,573 and 133,199 tonnes respectively.

The ever-increasing volumes of SW generation without separation, coupled with associated rapid urbanization and lack of existing systems to adequately handle them may result in indiscriminate disposal of wastes in water courses, drainage channels and on land. The leftover SW creates problems on the environment as well as human health and consequently economic and other welfare losses (Boadi, 2013).

The environmental impacts of landfills as well as incineration of mixed waste pose public health hazards and these affect human development (Centre for Disease Control, 2009; Mills-Tettey, 2011). The collected mixed solid wastes that

are burnt have potential to pollute the quality of air, water and land resources (Achankeng, 2003; Abagale, Mensah, & Agyeman-Osei, 2012). Again, the disposal and burning of solid waste in landfills generate methane gas that has high global warming potential (Papageorgiou, Barton & Karagiannidis, 2009). Records from the Cape Coast Metropolitan Health Directorate reveal that about 70% of reported outpatient cases are sanitation-related diseases, of which malaria accounts for 53% (Ghana Health Service, 2012). It is worth noting that poor environmental sanitation levels are significantly influenced by poor SW management practices especially dumping of SW in water bodies and uncontrolled dump sites (United Nation Commission on Sustainable Development, 2012). And this contributes to poor health and are predisposing issues in a high percentage of diseases reported at health facilities (Boadi & Kuitunen, 2005).

While most of the developed countries such as the United State, Japan, and United Kingdom have put waste management concepts into best practices through well organization and planning, developing countries are often encountered with ineffective management system (Owusu, 2010). Generally, inadequate technologies, poor financing, lack of policy and planning and workable legislation, regulation and implementation plans are common causes for ineffective SWM systems in Africa (Vidanarachi, Yuen & Pilapitiya, 2006; Alkhatib, et al; & Owusu, 2010).

According to Asase (2013), another problem of Ghana's SWM is lack of separation and classification of organic wastes from the inorganics. Due to the lack of waste classification; both at-source and on-site separation systems, most wastes

in Ghana are mixture of different composition, which make the retrieval of values for organic wastes both economically costly and technically difficult. The challenges are more pronounced in urban areas due to the diverse nature of the materials in the waste stream. Therefore, there is the need to put in place innovative and adequate systems to control and manage these waste challenges in order to prevent the negative impacts on health and environment.

In Europe for example, SW management growth has been in recycling form for energy recovery (Rondinelli & Berry, 2000). Source separation of SW by households is well established with separation into either biodegradable and non-biodegradable material or recyclable materials such as glass, metal cans, newspapers, etc. (Hogland, Visvanathan, Marques, & Manahdar, 2005). This management philosophy is to ensure the treatment of all waste as resource material, some suitable for recycling, others for conversion to compost (Hettiaratchi, 2007).

With the primary aim to lessen environmental damage and achieve environmental sustainability, waste separation and material recovery for recycling and reuse which form part of an Integrated Solid Waste Management (ISWM) system is recommended to save energy, conserve resources, reduce emissions from incinerators and prolong lifespan of landfills (Seik, 1997; Rondinelli & Berry, 2000; Tinmaz & Demir, 2006; Tsai, 2008; Yau, 2010).

Similarly, the need to promote, strengthen and expand waste separation, re-use and recycling systems was recognized in Agenda 21, the agreement reached among participating nations at the United Nations Conference on Environment and Development in Rio de Janeiro in 1992. It was reaffirmed at the conference that in

order to maintain the quality of the Earth's environment and to achieve sustainable development, environmentally sound practices for the management of waste is one major issue that must be addressed.

Consequently, Ministry of Environment & Science (MES), Ministry of Local Government & Rural Development (MLGRD) and Environmental Protection Agency [EPA] (2002) published a manual for the preparation of Districts' Waste Management Plans in Ghana to address their problems with SWM. According to the manual, MMDAs WM plans should make provision for the separate collection of portions of the SW for recycling, reuse and composting. However, these strategic plans are yet to be fully realized in the country. The revised environmental sanitation policy of Ghana recognizes the need to promote alternative uses of wastes through waste reduction methods such as separation and material recovery for recycling and reuse (MLGRD, 2010a). MMDAs have therefore been tasked, in conjunction with the EPA, to provide facilities and services for primary separation of SW at the household, community and public levels (MLGRD, 2010b).

It has been observed by Kaseva, Mbuligwe and Kassenga (2005) that waste prevention through separation and material recovery for recycling and reuse which can result in income generation, employment creation and reduction of the waste stream has often been ignored in developing countries. Medina (1997) reported that social, economic and environmental benefits of the recycling activities carried out by scavengers are not fully recognized by authorities in many developing countries. However, there is a wide reuse of plastics, bottles, paper, cardboard, cans for domestic purposes found commonly among the poor in various cities in Africa.

Although, SW separation at source has been acknowledged as an efficient strategy for recycling (Asase, 2010), its full potentials and benefits are yet to be realized or utilized and the rate of public participation also remains generally unknown in Ghana and in Cape Coast in particular. In addition, there is no handy and dependent guideline for households' SW separation and the practice initiatives in Cape Coast Metropolis. In view of this, waste separation needs to be adequately communicated to the public so that residents' attitudes and behaviours and can be influenced for the better to enabling local and national authorities to achieve government goals towards SWM. Thus, a lot of effort is required to make source separation successful since it is not naturally part of present day urban lifestyles (Annepu, 2012).

Statement of the Problem

According to Mensah and Larbi (2005 cited by Mariwah, 2012), Ghana generates 3.0 million tonnes of SW yearly based on the 24 million population and 0.45kg daily waste generation. Accra, the capital, and Kumasi, the second largest city, with a combined population of about 4 million and a floating population of about 2.5 million generate over 3,000 tons of SW daily (Mariwah). The 2015 projected population of Ghana stood at 27,741,176 and that of Cape Coast Metropolis was 226,820 (GSS, 2010). Thus, SW generation rates and the amount are therefore expected to increase significantly in line with increased population and economic parameters. It is, however, estimated that throughout the country

only about 10% of SW generated is properly disposed off (Mensah & Larbi, 2005 Asase, 2011).

Management of SW has placed a heavy burden on government of Ghana's expenditure. For example, public expenditure on sanitation (excluding households) amounted to GH¢49 million (USD 11.3 million) as of 2014 alone. Besides, public health expenditure is estimated at 4.9% of GDP and a significant portion of this is also attributable to disease related to poor environmental sanitation (WHO & World Bank, 2004 as cited in MLGRD, 2010b). Improper disposal of SW coupled with the high population growth and lack of institutional capacity to formulate and adopt strategies to ensure proper WM system had led to widespread diseases such as cholera, malaria, dysentery, diarrhea, and typhoid fever, which together constitute 70% to 85% of out-patient cases at health facilities in Ghana (MLGRD, 2010a; Danso-Manu, 2011). Improving SWM practices in Ghana undoubtedly has strong beneficial impacts on health of the people, in and around the country.

Although the Metropolitan, Municipal and District Assemblies (MMDAs) in Ghana are charged with the various operational aspects of SWM as stipulated in the Local Government Act, 1990 (Act 462), the Assemblies' WM practices have been merely collection, transportation and eventual disposal of co-mingled waste which limit utilization of reuse and recycling of waste activities. Currently, mixed (co-mingled) SW with approximately 67% by weight of biodegradables, 20% plastics, 5% textiles and 8% combinations of silt, paper, metal, glass and household hazardous waste end up in Ghana's landfills (Oteng-Ababio, 2011). The mixed nature of the waste, with plastics, metals, and raw faecal matter, especially in low

income areas has been a major problem (Boadi & Kuitunen, 2003). Mixed waste collection increases the risk of contamination of recyclables and reduces their marketing possibilities (Hoornweg & Bhada-Tata, 2012).

Coincidentally, the Sustainable Development Goal (SDGs) 11 advocates for making cities and human settlements inclusive, safe, resilient and sustainable and goal 12 targets substantially reduction of solid waste generation through reduction, recycling and reuse by 2030. Again, Ghana's Environmental Sanitation Policy (2010) seeks to promote waste minimization, reuse and recycling. However, reuse and recycling require effective source separation, which is determined first and foremost by residents' willingness and ability to separate wastes at household levels. It appears also that much attention has not been given to source separation of SW that is economically viable, socially acceptable, and environmentally friendly method of managing solid waste in the Cape Coast Metropolis. It is against this backdrop that this study sought to examine households' solid waste separation practices in the Cape Coast metropolis.

Research Questions

The following research questions guided the study:

i. What are the existing solid waste disposal practices of households in the metropolis?
ii. What are the source separation practices of solid waste among households in the study area?
iii. To what extent are households willing to separate solid waste in the metropolis?

iv. What challenges are associated with households' separation of solid waste in the metropolis?

Objectives of the Study

The main objective of the study was to examine households' solid waste separation practices in the Cape Coast metropolis. Specifically, the study sought to:

i. Examine the existing solid waste disposal practices of households in the metropolis;
ii. Analyse residents' households source separation practices of waste in the area;
iii. Explore households' willingness to separate waste in the metropolis; and
iv. Identify the challenges associated with source separation of waste in the metropolis.

Significance of the Study

The study is significant in many ways. The results of the study are hoped to help improve SW disposal practices of households and unearth new approaches in dealing with SWM in the Cape Coast Metropolis and the country at large. It will also help Cape Coast Metropolitan Assembly (CCMA) to implement sound administrative policy that seeks to encourage recovery of reusable and recyclable materials and protect human health and the environment.

The study would again serve as a major input to the CCMA and agencies such as the Cape Coast Metropolitan Waste Management Department and Zoomlion Company Ghana Limited to direct resources into sustainable SWM

practices that are environmentally responsible, socially accountable, and economically efficient in the Cape Coast Metropolis. The study will also provide information which will create source separation awareness as a means of ensuring environmental cleanliness, improving health and reducing cost on SWM. Lastly, findings from the study will add to existing knowledge on solid waste management practices and serve as a basis for further research.

Delimitations

Geographically, the study was conducted within the Cape Coast Metropolitan Area in the Central Region of Ghana. The study investigated solid waste separation practices of households in three randomly selected communities in the study area. The respondents were homemakers and stakeholders who are residents of their respective communities. Consequently, the results of the study are limited to the study area though references could be made to other areas with similar characteristics as the study area. It nonetheless, provides a good basis for further investigation in the issue of solid waste management.

Limitations of the study

A number of weaknesses pertaining to the data and the methodology should be kept in mind when the results of this study are considered.

1. First of all, there is bound to be some marginal errors because some respondents may be forgetful or were not thinking within the full context of

the study and therefore may have provided incorrect responses. This may affect the content validity to some extent.

2. The few (3) studied communities were randomly selected to represent the entire metropolitan area and a sample size of 246 was used. Although it is statistically meaningful, the data obtained may not be the true reflection of all the communities in the metropolis. The results of the study should therefore be interpreted bearing in mind these limitations.

Definition of Terms

Solid Waste - any material neither in liquid nor gaseous which comes from households, commercial, and industrial sources arising from human activities of production and consumption which has no value to people who possess it and is discarded as useless.

Types of Wastes - indicate the various components of the waste stream such as organic (food & yard wastes), plastic, paper, glass, metal and others (ceramics, textiles, leather, rubber, ashes, bulky materials and materials not included in above categories).

Solid Waste Management - deals with monitoring (handling and storage), collection, transport, processing and disposal of solid wastes.

Waste Management Hierarchy – explains methods of managing waste (reduction, reuse, recycling and composting, incineration and landfilling) to derive optimum benefits from products whiles generating the least possible amount of waste.

Source Separation of Solid Waste - setting aside of recyclable and compostable material at the point of generation so that they do not enter waste stream for the purposes of reuse, recycling and composting or improved solid waste management.

Solid Waste Disposal - Process of disposition of solid waste (uncontrolled and controlled dumping of refuse, sanitary land filling, composting and incineration).

Organization of the Study

The study is organized into five main chapters. Chapter one is an introduction to the study; it provides the background, the statement of the problem and the objectives of the study. It also looks at the research questions, the significance of the study, delimitations, limitations, definition of terms and the organization of the study. Chapter two focuses on the literature review to support the discussion of SWM issues and aspects related to the objectives of the study.

Chapter three outlines the methodology of the study; it considers methodological issues such as the study design, study area, sources of data, target population, sample size, sampling procedure, research instruments, pre-test of research instruments, data analysis, ethical issues arising from the fieldwork, and the challenges from the fieldwork. Chapter four concerns itself with the data analysis, the presentation and discussion of results. Chapter five provides the summary, conclusions and recommendations of the study.

CHAPTER TWO

LITERATURE REVIEW

Introduction

This chapter deals with the relevant literature to the study. The review of the literature is divided into two sections; the first part deals with issues and concepts related to SWM. These include waste, composition, volume and sources of solid waste, characteristics and types of solid waste, solid waste disposal practices and current situation of SWM in Ghana. It also considers source separation (SS) of solid waste, willingness of households to participate in waste separation and challenges associated with waste separation at household level. The second part presents Ajzen's Theory of Planned Behaviour (TPB) as conceptual framework for examining individual's behaviour towards solid waste separation practices.

Definition and Classification of Solid Waste

The OECD (2005) defines solid waste as "materials with less liquid content, characterized by a reactive and unstable nature when exposed to heat, some including acids or bases that can corrode metal containers". Alam and Ahmade (2013) confirms this by adding that some solid wastes are toxic and are harmful when ingested or absorbed and can also cause fire and explosion when found under certain conditions. Both definitions however remain positioned that any waste that

is neither in liquid nor gaseous form is referred to as solid waste. It is also implied in their definition that solid waste can change its form or state.

In addition, Zerbock (2003) states that solid waste includes non-hazardous industrial, commercial and domestic waste including household organic trash, street sweepings, institutional garbage, and construction wastes. The nature and abundance of the solid waste in a given region is said to be a function of the living standard and lifestyle of its inhabitants, the abundance and type of the region's resources and degree of industrialization (UNEP, 2005).

To Tchobanoglous and Kreith (2002), municipal solid waste describes the waste that is produced from residential and industrial (non-process wastes), commercial and institutional sources with the exception of hazardous and universal waste, construction and demolition waste, and liquid waste (water, wastewater, industrial processes). Operationally, it can therefore be said that, any material neither in liquid nor gaseous which comes from households, commercial, and industrial sources arising from human activities of production and consumption which has no value to people who possess it and is discarded as useless.

Sources and Types of Solid Wastes

Varieties of wastes arise from different sources as a result of the daily activities of human beings. Such sources in any community may include residential houses, institutions, commercial organizations, municipal services, allotments and treatment sites (Ezeah, 2006). Khan and Ahsan (2003) also mentioned that solid waste is generated from various sources like institutions, industries, construction

and demolition activities, municipal services, agricultural activities, treatment plants and special category sources. Table 2 shows sources and types of solid waste generated from daily activities of people.

Table 2: Sources and types of solid waste

Sources		Type of wastes
Residential	Single and multi-family dwelling	Food wastes, paper, plastics, textilesglass, metals, special wastes: bulky items, batteries,
Commercial	Stores, hotels, restaurants, markets, office buildings	Paper, cardboard, plastics, wood, food wastes, glass, metals, special wastes, hazardous wastes
Institutional	Schools, government, center hospitals, Prisons	Paper, plastics, food wastes, glass, metals, special wastes, hazardous wastes
Municipal services	Street cleaning, landscap in parks, beaches, recreational areas	Street sweepings, landscape and tree trimmings, general wastes from parks, beaches,
Construction and Demolition	New construction sites, road repairs, renovationsites, demolition of buildings	Wood, steel, concrete, dirt
Process (manufacturing)	Heavy and light manufacturing, refineries, chemical plants, mineral extraction and processing	Industrial process wastes, scrap materials, off-specification products, slay, tailings
Agriculture	Crops, orchards, vineyards, dairies, feedlots, farms	Spoilt food wastes, agricultural wastes, Hazardous wastes

Source: UNESCAP (2000)

Composition and Characteristics of Solid Waste

Individual components and their relative distribution in the waste stream make up waste composition (Boadi, 2013). Thus, waste composition indicates the various components of the total waste stream often given as a percentage of the total mass or volume. Asase (2011) asserts that the components categorized usually include: organic (food & yard wastes), plastic, paper, glass, metal and others (ceramics, textiles, leather, rubber, ashes, bulky materials and materials not included in above categories).

Abundance of a particular component of the waste stream may depend on the location and season within which they are generated. For example, plant debris may be high in the waste stream of countries located in tropical and subtropical areas whereas ash may be abundant in areas in which coal or wood are usually used for cooking and heating (UNEP, 2005). The United Nations Environmental Programme report explains that waste composition varies across and within countries and this is as a result of the size of population, urbanization and affluence (UNEP, 2010). However, waste generated in the developed and developing countries are highly different. The primary difference between them is the high organic and moisture content.

According to Hoornwey and Bhda-Tata (2012), most developing countries have the following waste compositions: organic (64%); Paper (5%); Plastic (8%); Glass (3%); Metal (3%); and others (17%). This is so because affluence increases at a slower rate in such countries and waste composition is influenced by factors including climate, culture, and economic development among others which further

influence solid waste collection and disposal. Similarly, case study by Peprah (2013) in Kumasi found that solid waste in the low-income area were as follows: organic (59.15%), plastics (11.01%), papers (3.15%), glass (0.89%), metals (0.96%) and others (24.84%). In the middle-income area however, the study indicated organics (65.68%), plastics (10.68%), papers (4.51%), glass (2.57%), metals (4.63%) and miscellaneous (11.93%). This means the highest fractions of solid waste in both income groups were organic wastes.

In a study by Asase (2011), plastics waste constitutes 69.2% of the total wastes analyzed with other waste such as organic, paper, metals, textiles and glass constituting 13.4%, 7.3%, 4.4%, 2.6%, 1.8% and 1.3% respectively. Ansah (2014) study in Tarkwa-Nsuaem Municipality also identified the following: organic waste accounts for 68.56%, followed by plastics/rubber at 16.02%, paper and cardboard at 4.87%, ash/sand at 4.15%, textiles at 3.23%, non-ferrous metal at 1.65%, glass/ceramics at 0.92%, ferrous metals at 0.31% and potentially hazardous 0.29%.

Another research carried out by Couth et al. (2010) in Durban reveals that the average organic content for urban municipal solid waste in Africa is around 56% and its degradation is a major contributor to greenhouse gas emissions. According to the UNEP (2005), knowledge of the composition of the wastes is an essential element in the selection of the type of storage and transport most appropriate to a given situation, the determination of the potential for resource recovery, the choice of a suitable method of disposal and the determination of the environmental impact exerted by the wastes if they are improperly managed.

Overview of Solid Waste Management (SWM)

The history of SWM is inevitably linked to urban history (Ali, 2004). Prior to Neolithic times (circa 10,000 B.C.) when the human race was mostly nomadic, the natural decomposition of waste appeared to be obvious. Waste became an issue as humans began to congregate in villages and communities and also as the accumulation of waste became a consequence of life (Boadi & Kuitunen, 2002). The ever-growing municipalities in Europe and in Northern America made necessary the elaboration of appropriate systems to properly manage solid waste. In effect, urbanization stopped the natural cycle of SWM (European Commission, 2010). Since then, municipal managers and citizens have struggled with the problem of solid waste till now. This is partly because, in the quest for development, humanity did not budget for the problems related to management of waste.

Solid waste management, according to UNEP (2005), deals with monitoring (handling and storage), collection, transport, processing, and disposal of solid waste. Skitt (1992) defines solid waste management as "the purposeful, systematic control of the generation, storage, collection, transport, separation, processing, recycling, recovery and disposal of SW". Waste management has also been defined by Pongrácz and Pohjola (2004) as "the control of waste-related activities with the aim of protecting the environment and human health and encouraging resource conservation". According to Zurbrugg (2004), SWM includes all activities that seek to minimize the health, environmental and aesthetic impacts of SW. Thus, the business of keeping our environment free from the contaminating effects of waste materials is generally termed waste management. These includes all activities that

control the generation, collection, processing, transportation and disposal of waste as well as the minimization of the production of waste and the conceptualization of waste as a resource.

The very aim of SWM options after generation and before final disposal has to do with waste minimization, collection and sorting, re-use, recycling, composting, anaerobic digestion, energy recovery (incineration or other more advanced thermal treatment techniques) and incineration (without energy recovery) (Kumah, 2007). It is true that the adoption of a particular solid waste management option in a region may depend on the materials, the WM systems available locally or regionally, the available market opportunities and the established waste management policy.

The Ghana Environmental Protection Agency (2002) has noted that waste management is essential in the present day context for the following reasons: (1) protect human health against waste-related hazards and risks; (2) prevent pollution of the environment and its natural resources like air, water and land; (3) produce energy which could be an alternative for the fast depleting fossil fuels and other conventional sources of energy; and (4) make optimum use of the waste generated for a better and sustainable future.

The objectives of SWM are also in line with the goals of the United Nations' 2005 Millennium Ecosystems Assessment (MEA) which focuses on waste processing and detoxification and points out that failure in waste management is the cause of the growing incidence of waste water-borne diseases, human health impairment and ecosystem damage (Millennium Assessment Report, 2005). The

objectives of SWM evolved from the primary concerns of environmental health protection to consider human safety, resource conservation and the reduction as much as possible the environmental burdens of WM (energy consumption, pollution of air, land and water and loss of amenity) in recent years (McDougall & Hruska, 2000).

In order to develop and implement sustainable MSWM systems based on integrated sustainable waste management framework, a practical holistic approach will involve the consideration of specific objectives and measures in the following areas (Schübeler et al., 1996): Planning and management (strategic planning, legal and regulatory framework, public participation, financial management including cost recovery, budgeting, accounting); Institutional arrangements including private sector participation and disposal facility sitting; Waste generation (waste characterization, generation rates, composition, waste minimization and source separation); and Waste handling (waste collection, waste transfer, treatment and disposal); and Special wastes (medical, small industries).

The general principle of the waste management hierarchy according to UNEP (2005 cited by Asase, 2011) consists of the following: (1) minimizing wastes; (2) maximizing environmentally sound waste reuse and recycling; (3) promoting environmentally sound waste treatment and disposal; and (4) extending waste service coverage. Similarly, Schubeller et al. (1996) subscribed to these principles of waste management by calling for the need to minimize waste generation, maximize waste recycling and reuse, and ensure the safe and environmentally sound disposal of waste. This means that waste management

should be approached from the perspective of the entire cycle of material use which includes production, distribution and consumption as well as waste collection and disposal.

Waste Management Hierarchy

The waste hierarchy primarily seeks to derive optimum benefits from products whiles generating the least possible amount of waste. The waste hierarchy is set out in Article 4 of the revised European Waste Framework (Directive 2008/98/EC) as consisting of the following stages; prevention, preparing for re-use, recycling, then composting, energy recovery by or gasification/combustion, commonly called waste-to-energy (WTE) and landfilling as seen in the pyramid (Figure 1).

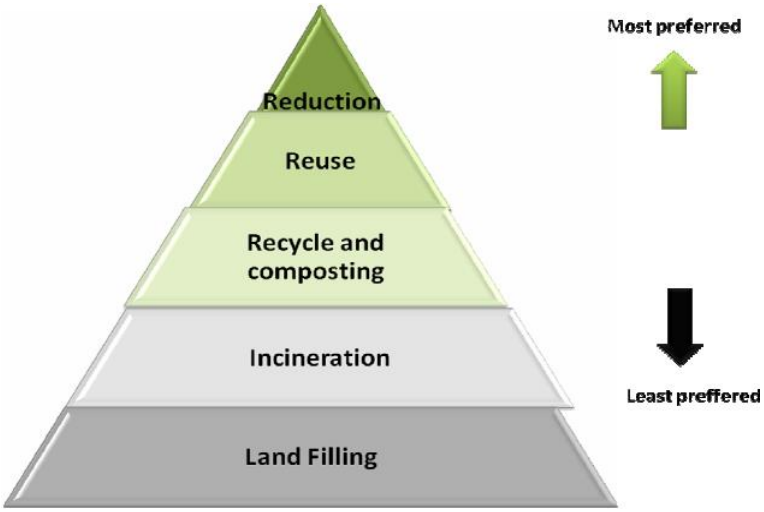

Figure 1: Stages of waste hierarchy

Source: DEFRA (2011)

The US Environmental Protection Agency (2011a) has roughly divided SWM methods into five; reduction, recycling and reuse, composting, thermal

treatment with energy recovery, and landfilling. According to Tchobanoglous and Kreith (2001), waste management will be effective if the waste management objective is to minimize or prevent waste in the first place. In this regard, the primary objective of waste management hierarchy and for that matter this thesis is to reduce the amount of SW to be disposed off in landfills or disposal sites. This is also in conformity with Fagan (2011) that the most preferred option for solid waste management is source reduction followed by re-use of whole products, recycling of materials, resource recovery as a means of material and energy, incineration and finally landfilling, the least preferred. Thus, in an effort to reduce the volume of wastes, separation of solid waste at household levels is needed in order to get materials for reuse and recycling. Reuse and recycling constitutes most viable means of expanding the life of the products through converting the materials into new form.

Waste reduction

Source reduction is the most preferred waste management strategy in the hierarchy because it eradicates the necessity of handling, transportation and disposal of wastes. The main idea is to minimize the amount of waste generated. Change in design, production, packaging, purchase and use of products or materials to reduce the toxicity and amount of waste generated at the source is referred as Source reduction (USEPA, 2010b). Thus, any activity which helps in reducing waste, toxicity, and focusing on reuse and recycling at the source is termed as source reduction. An individual practice of consuming fewer products and getting rid of less waste is also considered as source reduction (Sally, 2004).

Source reduction or waste minimization and prevention strategy should be applied in the life cycle analysis of a product from cradle to grave so that waste generated in each phase of the product' life can be identified and minimized at the earlier stages (Power Score Card, 2000; Kulkarni, 2008). Use of reusable products, buying products with less packaging, using rags instead of paper towels, electronic newspapers from online for reading news, electronic documents instead of papers for payment activities, use recycling products like aluminium cans and glass, purchase products that are non-hazardous, purchase in bulk, buy more durable products, minimize the use of product, etc. are some of the strategies for source reduction (Source Reduction and Reuse, 2011). Ketibuah, Asase, Yusif, Mensah and Fischer (2009) wrote that waste reduction can be accomplished through the increased use of source separation and subsequent material recovery and recycling.

Reuse

The material or product which can be used more than once for the same or different activities without any upgrading is defined as reuse (Kulkarni, 2008). Thus, reuse of material involves using such product repeatedly without the need for re-processing. Reuse plays a valuable resource conserving role (AfDB, 2002). Reuse is an important requirement for source reduction (Asase, 2011). The main application of reuse is to extend the life of the products or materials. Use of durable refilling bottles, reusing cardboard boxes, donating old computers to schools and NGO's, second hand furniture are some of the examples for reuse (AfDB). Others include plastic bags, paper, and cans which are recovered for domestic purposes normally at household levels. Compared to recycling, reuse is preferred most

because it does not undergo any upgrading and therefore no material and energy is used and at the same time reduces the cost and the need for disposal (Kulkarni). The demerits in reuse are cleaning, transportation and time consumption for sorting. However, its proper integration into a well-designed solid waste management programme will be beneficial in the areas of waste reduction, material conservation, cost savings and environmental protection (Diaz-Luis, 2012).

Recycling

Recycling is an activity of collecting, sorting and processing of used or discarded materials into useful products to its original form or for other purposes (Kumar, 2011). According to the USEPA (2010c), recycling is the process of making new materials out of previously new ones which have been considered as waste. This means that the primary aim of recycling treatment method is converting waste into valuable materials.

About 15-35% of solid wastes generated in cities in low and middle-income countries are being recovered as a result of informal recycling activities (UN-HABITAT, 2010). According to Ketibuah et al. (2009), separating waste materials at the household level occurs to some extent and prevents the most valuable and reusable materials from being discarded. Retention of valuable materials according to Gyankumah (2004) indicated that waste-pickers usually remove most valuable materials either before garbage enters the waste stream or en route, especially in the lower and middle-income areas. According to Boadi and Kuitunen (2003), waste recycling at households in low-income areas begins with the re-use of plastics, bottles, paper, cardboards and cans for domestic purposes. Materials like

paper, plastic, metals and glasses are some of the recyclable materials used for recycling and manufacturing new products (Korner, 2006). Specifically, Boadi and Kuitunen believe that paper can be converted into toiletries, organic into organic fertilizers, plastics into plastic toys and domestic products (bowls, plates) and textiles into bags and other accessories through recycling processes.

Metal recycling generally leads to material recovery, energy recovery, and minimization of virgin metals consumption and reduced greenhouse gas emission. According to EU report, utilizing recycling of raw materials for the production of new materials decreases around 200 million tonnes of CO2(4) emission per year Balancing Mechanism Reporting Agent [BMRA] (2010). Recycling aluminum conserves nearly 95% of energy used for producing new aluminum products from virgin aluminum (BMRA).

Recycling requires collective action in order to achieve the numerous benefits as outlined by Smith, Brown, Ogilvie, Rushton and Bates (2001) and Waste and Resources Action Programme [WRAP] (2006). Among these benefits are: Landfill spaces are saved because waste which might have ended up in landfills is diverted; Pollution is reduced and natural resources are conserved because virgin materials are not used to manufacture new products which ensure environmental sustainability as enshrined in SDGs; Energy and manufacturing costs are reduced; Recycling helps in reducing GHGs which contribute to climate change; Jobs are created helping to reduce poverty in accordance with SDGs, etc.

In general, recycling which demands effective source separation serves as conserving resources for future, consumes less energy than producing products

from virgin materials, uses and saves valuable metals from dumping, develops sustainability and reduces landfilling (All-recycling-facts, 2013). It is considered as one of the effective solution for saving landfill from producing greenhouse gas. To be effective, Zerbock (2010) argues that source separation of waste policies need to be implemented on both the national and local levels. Kaseva et al. (2005) conclude that SWM strategies in developing countries like Ghana should be redesigned to include a source separation, collection and processing system for waste recycling that can work parallel with the conventional systems already in operation as a result of success stories of recycling programmes that have been recorded elsewhere in the world.

Recovery

Recovery mainly refers to processes including material recovery, energy recovery, biological recovery as well as waste re-use (USEPA, 2010b). Recovery therefore means any WM operation that diverts waste material from the waste stream which results in a certain product with a potential economic or ecological benefit. This is necessary tool for waste recycling, reuse and reduction.

Composting

Composting is a natural way of recycling (Benefits of Recycling, 2010). It is a biological process which decomposes the organic matters into various micro-organisms under aerobic conditions (Ucopenaccess, 2011). Composting is an option to retain the nutrients from the waste and deliver back to other organisms in the natural system. According to Ucopenaccess, materials like garden waste, lawn clippings, leaves, weeds, hay, straw, wood products, food waste and manure are

used for composting. Various forms of composting technologies exist and these include open windrow, vermi-composting, enclosed composting, anaerobic digestion and fermentation (Engledow & Eichestadt, 2007). Soil enrichment, remediate contaminated soil, pollution prevention (USEPA, 2011b), reduction in GHG, regeneration of poor soils, minimize soil erosion, better soil porosity, less consumption of fertilizers and pesticides, high nutrients to soil are the environmental benefits of composting (Environmentalist Everyday, 2011).

Incineration

Burning of SW materials at a very high temperature is considered as incineration. Electricity and heating are the main products of waste incineration. The heat produced in burning the trash is used for generating electricity power and used for heating in cold countries, which is technically known as waste to energy. The residue after burning the waste is used to extract some of the non-combustible materials like glass, metals, etc. and rest of the fly ash is used as a mixture for engineering purposes and at worst case it is dumped in the landfill (Friends of Earth, 2002). Waste like paper, textiles, garden, wood, plastics comes under combustible materials (North Yorkshire County Council, 2010).

The advantages of incineration are that it minimizes the volume of waste being dumped in the landfill, produce energy with the heat produced during combustion (Statistics Canada, 2010). Incineration is attractive for its ability to reduce significantly the volume of combustibles by 80 - 95 percent further reducing the need for landfill capacity (Haukohl & Marxen, 2000). Reduction by incineration, along with sanitary disposal of the residue, would be a useful

alternative to traditional disposal methods and have proven useful in nations such as Bermuda and the British Virgin Islands (Browne & Allen, 2007).

Landfill

The placement of SW in landfills is probably the oldest and definitely the most prevalent form of ultimate garbage disposal (Palczynski, 2004). In this thesis, landfill is a place where the generated wastes are dumped beneath the soil in an isolated manner. It appears to be one of the most used methods for the disposal of waste. Around 62% of municipal wastes are dumped in the landfill (Infoplease, 2000). African nations (exception South Africa) have the fewest engineered landfills, with most nations practicing open dumping for waste disposal (Dolk, 2003). Landfills type may range from uncontrolled open dumps and controlled dumps to secure sanitary landfills. Plastic and paper waste contributes major part in land acquisition in the landfill as it is generated numerously and disposed at a great extent.

Source Separation of Solid Waste

Although collecting municipal solid waste is a major and expensive task for nations and local waste management authorities, efficient collection is a necessity (Yi, Xuemei, Zhiyun, Hua & Fangfang, 2007). Source separation or segregation at source refers to the practice of setting aside post-consumer materials and household goods so that they do not enter the mixed waste stream for the purposes of recycling, reuse or improved WM (Lardinois & Furedy, 1999; Asase, 2008). UNEP (2005) defines source separation of solid waste as setting aside of compostable and

recyclable material from the waste stream before they are collected with other MSW to facilitate reuse, recycling, and composting. There are two types of waste separation: source separation and central sorting (USEPA, 1995). Source separation is the segregation of specific materials at the point of generation for separate collection and central sorting refers to sorting after source separation (USEPA).

The main methods to recover recyclable materials are by either the generator or collector (with and without subsequent processing), or to collect mixed waste with processing for recovery of the recyclables materials. According to Lardinois and Furedy (1999) the items that are commonly separated from the household waste streams include: reusable items (such as clothes and accessories, utensils and appliances, containers, books and magazines); materials which are usually regarded by the primary consumer as wastes (such as newspapers, scrap paper, cardboard, broken or irreparable plastic items such as buckets and basins, food and drink cans and containers); organic matter (such as food wastes, organic residues and garden wastes); and toxic and hazardous wastes that are dangerous in landfills (such as biomedical items, used oils and pressurized cans).

Solid wastes can be segregated at households' level, transfer stations and disposal site for subsequent use of the materials as secondary materials. More emphasis should be on segregation at the household level since it is not widely practiced and waste recycling is minimal (Chandra & Devi, 2009). Bennagen, Nepomuceno and Ramil (2002) assert that it is better to separate recyclable materials at source rather than mixed waste recovery because cleaner and higher quality materials are produced through source separation. Al-Salem, Lettieri and

Baeyens (2009) emphasized that sorting is the most important step in the recycling loop irrespective of how efficient the recycling scheme might be. Lardinois and Furedy (1999) and USEPA (2002) categorized SS into two: customary practices; and collectively organized interventions. The customary practices entail gift, barter and sale of post-consumer materials linked to charity, trading and recycling. An example is selling post-consumer items to itinerant buyers. In collectively organized systems, separated materials may be collected either using drop-off or kerbside collection methods for recycling and composting. A study by Bandara, Hettiaratchi, Wirasinghe and Pilapiiya (2007) on *'Relation of waste generation and composition to socio-economic factors'* concluded that waste separation was high among household with high levels of income because they could afford waste separation bins for different wastes generated.

The Need for Source Separation (SS)

Source separation of recyclables is more preferable than any form of central sorting. With source separation, recovered materials are rather clean because they are not co-mingled from the source. Also, cleaner materials require less cleansing and, hence, the recycling process emits less pollution. Source separation educates people about the need for waste reduction, reuse, and recycling (Miller & McGeehin, 1992). During the separation process, people gain an understanding on which materials can be recycled as compared to centralized separation.

The benefits of separation of organic and inorganic wastes at source according to Lardinois and Van De Klundert (1994) are: reduction in injuries and

better health status of waste workers (scavengers, collection crew, etc.), increase in value of recyclables and in quality of compost produced from separated organic waste, reduction in the amount of waste collected and subsequently disposed, and increase waste treatment options.

According to Lardinois and Van De Klundert (1994) and Calabrò-Paolo (2009), SS will minimize energy and labour inputs to any downstream sorting process, reduce health hazard associated with sorting of mixed refuse, lower recycling costs and provide opportunities for innovation. Raheem, Hänninen and Huagie (1999) suggested that SS should be introduced with adequate citizens' education to ensure high participation and level of separation in order to increase the lifespan of landfills in West African Cities. Schertenleib and Meyer (1992b) argue that SS of recyclables could increase the price and markets for recyclable since cleaner or purer materials attract higher prices.

Many researchers support the argument that SS of recyclables, whenever possible, should be preferred to the recovery of materials from mixed wastes (Medina, 1997; Nordone & Franke, 1999; Schübeler et al., 1996). Calabrò-Paolo (2009) believe that, separate collection of waste does not only maximize the quantity and the quality of recyclable materials but also reduces the impact of MSW by removing from waste streams items containing dangerous substances such as batteries, wastes from electric and electronic appliances and drugs. Gould, Garrison and Foster (1992) discuss the possible drawbacks of SS of organic wastes. The drawbacks enumerated are: additional demand on waste generators, potential odours and additional storage space requirements, potentially lower capture rates

leading to higher disposal costs, greater uncertainty and technological risk because quantity and quality of the material collected depend on the behaviour of participants, and separate collection may induce additional costs.

The method employed to collect source-separated wastes determines how costly the system will be. Avoided costs associated with the reduced need for landfilling should be included in the computation of SS programme costs since total waste management costs may increase with the introduction of such a programme and revenue from the sale of recovered materials may not be adequate to offset added expenses (Lardinois & Furedy, 1999). Fehr, De Castro and Calçado (2000) advance the argument that SS will naturally attract the informal sector and will facilitate their incorporation into the formal waste management system.

The need for SS education

Adequate communication and information of SS programmes design at households are important because they can influence the habits and traditions as well as attitudes and motivations of the waste generators by ensuring that the goals and targets of SS schemes are met (Evison & Read, 2001). Adverts, newsletters and special events are some techniques mentioned to have been used to stimulate individuals to participate in SS programmes as noted in Table 3.

Table 3: Methods to promote waste management programmes

Passive approach	Active approach	Interactive approach
Advertising on collection vehicles	Cards delivered door-to-door to explain the system	Door-to-door surveys and education
Displays for use at fairs and public events	Collection receptacles provided free to residents	Presentations in schools, to groups or at conferences
Household leaflets	Promotional videos	Public meetings
Newspaper articles each month covering waste	Seasonal promotions to encourage participation	Radio spots, adverts or phone-ins
Reminder cards, answering questions	Community newsletter	Telephone hotline
Stickers to designate recycling bins	Display boards	Visits to the recycling centre/education facility

Source: Read (1999)

Folz (1991), Folz and Hazlett (1991) found that most successful recycling programmes surveyed in the United States of America were observed in cities where publicity and educational campaigns were prepared by local authorities with the help of local education personnel, environmental organizations or other citizen groups. Perrin and Barton (2001) identified that recoveries of all materials increased when SS scheme participants were provided with feedback on their performance through a leaflet. Mee and Clewes (2004) found 75% of respondents indicating that communications done mainly through a newsletter and personalized letters had influenced their participation in a recycling scheme instituted in a pilot area of Rushcliffe Borough Council in Nottinghamshire in the United Kingdom.

Waste Management Regulations in Ghana

It has been argued that SWM is the second most pressing challenge after the problem of inadequate water supply in the developing countries (Selin, 2013). Since Ghana's independence, many institutional frameworks have been established to deal with SWM at both local and national levels. Despite these many institutional frameworks, the core issues bordering on solid waste management remain largely unaddressed in any concerted manner till now (Issahaku, 2000).

The responsibility of managing solid waste in Ghana over the years has rested with local government. Specifically, waste management in Ghana is the responsibility of the Ministry of Local Government and Rural Development (MLGRD) which supervises the decentralized Metropolitan, Municipal and District Assemblies (MMDAs) (Boadi, 2013). However, regulatory authority is vested in the Environmental Protection Agency (EPA) under the auspices of the Ministry of Environment and Science (MES). According to Asase (2011), the MMDAs are responsible for the collection and final disposal of solid waste through the collaboration of the Waste Management Departments, Environmental Health and Sanitation Departments in the country. The author indicated that the policy frameworks guiding the management of hazardous, solid and radioactive waste include: The Local Government Act (1992), Act 462; The Environmental Protection Agency Act (1994), Act 490; The Pesticides Control and Management Act (1996), Act 528; The Environmental Assessment Regulations 1999, (LI 1652); The Environmental Sanitation Policy of Ghana (2010); and The Guidelines for Bio-medical Waste (2000).

All these Acts and Regulations come from the National Environmental Action Plan (UN, 2014). In addition to the above policies and legislations, the Ministry of Environment and Science, Ministry of Local Government and Rural Development and the Ministry of Health have prepared guidelines and standards for waste management.

Solid Waste Management Practices in Ghana

In order to maintain sustainable environment, it is important to reduce the amount of waste generated through recycling or reuse of discarded materials and products. Several solid waste management practices exist in Ghana today. The most common practices are recycling, composting, incineration and landfilling (CED, 2003). These management practices, according to the Centre for Environment and Development vary greatly with types of wastes generated and the local conditions. Therefore, the designing of SWM systems should take into consideration the fundamental goals, a clear analysis of local conditions and factors, an understanding of the full range of technology options that are available, and an awareness of the traditional wisdom and systems that the local people have developed (CED).

MLGRD (2010a) reported that about 76% of households rely on waste collection and disposal methods that are deemed inadequate in Ghana. Some methods of SWM used in the country are collection and open dumping, controlled burning and tipping at dumpsites. In most cases, municipal solid waste is disposed off without any processing and or treatment. The existing final disposal sites for some municipal solid waste in Ghana are not engineered and may be described as

crude dumpsites (Sam-Peter, 2009). There is no official waste separation at the sources of generation, and hazardous and clinical wastes are often handled together with municipal solid waste (Mawuena, 2013). The situation therefore creates a suitable environment for breeding of disease vectors such as mosquitoes and cockroaches and the proliferation of rodents such as rats and mice (Sam-Peter). The state of infrastructure and facilities for waste storage (Containers), vehicles and frequency of collection is woefully inadequate (Abdulai, 2011).

Solid waste collection

Solid waste collection plays a vital role in waste management processes because it links the process of generation to disposal. Waste collection process requires diverse elements involving collection system, special equipment and routes to collection sites including the loading and unloading activities (Baptiste, 2007). The methods of waste collection employed in Ghana include the door-to-door (which also includes curbside method) and the community waste collection (Akuyea, 2013). In certain prominent cities such as Accra, waste collection is done both on franchise and contract basis (Anomanyo, 2004). On franchise basis, a house-to-house collection is normally done in high income areas and the contractors charge the households some fees with weekly collection frequency. Boadi and Kuitunen (2003) observed that middle-income citizens were able to pay for waste collection services whiles residents in low-income households could not.

Also, the Kumasi Metropolitan Assembly [KMA] (2006) reports that there are two modes of solid waste collection in Kumasi Metropolis; house-to-house and communal. In low income communities characterized by limited access to solid

waste collection trucks, door- to-door collection services are not economically feasible, and only a communal container or bell system is viable (Cointreau-Levine, 1994). When uncollected wastes are dumped indiscriminately, they contribute to the flooding situations in some cities, breeding insects and rodents and the wide spread of diseases (World Resources, 1996; Zurbrugg, 2004; Mosler, Drescher, Zurbrugg, Rodriguesz & Miranda, 2005). However, when waste is properly collected and stored it prevents diseases-transmitting vectors and spread of diseases from being nuisance to households (Akuyea, 2013).

The situation is slightly different in CCMA since households rely on a mix of different service delivery models for the management of their solid waste (Ecorys Household Survey, 2013). According to the CCMA, two types of formal service delivery models exist; door-to-door collection by private service providers and collection in public containers. A third mode is indiscriminate solid waste disposal in the form of burning, burying or illegal dumping. Unlike in Accra, only a small proportion of the population in CCMA makes use of door to door solid waste collection (Ecorys Household Survey). Currently the collection is done by Zoomlion Ghana Ltd, Egyans Enterprise, and the waste department of the University of Cape Coast (Ecorys Household Survey). In the same study, Zoom Alliance, a subsidiary of Zoomlion, assists Egyans with some logistics such as trucks. Informal collection of plastics takes place on a small scale and mainly involves the collection of plastic or water sachets by youth. This activity has increased following the establishment of the Cyclus Recycling Plant at Aboransa

in the Komenda Edina Eguafo Abirem Municipality. Zoomlion has planned to establish a buy-back centre to partner Cyclus to buy these kinds of plastic wastes.

Waste transportation

Waste transfer stations are facilities where solid waste is unloaded from collection vehicles and briefly held while it is reloaded onto larger long-distance transport vehicles for transport to landfills or other treatment or disposal facilities (US EPA, 2011b). The collection vehicles are generally of the 6 - 7m^3 capacities and go directly from their point of last pickup to the disposal site (Palczynski, 2004). Downmore, Shepherd, Andrew, Barbara and Daniel (2011) reported that in Chinhoyi Municipality in Zimbabwe, an open 7-ton truck and two tractor drawn trailers are used to collect and dispose MSW.

Cape Coast Metropolis has a total of 70 transfer points being managed by Zoomlion Cape Coast Metropolitan Assembly [CCMA] (2014). They are made up of 8No.15m^3 (7.5tonnes) roll on/roll off, and 62No. 12m^3 (6tonnes) skips for communal collection service for low- income areas only (CCMA). The transfer points are managed by attendants who rake and collect the waste dumped on the ground on daily basis at the transfer points. Most of the time, the transfer points are subjected to negative activities as waste is intentionally dumped on the ground making the sanitary sites messy and untidy which together result in loss of collection time and increased maintenance cost to the Assembly (CCMA).

Solid waste disposal

In Ghana, SW disposal is a major concern and the chief concerns are on the indiscriminate dumping, lack of disposal sites, etc. The common means of SW

disposal in Ghana according to Danso-Manu (2011) are: uncontrolled or controlled dumping, sanitary land filling, composting, and incineration. All over the country, SW is ultimately disposed off in both authorized and unauthorized waste dumpsite (Mawuena, 2013). All kinds of wastes, regardless of their nature, are being dumped indiscriminately into depressions, sand pits, old quarries sites, beaches, drains and even along streets, without due regards to the nuisance and harm caused to the environment (Environmental Protection Agency, 2002). Yoada, Chirawurah and Adongo (2014) found in Ga East Municipality that 53.3% of the households in the low income disposed waste into the communal container under the PAYT system whiles 6% used door to door collection. Significantly, 20% burned their waste whiles another 20% combined the communal container and burning.

In the Cape Coast Metropolis, the situation is not different. Indiscriminate dumping of solid waste takes place in the Metropolis on numerous locations, many of which are known to the CCMA (CCMA, 2009). According to CCMA, the number and capacity of communal containers and trucks available for solid waste collection and management is largely insufficient. CCMA (2014) confirms that there are nearly 400 unapproved dumpsites in the Metropolis. The only landsite formally used by the waste contractors in the Metropolis is the Nkanfoa landfill sites. The Nkanfoa landfill site is even not properly engineered and SW of different kinds are dumped without being separated and residues pollute water sources too (CCMA, 2014).

Waste processing

According to the CCMA, there are no significant waste recovery and reuse activities in the Metropolis. Waste pickers are involved in a small-scale recovery and reuse operation (CCMA, 2009). In a contained criteria document of Ministry of Local Government and Rural Development (MLGRD) and Environmental Protection Agency [EPA] (2002), the municipal authorities shall adopt suitable technologies to make use of waste so as to minimize burden on landfill. According to Mawuena (2013), some of these technologies include composting biodegradable wastes, vermicomposting, anaerobic digestion or any other appropriate biological processing for stabilization of waste. Mixed SW containing recoverable resources shall follow the route of recycling. Incineration with or without energy recovery including pelletisation shall also be used for processing waste in specific cases. However, the realisation of these ideas seems to have never come to pass in Ghana.

In the Cape Coast Metropolis, waste disposal at the site is done by controlled crude dumping (CCMA, 2009). According to the CCMA, at the Nkanfoa landfill site, both solid and liquid wastes are dumped without treatment. In other words, waste in any form in the metropolis is hardly processed; they are often transported straight to dumpsites.

Willingness of Households to Separate Waste at Source

Separation efficiency as defined by Asase (2011) is the percentage of material correctly sorted and separated. The percentage of targeted material correctly sorted and separated depends on attitude and willingness of households

(McDougall, White, Franke & Hindle, 2001). Perrin and Barton (2001) emphasized that efficient target material to be recovered depends on: when and where the waste material is generated; if it requires immediate storage; and households' recognition of its recyclability. Reuse and recycling need some level of source separation. Much attention should be given to level of waste separation to create source separation awareness in Ghana since it is not naturally and culturally part of present day urban lifestyles (Annepu, 2012).

According to Peprah (2013), there are various socio-economic and socio-demographic factors that influence SS of solid waste at the household levels. These factors include income, gender, age, education level, space in the household, distance from home to community dumping site, religion, and so on (Lardinios & Furedy, 1999). Bennagen et al. (2002) indicated that the probability of household to participate in SS of SW is a function of three sets of variables: socio-economic household characteristics; household waste management-related attributes, and a community waste management-related feature.

Few studies have been reported in literature on the evaluation of organized SS at the household level in developing countries. To facilitate sorting of the waste at the source, three plastic bags were distributed to 80 households in a middle-income community in Dar es Salaam in Tanzania for storage of compostable, recyclables and other wastes. However, there was no indication of the level of waste separation at source (Kaseva et al., 2005). Nguyen (2005) undertook a pilot project of SS of compostable waste in 67 residences in Danang, Vietnam and found out that there was high purity of the separated compostable wastes as reported

separation efficiency was 97.8%. It was further indicated that the high number of participants (44 out of 67) separating waste correctly indicates their willingness to participate in the waste separation programme. Bennagen et al. (2002) study in Philippines noted that waste separation was high among household with high levels of income because they were able to raise money to buy waste separation bins for different wastes generated as compared to those in middle and low-income areas.

Ranninger, Bidlingmaier, and Li (2006) reported an average wrongly sorted material in the organic solid waste of 4% wet matter after evaluating an annual collection of two stream of wastes (Bio-Organic MW and Residual MW) from 244 households during a pilot study in China. It was also reported that willingness of households to participate in SS was increased from 86% at the onset of study to 97% at the end of 12 months of the study. Also, all of the project participants (100%) thought that the government should be encouraged to introduce obligatory SS. Further, it was indicated that 77.8% of project participants may continue the SS even if no waste bins would be available in the courtyard and only 2.3% may stop SS without waste bins.

A study in Ghana conducted by Asase (2010) in Kumasi reported that 95.40% of the respondents were willing to source separate solid waste whilst 4.6% thought otherwise and over 70 % of households were willing to separate waste so far as motivations such as free bins were in place. According to the author, the high percentage of people willing to partake in source separation of solid waste was due to the available knowledge on the benefits of source separation as compared to the already existing solid waste management system in Ghana.

Oduro-Appiah and Aggrey (2013) also found that 19.80%, mostly from high-income areas were willing to purchase their own extra bags and bins, 80.20% mainly from the middle-to-low income areas were not willing to purchase extra storage bags and bins for the sorting process. Out of the 80.20% who were not in a position to buy bins for the process, 79.50% looked forward to the TMA to purchase the bins on their behalf. Similarly, Addo (2009) in KMA found that 75.3% of households were willing to separate their waste only if they were given free bins, 72.3% were willing to separate their waste if the waste will be collected for free and only 21.9% were willing to separate their waste with no incentive. Asase and Oduro- Kwarteng (2010) likewise found that over 70 % of households were willing to separate waste so far as motivations such as free bins were in place.

The results from the studies enumerated above indicate that the willingness of households in developing countries to separate their waste at source is high and with incentives and careful scheme design, taking into consideration local conditions, source separation of household wastes in developing countries could be achieved successfully. Gyimah, Amuah and Berko (2016) therefore conclude that education is key in building strong administrative and technical empowerment towards such a behavioural pattern.

Challenges of Source Separation

Asase (2011) and Preprah (2013) reported that some household residents were not willing to separate their waste due to one of the following reasons: lack of time to separate, lack of space to accommodate extra bins, perceived health hazards,

difficulty of separating waste (not knowing the different compositions), perceived high cost with separating at source and untimely collection by the waste management company.

Oduro-Appiah and Aggrey (2013) on the other hand found that the chief impediments to implementing source separation were uncertainty about cooperation in the short and long-term by householders, businesses, and others who generate waste and the uncertainty of markets for recovered materials along with the reluctance of consumers of recycled goods to sign long-term purchase contracts (in view of uncertain community participation and the problems associated with recycled materials meeting market specifications). The rest of the challenges were costs of transporting recovered materials from remote communities to the fabricating plants of potential purchasers, inadequate attention by the local government to the innovative design of programmes, incentives, and contaminant control research so that source separated materials can meet market specifications, and the belief that low-income and urban householders will not cooperate with source separation programmes. According to the same study, 37.20% of the respondents, mostly from middle-to-low income areas were concerned with space for placement of bins and time involved in the separation process while 15.20% expected the central government to be the sole provider of bins for any future waste separation programmes.

Source separation process goes along with an initial increase in the cost of solid waste storage, collection and subsequent transportation (UN-HABITAT, 2010). Increased cost, however, is offset by cost recovery benefits of recycling and

composting in addition to extra gains achieved as a result of a decrease in levels of solid waste to landfill sites. According to UN-HABITAT, there are low efforts by waste management authorities to encourage source separation of municipal SW. UNEP (2010) recommend frequent public education and convenient collection services as a necessary requirement for successful household SW separation programme. The degree of source separation achieved in any ISWM scheme is a function of both the ability and especially the motivation of householders (McDougall et. al; 2001).

Conceptual Framework

In an attempt to investigate factors that influence people's intentions to participation in source separation of solid waste, there is a need for theory-based studies to better understand the mechanisms responsible for the said behaviours. This section therefore reviews Ajzen's Theory of Planned Behaviour [TPB] (2002) which provides a theoretical framework for systematically examining attitudes and intentions of people's behaviour on waste separation practices (Shamsi-Meymandi, Ziaeddini & Sharifi-Yazdi, 2008).

TPB has been widely used to investigate households' solid waste separation behaviours (Bortoleto, Kurisu, & Hanaki, 2012; Karim-Ghani, Rusli, Biak & Idris, 2013; Pakpour, Zeidi, Emamjomeh, Asefzadeh & Pearson, 2014). The central factor in the theory is the individual's intention to perform a given behaviour. According to the theory (Figure 2), individual's behaviour is based on his or her readiness to perform that behaviour (intention) (Tavousi, 2009). Intentions are

assumed to capture the motivational factors that influence a behaviour which are also indications of how hard people are willing to try and how much of an effort they are planning to exert in order to perform the behaviour (Ajzen, 2002).

Thus, behavioural achievement, according to the theory, depends on both motivation (intention) and ability (behavioural control). In this regard, the theory postulates six conceptually independent predictors of human behaviours; the behavioural beliefs, normative beliefs, control beliefs, attitude toward the behaviour, subjective norm and perceived behavioural control (Ajzen & Fishbein, 1980; Ajzen, 2002). The behavioural beliefs are the beliefs about the likely outcomes of the behaviour and the evaluations of these outcomes. The normative beliefs (social factors) are the beliefs about the normative expectations of others and motivation to comply with these expectations. Control beliefs refer to the perceived ease or difficulty of performing the behaviour and it is assumed to reflect past experience as well as anticipated impediments and obstacles. Whereas attitude toward the behaviour is the individual's positive or negative perception of performing a behaviour, subjective norm is the individual's perception of social pressure to engage or not in a behaviour. Lastly, perceived behavioural control refers to the individual's perception of his or her ability to perform a given behaviour.

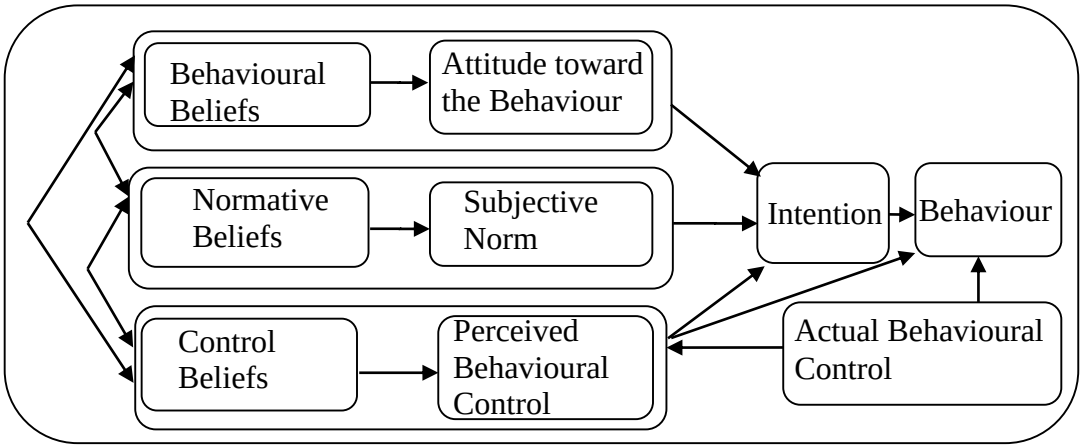

Figure 2: Theory of Planned Behaviour

Source: (Ajzen, 2002)

Limitations of the theory of planned behaviour

Although Ajzen's theory of planned behaviour (2002) presents model for examining attitudes and intentions of people to perform a given behaviour, it has some flaws. The model postulates that individual with high positive perceived behavioural control (more resources and opportunities) should also have a stronger intention to separate waste. However, intentions to separate waste are influenced by other independent factors such as environmental knowledge and situational factors (Schifter, 1985; Madden, 1986).

Again, the theory holistically focuses on attitude of people towards their separation practices neglecting other important behavioural determinants which influence intention to engage in waste separation. These behavioural determinants include institutional structures, administrative and technical capacities that control human intentions towards given behaviour. Because of these limitations, several studies have recommended adding more variables to improve the predictive validity

of the TPB (Karim et al., 2013). In order to overcome these limitations, the theory has therefore been adapted to incorporate other determinants of behaviour as discussed in (Figure 3) because they can influence people's intention to separate or not engage in waste separation practices (Ofori, 2013; Peprah, 2013; Oduro-Appiah et al., 2013). The adapted theory contains the relevant elements or variables that are needed for this study as showed in Figure 3 below.

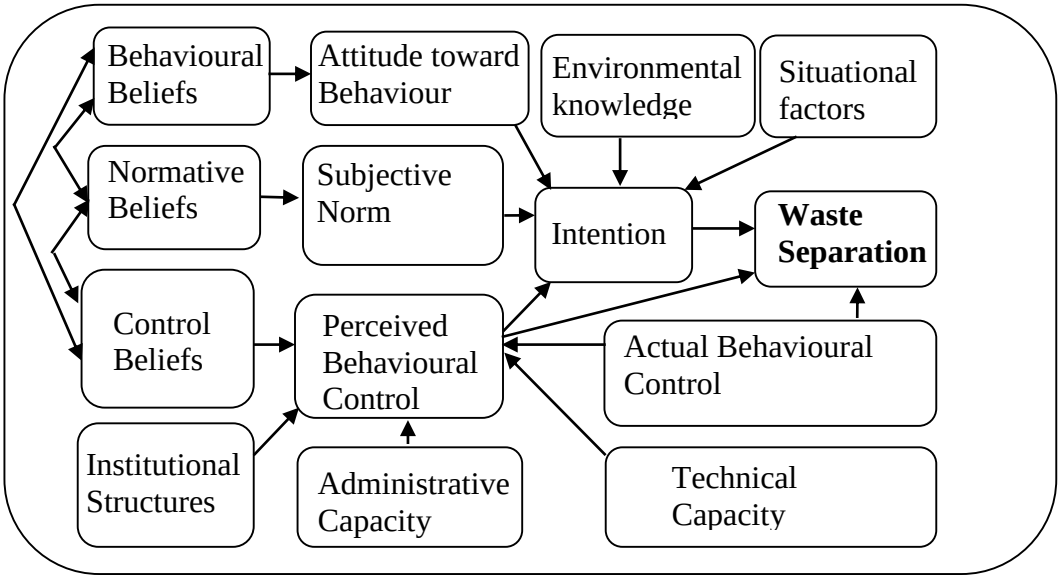

Figure 3: Behavioural Determinants of households' solid waste separation practices

Source: Adapted from Ajzen (2002)

The adapted TPB considers intention as immediate antecedent of behaviour and intention is based on attitudes toward behaviour, subjective norms, and perceived behavioural control (Karim et al., 2013). Therefore, within the context of the TPB, more attention is given to identifying the factors that influence solid waste separation behaviours (Barati, Allahverdipour, Moinei, Farhadinasa & Mahjub, 2014). These may include bye-laws, training and education, change in attitudes, traditions and conventions, etc.

An individual's attitude may have positive or negative effect on his/her intention to separate waste. This is because individual's attitude is based on his/her perception of behaviour as positive or negative, right or wrong, pleasant or unpleasant, or interesting or boring. Karim et. al. (2013) found that personal attitude has strongest correlation with waste separation intention. Thus, positive attitude results in a positive belief in oneself such as the belief that practicing waste separation at source is very crucial in achieving reuse and recycling of wastes. The results have also been confirmed by Nigbur, Lyons, Uzzell (2010) in a study of curbside recycling in the UK which concluded that attitude predicts the intention to recycle which in turn predicts recycling behaviour.

Subjective norms appear to have positive influence on waste separation intention. Subjective norms are social factors that include perceived social pressures to engage or not engage in a waste separation practices. Possible sources of these social factors may be pressure from family, neighbours, peers, or the community. Some studies conducted by Do-Valle, Reis, Menezes and Rebelo (2004) and Shaw (2008) have found that people's intentions to separate waste are substantially influenced by the social norms that they perceived or held by other persons or social groups which are important to them. Thus, social norms are positively related to person's intentions to separate their waste (Nigbur et al., 2010).

According to Mungure (2008), perceived behavioural control has a positive influence on waste separation intention. Perceived behavioural control reflects an individual's past experience and anticipates obstacles. The more resources and opportunities a person perceives in performing a specific behaviour and the fewer

the expected obstacles, the stronger the perceived behavioural control, making the behaviour more likely to occur. It includes institutional structures such as regulative, normative and cultural cognitive systems that together with associated process and procedures regularize people's behaviour and influence their intention to practice waste separation (Scott, 2001). Studies by Mungure and Mariwah (2012) confirm that when rules setting, monitoring and sanctioning activities are practiced, they have the capacity to influence people's behaviour and intention to separate their wastes.

To be effective, perceived behavioural control also requires building administrative capacity from the government and private sectors and also technical capacity for operating, maintaining and monitoring the waste separation process (Janicke, 1996). Capacity building in the form of staff training, for example, is important in building human resource (Mungure, 2008). Capacity building is therefore seen as the process by which individuals, organizations, institutions and societies develop abilities (individually and collectively) to perform functions, solve problems and set and achieve waste separation objectives (Janicke). There is a relationship between perceived behavioural control and the intention to practice waste segregation (Bortoleto et al., 2012). According to Pakpour et. al. (2014), Armitage and Conner (2001), there is a significant relationship between perceived behavioural control and the intention to practice waste separation.

Since intentions have positive influence on waste separation practices, combination of attitude, subjective norms, and perceived behavioural control intends result in the formation of a certain behavioural intentions (Omran,

Mahmood, Abdul-Aziz & Robinson, 2009). It has been established that a combined impact of more favourable attitude and subjective norms together with greater perceived behavioural control perhaps lead to stronger intention to perform a given behaviour (Diekmann, Preisendörfer & Green, 2003). Moreover, the stronger the intentions, the greater the likelihood that people will behave according to these intentions. Pakpour et al. (2014) found that intention had a strong correlation with waste separation behaviour whereas Karim et al. (2013) concluded that the relationship between intention and behaviour was significant and positive.

According to Boadi (2013), situational factors have a significant influence on waste separation practices. Situational factors are individuals' objective environment when they perform a particular behaviour. This variable is used to assess the extent to which respondents' situational conditions such as limited space, time, and inconvenience serves as barriers to carrying out waste separation behaviour. Karim et al. (2013) concluded that situational factors significantly influenced waste separation intentions.

Environmental knowledge is positively related to attitude and intention of people (Diekmann et al., 2003). The existence of a positive relationship between environmental knowledge and environmental behaviour is supported by the results of many studies (Kalantari, Fami, Asadi & Mohammadi, 2007; Omran et. al., 2009). For example, Ramkissoon, Graham and Weiler (2013) observed that there is positive correlation between environmental knowledge, attitudes and intentions. In particular, many studies demonstrated that specific knowledge of a given

behavioural scheme is significantly and positively related to individuals' attitudes (Kelly, Mason, Leiss & Ganesh, 2006).

From the adapted conceptual framework (Figure 3), households' waste separation practice is the focus. In order to separate waste, key influential factors; behavioural intention, institutional structures, environmental knowledge, situational factors, and administrative and technical capacities issues are considered. Since behaviours are influenced by intentions, waste separation depends on attitudes of the people. However, attitudes and behaviours to separate waste are also heavily influenced by regulative, normative and cultural cognitive systems. The generated solid wastes to be disposed off from the households have to be collected and transported. This process requires administrative, human and technical capacities and resources to be carried out. This in the end provides stability and meaning to social life.

CHAPTER THREE

METHODOLOGY

Introduction

This chapter presents the research methodology employed in this study. It also entails the profile of the study area, research philosophy, research design, source of data, target population, sample size and sampling procedures, methods and instruments of data collection, pre-testing of instruments, fieldwork, challenges and lessons learnt, reliability and validity, ethical concerns, and data processing and analysis.

Profile of Study Area

Location

The study area is Cape Coast Metropolitan Area in the Central Region of Ghana. The Metropolis is located about 145 kilometers West of Accra and 84 kilometers east of Takoradi. The geographical coordinates of the Metropolis are 050º 06'00"N and 01º15'00"W. It occupies an approximate area of 122 Km², and it is bordered to the south by the Gulf of Guinea; to the north by Twifo Heman-Lower Denkyira District; to the west by Komenda-Edina-Eguafo-Abrem Municipality and to the east by Abura-Asebu-Kwamankese District as illustrated in Figure 4.

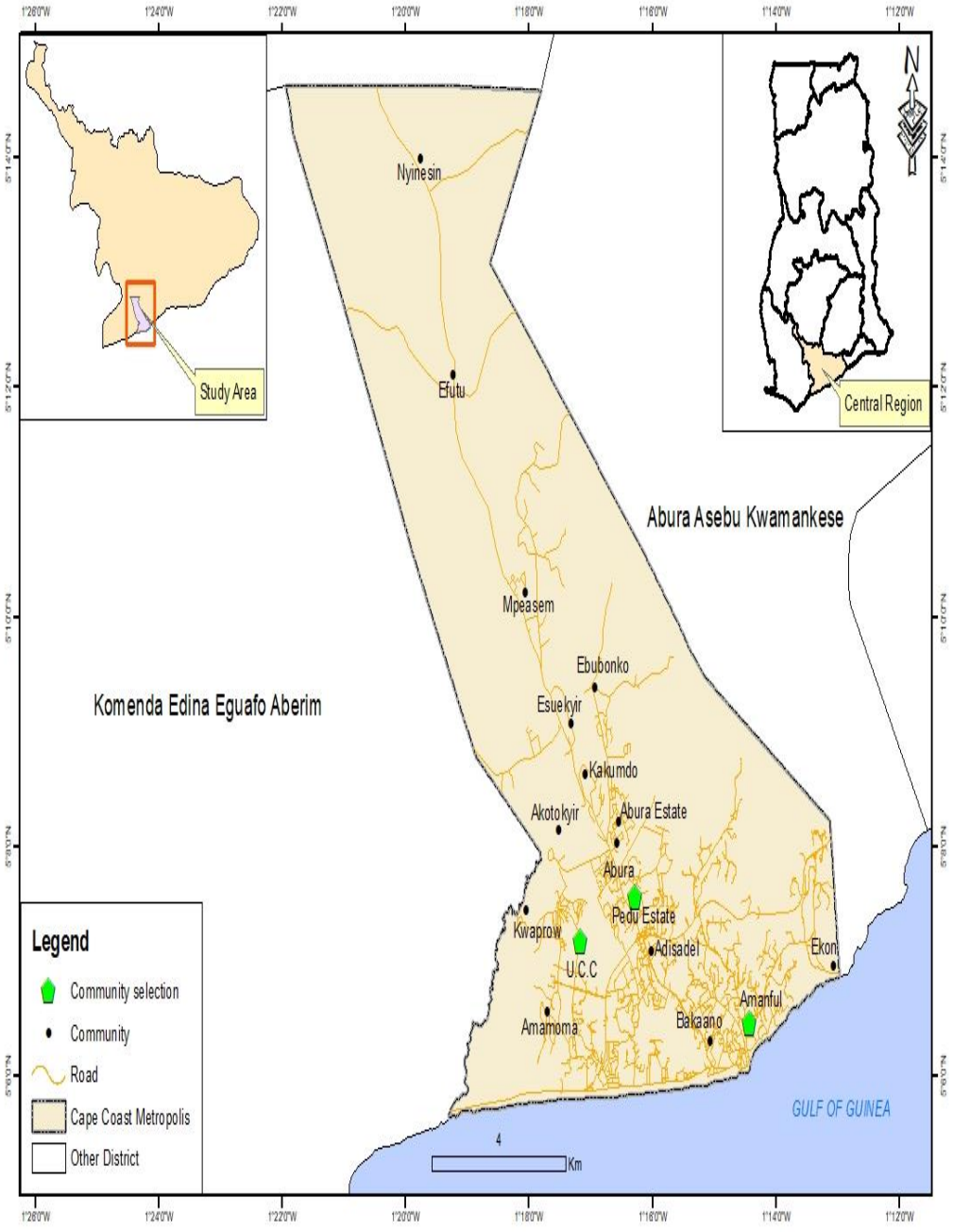

Figure 4: Study Area in the Regional and National Context

Source: Cartography & G.I.S. Unit, Dept. of GRP, UCC (2016)

Physical Characteristics

The study area falls within the coastal lowland belt of Ghana and is dominated by batholith and is generally undulating with steep slopes (Dickson & Benneh, 1998). The area consists of valleys of various streams, with Kakum River being the largest. Some of the small streams end in wetlands whiles others drain into the Fosu Lagoon at Bakano. The soils of the metropolis are generally lateritic and are derived from the weathered granite and schist (Dickson & Benneh). In the valleys and swampy areas, fine sandy deposits occur extensively.

Cape Coast Metropolis is a humid area with mean monthly relative humidity varying between 75% and 85% (Kendie, Ghartey & Akantapulsi, 1997). The sea breeze has a moderating effect on the local climate. The Metropolis has double maxima rainfall between 750 mm and 1000 mm (Boadi, 2013) while the major rainy season occurs between May and July and the minor around September and October. The vegetation of the area consists of shrubs, grasses and a few scattered trees (Addo, 2009). Due to its location, the Metropolis appears to experience relatively high temperatures and high relative humidity throughout the year, which indicate increase rate of decomposition of SW (Kendie et al.). Under such conditions, mixed solid wastes with high organic content have a devastating effect on the environment especially human, plants and animals.

Socio-Economic Characteristics

The major economic activity in the southern part of the metropolis is fishing (Bannerman, Koranteng & Yeboah, 2001). Others are the automobile garages at Siwdu, Palm Kernel Oil Production at the Adisadel village, commercial activities

in Abura, Kotokuraba and also along some principal streets. Mixed wastes from all these human activities have dreadful consequence on water bodies, plants, animals and human.

The metropolitan area is one of the urbanized areas in Ghana, with a large drifting of students' population due to existence of many educational institutions, including Senior High Schools, Technical Institutes, Polytechnic, College of education, Nursing Training Colleges and University (Boadi, 2013). There is also seasonal arrival of tourists in the area due to the Cape Coast Castle's historical development, and other tourist sites such as Kakum National Park, Hans Cottage Crocodile Pond, etc. The activities of these tourists and students contribute largely to the alarming volume of solid waste generation in the metropolis.

The population of the Cape Coast Metropolis stands at 169,894 comprising 82,810 males (48.7%) and 87,084 females (51.3%) (GSS, 2010). According to the GSS (2012), there is high dependency ratio due to the few opportunities for employment that had led to economic hardship and poverty. Undoubtedly, economic hardship and poverty have severe consequences for environmental management such as solid waste separation.

The Cape Coast Metropolis was chosen as the study area because of the researcher's observations of the following. Firstly, there is an alarming volume of solid waste in the metropolis which has affected public cost (Addo, 2010). As a result, the national government and in particular Cape Coast Metropolitan Assembly incur huge cost in managing the solid wastes from individual households, institutions, factories and other sources. For an example, as of 2014 the

Metropolitan Assembly was spending Gh1,500.00 weekly and about Gh710,400 per year on SWM (CCMA, 2015). This amount constitutes substantial percentage of the Assembly's annual budgets besides periodic financial support from other development partners (MLGRD, 2010a).

Secondly, indiscriminate solid waste disposal practices increasingly threaten development of the environment and other environmental resources such as air, water and land in the area. Solid waste is illegally dumped in open spaces, lorry parks, sea, gutters, along the streets or roadsides, the Fosu Lagoon and its surrounding wetlands with the resultant stench and flies' nuisance couple with the annual rituals of flooding in the metropolis (CCMA, 2009). This has therefore led to sporadic environmental waste related diseases outbreaks such as malaria, cholera, typhoid fever, diarrhea, intestinal worms and acute upper respiratory tract infections that are commonly reported cases in the health facilities in the metropolis (MLGRD, 2010b, Ghana Health Service, 2012).

Thirdly, the Assembly's SWM practices in the study area have merely been waste collection, transportation and disposal without any means of significant waste recovery, reuse, recycling and composting or treatment (CCMA, 2009) thereby affecting all the components of the environment negatively; air, water and land. This study will significantly contribute to best alternative SWM practices in the study area.

Research Philosophy

The theoretical perspectives that have influenced the structure, process and direction of social researches are many and diverse. The study employed mixed methods (pragmatism). This philosophy integrates both quantitative and qualitative data research methods. Research methods derived from quantitative concerns itself with gathering of data and translating these data into numerical form for description, explanation and prediction (Blaxter, Hughes, & Tight, 2001). This philosophy was applicable to the study because quantitative data provides results that are statistical and reliable. Hence, objective statistical findings and generalizations were made.

On the other hand, qualitative research assumes that reality is socially constructed and that there is no single observable reality. Thus, according to Miles and Huberman (1994), words have concrete, vivid and meaningful flavour that often proves far more convincing to a reader. This philosophy was appropriate to the study because qualitative method allows room for analyzing people's opinions and observation of actions as well as manual transcription of key informants' interviews in relation to the research questions. These paradigms were deemed relevant to the study because mixed research approach uses both deductive and inductive methods, obtains both quantitative and qualitative data, attempts to corroborate and complement findings, and takes a balanced approach to research. Therefore, the mixed approach adopted has complementary strengths and non-overlapping weaknesses in the study.

Research Design

Since the study focuses on households' solid waste separation practices (case study), descriptive research design was employed. The design employs inductive method that seeks to discover, describe and explain in words, the actions and behaviours of people (Silverman, 2010). This research design was chosen because it allows for comprehensive and statistical analysis of people's attitudes, opinions, behaviours or actions.

Source of Data

Data for the study were derived mainly from primary sources. They were gathered from households' respondents and key informants in Amanful, Pedu Estates and U.C.C. communities in the Metropolis. These primary data were obtained mainly from structured questionnaires and interviews conducted on the field. Even though the sources of data were primary, relevant secondary information from Waste Management Department also guided the study.

Target Population

In this study, the target population comprises the homemakers and key informants in Amanful, Pedu Estates and U.C.C. communities. Homemakers operationally refer to persons (males or females) who manage homes. These targeted populations were chosen because they have much experience, knowledge and exposure to solid waste management and were in suitable position to provide adequate information on the study topic.

Sample Size and Sampling Procedures

According to Hair (2000), sample is selecting a group of people or object from a targeted population for a study. Similarly, Sarantakos (1998) pointed out that sampling is a process of choosing the units of the target population which are to be included in the study. Thus, sampling enables researcher to study a relatively small number of units in place of the target population and obtain data that may be representative of the whole target population. Sample size also answers basic questions such as how large or small must the sample size be for a study to be representative (Sarantakos).

To get the sample size for the household respondents (homemakers), the Fisher, Laing, Stoeckel and Townsend (1998) formula was adopted. This formula was deemed relevant because it offers statistical estimation of meaningful sample size and hence makes the estimated sample size more reliable. That notwithstanding, the proportion in the target population estimated to have a particular characteristic usually varies and not constant. This according to Fisher. et al. depending on the environmental conditions and other socio-cultural dimensions of the target population.

$$n = \frac{z^2 pq}{d^2}$$

Where:

n= the desired sample size (when population is greater than 10000).

z= the standard normal deviation, usually set at 1.96 which corresponds to the 95 percent confidence level.

p= the proportion in the target population estimated to have a particular

characteristic set at 0.8.

d= degree of accuracy desired, usually set at 0.05

q= 1.0 – p

q=1.0-0.8=0.2

Substituting these into the formula,

$$n = \frac{(1.96)^2(0.8)(0.2)}{(0.05)^2}$$

$$n = \frac{(3.8416)(0.16)}{0.0025}$$

$$n = \frac{0.614656}{0.0025}$$

$$n = 245.86$$

$$n = 246$$

The calculated value 'n' shows that 246 households were selected for the study. This figure was considered adequate because according to Hair, Anderson and Tatham (1987), a sample size of at least 100 is recommended to conduct a test of statistical significance.

Consequently, the total number of the households in each of the three (3) selected communities was summed. Then a proportion of the households in each selected community to the total number was calculated. Finally, the proportion of each of the three (3) selected communities was multiplied by the total households' sample size (246) to obtain the number of respondents to be selected from each selected community as presented in Table 4.

Table 4: Sample population of households

Selected communities	Income zones	Total houses	Total households	Proportion to households	Households sample size
U.C.C.	High	831	2293	0.2284	56
Pedu Estate	Middle	1290	3539	0.3525	87
Amanful	Low	1530	4208	0.4191	103
Total		3651	10040	1	246

Source: Ghana Statistical Service (2010)

This study adopted multiple stage sampling techniques: stratified sampling, simple random sampling, systematic sampling and purposive sampling techniques. The first stage was to stratify Cape Coast metropolis into low, middle and high-income areas based on income. According to Kendie et al. (1997) and Boadi (2013), the Cape Coast Metropolis comprises five (5) zonal councils: Efutu-Kokoado-Mpeasem; OLA-University and; Abura/Pedu Estate, Adisadel Estate and Kotokuraba; Aboom-Bakano and Amanful-Ntsin zonal councils. Based on Boadi (2013) demarcations of the Cape Coast metropolis on the basis of income, Efutu-Kokoado, Amanful-Ntsin, Akotokyer, Ankaful and Kotokuaraba represent the low-income areas, Aboom-Bakano, Abura, Pedu Estate, Cape Coast Central, Adisadel and Kakumdo represent middle income areas and OLA Estate, U.C.C. and the Ridges (1st, 2nd, 3rd and 4th) represent the high-income areas. It is worthy to acknowledge that some zonal councils have mixed; thus, first, second and third-class settlements. However, with the assistance of the Ghana Statistical Service and CCMA officials, the selection of the areas was done in such a way that they

represented the characteristics of a first class, second class or third class residential areas only.

The second stage involved selection of communities. Simple random sampling was used to select one community from each income stratum to represent high, middle and low-income areas of the Metropolis. This was done by writing the names of all the said communities of the income zones of the metropolis on pieces of paper and one community was randomly selected. The selection of one community from each income stratum was based on Nie (2007) and Schübeler et al. (1996) assertion that people's waste generation and disposal patterns are influenced by those of their neighbours and income. Thus, people living within the same income zones tend to have similar waste management characteristics and patterns from point of generation, collection and disposal. As such, U.C.C. (high-income zone), Pedu Estate (middle-income zone) and Amanful (low income zone) were selected to represent the three income zones.

The third stage was to select the houses from which the households were to be selected. All the houses in the selected communities were listed (summed) as sampling frame using household numbers. Sampling interval was determined by dividing total number of houses by the sample size (3651÷246=14.8). Systematic sampling was used to select each house at intervals of 14 from the sample frame until the sample size of each income zone was obtained (Table 7). In cases where there was only one household in a house, the household was automatically selected otherwise simple random sampling was used to select one household from each house. As an essential requirement of every research, some boundaries were set for

the selection of the household respondents. The household questionnaire was administered to the homemaker of each household because they play an important role in the management of home environment such as collection, transportation and disposal of solid wastes.

The last stage was the selection of the key informants. They were the Assembly members of the selected communities, two Members of Oguaa Traditional Council, Deputy Regional Manager of Zoomlion Ghana limited (Cape Coast) and Solid Waste Manager of CCMA waste management department. The Assembly Members were considered as part of major opinion leaders in the communities since they serve as the link between the generators of solid waste (the general public) and the owner and manager of solid waste (the Metropolitan Assembly). These key informants were purposively selected for the study because they were assumed to be in the best position to provide the necessary information, adequate knowledge and experience on solid waste management in the Metropolis. In all, a total of 253 respondents were selected for the study and the breakdown is presented in Table 5.

Table 5: Total sample size

Units of sampling	Sample size
Households' homemakers	246
Assembly Members	3
Waste Management Department	1
Oguaa Traditional Council	2
Zoomlion Ghana limited	1
Total	253

Source: Fieldwork, 2016

Methods and Instruments of Data Collection

Since qualitative and quantitative methods were used in this study, the instrument used for data collection incorporated both methods. The study used structured questionnaires for homemaker and in-depth interviews for key informants. Observations was also used in the methods of data collection. Digital camera, tape recorder, questionnaires, observation checklists and interview guides were therefore used as instruments for the data collection.

The questionnaire

Detailed-structured questionnaire was administered to collect data from household respondents. The choice of the instrument was because of its inherent advantages. It was less expensive than other tool such as focus group discussion. Due to the complex nature of solid waste management in the Cape Coast

Metropolis, the use of the questionnaire enhanced the chances of getting a more reliable data and also minimized the chances of bias.

The questionnaire was divided into five sections; Section A focused on general information on socio-demographic characteristics of the respondents such as sex, age, marital status, level of education, etc. whilst Section B dealt with households' solid wastes disposal practices. The Section C looked at the solid waste separation practices of households, Section D looked at households' willingness to separate solid waste and finally Section E dealt with challenges associated with households' solid waste separation.

In-depth interview (IDI)

The in-depth interview was conducted for the key informants on solid waste disposal practices, solid waste separation practices, willingness to separate solid waste and challenges associated with solid waste separation practices. The in-depth interview was open-ended. This was used because it helped the researcher and the informants to clarified issues with each other when they were in doubt. Also, it allowed the informants to freely say whatever they feel in their own words. Again, this method allowed the researcher to have greater control during the interview and also complements and cleans gaps and misunderstanding of any issues under study.

Observations

With regard to observations, visits were paid to observe the Zoomlion Ghana Limited and CCMA waste facilities, Nkanfoa landfill site and other waste facilities available in the various residential areas in the metropolis. Also, other field observations were either captured through photographs or recorded as they

occurred. To achieve better results, an observation check list was prepared through which a list of items to be observed were indicated such as putting all wastes in containers, evidence of waste separation, presence or absence of waste separation containers, etc. Observation was critical to this study because it offered firsthand knowledge on the waste separation practices of the households. Observed data were used to augment the questionnaires and in-depth interviews.

Pre-Testing of Instruments

Two research assistants were trained for the pre-testing of instruments. The purpose of the pre-testing was to look at realities in administering the instrument, the translation of the questionnaires into other languages (in case of illiterates) and also identification of possible challenges that could be faced during the actual fieldwork.

The pre-testing was conducted in the Assin Fosu Municipality. In all, thirty-one (31) respondents were selected for the study comprising ten respondents from Assin Dwaaso (low-income community), Masalachi (middle-income community) and Habitat (high-income community). One official from Assin Fosu Municipal Assembly's Waste Management Department was also interviewed. The researcher together with two trained research assistants first embarked on a reconnaissance visit to the said communities. This initial visit provided the opportunity for the researchers to seek permission from chiefs and elders of the communities and also to observe the arrangement of houses in those communities. The pre-testing started on 23rd May, 2016 and ended 30th May, 2016.

During the pre-testing of the instruments, some residents initially showed unwillingness to partake in the study because they perceived the researchers as sanitary inspectors (Asaman-saman) coming from the Assin Fosu Municipal Assembly to summon them. Others also thought that the researcher were tax collectors from the Assin Fosu tax revenue service. After the pre-test of the instruments, a few changes were made to make the instruments more accurate and appropriate for the study.

Fieldwork, Challenges and Lessons Learnt.

The main fieldwork started on 6th June, 2016 and ended 8th August, 2016. The study found it difficult getting the key informants for the in-depth interviews because the interviewees had to attend to their busy work schedules and some emergency meetings. This stretched the data collection period beyond the planned date. However, this was managed by exercising patience until the appropriate time came for the administration of the said interviews.

Another challenge was that some of the interview sessions were often interrupted by phone calls and drop-in visitors which sometimes made interviewees lose focus of the topic under discussion. This was overcome because the researcher constantly prompted the interviewees of issues under discussion.

Finally, some of the households' respondents refused to take part in the study because of research fatigues. In such instances, the researcher resorted to replacement of the said households. Also, some of the respondents were not willing to disclose the exact amount of their monthly income because they thought it will

be used as a basis to render sanitation services to them by the CCMA and other private waste companies. However, most of them freely gave out the figure after they were made to understand that the study was purely for academic purposes and not an exercise for CCMA and other private waste companies in the metropolis.

Reliability and Validity

Reliability refers to the degree of consistency with which an instrument measures the attribute it is designed to measure (Wallen & Fraenkel, 2001). According to Patten (2004) and Wallen and Fraenkel, an instrument is valid if it measures what it is intended to measure and accurately achieves the purpose for which it was designed. Validity therefore involves the appropriateness, meaningfulness and usefulness of inferences made by the researcher on the basis of the data collected.

Careful examination of the instruments was done to check for inconsistency. The researcher also gave the instruments to the supervisors to vet for reliability and inconsistency before administration. Pre-test of the research instruments was carried out to ensure that high quality data collection instruments were used during the main fieldwork period. The researcher used triangulation by using multiple sources of data such as key informants' responses (qualitative), observation of selected items, chi-square and Alpha Cronbach's statistical test tools to confirm the emerging findings from the study.

Ethical Concerns

Ethics means conforming to accepted standards and being consistent with agreed principles of moral conduct (Strydom, De Vos, Fouche & Del Port, 2005). The study complied with the ethical concerns and code of ethics. In the first place, the researcher introduced himself without providing any false impressions. Secondly, informed consent was sought from the respondents. This was achieved by explaining or informing them about the nature and the objectives of the study upon which they willingly accepted to participate by providing relevant information.

Respondents were also given their right of privacy by respecting their views in situations where respondents were unwilling to respond to some questions. Moreover, the study observed respondents' rights of anonymity. It was further explained that names were withheld and would not be attached to any report from the study. Finally, respondents were accorded their right to confidentiality. Thus, information disclosed by respondents was used by the study for academic work only and not for any other purposes.

Data Processing and Analysis

The study ensured that the questionnaires and interview schedules were numbered. Completed questionnaires and interviews were collected and cross-checked for consistencies at the end of each day's fieldwork to correct any mistakes that might have occurred during the fieldwork. Each of the questionnaires was given a serial number and a code for easy identification before entering the

responses into the SPSS software. The questionnaires were processed using the Statistical Product and Service Solutions (SPSS) (2002) version 21.10 and the results were then presented in table forms and bar graphs.

Descriptive statistic (mainly frequencies and percentages) was employed to describe patterns of variables in the study. Alpha Cronbach and chi-square test tools were used to statistically verify the reliability of the responses' and also determine whether residential typologies influence households' waste separation in the metropolis respectively. Whereas observations of selected items from the field were presented to support the findings from questionnaires and interviews in order to make well inform and reliable analysis for acceptable and reliable conclusion to be drawn, the key informants' interviews were also manually transcribed into meaningful themes and used where applicable to support the quantitative data.

CHAPTER FOUR

RESULTS AND DISCUSSION

Introduction

This chapter presents the results and discussion of the study. The analysis focused on socio-economic and demographic characteristic of respondents. The analysis further looked at the solid waste disposal practices, solid waste separation practices, willingness of households to separate their solid waste and the challenges associated with solid waste separation practices by households.

Out of the 246 sampled respondents, 215 (87%) completed the questionnaire, comprising 92 respondents from low-income areas, 69 from middle-income areas and 54 from high-income areas. Seven (7) (86%) out of eight (8) key informants also responded to the in-depth-interviews.

Socio-economic and demographic characteristics of respondents

This section entails information on sex, age, marital status, educational level, occupation, monthly income and the number of years that the respondents have stayed in the community (Table 6). The rationale for selecting these variables was that they have policy implications for ascertaining the perceptions of the respondents towards waste separation practices (Fiafor, 2010).

Table 6: Socio-demographic characteristics of respondents

	Income zones							
Variables	Low-income		Middle-income		High-income		Total	
Sex	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Males	32	34.8	25	36.2	20	37	77	35.8
Females	60	65.2	44	63.8	34	63	138	64.2
Age group								
< 20	12	13.1	6	8.7	0	0	18	8.4
20 - 29	46	50	16	23.2	12	22.2	74	34.4
30 – 39	14	15	15	21.7	21	38.9	50	23.3
40 – 49	12	13	14	20.3	9	16.7	35	16.3
50 – 59	6	6.5	17	24.6	4	7.4	27	12.6
60+	2	2.1	1	1.5	8	14.8	11	5.1
Marital status								
Single	7	7.6	16	23.2	4	7.4	27	12.6
Married	67	72.8	51	73.9	48	88.9	166	77.2
Separated	6	6.5	1	1.5	00	00	7	3.3
Divorced	3	3.3	00	00	00	00	3	1.4
Widowed	9	9.8	1	1.5	2	3.7	12	5.6
Education								
No educ.	20	21.7	6	8.7	2	3.7	28	13.0
Basic	37	40.2	20	29.0	3	5.6	60	27.9
Secondary	28	30.5	20	29.0	12	22.2	60	27.9
Tertiary	7	7.6	23	33.3	37	68.5	67	31.2

Table 6 continues

Economic Activity								
Trading	22	23.9	20	28.9	6	11.1	48	22.3
Others	16	17.4	6	8.7	18	33.3	40	18.6
Teaching	4	4.3	10	14.5	11	20.4	25	11.6
Unempl'd	15	16.3	8	11.6	2	3.7	25	11.6
Doc & nur.	2	2.2	11	15.9	9	16.7	22	10.2
Fishing	18	19.6	3	4.3	0	0	20	9.3
Students	11	11.9	5	7.2	2	3.7	18	8.4
Hos&Tou.	4	4.3	6	8.7	6	11.1	16	7.4
Income (Gh¢)								
100 - 299	20	21.8	00	00	00	00	20	9.3
300 – 499	30	32.6	7	10.2	00	00	37	17.7
500 – 699	9	9.8	27	39.1	00	00	36	16.7
700 – 899	15	16.3	144	20.3	4	7.4	33	15.4
900+	13	14.1	10	14.5	41	75.9	64	29.8
Unempl'd	5	5.4	11	15.9	9	16.7	25	11.6
Years of stay								
< 6 years	14	15.2	20	28.9	15	27.8	49	22.8
6-10 years	30	32.6	30	43.5	10	18.5	70	32.6
11-15 years	20	21.8	6	8.7	14	25.9	40	18.6
16-20 years	6	6.5	8	11.6	5	9.3	19	8.8
21 years +	22	23.9	5	7.3	10	18.5	37	17.2
Total	92	100	69	100	54	100	215	100

Source: Field data (2016)

With regard to the sex of the respondents, 64.2 percent were females whilst 35.8 percent were males reflecting similar patterns across all the residential typologies. This was not surprising due to the observation that in many Ghanaian traditional societies, females are charged with the responsibility of managing waste at the household level.

The ages of the respondents were an important socio-demographic characteristic because according to Al-Khatib, Arafat, Daoud and Shwahneh (2009), it affords them opportunity to better understand waste separation issues. Across all residential types, it was found that about two-thirds (66.1%) of the respondents were below 40years, with half of those in the low-income zone being between 20-29 years. Similarly, the majority (77.2%) of respondents were married, with divorce and separation being confined mostly to the low income zone.

The respondents' level of education was vital because it improves ability to critically reason and participate in decision making and also influences one's intention to practice waste separation (Peprah, 2013). Generally, more than half (59.1%) of the respondents had received secondary education or higher. The results revealed that 37 percent of the respondents from low-income zone had basic education, 33.3 percent and 68.5 percent from middle and high-income zones respectively had tertiary education whilst only 3.7 percent respondents from high income class had no formal education. Among the 13.0 percent of the respondents who had no formal education, 9.3 percent were from low-income areas alone.

This result portrays that majority (86.2%) of the respondents were educated. The high educational level can be explained by the fact that there are

many educational institutions such as Senior High Schools, Technical Institutes, a Polytechnic, a College of education, Nursing Training Colleges and a University in the Cape Coast metropolis which offer educational opportunities to the populace (Boadi, 2013). Education is a major component for any realistic programme designed to solve environmental problems (Gyimah et al., 2016) and that the abuse of the environment results from lack of understanding and ignorance (Fiafor, 2010). Besides, since environmental studies forms part of the formal school curriculum, the implication is that people with formal education may better understand and appreciate the importance of waste separation practices. Thus, given a specific environmental knowledge in the form of education would have significant and positive effects in general attitudinal change and intentions of individuals towards waste separation practices (Kelly et al., 2006)

Table 6 further shows that the dominant occupation among the respondents was trading (22.3%), with about half confined to high-income area alone. Other occupations such as artisan, driving, hair dressing, masonry, etc. recorded highest proportion in the high-income zone but it was 8.7 percent and 17.4 percent in middle and low-income respectively. This could be due to the fact that most of the people in the said occupations are apprentices who live with and rely heavily on so called ‘rich people’ in the high-income area.

In addition, no respondent was engaged in fishing in high-income class whilst in the low-income residential area, fishing was the second dominant occupation due to the fact that most of the fishing activities were confined to the coastal areas of the low-income zones. Out of 11.6 percent respondents who were

unemployed, only (0.9%) respondents were from the high-income zone, with majority (7.0%) in low income zone. This could have severe consequences for environmental management practices such as SW separation because economically active people are in better position to afford cost involved in waste separation activities (Oduro-Appiah et al., 2013).

With regard to the monthly income, majority of the respondents earn more than Gh¢500 per month, with about 3 out of 10 earning more than Gh¢900. Specifically, 32.6 percent respondents from low-income area agreed that they earn between Gh¢300–499 monthly, 39.1 percent respondents from middle-income area receive between Gh¢500–699 monthly whilst 75.9 percent from high-income area receive Gh¢900 and above monthly.

It can be generally observed from Table 6 that 77 percent of the respondents have stayed in the metropolis for more than 6 years. The results indicate that 32.6 percent, 43.5 percent and 18.5 percent from low, middle and high-income areas respectively have stayed in the metropolis for 6 to 10 years whilst those who have stayed in the community for 16 to 20 years constitutes the lowest (8.8%) across all the income zones. The length of stay of respondents could influence the reliability and validity of their responses to the prevailing and environmental sanitation situations in the metropolis. Thus, the longer the years one might have stayed in the community, the more reliable of his/her responses to the prevailing situations could be.

Solid Waste Disposal Practices of Households

Waste generation and management need much attention since improper waste disposal has serious environmental and health consequences. This section therefore presents solid waste disposal practices, including type of waste households generate, means of waste storage, waste disposal site and monthly amount of money paid for waste disposal services in the metropolis.

Types of wastes generated by the respondents

To examine the existing solid waste disposal practices of households within the metropolis, respondents were first asked to indicate the types of solid wastes they generate daily in their households. Knowledge on waste composition is an essential element in selecting type of storage and transport facilities that may be most appropriate to a given situation (UNEP, 2005). And it is also for the determination of the potential for resource recovery, the choice of a suitable method of disposal and the determination of the environmental impact exerted by the waste if they are improperly managed. The types of wastes generated by households according to residential type are presented in Table 7.

The Table shows that plastic and food wastes are the two most dominant waste generated by households, recording 27.6 percent and 31.1 percent respectively. The results revealed virtually no variations across the three income zones. The findings in Table 7 are therefore in line with the general household waste composition in developing countries as indicated by Couth & Trois (2010) and Hoornwey & Bhada -Tata (2012) and in Ghana by Peprah (2013) and Ansah (2014).

Table 7: Types of wastes generated by the respondents

Waste materials	Income zones							
	Low income		Middle income		High income		Total	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Organics	45	30.8	47	30.7	55	33.3	147	31.1
Plastics	36	24.7	42	27.4	50	30.3	128	27.6
Papers	20	13.7	18	11.8	21	12.7	59	12.7
Others	14	9.6	16	10.5	13	7.9	43	9.3
Textiles	18	12.3	9	5.9	6	3.6	33	7.1
Metals	6	4.1	11	7.2	11	6.7	28	6.0
Glass	7	4.8	10	6.5	9	5.5	26	5.6
Total	146	100.0	153	100.0	165	100.0	*464	100.0

*Multiple responses (*n= 464)

Source: Field data (2016)

Confirming this observation, most of the key informants interviewed indicated that plastic and organic wastes were the commonest solid wastes that households in the Cape Coast metropolis generate. The following statements by two key informants are illustrative of that observation:

> *Most households usually generate plastic and organic wastes but the plastic waste is the highest followed by organic*. [A 50-year-old member of Oguaa Traditional Council]

> *We generate organic, plastics and metal wastes. This is the reason why there are many plastic rubbers everywhere in the Cape Coast metropolis nowadays.* [A 36-year-old Assembly man]

The finding may be favourable for source separation process because these ever-increasing amount of wastes (plastics, organics, papers, metals, glass, textiles, etc.) generated by the respondents could easily be separated. The high proportion of organics (biodegradable) for example if separated could be used for compost while the plastics could be reused or recycled into other valuable materials. Residents should therefore be encouraged to separate waste because according to the intention variable in the TPB model (Figure 3), achievement of waste separation practices in metropolis will depend on both motivation and ability to control behavioural intentions and that the strong the intention, the more likely the people will separate waste.

Waste Storage methods

This section examines how respondents store refuse in their households because proper waste collection and storage prevent disease-transmitting vectors and spread of diseases from being nuisance to households (Akuyea, 2013). Figure 5 presents waste storage methods in the three income zones of the metropolis.

Across the three income zones, waste bins are the dominant methods of waste storage at the household level. The majority (84.6%) of the respondents, comprising 33.4 percent, 28.4 percent and 22.8 percent from low, middle and high-income areas respectively store their waste in a waste bin.

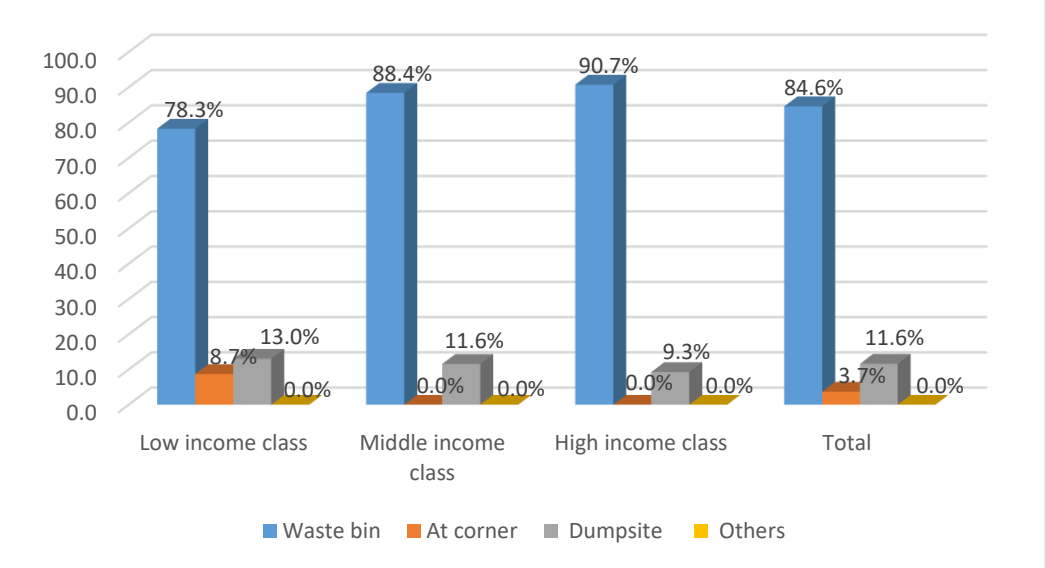

Figure 5: Waste storage methods of the respondents

Source: Field data (2016)

About 1 in 10 respondents from low-income area said they heap their waste at a corner for some time before they transport them into communal containers. In an in-depth interview, an Assembly Member confirmed that:

> *Some residents store their waste in polythene bags, and plastic containers before they dispose them into the communal container*. [A 35-year-old Assembly man]

Figure 6 clearly confirms the key informant's views on waste storage methods of the households in the Cape Coast metropolis.

Figure 6: Polythene bag and plastic container containing wastes at Amanful

Source: Field data (2016)

It is evidenced from the above that waste storage methods are perhaps influenced by normative beliefs and subjective norms contained in adapted conceptual framework model (Figure 3). This is because the storage methods show no variation across the three income zones.

Waste disposal methods

The study again probed into how respondents disposed of waste after storage. This is important because improper waste disposal has serious environmental and health consequences (Fiafor, 2010). The views of the respondents by income zones are presented in Table 8.

The study generally observed communal waste containers as the most used waste disposable method, recording 80.0 percent without any variation in the three income zones. Only 0.5 percent from low income area agreed that they sometimes

disposed waste indiscriminately by throwing waste into gutters, open spaces, streets, etc.

Table 8: Households waste disposal methods

Waste Disposal methods	Income zones							
	Low income		Middle income		High income		Total	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Communal containers	73	73.4	50	72.5	49	90.7	172	80.0
Burn them	6	6.5	11	15.9	5	9.3	22	10.2
Dump site	12	13.0	8	11.6	00	0.0	20	9.3
Others	1	1.1	0.0	0.0	0.0	0.0	1	0.5
Total	92	100.0	69	100.0	54	100.0	215	100.0

Source: Field data (2016)

The finding is in line with Yoada et al. (2014) that most residents disposed their waste in public containers. The result also shows that in places where the communal container services supported by the central government are available, they tend to continue to remain the most utilized means of household waste disposal services in the Cape Coast metropolis.

All the key informants interviewed also attested to the household respondents' views that majority of residents dispose off their waste in communal containers provided by CCMA, Zoomlion or Zoom Alliance. The following quotes summarize their views:

They (residents) put their waste into communal containers, especially institutions and organizations whilst others burn or indiscriminately disposed them. [A 55-year-old member of Oguaa Traditional Council]

Most residents deposit their waste into communal waste containers. Others too have a pit where they deposit their waste and usually set fire on (burn) them. [A 45-year-old Assembly man]

The respondents' and the key informants' views are in agreement with adapted conceptual framework model (Figure 3) that there exists environmental knowledge in the study area which is positively related to residents' attitude and intention since most (80.0%) residents dispose off their waste properly (into communal containers). Thus, residents are aware of implications of improper waste disposal practices and therefore use the preferred disposal method.

Payment for waste disposal services

Respondents were further asked to indicate whether they pay for the waste disposal services. The number of residents who pay for waste disposal service appears to influence the type of waste disposable programmes to be implemented. Figure 7 summarizes the results from the field.

As illustrated in Figure 7, out of the 80.0 percent of respondents who dispose their waste into the communal containers, only 45.6% percent pay for waste disposal service, whilst 34.4 percent do not pay for waste disposal. The results also

revealed that most of those who do not pay for waste disposal services reside in low income area (63%) whilst 90.7 percent of residents in the high income area said they pay for their waste disposal services.

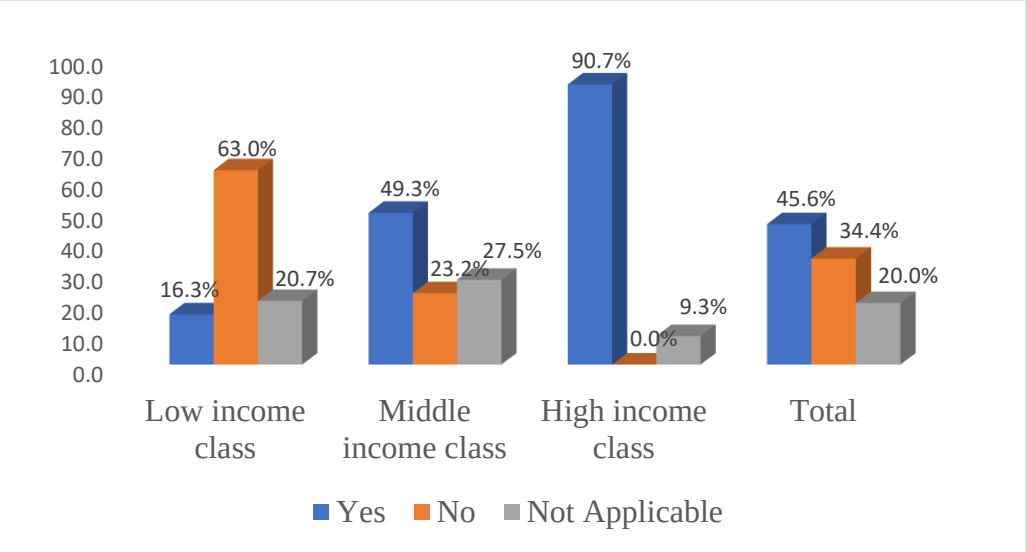

Figure 7: Payment of waste disposal service

Source: Field data (2016)

This result is consistent with Boadi and Kuitunen's (2005) observation in Accra Metropolitan Area that low-income household residents could not pay for waste disposal services. The reason accounting for this is contain in TPB model (Figure 3) adapted for this study that most residents in low income zones are influenced by normative and control beliefs and that they perceive difficulty in paying for waste disposal services since they were not paying in the past. The following assertions expressed by key informants are also illustrative:

For the low-income earners, they deposit their waste in community bin free of charge but those in high income area usually pay for house to house waste collection services. [A 35-year-old Assembly man]

CCMA has both small and big waste collection bins in areas like Abura and Pedu and some at market places where market women, hawkers and the rest of the people dispose their waste. Those at low income areas which are provided by CCMA are free unlike other residential areas such as UCC and 3rd Ridge. [A 36-year-old Assembly man]

Many residents in low and some parts of the middle-income areas were not willing to pay for their waste disposal services. As such, in some part of low and middle-income areas where the population density is high, CCMA waste containers are strategically placed to effectively curb what could be an environmental disaster. [A 38-year-old CCMA waste Manager]

The application of institutional structures such as rule setting, monitoring and sanctioning activities embodied in the adapted TPB model (Figure 3) will regularize these regulative, normative and cultural cognitive systems of the residents to bring stability and meaning to social life.

Amount of money respondents pay for waste disposal services

Table 9 indicates the amount of money respondents pay for the waste disposal services based on the 98 people who said in Figure 7 that they pay fees for the waste disposal services. According to Mawuena (2013), the amount of money that residents pay determines the type and quality of delivery services to be provided as well as the authorities' decision-making process.

Table 9: Amount of money pay for waste disposal services

	Income zones							
Amount in Gh¢	Low income		Middle income		High income		Total	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%
< Gh¢10	2	13.3	11	32.3	4	8.2	17	17.4
Gh¢10 - 19.99	5	33.3	15	44.1	3	6.1	23	23.5
Gh¢20 - 29.99	8	53.4	6	17.7	37	75.5	51	52.0
Gh¢30 - 39.99	0.0	0.0	2	5.9	5	10.2	7	7.1
Gh¢40+	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	15	100.0	34	100.0	49	100.0	98	100.0

Source: Field data (2016)

Out of the 98 respondents who indicated that they pay for their waste disposal services, majority (75.5%) pay between Gh¢10-29.99 across all the three income residential typologies, with high income zone recording highest (40.8%). It is seen that residents in high income zone pay more for their waste disposal service than low and middle-income zone. In an interview, one of the key informants disclosed that:

The few who pay are from high income class residential areas and therefore could afford the cost of the waste disposal services. And in most cases, they rather request the CCMA bins. [A 38-year-old CCMA Waste Manager]

Solid waste separation practices among households

The benefits of both organic and inorganic solid waste separation are many: potential for recycling, reuse and composting; ensure environmental cleanliness, enhance human health status, increase waste treatment options and offer employment to people (Lardinois et al., 1994; Calabrò-Paolo, 2009). Therefore, respondents were asked to indicate whether they separate waste or not, why they separate or otherwise, the kind of waste they separate and benefits of solid waste separation practices, among others. The results were disaggregated based on the income zones in which respondents reside. This is important because according to Peprah (2013) and Lardinois et al. monthly income is a socio-economic factor that influences waste separation at the household level. Thus, high income earners have ability to afford the cost of waste separation materials, transportation and treatment and vice versa.

Previous waste separation practices

The study sought respondents' views on whether they have separated their waste before (Table 10). Knowledge on previous households' waste separation practices among the three income zones could inform policy makers on the best type of waste separation scheme or programmes to be implemented (Calabrò-Paolo, 2009).

The results show that majority (87.0%) of the respondents have not separated their waste before in all the income zones. However, only few (13.0%) respondents said they have practiced waste separation. It can be observed from Table 10 that 80.4 percent, 89.9 percent and 94.4 percent of respondents from low, middle and high-income zones respectively have never separated their waste before. The high percentage of respondents who have not ever separated their waste before confirms Annepu's (2012) assertion that source separation is not naturally part of urban lifestyles in Ghanaian societies and that research is therefore needed to create its awareness.

Table 10: Respondents' previous waste separation practices

	Income zones							
Responses	Low income		Middle income		High income		Total	
	Freq.	%	Freq.	%	Freq.	%	No.	%
Yes	18	19.6	7	10.1	3	5.6	28	13.0
No	74	80.4	62	89.9	51	94.4	187	87.0
Total	92	100.0	69	100.0	54	100.0	215	100.0

Source: Field data (2016) $X^2(2, n = 215) = 11.769,\ P < 0.019$

The chi-square test results reveal that residential typologies statistically influenced previous waste separation in the metropolis $\{ X^2(2, n = 215) = 11.769,\ P < 0.019 \}$. Thus, residents in the low income residential areas practice waste separation than those in middle and high-income areas. This is probably due to the fact that residents in low income areas reuse bottles, plastics, metal and other

items and therefore need to separate them. Most of the key informants interviewed also expressed the low separation rates:

> *Previously people were not separating their waste. They were taught on how to separate their waste before.* [A 50-year-old member of Oguaa Traditional Council]

> *People were not separating their waste at all! Else we would not have been seeing these plastics and polythene bags littered around in our major streets, gutters, market places and others in our communities in those days.* [A 38-year-old CCMA Waste Manager]

However, it came out of the study that the 13.0 percent respondents who have ever separated their waste before did so to get materials such as bottle, cans, metals, aluminum and other plastics to sell them to itinerant buyers for money to supplement their income. This was confirmed by one Assembly Member who said that:

> *Generally, people were not separating their waste but occasionally some did separate sachet water rubbers and sold them to officials from Cyclus Recycling Limited.* [A 36-year-old Assembly man]

This view of the Assembly Member is in line with the central idea in the TPB (Figure 3) in that residents have an intention to separate waste but they need

motivational factors such education, institutional measures, capacity building and favourable perceived behavioural control to influence their behaviour in achieving the practice.

Present waste separation practices

Table 11 reveals the present waste separation practices of the respondent (at the time of the study) in the Cape Coast metropolis.

Table 11: Respondents' present waste separation practices

	Income zones							
Responses	Low income		Middle income		High income		Total	
	Freq.	%	Freq.	%	Freq.	%	No.	%
Yes	11	12.0	5	7.2	5	9.3	21	9.8
No	81	88.0	64	92.8	49	90.7	194	90.2
Total	92	100.0	69	100.0	54	100.0	215	100.0

Source: Field data (2016)

$X^2\ (2, n = 215)\ =\ 8.556\ \ P > 0.073$

The results also showed that the majority (90.2%) constituting 37.7 percent, 29.8 percent and 22.7 percent from low, middle and high-income zones respectively did not practice waste separation at the time of the study. Statistically, the study results show no significant difference in present waste separation practices among the three income zones { $X^2\ (2, n = 215)\ =\ 8.556\ \ P > 0.073$ }. The implication is that residential typologies did not influence waste separation practices at the time of the study. This finding is contrary to a study by Bennagen et al. (2002) who noted that waste separation was high among household with high levels of income who could afford waste separation bins for different waste generated. The chi-square

test result is also contrary to the perceived behavioural control variable in TPB (Figure 3) that given more resources (income), opportunities and confidence, a person in high income zone is expected to separate waste with few perceived obstacles.

The result above was confirmed by the key informants. In the interview, an Assembly Member said:

> *People are not separating their waste. They combine everything. It is evidenced when you go to Nkanfoa (the final waste disposal site) to see things for yourself.* [A 45-year-old Assembly man]

Another key informant, who is an expert in environmental issues, supported the previous response by indicating that:

> *Residents don't separate their waste. They just put all generated waste; (whether organic, plastic or metal) into the same bin. At times some people even dump human feces and liquid wastes into central containers.* [A 40-year-old Zoomlion Waste Manager]

Figure 8 also confirms the finding that people generally do not separate waste at the household level.

Figure 8: CCMA container showing mixed wastes at a study community

Source: Field data (2016)

The respondents (90.2%) who were not separating their waste at the time of the study gave a wide range of reasons, including unavailable waste separation bins, inadequate space to accommodate separation bins, not having time to separate, absence of education on the practices, unavailable waste recycling plants in the metropolis, among others.

Type of wastes respondents separate

With reference to the number of respondents who separate waste at the time of the study, Table 12 highlights the types of wastes they separate. Generally, plastics and metals dominate the types of wastes mostly separated by the respondents. Many (38.2%) responses comprising 21.1 percent, 9.2 percent and 7.9 percent responses from low, middle and high-income areas respectively showed that they separate plastic waste.

Table 12: Kinds of wastes that respondents presently separate

Waste materials	Income zones: Low income		Middle income		High income		Total	
	Freq.	%	Freq.	%	Freq.	%	No.	%
Plastics	16	36.4	7	35.0	6	50.0	29	38.2
Metal	20	45.4	5	25.0	2	16.7	27	35.5
Food (organic)	4	9.1	6	30.0	1	8.3	11	14.5
Others	4	9.1	2	10.0	3	25.0	9	11.8
Total	44	100.0	20	100.0	12	100.0	*76	100.0

*Multiple responses (*n=76)

Source: Field data (2016)

It is observed from the study results that residents in low income areas practice plastic and metal wastes separation more than those in middle and high income residential areas in the metropolis. The reason accounting for this is contained in responses of key informants who declared that:

> *Many of the residents here especially those along the coast usually pile up plastics and metal wastes at their homes and later sell them to itinerary buyers.* [A 50-year-old member of Oguaa Traditional Council]

> *Yes, some people move from house to house to buy those separate plastic and aluminum wastes.* [A 45-year-old Assembly man]

The results also found papers, cardboards, glasses and textiles as other wastes separated at household level. This result therefore indicates viability of plastic and organic wastes separation practices at households' levels since responses from all the income areas indicate that they already undertake such practices on small scale. Figure 9 confirms the respondents' views on plastic and metal wastes separation.

Figure 9: Separated plastics, metals and aluminum wastes at Abura.

Source: Field data (2016)

Figure 9 is therefore in agreement with behavioural achievement in the TPB model (Figure 3) that residents have intention to separate waste but need motivational factors such as provision of bins, recycling plants, etc. as well as technical and administrative capacities building to help achieve the practice.

Respondents' views on the benefits of solid waste separation

The respondents' views on some of the benefits of waste separation practice are presented in Table 13. This is relevant because their perception on the benefits could influence the respondents' decision making and behaviour towards waste separation as well as acceptability of the practice in the Cape Coast metropolis.

Table 13: Perceptions on the benefits of waste separation practice

	Income zone							
Benefits	Low income		Middle income		High income		Total	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Environmental cleanliness	81	52.6	70	45.2	20	13.8	172	37.8
Recovery, Recycling, reuse and composing	36	23.4	34	21.9	26	17.9	96	21.1
Increases waste treatment options	6	3.9	22	14.2	55	37.9	83	18.2
Employment	13	8.4	15	9.7	24	16.6	52	11.4
Reduced health hazards	10	6.5	11	7.1	12	8.3	33	7.3
Others	8	5.2	3	1.9	8	5.5	19	4.2
Total	154	100.0	155	100.0	145	100.0	*455	100.0

*Multiple responses (*n=455)

Source: Field data (2016)

With regard to responses on waste separation benefits, respondents generally acknowledged the practice as a means of achieving environmental cleanliness, recycling and better waste treatment option across the three income residential zones. Specifically, the results revealed that whilst many (52.6%) and

45.2 percent respondents from low and middle-income areas respectively indicated that waste separation ensures environmental cleanliness, 37.9 percent of those from high income area rather perceived waste separation as means to increases waste treatment option. The key informants believed that source separation of waste will take plastic waste off the streets:

> *Separation of waste will help to remove most of the plastics and other wastes in all gutters and hence clean our environment.* [A 40-year-old Zoolion waste Manager]

> *If we had practiced waste separation and recycling, we would not be seeing all these plastics and polythene bags littered around in our major streets, gutters, market places and others in our communities.* [A 45-year-old Assembly man]

The responses also indicate that reduction in health hazards associated with sorting of mixed waste constitutes the least (7.3%) perceived benefits of waste separation in the study area. This means that environmental cleanliness and economic benefits of waste were more important to residents than the health benefits. Environmental knowledge variable contained in the TPB model (Figure 3) should therefore be strengthen through education to positively have impact on residents to appreciate the practice.

Table 14 highlights respondents' perceptions on whether CCMA should make it compulsory for all households to separate their waste. The benefits of compulsory waste separation practices include potential for recycling, reuse and composting; environmental cleanliness, improved health and treatment options, etc. (Calabrò-Paolo, 2009).

Table 14: Making waste separation compulsory for all households

	Income zones							
Making separation compulsory	Low income		Middle income		High income		Total	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Strongly Disagree	10	10.9	4	5.8	2	3.7	16	7.4
Disagree	18	19.6	12	17.4	4	7.4	34	15.8
Undecided	13	14.1	8	11.6	6	11.1	27	12.6
Agree	31	33.7	40	58.0	20	37.0	91	42.3
Strongly Agree	20	21.7	5	7.2	22	40.8	47	21.9
Total	92	100.0	69	100.0	54	100.0	215	100.0

Source: Field data (2016)

It is observed that majority (64.2%) of the respondents either agreed or strongly agreed to the statement that waste separation should be made compulsory at the household level. The key informants also support this view as summarized in the following quotes:

Yes, it is a good thing so CCMA via its bye laws should influence people's behaviour to separate their waste compulsorily if possible. [A 38-year-old CCMA waste Manager]

CCMA can make it compulsory but must first encourage waste separation education for people to understand the need to separate their waste. [A 55-year-old member of Oguaa Traditional Council]

The above finding is consistent with institutional and normative variables in the TPB (Figure 3) which emphasize that more attention should be given to identifying the factors such as bye-laws, rules and social norms that compel and influence peoples' behaviours towards intentions to separate their waste (Barati et al., 2014). This implies that there is the need for stakeholders' consultation approach and guidance to adopt and implement waste separation policy that is in conformity with the people's culture and environment to deal with current and future solid waste situation in the metropolis.

Willingness of households to separate solid waste

The success of any waste separation scheme depends largely on the waste generators' willingness to separate waste at the point of generation and the proportion of target material to be correctly separated depends on attitude and willingness of households (McDougall et al., 2000). Therefore, the willingness of households to separate waste was assessed in relation to issues such as purchasing of receptacles, participation in waste separation training, collection of waste,

provision of incentives, etc. In order to get an insight into the respondents' willingness towards waste separation, they were asked to indicate their level of agreement on the said issues in a likert scale (Table 15).

Table 15: Willingness of households to separate solid waste

Statements	Income zones							
	Low (%)		Middle (%)		High (%)		Total (%)	
	A	DA	A	DA	A	DA	A	DA
Willing to separate waste	92.4	7.6	71.0	29.0	79.6	20.4	81.0	19.0
Willing to buy receptacles to separate waste	5.4	94.6	13.0	87.0	18.5	81.5	12.3	87.7
Willing to separate waste only if receptacles are provided for free	76.1	23.9	72.5	27.5	77.8	22.2	75.5	24.5
Willing to participate in waste separation training	89.1	10.9	95.7	4.3	100	0.0	94.9	5.1
Willing to separate waste if it will be collected for free	92.4	7.6	92.8	7.2	100	0.0	95.1	4.9
Willing to separate waste without incentives	22.8	77.2	36.2	63.8	44.4	55.6	34.5	65.5

{$\alpha = 0.70$} (A=Agree DA=Disagree)

Source: Field data (2016)

From Table 15, majority (81.0%) of the respondents were willing to separate their waste. This result conforms to a similar study by Asase (2010) in Kumasi Metropolis which showed that 95.4 percent of the respondents were willing

to source separate solid waste. Alpha Cronbach's test tool was employed to statistically verify the reliability and internal consistency of respondents' responses. The results indicate high reliability and consistency of the said responses {α = 0.70}. However, most of the key informants interviewed expressed contrary views that:

> *People are not willing to separate their waste now because many have limited knowledge on it. But maybe in the near future through education and training they will separate it.* [A 35-year-old Assembly man]

> *Many residents may not be willing to separate their waste now! For what! Even if some do, they will end up putting them into the same waste bin because they have not been educated on it and there is no recycling plant to recycle the separated waste.* [A 38-year-old CCMA waste Manager]

The proportion of respondents who were willing to separate their waste mentioned that they were aware of the benefits of waste separation contrary to the earlier views expressed by most of the key informants. With respect to households' willingness to buy their own receptacles to separate waste, only 12.3 percent mostly from middle and high-income areas agreed to buy their own receptacles (Table 15). This finding confirms Oduro-Appiah and Aggrey's (2013) case study in Tema Metropolis in which they found that 19.80 percent of the respondents from high income areas were willing to purchase their own extra bags and bins while 80.20

percent mainly from the middle-to-low income areas were not willing to purchase extra storage bags and bins for the sorting process. This trend in high income communities is in line with perceived behavioral control in the adapted conceptual framework (Figure 3) that better economic status and high-income level directly influence purchasing power and hence ability to separate waste with ease.

Moreover, three out of four (75.5%) respondents mostly from low income area agreed that they are willing to separate their waste if the receptacles will be provided for free. Thus, confirming Addo's (2009) study in Kumasi Metropolis which reported that 75.3 percent of households were willing to separate their waste only if they were given free bins. It was further observed that all (100%) respondents in high income area and 89.1 percent and 95.7 percent from low and middle-income areas respectively were willing to participant in waste separation training. This is where the adapted Theory of Planned Behaviour (2002) and Gyimah et. al's (2016) call for the need to build strong administrative and technical capacities in monitoring waste separation process in the metropolis becomes relevant. This result indicates the need to provide guidelines for the adoption and implementation of waste separation in Cape Coast metropolis since generally the residents would be willing to participate in waste separation programmes.

Also, the majority (95.1%) of the respondents across the three income areas were willing to separate waste if the waste will be collected for free. This was also corroborated in the interviews during which one key informant indicated that:

If waste bins are provided for and taken for free, many people will separate their waste. [A 36-year-old Assembly man]

This result is in affirmation of Addo's (2009) studies in Kumasi Metropolis in which he found that 72.3 percent respondents were willing to separate their waste if the waste will be collected for free.

Challenges associated with households' waste separation

A number of factors impede households' attempt to separate waste at source (Oduro-Appiah & Aggrey, 2013). Among them are time, limited space for the bins, lack of education, affordability of bins, unavailable waste recycle plant, etc. (Asase, 2011; Preprah, 2013). Understanding these factors is the most important step towards achieving and increasing successful waste separation participation. This section discusses challenges that prevent people from separating waste. In an attempt to understand these factors, respondents were asked to indicate conditions which will prevent them from separating their waste (Table 16).

From the results, the two major challenges of waste separation in all the three income zones are unavailable waste recycling plant and inability of residents to purchase waste separation bins, which recorded 37.9 percent and 27.1 percent respectively. A considerable number (12.6 %) and 8.6 percent of responses attributed the challenges to inadequate time to separate waste and limited space to accommodate the bins respectively. The other challenges were perceived health implications, untimely waste collection by the waste management companies,

inadequate incentives and low economic benefits to motivate people to separate their waste as well as absence of bye-laws on the practices.

Table 16: Challenges associated with households' waste separation

Challenges associated with waste separation	Income zones: Low income		Middle income		High income		Total	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%
There is no recycle plant	28	20.6	40	28.6	86	66.2	154	37.9
I cannot afford separation. bins	62	45.6	44	31.4	4	3.1	110	27.1
I don't have time	18	13.2	15	10.7	18	13.9	51	12.6
I don't have space for bins	10	7.4	20	14.3	5	3.8	35	8.6
I don't know how to separate waste	12	8.8	13	9.3	5	3.8	30	7.4
Others	6	4.4	8	5.7	12	9.2	26	6.4
Total	136	100.0	140	100.0	130	100.0	*406	100.0

*multiple responses (*n=406)

Source: Field data (2016)

The key informants' interviews corroborated the responses of the household residents as the following quotes reveal:

> *There are no recycle plants in the metropolis. So, what will be the essence of separating waste if waste recycle plants are still unavailable here in Cape Coast?* [A 40-year-old Zoomlion waste Manager]

> *There are no facilities for waste separation activities and place to even deposit the separated waste. So even if they separate it, where will they send them to?* [A 38-year-old CCMA Waste Manager]

> *Most residents don't have separation containers to separate waste.* [A 36-year-old Assembly man]

A key informant, however, disagreed with these factors and blamed poor attitudes and inadequate administrative and technical capacities as reviewed in the adapted conceptual framework:

Many people in the metropolis are lazy and pretend that they do not have time. We need change of attitude which may require institutional, administrative and technical capacities. [A 55-year-old member of Oguaa Traditional Council]

It can be observed that whilst provision of bins was a major motivational factor for the middle to low-income areas to separate waste, it was the least concern in high-income areas. In this regard, it may be appropriate for the city authorities to provide free waste separating bins as a motivational tool towards a successful and sustainable waste separation practices in the metropolis. This finding supports that of Asase (2011) and Preprah; Oduro-Appiah and Aggrey (2013) that many residents were not willing to separate their waste due to time, space to

accommodate extra bins, health hazards, lack of education and cost of separating bins.

The findings are also in line with the conceptual framework (Figure 3) which states that more attention should be given to identifying the factors that influence behaviours towards waste separation such as conventions, bye-laws, attitudinal change and training and education (Barati et al., 2011). Additionally, this finding is also in tandem with the Ajzen's TPB (2002) in that institutional structures, administrative and technical capacity building from government and private sectors can influence people's behaviour and intention to separate their waste as indicated by Ofori (2013); Peprah (2013) and Oduro-Appiah and Aggrey (2013).

Institutions responsible for addressing the challenges

As part of the measures to address the challenges, the study enquired respondents to indicate institutions that could be helpful in addressing the challenges. The institutions were important because according to Mungure (2008) waste separation and environmental sanitation related issues are best addressed from institutional point of view. Coincidentally, Mariwah (2012) also agrees that the problems of waste separation are more attitudinal which require application of rules, monitoring and sanctioning activities to effectively influence people's behaviour and intention to separate their waste. Table 17 summaries the responses on that subject of interest.

Table 17: Institutions responsible for addressing the challenges

Institutions	Income zones							
	Low income		Middle income		High income		Total	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%
CCMA	65	48.2	55	36.7	50	43.5	170	42.5
Public-Private	30	22.2	45	30.0	35	30.4	110	27.5
Private Entities	20	14.8	25	16.7	15	13.0	60	15.0
Households	12	8.9	15	10.0	9	7.8	36	9.0
others	8	5.9	10	6.6	6	5.2	24	6.0
Total	135	100.0	150	100.0	115	100.0	*400	100.0

*Multiple responses (*n=400)

Source: Field data (2016)

Across the three income zones, CCMA and public-private partnership (PPP) are the two most dominant institutions that were mentioned to address the challenges and promote waste separation. For CCMA in particular, 48.2 percent, 36.7 percent and 43.5 percent from low, middle and high-income zones respectively agreed that it is in a good position to address the said issues. According to the respondents, the Assembly has enough financial resources and legal authority, technical and administrative capacities to supervise, maintain and improve the health and environmental cleanliness in the metropolis. In the interview, some Assembly Members collaborated by indicating that:

> *CCMA particularly has legal mandate for all activities and are entrusted with such legal authority to ensure cleanliness in the metropolis.* [A 36-year-old Assembly man]

The CCMA possesses authority and can also raise enough funds to procure waste separation containers. [A 35-year-old Assembly man]

This finding is consistent with Mungure (2008) and Mariwah (2012) as well as the institutional structure variable embodied in the adapted conceptual framework (Figure 3) that when rule setting, monitoring and sanctioning activities are practiced to some extent, they have the capacity to influence people's behaviour and intention to separate waste. The results also show that 27.5 percent of the respondents are of the view that public-private partnership could equally handle the challenges because they could combine their financial, technical and administrative resources effectively. The respondents' views are in accordance with those expressed by the key informants as summarized by the following quotes:

The CCMA, NGOs and private companies for example have enough technical and administrative capacities as well as combining their resources effectively for the execution of waste separation programmes. [A 45-year-old Assembly man]

The public-private partnership leads to effective decision making, bringing experts on board and checks and balances as well as ensuring quick execution of waste separation activities. [A 38-year-old CCMA waste Manager*]*

A small proportion (15.0%) of the respondents mostly from low and middle-income areas agreed that waste separation challenges could be addressed by private entities alone due to the followings reasons; effective supervision and coordination of all activities, avoidance of unnecessary government interferences, on time collection of the waste, innovative incentives to motivate people to separate their waste, etc. The following quotes are illustrative of the perspective:

> *The private waste management companies usually have innovative, incentives and reliable services.* [A 50-year-old member of Oguaa Traditional Council]

> *The private companies usually have enough facilities and personnel to deal with waste related issues.* [A 36-year-old Assembly man]

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Introduction

This chapter presents the summary, conclusions and recommendations of the study. Whilst the summary recaps the overview of the research problem, objective, population, sampling procedures, data processing and analysis and the key findings of the study, the conclusions deal with the implication of findings of the study. The recommendations present specific strategies to be implemented by policy makers based on the conclusions of the study.

Summary

This study sought to investigate solid waste separation practices among households in the Cape Coast Metropolis. Specifically, the study examined the existing solid waste disposal practices, waste separation practices among households, willingness of households to separate waste and challenges associated with households' separation of solid waste.

Ajzen's Theory of Planned Behaviour (2002) provided a theoretical framework for systematically examining behaviour concerning waste separation practices. The goal of the review was to assess the influential factors (income, environment, institutions structures, education, gender, culture/ethnicity, etc.) on

attitude and intention toward participation in waste separation among households in the study area.

The study adopted mixed research methods philosophy because such approaches are appropriate to complement each other's flaws. Quantitative and qualitative research designs therefore provided the theoretical basis for the methodologies employed in this study. Data for the study were mainly derived from primary sources, and instruments of data collection were structured questionnaires, in-depth interviews and observations checklist. The target population were homemakers of households and key informants within the metropolis. The study adopted multi-stage sampling techniques. To get the sample size for the household respondents, the Fisher et al. (1998) formula was adopted to arrive at 246 respondents for homemakers and 7 key informants.

The data processing was done using the Statistical Product and Service Solutions (SPSS) version 21.10. Both descriptive and inferential statistics were used in the data analysis to arrive at key findings. In addition, interviews were manually transcribed into themes and used appropriately to either confirm or reject the quantitative analyses, whereas observations in the form of pictures from the field were also presented to support the findings from questionnaires and interviews.

Key findings of the study

The main findings of the study based on the research questions and objectives are as follows:

1. The study identified plastic and organic wastes as two most dominant waste generated by households in the Cape Coast metropolitan area, recording 27.6 percent and 31.1 percent respectively with virtually no variations across the three income zones;
2. The majority (84.6%) of the respondents comprising 33.4 percent, 28.4 percent and 22.8 percent from low, middle and high-income areas respectively store their wastes in a plastic waste bin before they dispose them into the communal waste containers.

   With regard to disposal of waste among households, 80.0 percent from low income area, 72.5 percent from middle income area and 90.7 percent from high income areas indicated that they dispose their waste into communal containers provided by the CCMA, Zoomlion or Zoom Alliance;
3. The study also revealed that 63.0 percent of respondents from low income area do not pay for their waste disposal service whilst 90.7 percent residents in the high income area pay for their waste disposal services. In the interview, some key informants expressed that because low income residents are not willing to pay for their waste disposal services, the CCMA has therefore provided waste containers for them free of charge to prevent indiscriminate dumping of waste;
4. It also came out of the study that 80.4 percent, 89.9 percent and 94.4 percent respondents from low, middle and high-income areas respectively have never separated their waste before. The study also observed that majority (90.2%) do not practice waste separation at the time of the study. The study

highlighted that for the few (9.8%) who separate waste at the time of the study, most of them were separating plastic and metal wastes, recording 38.2 percent and 35.5 percent respectively. This finding was confirmed by field observations and also in the responses given by most of the key informants who said that some households usually separate plastic and metal wastes so as to sell them to itinerary buyers in the metropolis;

5. On the perception of benefits of waste separation practices, the study noted that 52.6 percent, 45.2 percent and 13.8 percent from low, middle and high-income areas respectively said that waste separation ensures environmental cleanliness. And 21.1 percent comprising 23.4 percent, 21.9 percent and 17.9 percent from low, middle and high-income areas respectively also indicated that the practice leads to material recovery, recycling, reuse and composting in the metropolis. Many key informants interviewed indicated that waste separation ensures environmental cleanliness, recycling, reuse, material recovery, better waste treatment options and creates employment.

   Besides, the study revealed that majority (64.2%) of the respondents suggested that CCMA should make waste separation compulsory for all households in the metropolis. The key informants likewise agreed that waste separation must be made compulsory by CCMA in consultation with all stakeholders in the metropolis.

6. The results showed that majority (82.3%) of the respondents were willing to separate their waste. However, this finding contradicts the views of the key informants who indicated that residents were not willing to separate

waste because they have limited knowledge on the practice and that in the near future through education and training they will separate their waste; and

7. Most of the respondents identified unavailable waste recycles plant and separation bins as the major challenges of waste separation in the metropolis.

Conclusions

The following conclusions have been drawn from the study based on the objective and major findings:

1. The study found that the dumping of waste into communal containers is free for most people living in low income areas whereas people living in middle and high-income areas make monthly payment;
2. The study gathered that in the Cape Coast Metropolitan Area, households rarely engage in waste separation practices because they are not compelled to do so. However, few households separate plastic and metal waste with the purpose of selling them to Cyclus Recycling Plant at Aboransa and other itinerant buyers respectively;
3. In general, the study further established high willingness of residents to separate their waste. The respondents stressed that if possible the CCMA should make waste separation compulsory to bring sanity into the environment of the metropolitan area; and

4. The unavailability of waste recycling plant in the Cape Coast metropolis and lack of separation bins are the major challenges of waste separation.

Recommendations

Based on the forgoing findings on households' waste separation practices in the Cape Coast metropolitan area, the following recommendations are submitted:

1. The study revealed that most residents living in low income areas do not pay for their waste disposal service. In light of this, the Metropolitan Assembly should introduce innovative waste disposal schemes such as non-profit making or public participation programmes so that the people themselves become responsible for charging and managing their waste generated. This could succeed when the city authorities offer sensitization programmes to educate residents on proper waste management practices, consequences of indiscriminate waste disposal and the need to pay for waste management service. NGOs, churches, and Oguaa Traditional Council should assist in the provision of waste containers in the said communities to prevent indiscriminate disposal of waste;
2. The study established low waste separation practices in the three income residential typologies of the metropolis because residents are not compelled to do so. The study therefore recommends education and sensitization of the public about waste separation practices especially those in low and middle-income communities for them to appreciate and understand the importance of the practice. This calls for a joint effort by both the central government

and the CCMA to use both the print and electronic media to educate and encourage individual, households, organizations and any other institutions to separate their waste in order to achieve material recovery, reuse, recycling and composting, increases waste treatment options, reduced health hazards associated with mixed wastes, ensure environmental cleanliness, employment and also improved solid waste management;

3. Moreover, there is a general willingness of residents to separate their waste with virtually no variations across the three income zones. The study therefore recommends that the central government and CCMA in collaboration with its development partners, NGOs, churches, Oguaa Traditional Council should introduce and implement waste separation programmes that is sound and culturally acceptable to Cape Coast metropolis. This will encourage residents' participation as well as attracting many entrepreneurs into the waste recycling business, improve environmental sanitation, create aesthetic environment and employment and prevent waste from becoming threat to human lives;
4. Again, the study found unavailability of recycling plant and inability to purchase waste separation bins as the major challenges of waste separation across all the three residential typologies in the study area. The study therefore recommends that the central government and CCMA in conjunction with development partners, NGOs, and Oguaa Traditional Council should institute waste recycling plant especially plastic, organic and metal wastes recycling plants to recycle separated waste components

generated in the study area. The said institutions should also assist in the provision of waste separation bins in the various households in the metropolis to encourage the practice. The CCMA within its entrusted authority should also enact and enforce bye-laws on waste separation to control and compel people's actions and intentions to separate waste.

Areas for further studies

The study suggests that comprehensive studies should be conducted into determinants of source separation of solid waste in the study area.

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APPENDICES
APPENDIX A
UNIVERSITY OF CAPE COAST
COLLEGE OF HUMANITIES AND LEGAL STUDIES
FACULTY OF SOCIAL SCIENCES
DEPARTMENT OF GEOGRAPHY AND REGIONAL PLANNING
QUESTIONNAIRE FOR HOUSEHOLDS

NAME OF THE RESEARCHER: GYIMAH PETER (**0242175375**)

This questionnaire is intended to obtain data for research on '**Households' *Solid Waste Separation Practices in the Cape Coast Metropolis'***. The data collected is for academic purpose and would therefore be treated with the utmost confidentiality and that names will not be attached to any report from the study.

Name of the Community/Suburb ……...…...

Date……

Please indicate your responses by ticking [√] where appropriate

Section A: Demographic background of the respondents

1. Sex
   a. Male = [ ]
   b. Female = [ ]
2. Age
   a. <20 years = [ ]
   b. 20-29 years = [ ]
   c. 30-39 years = [ ]
   d. 40-49 years = [ ]
   e. 50-59 years = [ ]
   f. 60 years and above = [ ]
3. Marital status
   a. Single = [ ]
   b. Married = [ ]
   c. Separated = [ ]
   d. Widowed = [ ]
   f. Divorced = [ ]

e. Other = [ ] Please, specify……

4. Level of education

a. No formal education = [ ]

b. Basic education = [ ]

c. Secondary education = [ ]

d. Tertiary education = [ ]

e. Other [ ] Please, specify……

5. Occupation

a. Fishing = [ ]

b. Trading = [ ]

c. Teaching = [ ]

d. Farming = [ ]

e. Others [ ] Please, specify ……

6. Approximate monthly income

a. <Gh¢100 = [ ]

b. Gh¢100-Gh¢299 = [ ]

c. Gh¢300- Gh¢499 = [ ]

d. Gh¢500- Gh¢699 = [ ]

e. Gh¢700- Gh¢899 = [ ]

f. Gh¢ 900 and above = [ ]

7. How long have you lived in this community?

a. < 6years = [ ]

b. 6-10 years = [ ]

c. 11-15 years = [ ]

d. 16-20 years = [ ]

f. 21years and above = [ ]

Section B: Solid waste disposal practices

I would like to discuss with you issues on solid waste disposal practices

8. What kind of wastes do you usually generate? ***[Tick all that apply]***

a. Plastics = [ ]

b. Organic = [ ]

c. Paper and Cardboards = [ ]

d. Metals = [ ]

e. Glasses = [ ]

f. Textiles = [ ]

f. Other [ ] Please, specify……...……

9. How do you store your waste?

a. In a dust bin = [ ]

b. Heap them in a corner without dust bin = [ ]

c. Straight to disposal site without storage = [ ]

d. Other [ ] Please, specify ……

10. Where do you dispose your wastes?

a. Containers provided by the CCMA = [ ]

b. Dump site = [ ]

c. Burn them = [ ]

d. Other [ ] Please, specify ……..……

11. Do you pay for your wastes disposal?

a. Yes = [ ]

b. No. = [ ] ***If no, please go to Q13***

12. If ***yes***, how much do you pay on monthly bases?

a. <Gh¢10 = [ ]

b. Gh¢10-Gh¢19.99 = [ ]

c. Gh¢20- Gh¢29.99 = [ ]

d. Gh¢30-Gh¢39.99 = [ ]

e. Gh¢40 and above = [ ]

Section C: Solid waste separation practices

I would like to discuss with you issues on solid waste separation practices

13. Have you ever separated your waste before?

a. Yes = [ ]

b. No = [ ]

14. Do you currently separate your waste before disposal?

a. Yes = [ ]

b. No = [ ] ***If no, please go to Q16***

15. If ***yes***, which of the following wastes do you often separate?

a. Plastic = [ ]

b. Organic = [ ]

c. Metal = [ ]

d. Other [ ] Please, specify ……

16. Which of these are the benefits of solid waste separation? (***tick all that apply***)

a. Help material recovery, recycling, reuse and composting of waste = [ ]

b. Ensure environmental cleanliness = [ ]

c. Reduce health hazards associated with mixed waste = [ ]

d. Increase waste treatment option = [ ]

e. Offer employment to people = [ ]

f. Others [ ] Please, specify ……..

17. The Metropolitan Assembly should make it compulsory for all households to separate their waste to ensure good waste management system.

a. Strongly Disagree (SD) = [ ]

b. Disagree (D) = [ ]

c. Undecided (U) = [ ]

d. Agree (A) = [ ]

e. Strongly Agree (SA) = [ ]

Section D: Willingness of households to separate their solid waste

I would like to discuss with you issues on willingness of households to separate their solid waste.

Please, indicate the extent to which you agree or disagree with the following statements in the table where Strongly Disagree = (SD), = Disagree = (D), Agree = (A) and Strongly Agree (SA) by ticking [√]

Statements		**SD**	**D**	**A**	**SA**
18.	I am willing to separate my waste				

19.	I am willing to buy my own receptacles to separate my waste				
20.	I will separate my waste only if receptacles are provided for free				
21.	I am willing to participate in waste separation training				
22.	I am willing to separate my waste if it will be collected for free				
23.	I am willing to separate my waste even if there is no incentives provided				

Section E: Challenges associated with households' separation of solid waste in the Cape Coast metropolis

I would like to discuss with you issues on the challenges associated with solid waste separation

24. On a scale of ***1-4 where 1 being the 'most important' and 4 the 'least important'***, number the order of importance, four main challenges associated with solid waste separation practices in the Cape Coast Metropolis.
    a. I don't have time to separate my waste = [ ]
    b. I don't have space to accommodate the separation bins = [ ]
    c. I am not educated on waste separation practices = [ ]
    d. I cannot afford waste separation bins = [ ]
    e. There is no wastes recycle plant in the metropolis = [ ]
    f. Others = [ ]
25. Which of these institutions should be responsible for addressing the challenges? (***tick all that apply***)
    a. The Cape Coast Metropolitan Assembly = [ ]
    b. Households in the Metropolis = [ ]
    c. Private Entities = [ ]
    d. Public –Private Partnership = [ ]

e. Others = [ ]

26. Why should such institution/institutions be responsible for addressing those challenges?
27. Any other comment/suggestion?……...

APPENDIX B
UNIVERSITY OF CAPE COAST
COLLEGE OF HUMANITIES AND LEGAL STUDIES
FACULTY OF SOCIAL SCIENCES
DEPARTMENT OF GEOGRAPHY AND REGIONAL PLANNING
INTERVIEW GUIDE FOR KEY INFORMANTS

NAME OF RESEARCHER: GYIMAH PETER (**0242175375**)

This questionnaire is intended to obtain data for research on '***Solid Waste Separation Practices in the Cape Coast Metropolis'***. The data collected is for academic purpose and would therefore be treated with the utmost confidentiality and that names will not be attached to any report from the study.

Section A: demographic background of respondents

1. Name of your institution
2. Name of interviewee
3. Educational level
4. What are your roles in the institution?

Section B: Solid waste disposal practices of households

5. What types of wastes do households in the metropolis usually generate?
6. What methods do households in the metropolis use to store their wastes?
7. What methods do households in CCMA use to dispose their wastes?
8. Do households in CCMA pay for their waste disposal services?
9. Those who pay, how much do they pay for their waste disposal services?
10. What do you consider to be the ideal ways of disposing solid waste in the Metropolis?

Section C: solid waste separation practices of households

11. Do households in CCMA ever separate their wastes before?
12. Do households presently separate wastes before final disposal?
13. Those who presently separate waste, what kind of waste do they separate?
14. What do you think are some of the benefits of waste separation practice?
15. Should CCMA make waste separation compulsory for all households? Why?

Section C: willingness of households to separate solid waste

16. Do you think that households in CCMA are willing to separate their waste?
17. Do you think that households in CCMA are willing to buy their own receptacles to separate my waste?
18. Do you think that households in CCMA are willing to separate their waste if receptacles are provided for free?
19. Do you think that households in CCMA are willing to participate in waste separation training?
20. Do you think that households in CCMA are willing to separate their waste if the separated waste will be collected for free?
21. Do you think that households in CCMA are willing to separate waste without incentive?

Challenges associated with solid waste separation in the cape coast metropolis

22. What are some of the challenges associated with households' waste separation?
23. Which institutions in the metropolis should be responsible for addressing the challenges?
24. Why should the said institutions be responsible for addressing the challenge?
25. Any other comment/suggestion?

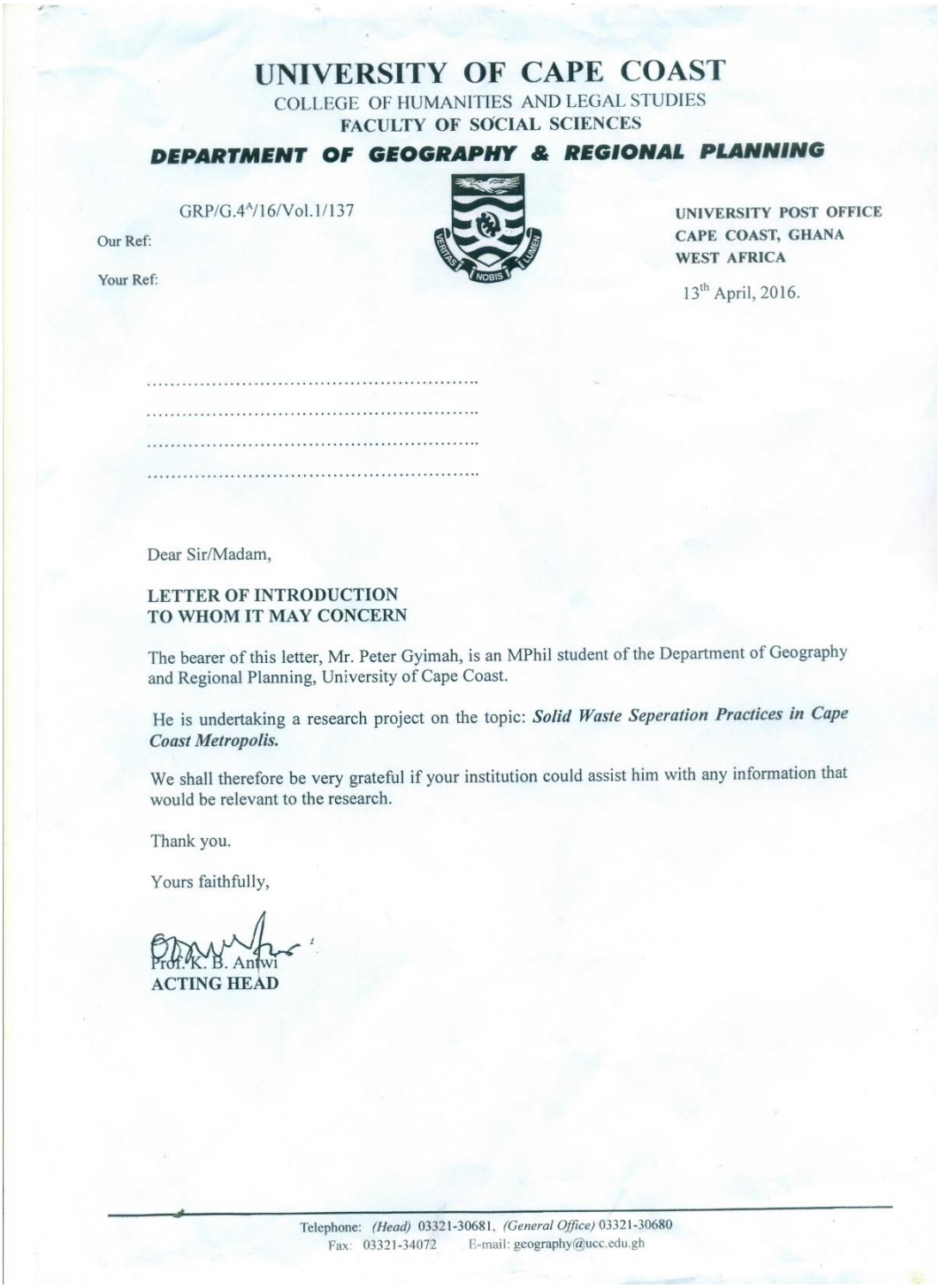
APPENDIX C
UNIVERSITY OF CAPE COAST
COLLEGE OF HUMANITIES AND LEGAL STUDIES
FACULTY OF SOCIAL SCIENCES
DEPARTMENT OF GEOGRAPHY AND REGIONAL PLANNING
OBSERVATION CHECKLIST

NAME OF RESEARCHER: GYIMAH PETER (**0242175375**)

This observation checklist has been prepared to collect data in the form pictures to complement questionnaires and in-depth interviews.
Please indicate responses by ticking [√] where appropriate

OBSERVATIONS	PRESENT	ABSENT
Methods of waste storage		
Places of waste disposal		
Evidence of waste separation		
Types of wastes separated		
Presence of waste separation bins		

APPENDIX D



UNIVERSITY OF CAPE COAST
COLLEGE OF HUMANITIES AND LEGAL STUDIES
FACULTY OF SOCIAL SCIENCES
DEPARTMENT OF GEOGRAPHY & REGIONAL PLANNING

Our Ref: GRP/G.4A/16/Vol.1/137

Your Ref:

UNIVERSITY POST OFFICE
CAPE COAST, GHANA
WEST AFRICA

13th April, 2016.

.....
.....
.....
.....

Dear Sir/Madam,

LETTER OF INTRODUCTION
TO WHOM IT MAY CONCERN

The bearer of this letter, Mr. Peter Gyimah, is an MPhil student of the Department of Geography and Regional Planning, University of Cape Coast.

He is undertaking a research project on the topic: ***Solid Waste Seperation Practices in Cape Coast Metropolis.***

We shall therefore be very grateful if your institution could assist him with any information that would be relevant to the research.

Thank you.

Yours faithfully,

Prof. K. B. Antwi
ACTING HEAD

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