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SOLID WASTE MANAGEMENT IN AWUTU SENYA EAST MUNICIPALITY



**THIS DISSERTATION IS SUBMITTED TO THE UNIVERSITY OF GHANA,
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AWARD OF MASTER OF ARTS IN DEVELOPMENT STUDIES**

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DECLARATION

I, Nii Ofoli Gakpo Quarcoo, hereby declare that except for references to other people's work which have been duly acknowledged, this thesis is the result of my own research carried out at the Institute of Statistical, Social and Economic Research (ISSER), University of Ghana under the supervision of Dr. Aba Obrumah Crentsil (ISSER). I further affirm that this thesis has neither in whole nor in part been published and presented for another degree in any institution.

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DEDICATION

I dedicate this dissertation to my late father; Henry Nii Adu Quarcoo, for his sacrifices yet his inability to see this day. Daddy you will forever remain in my heart.



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I wish to express my sincerest appreciation to God Almighty for the grace and mercies to complete this project as well as my Master's program. I owe a particular debt of gratitude to my supervisor, Dr. Aba Obrumah Crentsil and Professor William Steele for thoroughly guiding my work during the course of this research. Another heartfelt gratitude goes to Rev. Dr. Alexis L. Felder for supporting every part of my education. I am also grateful to my family, class mates, friends and well-wishers as well as the officers at the Awutu Senya East Municipal Assembly for their cooperation.



ABSTRACT

The study investigated waste management in the Awutu Senya East Municipality. This study sought to critically assess the types of solid waste generated in the Awutu Senya Municipal area. It also sought to identify how people disposed of domestic waste, how frequently waste was collected and disposed of, the resources that are available in collecting the waste generated and challenges faced by Awutu Senya Municipal Assembly when it comes to solid waste management. The study was particularly carried out at Kasoa. The Mixed methods approach was used in the study. A questionnaire survey was conducted whilst in-depth interviews were done involving key informants. Data was collected from households, officers at the Municipal Assembly as well as officers of two waste management companies that operate in the Municipality. The results revealed that communal skip containers were woefully inadequate in Awutu Senya East Municipality. This led to indiscriminate disposal of refuse. Indeed, as many as 59.59 % of the households resorted to unacceptable methods of waste disposal. Some of the unacceptable waste disposal methods included burning of refuse and dumping of refuse into open spaces and drains. It was observed that residents in the Municipality do not engage in waste separation and only a few (12 %) of the respondents reused some the waste they generated. Furthermore, it was observed that the major challenges of solid waste management within the Municipality included inadequate financial resources, low number of sanitation workers, outdated and limited number of solid waste management equipment. It is recommended that the Municipal Assembly should consider waste reduction strategies such as the reuse of food waste and other organic components of waste to generate compost for use in agriculture.

LIST OF ACRONYMS

AMA	Accra Metropolitan Assembly
ASEMA	Awutu Senya East Municipal Assembly
CED	Centre for Environment and Development
CP	Concrete Product
DMTDP	District Medium Term Development Plan
EHSD	Environmental Health and Sanitation Departments
EPA	Environmental Protection Agency
ESICOME	Expanded Sanitary Inspection and Compliance Enforcement
IETC	International Environment Technology Center
ISWM	Integrated Solid Waste Management
ISWMM	Integrated Solid Waste Management Model
LI	Legislative Instrument
MLGRD	Ministry of Local Government and Rural Development (MLGRD)
MMDA	Metropolitan Municipal and District Assemblies
MSW	Municipal Solid Waste
MSWM	Municipal Solid Waste Management
NEMA	National Environmental Management Authority
NGO	Non-Governmental Organizations
NIMBY	Not In My Backyard
SPSS	Statistical Package for Social Sciences
SW	Solid Waste
SWM	Solid Waste Management
UN	United Nations
UNDP	United Nation Development Program

UNEP	United Nations Environmental Programme
USEPA	United States Environmental Protection Agency
WHO	World Health Organization
WMDs	Waste Management Departments (WMDs)

TABLE OF CONTENTS

Content	Page
DECLARATION.....	i
DEDICATION.....	ii
ACKNOWLEDGEMENTS.....	iii
ABSTRACT	iv
LIST OF ACRONYMS	v
TABLE OF CONTENTS	vii
LIST TABLES.....	xii
LIST OF FIGURES	xiii
LIST OF PLATES	xiv
CHAPTER ONE.....	1
INTRODUCTION	1
1.1 Background of the Study.....	1
1.2 Problem Statement	4
1.3 Research Questions	6
1.4 Aim and Objectives of Study	6
1.5 Justification	7
1.6 Scope of the Study	8
1.7 Limitation of the Study	8
1.8 Organization of the Study	8

CHAPTER TWO	10
LITERATURE REVIEW	10
2.1 Introduction	10
2.2 Definition of Solid Waste	10
2.3 Sources and Types of Solid Waste.....	11
2.4 Components of Solid Waste.....	14
2.5 Solid Waste Management	16
2.6 Solid Waste Management Processes.....	16
2.6.1 Waste Generation.....	17
2.6.2 Storage	18
2.6.3 Collection.....	18
2.6.4 Transfer and Transport	19
2.6.5 Processing and Recovery	19
2.6.6 Disposal	19
2.7 Early Practices of Solid Waste Management.....	20
2.8 Contemporary Methods of Managing Solid Waste.....	21
2.8.1 Source Reduction.....	21
2.8.2 Sanitary Landfill	22
2.8.3 Recycling	23
2.8.4 Composting.....	24
2.8.5 Incineration	25
2.8.6 Integrated Solid Waste Management.....	25
2.9 Problems of Managing Solid Waste.....	27

2.9.1	Technical Constraints	27
2.9.2	Financial Constraints	27
2.9.3	Institutional Constraints.....	28
2.10	Solid Waste Management in Ghana.....	29
2.10.1	Solid Waste Generation	30
2.10.2	Solid Waste Collection	31
2.10.3	Solid Waste Disposal.....	33
2.10.4	Waste Management Regulation and Policy	34
2.10.5	Problems of Waste Management in Ghana	37
2.11	Waste Recycling	38
2.12	Conceptual Framework	39
CHAPTER THREE		42
PROFILE OF STUDY AREAS AND METHODOLOGY		42
3.1	Introduction.....	42
3.2	Profile of study area	42
3.2.1	Location and Size of the Awutu Senya East Municipality.....	43
3.2.2	Zonal Councils/Electoral Areas.....	44
3.2.3	Major Settlements.....	45
3.3	Research design.....	46
3.4	Data Collection Instruments.....	46
3.3	Sources of Data	47
3.3.1	Primary Data.....	47

3.3.2	Secondary Data	47
3.4	Sample Size.....	48
3.5	Sampling Techniques	48
3.6	Procedure	49
3.7	Ethical Considerations	50
3.8	Data Processing and Analysis	50
CHAPTER FOUR		52
RESULTS AND DISCUSSION		52
4.1	Introduction.....	52
4.2	Demographic characteristics of Respondents	52
4.2.1	<i>Location of House</i>	52
4.2.2	<i>Age</i>	54
4.2.3	<i>Sex</i>	54
4.3	Types of solid waste generated in Awutu-Senya Municipality	54
4.4	Waste Management methods: Separation and Reuse	57
4.5	Place of solid waste disposal by households.....	59
4.6	Availability of domestic waste management facilities	64
4.7	Influence of Place of Residence on Methods of Waste Disposal	66
4.8	Time spent to dispose-off waste.....	69
4.9	Door to Door waste Collectors (Kaya Bola).....	71
4.10	Regularity of collection.....	71
4.11	Challenges facing Solid Waste Management.....	73

4.12	Willingness to pay for Disposal	74
4.13	Summary of Findings	74
CHAPTER FIVE		75
SUMMARY, CONCLUSIONS AND RECOMMENDATIONS		77
5.1	Summary of findings	77
5.2	Conclusions.....	78
5.3	Recommendations.....	79
REFERENCES		81
APPENDIX : QUESTIONNAIRES		88

LIST TABLES

Table 2.1: Typical Waste Generation Facilities, Activities, and Locations Associated with various Sources of Solid Waste	12
Table 4 1: Demographic Characteristics of Respondents.....	53
Table 4.2: Summary of the most Domestic Solid Waste Generated in Awutu-Senya Municipality.....	55
Table 4.3: Distribution of Respondents Reuse of Solid Waste	58
Table 4 4: Distribution of Communal Skips within the Municipal Capital.....	64
Table 4.5: Cross tabulation of Place of Residence and disposal of waste by households	68
Table 4.6: Chi-Square Tests on the influence of Place of Residence and method of waste disposal by households	69

LIST OF FIGURES

Figure 2.1: Key Elements of Solid Waste Management.....	17
Figure 2. 2: Model of the ISWM.	26
Figure 2.3: Waste Disposal of Households in Ghana, 2004	34
Figure 2.4: Conceptual Framework	40
Figure 3.1: Awutu Senya East in the Regional Context	44
Figure 3.2: Zonal Councils/Electoral Areas in Awutu-Senya Municipal Assembly	45
Figure 4.1: Summary of the place of disposal of solid waste among the respondents	59
Figure 4.2: How long it takes to dispose-off refuse in the skip containers	70
Figure 4.3: Regularity of waste collection.....	72

LIST OF PLATES

Plate 1: Plate Showing On-Street Dumping of Solid within Kasoa Township	61
Plate 2: Indiscriminate Waste Dumping resulting in Choking of Storm Drain by Solid Waste in Kasoa Township	62
Plate 3: Picture showing the practice of open dumping of solid waste at Ofankor, Kasoa.....	66
Plate 4: Photograph Showing Overflowing Skips at the Kasoa Market Area	73

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

The Ghana Living Standards Survey (2014) shows that more than half (52.4%) of households in Ghana dispose of their rubbish at a public dump while 12.8 percent dispose of them indiscriminately. According to the same survey, less than one-fifth (18.2%) of households have their rubbish collected. Consistent with the Ghana Living Standards Survey report, The World Health Organization (2010) estimated that at least 50 percent of the populations in Ghana reside in urban areas of which only 18 percent have access to improved sanitation and 90 percent have access to improved drinking water sources. Osumanu (2008), in a research paper, indicated that the provision of water and sanitation services in poor urban areas remains a critical challenge for the realization of the Millennium Development Goals. Larbi (2006) also stated that poor access to improved water and sanitation in Ghana is attributed to a number of reasons which include weak sector policies, lack of political will, weak local government capacity and inadequate financing.

Farvacque-Vitkovic, Madhu, Eghoff and Boakye (2008) asserted that by 2010, more than half of Ghana's population will be living in urban areas, with urbanization expected to reach 65 percent by 2030. This prediction has been confirmed by the 2010 Population and Housing Census which indicated that approximately 50.9 % of Ghanaians live in urban areas (Ghana Statistical Service, 2012). Also, the most recent population and housing census has indicated that the housing stocks of various regions have also increased with the national rate being 55.5 %. The Central region for instance has witnessed approximately 55.3% increase in its housing stock and majority of these new

houses are located in upspring communities closer to old towns like Kasoa (Ghana Statistical Service, 2012).

Chati (2012) indicated that in the olden days, waste management across the world did not pose many problems because of the smaller populations sizes in communities. It has however become problematic due to the large masses of people in the towns, and sprawling communities and cities where the problem is serious. Urban sprawls, poor financing capacity of local authorities, low technical capacity for planning and management of solid waste and weak enforcement of environmental regulations have significantly contributed to compounding the difficulties associated with waste management (Chati, 2012). For instance, the weak implementation of environmental regulations has allowed individuals and local authorities to flout environmental regulations without any sanctions.

Shafiul and Mansoor (2003) defined solid waste as any material which comes from diverse sources including domestic, commercial, and industrial. Solid waste is usually the remnants of human activities and has no value to people who possess them and hence can be discarded as useless. According to Ogbonna et al (2002), as a result of increasing population and increased consumption of variety of products and its associated packaging, there are heaps of solid wastes along roads stream channels, riverbanks and in open spaces. Also, Bussinessdictionary.com defined solid waste management as systematic control of generation, collection, storage, transport, source separation, processing, treatment, recovery, and disposal of solid waste. Another definition by Zerbock (2003) stated that it is the source separation, storage, collection, transportation and final disposal of waste in an environmentally sustainable manner. From the above

definitions, it means that in an effort to manage solid waste, there needs to be a deliberate methodical effort that will be aimed at controlling how solid waste is generated, stored, collected, and transported as well as, how it is treated either for final disposal or reuse.

Available literature indicate that significant proportion of solid waste generated are not collected and thus end up in open spaces and drains (Monney et. al 2013). Studies have shown that, in Accra and Kumasi, the two largest cities in Ghana, over 3,000tons of solid waste is generated daily out of which approximately 70% is collected (Anomanyo 2004; Ketibuah 2004; Mensah and Larbi 2005).The health implications of poor waste management can be very damaging to the people exposed to these unsanitary conditions. These effects of poor waste management include flooding, water pollution, spread of diseases and ugly sights of stinking and pest-infested piles of solid waste in some parts of urban areas (Boadi and Kuitunen 2004; Puopiel 2010).

The collection, transfer and disposal of waste have been generally assumed by city authorities in both the developed and developing countries. This constitutes a basic and expected government function. The format varies in most urban areas where solid waste is collected either by a government agency or private contractor. The problems caused by solid waste in urban Africa is largely due to the explosive growth rates, particularly in sub-Saharan Africa, which eventually translates into generation of copious amounts of solid waste (UN-HABITAT 2010; Taiwo, 2011). Despite the fact that developing countries do spend about 20 to 40 per cent of metropolitan revenues on waste management, they are unable to keep pace with the scope of the problem (Zerbock, 2003). Ogwueleka (2009) indicated that what accounts for this is that city authorities

lack the financial and technical resources to keep pace with the challenges associated with huge amounts of solid waste (Ogwueleka, 2009). Consequently, heaps of solid wastes are not uncommon sights in these areas.

1.2 Problem Statement

According to Senkoro (2003) the World Health Organization (WHO) has identified solid waste as the second most important problem after water quality among other environmental health concerns. Farvacque-Vitkovic, et.al (2008) argued that the current rapid and largely uncontrolled urban growth is stressing capacity to efficiently deliver infrastructure and services and is resulting in urban sprawl and inefficient use of land. According to the World Bank (2000), as cited in White et. al. (2007) a peculiar problem of cities in Africa is that the governing bodies are not able to adequately deal with waste and sanitation. In addition to that the cities are not serving as engines of growth and structural transformation as the case may be in developed countries, thus, it is a huge burden on cities to provide economic and social opportunities for its inhabitants.

According to the World Bank (2012) there is an obvious sanitation problem in Ghana. This was revealed in a report released in 2012 by the World Bank's Water and Sanitation Program (WSP), Ghana's economy loses 420 million Ghanaian Cedis each year (US\$290 million, that is 1.6 percent of GDP), due to poor sanitation. The desk study titled Economic Impacts of Poor Sanitation in Africa - Ghana, found that the majority (74 percent) of these costs come from the annual premature death of 19,000 Ghanaians from diarrheal disease, including 5,100 children under the age of 5, nearly 90 percent of which is directly attributable to poor water, sanitation, and hygiene. The study also found 4.8 million Ghanaians have no latrine at all and defecate in the open (World Bank,

2012).

For many years, waste disposal has been a major problem for many communities in Ghana. There is indiscriminate dumping, irregular collection of waste generated and inadequate resources which constitute the key problems facing solid waste management in many district, municipalities and metropolitan authorities including Awutu Senya East Municipal Assembly (ASEMA). According to the Ministry of Finance, it is estimated that about 900 tons of waste is generated daily in the Awutu Senya East Municipal Assembly. Out of this, only 300 tons is hauled every day leaving a backlog of 600 tons uncollected a day (www.mofep.gov.gh).

As a result of the under collection of the waste that is generated, there is significant littering and heaping of waste on the streets of the Awutu Senya East Municipal Assembly and most especially, the Municipal Capital, Kasoa. The sight of skips that are overflowed with waste within the municipality is also a common phenomenon. More so, the proliferation of polythene bags for packaging food and non-items has seriously goaded the situation in the study area. This makes many residential areas filthy and unattractive for living. Consequently, there is the possibility of the outbreak of communicable diseases such as cholera and typhoid if the situation is left unchecked. This may adversely affect people exposed to these unsanitary conditions. Hence this study intends to examine the solid waste management practices in the Awutu Senya East Municipal Assembly. The choice of Awutu Senya East Municipal Assembly was occasioned by the fact that it is a new district and that all previous studies of solid waste management practices in urban areas focused on major cities in Ghana including Accra, Kumasi and WA.

1.3 Research Questions

The research therefore seeks to establish the causes of this problem by answering the following questions:

- ❖ What types of solid waste are generated in the Awutu Senya East Municipal Assembly?
- ❖ How do people dispose of their domestic waste?
- ❖ How frequently is the waste collected and disposed of?
- ❖ What resources are available in collecting the waste generated?
- ❖ What are the challenges facing the Awutu Senya East Municipal Assembly in solid waste management?
- ❖ Does the residential location of people within the municipality influence the method of waste disposal?

1.4 Aim and Objectives of Study

The main aim of the study is to examine the factors affecting effective solid waste management in the ASEMA and suggest possible measures to tackle the problem. Specifically, the research aims at achieving the following objectives:

- ❖ To assess the types and components of solid waste generated in the Awutu Senya East Municipal Assembly.
- ❖ To examine the methods of waste disposal by households (place of disposal) in the district.
- ❖ To investigate the frequency of solid waste collection and disposal in the municipality.
- ❖ To explore the challenges faced by the Awutu Senya East Municipal authorities in solid waste management
- ❖ To examine the influence of location on the methods of waste disposal.

1.5 Justification

The problem and difficulties associated with solid waste management in Ghanaian cities are not peculiar to the country but cut across Sub-Saharan Africa and other developing countries. Sanitation management in various urban and peri-urban environments has become an international concern as the phenomenon transcends all aspects of human life. It has been identified that Awutu Senya East Municipal Assembly has problems when it comes to the management of solid waste (www.mofep.gov). This deserves not only the attention of the municipal assembly and the waste management institutions but also concerns of corporate organizations and individuals to find a lasting solution to the problem. This is because the ramifications solid waste management which include flooding, water pollution, spread of diseases and ugly sights of stinking and pest-infested piles of solid waste in some parts of urban areas (Boadi & Kuitunen 2004) are likely to impact negatively on the lives of the residents. This may affect the readiness of investors to put their much cherished resources into ventures in communities that are not clean. The study therefore intends to explore appropriate strategies and recommendations in managing solid waste in all places within the municipality in a sustainable manner. Despite the immensity of the problem, very little research on solid waste management has been carried out in the municipality. The current study therefore will serve as a reference point to the municipal assembly and waste management institutions as far as solid waste management is concerned. In this case, it will give them an in-depth understanding of what the problems of solid waste management are and the strategies to tackle the problems. Additionally, the study will contribute to the existing body of knowledge on solid waste management and also stimulate further research on the subject in other municipal and metropolitan areas in Ghana. Academically, the results of the study will be useful for future studies on urban sprawl and sanitation issues.

1.6 Scope of the Study

Geographically, the study was conducted in Awutu-Senya East Municipal Assembly (ASEMA) in the Central Region of Ghana. This municipality is among the top rapidly growing communities in Ghana (Ministry of Finance, 2014). Data was collected from individuals from households, waste management companies, individual waste collectors (Kaaya Boola), waste management department of the municipality and the municipal finance officer (s). This study focuses on the methods used by the municipal assembly's waste management companies to manage solid waste that is generated within the municipality. Previous studies from other parts of the world were reviewed to ascertain how urban sprawl cities have been managed using similar approaches. Various theories on urban growth and human settlement development were also reviewed and assessed to establish their application or otherwise in Ghana.

1.7 Limitation of the Study

The study was conducted in the Awutu Senya Municipality. The conditions prevailing in this municipality may not be similar to that of other municipalities in the Central Region and Ghana as a whole. This means that the findings of the research may not be applicable in other regions in Ghana.

1.8 Organization of the Study

The study has five main chapters. The first chapter provides the general introduction to the research and it analyses the extent of the problem of waste management in Awutu Senya East Municipality. The chapter also addresses the significance of the study, background information and the statement of the problem. Furthermore, it the chapter outlines the questions the study seeks to answer and the objectives to be achieved, the

justification for doing the study. The second chapter reviews literature about the subject from various sources. The literature review looks at waste management challenges in urban settlements in Africa and other parts of the world. That is concepts, processes and methods of managing solid waste. Based on the literature review, a conceptual framework that seeks to explain waste management was developed. The third chapter gives a profile of Awutu-Senya East Municipal Assembly which is the location in which the study was conducted. This included the history, population and housing characteristics as well as cultural values and their relationship with solid waste generation and management. It further spells out the methodology used to carry out the entire study including research design, sampling techniques, data sources and means of analysis and presentation. The fourth Chapter presents the results and the discussion of the findings from the analyses of the data obtained from the research field. Descriptive statistical tools such as frequency tables, bar charts and pie charts were used in the presentation of the results. Chapter five presents the summary of key findings, conclusions drawn from the study and the recommendations for solid waste management and future research.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter explores literature on solid waste management. It examines key concepts, methods and problems of waste management in municipalities, districts and metropolis across the world. The chapter concludes with the summary of key lessons learnt from the review and a conceptual framework that guides the study.

2.2 Definition of Solid Waste

There are varied definitions of the term solid waste. Tchobanoglous, Theisen, and Vigil (1993) indicated that solid waste includes materials that arise from both human and animal activities and they are normally discarded because they are no longer needed. And these useless materials (solid waste), according to Zerbock (2003), comprises of commercial, non-hazardous industrial, and domestic waste. Examples of these solid wastes are household organic trash, institutional garbage, construction wastes and street sweepings. Another definition given by Ghana Innovation Market Place [GIM] (2009) posited that solid waste does not include atmospheric emissions and wastewater discharges which may arise from commercial, industrial, institutional and domestic activities. That is any form of waste that is neither liquid nor gaseous. Solid waste is the unwanted or useless solid materials generated from combined residential, industrial and commercial activities in a given area.

From the above definitions, solid waste can operationally be defined as materials that may come from domestic, commercial, and industrial sources and they result from human actions or activities and may have no value to people who own them and

therefore are thrown away as useless. It is important however, to note that significant amount of these waste materials could be recycled into useable materials and hence not all waste materials are useless.

2.3 Sources and Types of Solid Waste

As shown in the definitions above, there are different categories of solid waste and many researchers have classified solid waste based on these categories. Solid waste may be categorized according to its origin (example domestic, industrial, commercial, construction or institutional); according to its contents (example organic material, glass, metal, plastic paper); or according to hazard potential (example toxic, non-toxin, flammable, radioactive and infectious). Tchobanoglous et. al. (1993) have categorized solid waste according to sources, the facilities that generate the waste, the types of activities that generate the waste, and the locations associated with the type of waste. This classification is presented in Table 2.1.

Table 2.1: Typical Waste Generation Facilities, Activities, and Locations Associated with various Sources of Solid Waste

Source	Typical location	Types of solid Waste
Residential	Single-family and multifamily dwellings, low-medium, and high-rise apartments.	Food wastes, rubbish, ashes, special wastes
Commercial/ Municipal	Stores, restaurants, markets, office buildings, hotels, motels, print shops, auto repair shops, medical facilities and institutions.	Food wastes, rubbish, ashes, demolition and construction wastes, special wastes, occasionally hazardous wastes
Industrial	Construction, fabrication, light and heavy manufacturing, refineries, chemical plants, lumbering, mining, demolition.	Food wastes, rubbish, ashes, demolition and construction wastes, special wastes, occasionally hazardous wastes.
Open areas	Streets, alleys, parks, vacant plots, playgrounds, beaches, highway and recreational areas.	Special wastes, rubbish
Treatment plant sites	Water, wastes water, and industrial treatment processes.	Treatment plant wastes, principally composed of residual sludge
Agricultural	Field and row crops, orchards, vineyards, dairies, feedlots and farms.	Spoiled food wastes, agricultural wastes, rubbish, hazardous wastes

Source: Tchobanoglous et. al. 1993 p.52-53

In addition to the above classification of waste, Tchobanoglous et. al. (1993) also identified forms of solid waste and grouped them into food waste, rubbish, ashes and residues and special waste. Each of these forms of solid waste has been explained in the ensuing paragraphs.

Food waste: Tchobanoglous et al (2008) stated that food wastes include all animal, plant and vegetable residues which may result from preparation, cooking and eating of foods. One important feature of food wastes is that they are exceedingly putrescible and in warm weather, they decompose very quickly. Regularly, offensive odors may be developed as a result of the decomposition. The rapid decomposition nature of food waste usually influence the design and operation of the solid waste collection.

Rubbish: The composition of rubbish is combustible and non- combustible solid wastes which are generated from institutions, commercial activities and households. It excludes food wastes or other extremely perishing materials. Typical combustible rubbish includes of items such as plastics, paper, rubber, textiles, cardboard, wood, garden trimmings leather and furniture. In addition, the non-combustible rubbish comprises of dirt, ferrous and non-ferrous metal, glass, tin cans, and aluminum cans.

Ashes and Residues: Tchobanoglous et. al. (1993) indicated that ashes and residues are materials that are left from the burning of wood, coal, coke and other combustible wastes industrial, institutions and domestic settings. The purposes of burning these items include heating, cooking and disposing off the waste materials and the remains after the burning process are to generate ashes and residues.

Special waste: The items included in the list of special waste are roadside litter, litter from municipal containers, catch-basin debris, street sweepings, and abandoned vehicles and dead animal (Tchobanoglous et al., 1993).

In addition to the classification of solid waste by Tchobanoglous et. al. (1993; 2008), the Centre for Environment and Development [CED] (2003) has also categorized solid waste types on three main grounds. The first basis is on the source (for example food waste, ashes and residues, rubbish, demolition and construction, agriculture waste). The second classification is based on features of the material (biodegradable and non-biodegradable) while the third classification is based on the risk potential (hazardous waste). Further, the center enumerated sources of solid waste as residential, waste from shops, commercial establishments, hotels/restaurants/eating stalls, slaughter houses and others. It is obvious that the CED classification is akin to the sources and types categorization done by Tchobanoglous et al (1993). On the grounds of types of solid waste enumerated by Tchobanoglous et al (1993) and the Centre for Environment and Development (2003), solid waste largely includes the following items: food waste, rubbish, ashes and residues, demolition and construction, and agriculture waste. The sources of solid waste also include domestic, commercial and industrial.

2.4 Components of Solid Waste

Tchobanoglous and Kreith (2002) indicated that an understanding of the characteristics of the waste stream is a must in any solid waste management system. According to Cheremisinhoff (2003), this is helpful to municipalities in determining the best management methods for different materials, planning recycling and recovery programmes, purchasing equipment etc.

Boadi and Kuitunen (2003) stated that as in most developing cities, solid waste in most cities of Ghana has a high putrescible organic content. Asomani-Boateng and Haight (1999) also stated that organic fraction composes of kitchen waste including food

leftovers, rotten fruits, vegetables, leaves, crop residues, animal excreta and bones. Plastics, glass, metals, and paper account for less than 15 percent of the total waste. High organic and moisture contents coupled with prevailing high temperatures necessitate frequent removals, which place additional burden on an over strained collection system. When the waste is not collected in time it emanates a foul smell especially in low income areas where the waste is often mixed with human waste due to inadequate sanitation facilities (Boadi and Kuitunen, 2003).

Hai (2005) alludes to the fact that information about physical and chemical properties of solid waste is important in evaluating equipment needs, systems and management programs and plans, especially with respect to the implementation of disposal and resource and energy recovery options. Characterization of waste is also important to determine its possible environmental impacts. The waste components, although vary widely with the location and season of the year, include food wastes, paper, plastic, cloths, metal, glass, construction materials and others (Dhaka City Corporation, 1999).

There are varied components of solid waste. These include materials that can burn and those that cannot; material that are recyclable and others that are non-recyclable. From this background, it is obvious that a comprehensive appreciation of the content of solid waste will give direction to the methods that can be used to manage the waste. As stated earlier, solid waste is made of materials that are combustibles and non-combustible. Some of the combustible materials are yard debris, plastics, food waste, paper, disposable diapers, textiles, wood, and other organic materials. On the other hand, examples of non-combustibles are metal, glass, leather, aluminum and bones (Kreith 1994; Zerbock, 2003).

2.5 Solid Waste Management

Many researchers have varied views on what the definition of term solid waste management should be. Kumah (2007) describes the term as “the administration of activities that provide for the collection, source separation, storage, transportation, transfer, processing, treatment, and disposal of waste”. In a more comprehensive definition, Tchobanoglous et. al. (1993), stated that solid waste management. “.....that discipline associated with the control of generation, storage, collection, transfer and transport, processing and disposal of solid wastes in a manner that is in accord with the best principles of public health, economics, engineering, conservation, aesthetics and other environmental considerations and that is also responsive to public attitudes”.

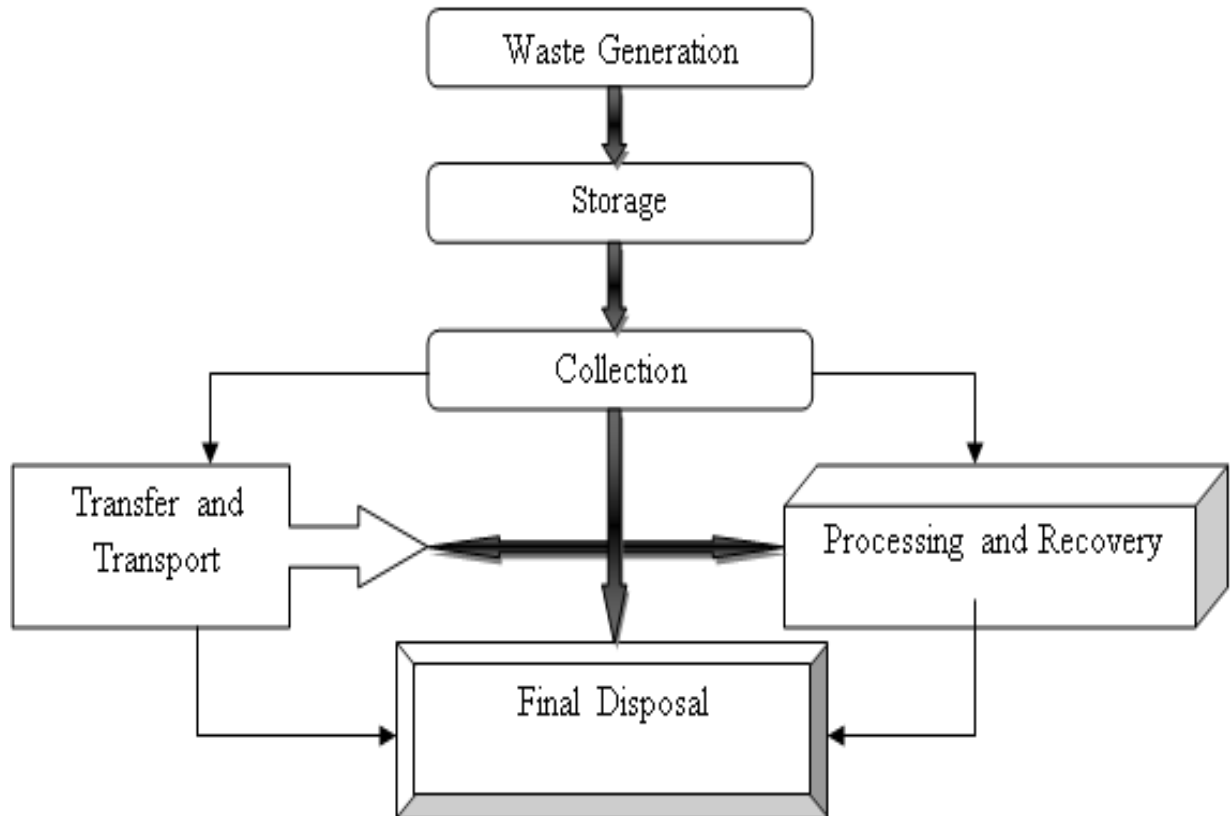
In that vein, the essential aspects and relationships involved must be identified and understood clearly if solid waste management is to be accomplished in an efficient and methodical manner (Tchobanoglous et. al, 1993). On this foundation, it implies that solid waste management must incorporate the following: source, storage, collection, transportation and disposal of solid waste in an environmentally sustainable manner.

2.6 Solid Waste Management Processes

As shown in Figure 2.1, the key elements in solid waste management include: waste generation, storage, collection, transfer and transport, processing and recovery and final disposal. This means that when waste is generated it is first stored in either dustbins or skips at the point of generation. It is then collected, transported and finally disposed of in landfill. Also, when waste is collected it can be transferred from small collection equipment like the tricycle to a bigger truck for final disposal. On the other hand, waste

collected can be processed and recovered in the form of materials or instruments to be reused. These elements are further elaborated in the following section.

Figure 2.1: Key Elements of Solid Waste Management



Source: Puopiel, 2010; Pg 12

2.6.1 Waste Generation

Waste generation encompasses those activities in which materials are identified as no longer being of value and are either thrown away or gathered together for disposal (Momoh and Oladebeye, 2010). According to United Nations Environment Program (2009), in 2006 the total amount of municipal solid waste (MSW) generated globally reached 2.02 billion tonnes, representing a 7 per cent annual increase since 2003. It is further estimated that between 2007 and 2011, global generation of municipal waste will rise by 37.3 per cent, equivalent to roughly 8 per cent increase per year (UNEP, 2009).

The program also says that, as per WHO estimations, the total health-care waste per person per year in most low income countries, is anywhere from 0.5 kg to 3 kg. That notwithstanding, the causes of this increased should have enumerated by the organization and therefore, has not exhausted the issue on discussion. It is accepted that solid waste generation is increasing at a faster rate globally as indicated by UNEP and this is confirmed by Mensah and Larbi (2005) concerning solid waste generation in Ghana.

2.6.2 Storage

Tchobanoglous et. al. (1977) explains storage to mean where solid waste is stored before it is collected. It could be stored in a skip or dustbins and not thrown away indiscriminately. According to them, storage is of primary importance because of the aesthetic consideration.

2.6.3 Collection

The element of collection includes not only the gathering of solid waste, but also the hauling of waste after collection to the location where the collection vehicle is emptied (Kreith, 1994). According to Kreith (1994), the most common type of residential collection services in the United States of America (USA) include “curb”, “setout-setback” and “backyard carry”. According to a study commissioned by the United States Postal Services [USPS] (2000), in the city of Thimphu in Bhutan the collection of solid waste from households, commercial set-ups was done in concrete receptacles placed at strategic points and conveyed by trucks/tractors. Accordingly, there were concrete bins and containers provided at various locations from where the waste was lifted for disposal. Individual bins/containers were also placed alongside the shops in certain areas, which were emptied directly into the trucks/tippers. This prevents people from dumping

waste indiscriminately. Even though this is a very commendable practice, the building of these concrete bins and containers may be expensive to do in Ghana and for that matter ASEMA.

2.6.4 Transfer and Transport

According to Kreith (1994), transfer and transport involves two steps. The first step involves transfer of wastes from the smaller collection vehicle to the larger transport equipment while the second step involves the subsequent transport of the wastes, usually over long distances to the final disposal site.

2.6.5 Processing and Recovery

The element of processing and recovery includes all the technology, equipment, and facilities used both to improve the efficiency of other functional elements and to recover usable materials, conversion products or energy from solid wastes (Tchobanoglous et al, 1977). Tchobanoglous et al (1993) further indicated that in the recovery, separation operations have been devised to recover valuable resources from the mixed solid wastes delivered to transfer stations or solid waste processing plants.

2.6.6 Disposal

It is the ultimate fate of all solid wastes whether they are residential wastes collected and transported directly to landfill site. Having explained the various elements in the diagram, the subsequent section analyses in detail the final disposal methods of solid waste. Several methods of solid waste management have evolved over the years. These methods according to the Centre for Environment and Development (2003) vary greatly with types of wastes and local conditions. For the purpose of this analysis, this section is

divided into early practices of managing solid waste and contemporary methods of waste management systems.

2.7 Early Practices of Solid Waste Management

According to Tchobanoglous et al (1993: 17-18), the most commonly recognized methods for the final disposal of solid wastes include dumping on land, canyons and mining pits; dumping in water; ploughing into the soil; feeding to hogs; and reduction and incineration. Present day research and experience have shown that some of these methods of solid waste disposal are actually unhealthy. However, some of these methods are still being used in villages, towns and even cities in Ghana today. Indiscriminate dumping on opened land and dumping in gutters particularly are clearly evident in towns and cities, while dumping in water especially people living in coastal towns is common. The burning of dumps is also common in peri-urban and rural communities in Ghana and in many other less developed countries (Farvacque-Vitkovic, et al (2008).

A study carried out in Ado-Akiti in Nigeria by Momoh and Oladebeye (2010) showed that, the methods of solid waste disposal included dumping of waste in gutters, drains, by roadside, unauthorized dumping sites and stream channels during raining season and burning of wastes on unapproved dumping sites during the dry season. This has gone to confirm that the practices of solid waste disposal in the 1950s still exist today. On the other hand, Momoh and Oladebeye's (2010), assessment of waste situation in Ado-Akiti in Nigeria is questionable as they did not further explain what brought about the indiscriminate dumping. It could be that people dumped the waste any how because they were no skips or dustbins for the people to store their waste for collection.

2.8 Contemporary Methods of Managing Solid Waste

According to Denison and Ruston (1990), in this contemporary era, the methods of managing solid waste include source reduction, sanitary landfills, composting, recycling, and incineration. The following sub-sections discussed some of these contemporary methods.

2.8.1 Source Reduction

Denison and Ruston (1990) viewed source reduction as any action that reduces the volume or toxicity of solid waste prior to its processing and disposal in incinerators or landfills. This view is similar to the one given by Kreith (1994). According to him, source reduction focuses on reducing the volume and /or toxicity of waste generated. Source reduction includes the switch to reusable products and packaging, the most familiar example being returnable bottles. According to USPS (2000) in the city of Thimphu in Bhutan to reduce waste problems in future, reduction in waste generation would be the most important factor. Examples of possible reduction at the consumption level include reuse of containers (including bags), better buying habits, and cutting down on the use of disposable products and packaging (USPS, 2000).

It is agreed that, source separation and resource recovery is an important method in waste management. This is because there is nothing like waste on this earth. Wastes that are discharged may be of significant value in another setting, but they are of little or no value to the possessor who wants to dispose of it. According to Tsiboe and Marbel (2004), Austria, the Netherlands, and Denmark developed a waste management processes to efficiently resolve the waste disposal problem by essentially coaxing their citizens to separate their domestic solid waste into glass, paper, plastic categories; thereby enabling easy collection and consequently reuse. As suggested by the three authors, one way of

effectively managing solid waste is to minimize solid waste generation through source reduction.

2.8.2 Sanitary Landfill

Sanitary land filling includes confining the waste, compacting and covering with soil. It not only prevents burning of garbage but also helps in reclamation of land for valuable use (Centre for Environment and Development, 2003). The placement of solid waste in landfills is the oldest and definitely the most prevalent form of ultimate waste disposal (Zerbock, 2003). He further argued that “landfills” are nothing more than open, sometimes controlled dumps. According to him the difference between landfills and dumps is the level of engineering, planning, and administration involved. Open dumps are characterized by the lack of engineering measures, no leachate management, no consideration of landfill gas management, and few, if any, operational measures such as registration of users, control of the number of “tipping fronts” or compaction of waste (Zerbock, 2003). Furthermore, landfills are one form of waste management that nobody wants but everybody needs (Kreith, 1994) According to him, there are simply no combinations of waste management techniques that do not require land filling to make them work. Of the basic management options of solid waste, landfills are the only management technique that is both necessary and sufficient. According to Kreith (1994) some wastes are simply not recyclable, many recyclable wastes eventually reach a point where their intrinsic value is completely dissipated and they no longer can be recovered, and recycling itself produces residuals. He further highlighted that the technology and operation of modern land fill can assure the protection of human health and the environment.

In contrast to what the various authors have said about sanitary landfill as an option for waste management, they have failed to recognize that land fill in itself has some disadvantages as it is costly to construct and maintain, can pollute ground water through leaching, location is a problem in terms of availability of land particularly in the cities. Other critical factors such as gas recovery, composting, waste to energy recovery, storm water control, distance to any settlement and water body were not clearly spelt out by the authors. Therefore, there could be an alternative which is recycling.

2.8.3 Recycling

According to Momoh and Oladebeye (2010) recycling has been viewed as a veritable tool in minimizing the amount of household solid wastes that enter the dump sites. It also provides the needed raw materials for industries. According to them, it has been established that, it is the best, efficient and effective method of solid waste management system. However, this may not be cost effective in developing countries like Ghana. The United States Environmental Protection Agency (USEPA) (1999) has recommended recovery for recycling as one of the most effective waste management techniques. According to USEPA, recycling turns materials that would otherwise become waste into valuable resources and, it yields environmental, financial, and social returns in natural resource conservation, energy conservation, pollution prevention, and economic expansion and competitiveness. More importantly, a sizeable portion of what is thrown away contains valuable resources—metals, glass, paper, wood, and plastic—that can be reprocessed and used again as raw materials (USEPA, 1999).

Kreith (1994) has also added that, recycling is the most positively perceived and doable of all the waste management options. According to him recycling will return raw materials to market by separating reusable products from the rest of the municipal waste stream. The benefits of recycling are many, he added. It saves precious finite resources, lessens the need for mining of virgin materials which lowers the environmental impact for mining and processing. For example, according to the Institute of Waste Management cited by Tsiboe and Marbel (2004), UK recycles only 11 per cent of its household waste, Italy and Spain only 3 per cent, Netherlands 43 per cent, Denmark 29 per cent, and Austria 50 per cent respectively. Having proposed recycling by different authors as the best option to manage solid waste in modern times; they have forgotten about the cost component which is important to successful implementation of any recycling project. Even developed countries are not able to successfully do it. But alternatively, it may be the best option for effectively managing solid waste in Ghana.

2.8.4 Composting

Composting process uses microorganisms to degrade the organic content of the waste. Aerobic composting proceeds at a higher rate and converts the heterogeneous organic waste materials into homogeneous and stable humus (Centre for Environment and Development, 2003: 9). UNEP (2009) has also defined composting as a biological decomposition of biodegradable solid waste under controlled predominantly aerobic conditions to a state that is sufficiently stable for nuisance-free storage and handling and is satisfactorily matured for safe use in agriculture. According to the UNEP (2009), composting is the option that, with few exceptions, best fits within the limited resources available in developing countries. A characteristic that renders composting especially suitable is its adaptability to a broad range of situations. According to Zerbock (2003), a low-technology approach to waste reduction is composting. He further says that in

developing countries, the average city's municipal waste stream is over 50 per cent organic material.

2.8.5 Incineration

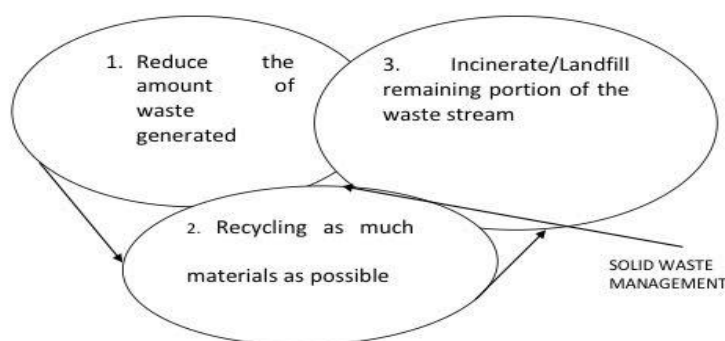
According to the Centre for Environment and Development (2003: 9), incineration is a controlled combustion process for burning combustible waste to gases and reducing it to a residue of non-combustible ingredients. According to the Centre, during incineration, moisture in the solid waste gets vaporized and the combustible portion gets oxidized and vaporized. CO₂, water vapor, ash and non-combustible residue are the end products of incineration. Incinerators have the capacity to reduce the volume of waste drastically, up to nine fold than any other method (Kreith, 1994). According to him incineration can also recover useful energy either in the form of steam or electricity. He however recognized that the main constraints of incineration are high cost of operation, relatively high degree of sophistication needed to operate them safely and economically as well as the tendency to pollute the environment through emissions of carbon dioxide. Having assessed the major methods that have been proposed by the various authors, literature has further revealed that there is an alternative method of managing solid waste effectively which is synonymous to waste reduction and recycling as mentioned earlier on.

2.8.6 Integrated Solid Waste Management

Although considerable efforts are being made by many Governments and other entities in tackling waste-related problems, there are still major gaps to be filled in this area (UNEP, 2009). According to UNEP (2009), the World Bank estimates that in developing countries, it is common for municipalities to spend 20 to 50 percent of their available

budget on solid waste management, even though 30 to 60 percent of all the urban solid wastes remain uncollected and less than 50 percent of the population is served. UNEP (2009) suggested that if most of the waste could be diverted for material and resource recovery, then a substantial reduction in final volumes of waste could be achieved and the recovered material and resources could be utilized to generate revenue to fund waste management. This forms the premise for the Integrated Solid Waste Management (ISWM) system. ISWM is based on 3Rs (reduce, reuse and recycle) principle. ISWM system has been pilot tested in a few locations (Wuxi, PR China; Pune, India; Maseru and Lesotho) and has been well received by local authorities. It has been shown that with appropriate segregation and recycling system significant quantity of waste can be diverted from landfills and converted into resource (UNEP, 2009). Similarly, the United States Environmental Protection Agency (1999) has said that if a state or local government wants to plan for and implement ISWM, they have to consider the hierarchies of methods which include reduce, recycle, and incinerate/landfill. Figure 2.2 is a model of the ISWM.

Figure 2. 2: Model of the ISWM.



Source: Puopiel, 2010; pg 19.

Having discussed extensively by different authors on the methods that can be used to manage solid, the next section assesses the problems facing effective solid waste management in developing countries.

2.9 Problems of Managing Solid Waste

According to Ogawa (2005), a typical solid waste management system in a developing country displays an array of problems, including low collection coverage and irregular collection services, crude open dumping and burning without air and water pollution control. He categorized these challenges into technical, financial, institutional and social constraints. Ogawa further discussed these constraints in relation to the sustainability of solid waste in developing countries.

2.9.1 Technical Constraints

Ogawa (2005) indicated that to him, in most developing countries, there are inadequate human resources at both the national and local levels with technical expertise necessary for solid waste management planning and operation. Many officers in charge of solid waste management, particularly at the local level, have little or no technical background or training in engineering or management.

2.9.2 Financial Constraints

Ogawa (2005) intimated that, solid waste management is given a very low priority in developing countries, except perhaps in capital and large cities. As a result, very limited funds are provided to the solid waste management sector by the governments, and the levels of services required for protection of public health and the environment are not attained. The problem is acute at the local government level where the local taxation

system is inadequately developed and, therefore, the financial basis for public services, including solid waste management, is weak. This weak financial basis of local governments can be supplemented by the collection of user service charges. However, users' ability to pay for the services is very limited in poorer developing countries, and their willingness to pay for the services which are irregular and ineffective.

2.9.3 Institutional Constraints

In Ogawa's observation, several agencies at the national level are usually involved at least partially in solid waste management. However, there are often no clear roles or functions of the various national agencies defined in relation to solid waste management and also no single agency or committee designated to coordinate their projects and activities. ".....The lack of coordination among the relevant agencies often results in different agencies becoming the national counterpart to different external support agencies for different solid waste management collaborative projects without being aware of what other national agencies are doing. This leads to duplication of efforts, wasting of resources, and unsustainability of overall solid waste management programs. The lack of effective legislation for solid waste management, which is a norm in most developing countries, is partially responsible for the roles/functions of the relevant national agencies not being clearly defined and the lack of coordination among them" (Ogawa,2005). The author opines that Legislation (Public Health Act, Local Government Act, Environmental Protection Act) related to solid waste management in developing countries is usually fragmented.

Zurbrugg (2009) indicates that, solid waste collection schemes of cities in the developing world generally serve only a limited part of the urban population. The people remaining

without waste collection services are usually the low-income population living in peri-urban areas. The author further indicates that one of the main reasons is the lack of financial resources to cope with the increasing amount of generated waste produced by the rapid growing cities. Often inadequate fees charged and insufficient funds from a central municipal budget cannot finance adequate levels of service. He indicated that, apart from financial constraints that affect the availability or sustainability of a waste collection service; operational inefficiencies of solid waste services such as deficient management capacity of the institutions and inappropriate technologies affect effective waste management. Zurbrugg (2009) therefore underscores the key challenges of waste management which include financial and institutional constraints.

2.10 Solid Waste Management in Ghana

The responsibility of waste management in Ghana is placed on Metropolitan, Municipal and District Assemblies (MMDAs). By the Local Government Act (1993), Act 462 section 10 subsection 3 (d and e), MMDAs are mandated to initiate programmes for the development of basic infrastructure and provide municipal works and services and also be responsible for the development, improvement and management of human settlements and the environment in the district. This means that all waste deposited in the public domain is the property of the District Assembly. The selection of a site for developing a dump site is therefore one of the most important decisions MMDAs make in executing their waste management responsibilities. They are further required to ensure that they make available adequate sites for the present and future storage, treatment and disposal of wastes by identifying, acquiring, demarcating and protecting suitable areas for such purpose (Environmental Sanitation Policy, 1999).

On daily basis, the amount of solid waste that pile up in public places such as markets and walkways is a sure indication that solid waste disposal in Ghana has become a major challenge for metropolitan, municipal and district assemblies. As a result of increasing densities and urbanization, metropolitan assemblies find it challenging to deal with the large quantities of solid waste generated. This is due to the fact that, people resort to haphazard dumping as the only means to managing their domestic solid waste thus resulting in littering and heaping of waste. This section of the review analyses solid waste management processes in some municipalities Ghana. These include collection and disposal as well as waste management regulation and policy in Ghana. In Ghana, deficiencies in solid waste management (SWM) are most visible in and around urban areas such as Accra, Tema and Kumasi where equally important competing needs and financial constraints have placed an inordinate strain on the ability of the authorities to implement proper SWM strategies in tandem with the rapid population growth (Oteng-Ababio, 2011).

2.10.1 Solid Waste Generation

Being the biggest metropolis in Ghana, WaterAid and European Union (2008) have estimated that refuse generation in the Accra Metropolis has increased three-fold over the last two decades, due to factors including population growth, increased urbanization, urban sprawls and lifestyle changes. Furthermore, the population in urban areas is projected to double within the next decade (WaterAid & EU, 2008). At the current population, records indicate that approximately 2,000 metric tons of waste are generated daily, but only 1,200- 1,300 tons are properly collected (Accra Metropolitan Assembly, 2010). Given anticipated population increases in the near future, and urbanization, determining solutions for solid waste management in Accra has become an extremely

critical issue. The subject is especially critical in low-income areas, which are particularly susceptible to the negative effects of a poorly managed municipal solid waste system.

2.10.2 Solid Waste Collection

Tsiboe and Marbel (2004), who did an extensive work on waste management in Ghana, have observed that there are basically three methods of household waste collection in most metropolitan, municipal and district assemblies in Ghana. The first method involves Waste Management Department (WMD) curbside collection by trucks directly outside each house. According to them, this collection method was provided weekly in the high-income residential areas by compactor trucks. The second method involves WMD collected from communal containers to which people must bring their own waste. These were restricted to low-income areas and there are communal containers provided for such purposes. Households that could not afford the house to house collection service usually would have to take their waste to any of the communal containers and from which the WMD would collect the waste and dispose of it at a landfill site. The last method Door-to-door collection services in middle-income areas.

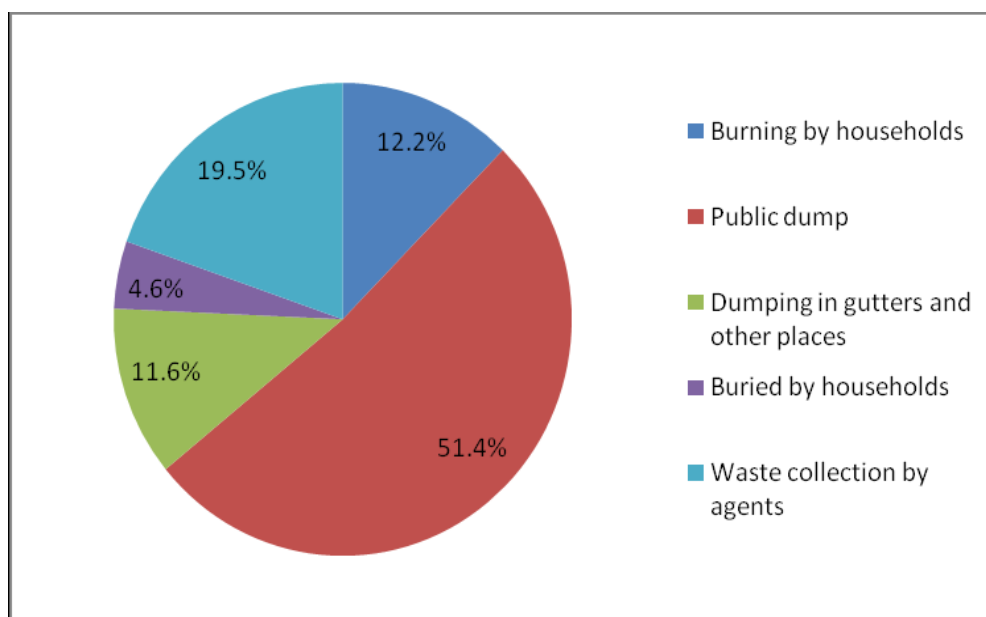
According to Anomanyo (2004), for the purpose of effective waste collection, most cities are demarcated into waste collection districts where a company was contracted by the various metropolitan, municipal or district assemblies to collect waste in one or two districts. This means that in many assemblies various waste collection companies are contracted. These include: Liberty Waste Service Company, Vicma Waste Construction, Ako Waste Management Limited, Gee Waste Limited Zoomlion Waste Management Limited, and Daben Cleansing Construction Services Limited. The main types of

vehicles used by these waste management companies and assemblies were compaction and skip trucks (Anomanyo, 2004). The wastes are taken by road directly to the disposal sites. There were no waste transfer stations. The author also stated that solid waste collection in the city was carried out both on franchise and contract basis. On the franchise basis, house-to-house collections are done in high income areas and the contractors charge the households some fees with weekly or monthly collection frequency. Mostly, such areas are well-planned residential areas with access roads described as first and second class areas and include areas such as Airport residential area and Cantonments in Accra. Each household had plastic containers with covers. These contractors then paid a tipping fee to the AMA for the use of its dump site. The user fees charged form about 20 per cent of general service to the beneficiaries whose wastes are collected. On contract basis, waste contractors are paid by the various assemblies to perform both block and communal container collection in some communities. Block collection occurred in middle-income residential areas including Dansoman, Adabraka, Kaneshie and other parts of Accra. Central communal skip collection occurred in low income high population density and deprived residential areas such as James Town, Nima and other parts of Accra where houses were not well planned with poor or even no access roads (third class areas). Market places were also covered under this arrangement. Residents deposited their waste in such communal containers and the frequency of collection was at least once daily. Waste generators here did not pay user charges. The author further added that despite the strategies put in place for the collection of waste in Accra, maximum waste collection was not achieved. Between 65 and 75 per cent of waste was collected per day.

2.10.3 Solid Waste Disposal

Johannessen and Boyer (1999) found out that in many cities of Ghana (e.g., Accra, Kumasi, Takoradi and Cape Coast) open dumps were the means of solid waste disposal. It is under the World Bank's Urban Environmental Sanitation Project that Ghana developed plans to build its first sanitary landfills in its cities (Government of Ghana, 2003).

Insufficient funding only compounds the problem. The waste management system so far in Ghana has not properly integrated other solutions as collection, treatment, and supply for re-use, reprocessing and final disposal. The system has also not delivered the optimum economic and environmental result for now and has not provided enough room to adapt to future pressures (increases in waste quantities and composition). From the observations of the Ghana Landfill Guidelines (2002), solid waste disposal practices in the country have not been environmentally friendly. Some of the solid waste management practices by individuals in various parts of Ghana are presented in Figure 2.3.

Figure 2.3: Waste Disposal of Households in Ghana, 2004

Source: Accra Metropolitan Assembly, 2004

It can be seen from the pie chart above that more than half (51.4 %) of households in Ghana dispose of waste in public dump sites. Also, 19.5 % of households rely on waste disposal agents for the disposal of waste whereas 12.2 % of households in the country dispose waste by burning. Astonishingly, 11.6 % of households dump their waste in gutters and other places. However, only 4.6 % of the households dispose of waste by burying the waste.

2.10.4 Waste Management Regulation and Policy

According to the Ministry of Local Government and Rural Development (MLGRD) (2004), general waste management in Ghana is the responsibility of the MLGRD, which supervises the decentralized Metropolitan, Municipal and District Assemblies (MMDAs). However, the ministry indicates that, regulatory authority is vested in the Environmental Protection Agency (EPA) under the auspices of the Ministry of Environment and Science. The Metropolitan, Municipal and District Assemblies are

responsible for the collection and final disposal of solid waste through their Waste Management Departments (WMDs) and their Environmental Health and Sanitation Departments (EHSD). The policy framework guiding the management of hazardous, solid and radioactive waste includes the Local Government Act (1994), 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 (1999), the Guidelines for the Development and Management of Landfills in Ghana, and the Guidelines for Bio-medical Waste (2000). All these Acts and Regulations emanate from the National Environmental Action Plan (MLGRD, 2004).

Furthermore, the ministry has published the National Environmental Sanitation Policy (NESP) since May 1999. Accordingly, the policy looks at the basic principles of environmental sanitation, problems and constraints. The role and responsibilities assigned to communities, ministries, departments and agencies and the private sector impinge on environmental management and protection, legislation and law enforcement and the criteria for specifying services and programmes, funding, equipment and supplies. Out of the National Sanitation Policy, the MLGRD has also developed a technical guideline document entitled 'The Expanded Sanitary Inspection and Compliance Enforcement (ESICOME) programme guidelines. The programme guidelines which are implemented by the MMDA's, routinely looked at four broad areas namely; effective environmental health inspections (Sanitary Inspections), dissemination of sanitary information (Hygiene Education), pests/vector control and law enforcement. All MMDAs have developed waste management and environmental health plans to help solve the numerous sanitation problems. Generally, the National Environmental

Sanitation Policy Co-ordination Council (NESPoCC) is responsible for coordinating the policy and ensuring effective communication and cooperation between the many different agencies involved in environmental management in their respective Districts (MLGRD, 2004).

The Ministry of Local Government further indicates that in an effort to address the problem of waste management, Government has over the years put in place adequate national policies, regulatory and institutional frameworks. Due to this the Environmental Sanitation Policy (ESP) was formulated in 1999. This policy has currently been amended and strategic action plans developed for implementation according to the report. Various relevant legislations for the control of waste have also been enacted. These include the following:

- ❖ Local Government Act, 1990 (Act 462)
- ❖ Environmental Assessment Regulations, 1999 (LI 1652).
- ❖ Criminal Code, 1960 (Act 29).
- ❖ Water Resources Commission Act, 1996 (Act 522).
- ❖ Pesticides Control and Management Act, 1996 (Act 528).
- ❖ National Building Regulations, 1996 (LI 1630).

The Ministry of Local Governments and Rural Development also in collaboration with the Ministry of Environment, Science and Technology (MEST), EPA and the Ministry of Health have prepared the following guidelines and standards for waste management:

- ❖ National Environmental Quality Guidelines (1998);
- ❖ Ghana Landfill Guidelines (2002);
- ❖ Manual for the preparation of district waste management plans in Ghana (2002);

- ❖ Guidelines for the management of healthcare and veterinary waste in Ghana (2002);
- ❖ Handbook for the preparation of District level Environmental Sanitation Strategies and Action Plans (DESSAPs).

It is observed from the above that, despite the numerous sanitation regulations and policies that have been put in place by the MLGRD to deal with the solid waste menace in the country, there has not been any improvement in the area of solid waste management. Rather it has moved from bad to worst and therefore has failed to achieve its goal of clearing filth in the country. Secondly, drawing from the views given by the Sanitation Country Profile Ghana and the National Report for Waste Management in Ghana, it can be said with certainty that MMDAs are the primary authorities to manage solid waste at the local level.

2.10.5 Problems of Waste Management in Ghana

In Ghana, Boadi and Kuitunen (2004) pointed out some of the problems affecting solid waste management. These include: weak institutional capacity and lack of resources; both human and capital. They also indicated that, home collection of waste is limited to high and, some middle income areas while the poor are left to contend with the problem on their own. This leads to indiscriminate disposal of waste in surface drains, canals and streams, creating unsanitary and unsightly environments in many parts of the city. Furthermore, MLGRD (2004) summarizes the challenges of solid waste management in Ghana as follows: poor planning for waste management programs; inadequate equipment and operational funds to support waste management activities; inadequate sites and facilities for waste management operations; inadequate skills and capacity of waste management staff; and negative attitudes of the general public towards the environment

in general. It can therefore be said that the main challenges facing solid waste management in developing countries and for that matter Ghana include: inadequate funds to support waste management, inadequate equipment to support waste storage, collection and disposal, low collection coverage and irregular collection services, crude open dumping and burning without air and water pollution control.

Another researcher Anomanyo (2004) stated that apart from lack of funds, insufficient information on quantities and characteristics of waste is the major contributing factor to Ghana's waste management problems. According to him, the existing waste management systems that exist in Ghana have not properly combined other essential components of waste management such as reuse, recycling, reprocessing and treatment.

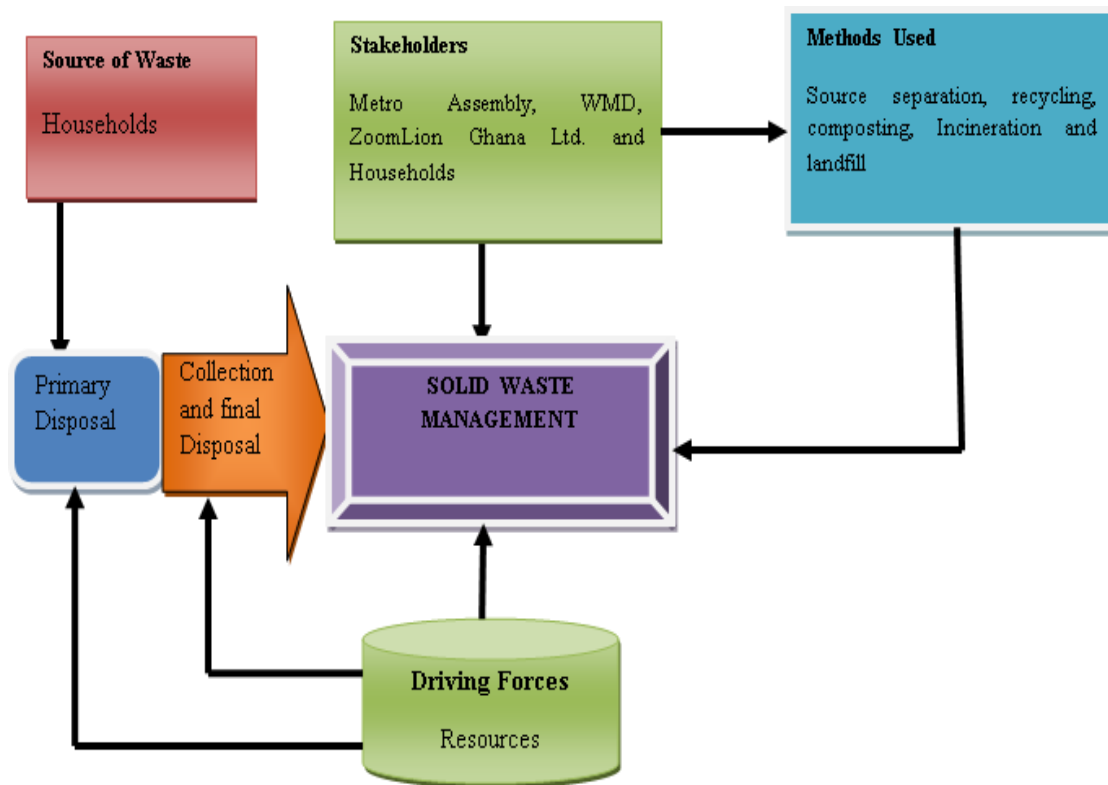
2.11 Waste Recycling

According to Boadi and Kuitunen (2004), in Ghana, waste recycling at the household level begins with the reuse of plastics, bottles, paper, cardboards, and cans for domestic purposes. These materials are disposed of only when they are no longer of any use to their owners. In high income areas, recovery is mainly carried out by domestic servants who sell the materials to middlemen to supplement their incomes. Metals, particularly, aluminum, are recovered and sold to small-scale recyclers who use them to produce valuable items, such as lamps, cooking pots, and washing pans. Scavenging is undertaken at public containers and dumping sites. Johannessen and Boyer (1999) also stated that waste pickers sort through waste in public container sites and at dumping sites. Furthermore, solid wastes including sugar cane leftovers, dry corncobs, and coconut shells are used to smoke fish in open ovens in fishing communities. The collection of these wastes provides employment for people who collect them for sale to

fish smokers. Organic waste is also, used to feed livestock in peri-urban farms. Farm owners collect organic waste from homes and sometimes pay a little fee. The practice help in reducing the amount of household waste for disposal and also check indiscriminate dumping. This activity however, poses a major health risk since any contamination in animals can easily be transmitted to humans. When solid waste, contaminated with human excreta is ingested, animals can become a reservoir for later infection of humans (Cointreau-Levine, 2000).

2.12 Conceptual Framework

The literature review above forms the basis of the conceptual framework of this study. The frame work focuses on three key issues which are: primary level of waste disposal, methods used in managing solid waste and the availability of resources both material and human in managing the solid waste in ASEMA. Figure 2.4 illustrates the conceptual frame work of the study.

Figure 2.4: Conceptual Framework

Source: Adopted from Puopiel, 2010

The focus of this study is to investigate how household solid waste is managed by the households, municipal authorities and waste collection institutions. The framework shows that the source of generation of solid waste is households. It is seen from the Figure 2.4 that in solid waste management stream, three main issues are important and need to be considered. These include the role stakeholders play (MMDAs, waste management institutions and waste generators, i.e., households and individuals) in managing solid waste, driving forces of managing solid waste (resources) and the methods used (source separation, reuse, recycling, composting and landfill). Even though, the major portion of solid waste comes from domestic sources, its proper disposal depends heavily on availability of skips and waste bins and attitudes of the people.

It is also seen from Figure 2.4 that waste produced by household are disposed of at the primary disposal site which may be in the skips and waste bins. The basic disposal is dependent on resources. The municipal assemblies, individuals and even waste management institutions need resources to provide households with the basic disposal site. The waste bins and skips that may be available in vantage points for households and individuals to dispose of their waste are purchased with cash. From the primary disposal sites, the waste has to be collected and transported for final disposal. The collection and transportation depends heavily on resources. The resources needed includes heavy duty compactor vehicles and waste carrier vehicles. From the literature reviewed in the foregoing sections an appropriate research methodology has been developed to collect data to fill the gaps identified in relation to three key issues outlined in the framework.

CHAPTER THREE

PROFILE OF STUDY AREAS AND METHODOLOGY

3.1 Introduction

This chapter has two main divisions. The first aspect provides details on the profile of the study area and the other dwells on the research method. The profile of the study area includes the location, population and other demographic characteristics of the area. The research method includes the design, the sample size and sampling techniques that were used in the study.

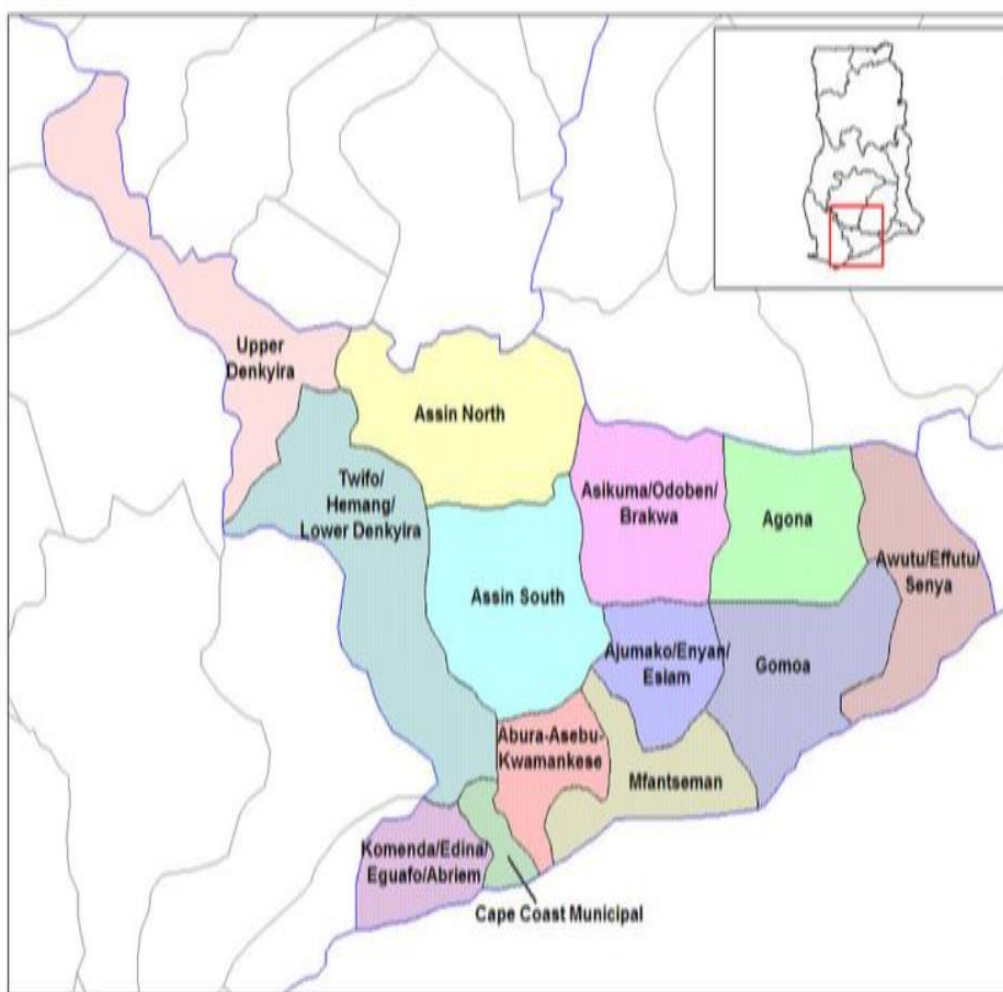
3.2 Profile of study area

The study was conducted in Kasoa; the Municipal capital of the Awutu Senya East Municipal Assembly (ASEMA). According to the assembly's official website (www.asema.gov.gh) Awutu Senya East Municipal Assembly is one of the newly created Municipalities in the Central Region. The Municipality was carved out of the former –Awutu Senya District in 2012 and established as a Municipality by Legislative Instrument (LI) 2025. The rationale was to facilitate government's decentralization programs and local governance system. The people of the Municipality are mainly Guans. There are other settler tribes of different ethnic backgrounds; these include the Gas, Akans, Ewes, Walas/Dagartis, Moshies, Basares and other numerous smaller tribes. The Awutu Senya East Municipal Assembly exists to facilitate the improvement in the quality of life of the people in close collaboration with the private sector and other development partners in the municipality through the mobilization and the judicious use of resources and provision of Basic Socio-Economic Development within the context of commitment to Equity, Accountability, Transparency and excellence. The population of the ASEMA is estimated at 270,000 (projected from 2010 Population and Housing

Census). The average annual growth rate of the Municipal is 3.0%. The ratio of male to female 1 to 1.06 and the population is basically youthful (Ministry of Finance, 2014). The target population for this study is all households in the Awutu Senya East Municipality, municipal authorities in charge of waste management, individual waste collectors and waste management companies. The population of persons aged 18 years and above has been estimated to be about 92000 (projected from 2010 Population and Housing Census). The gender ratio is about 1 male to 1.06 females (www.asema.asemadevelopments.gov.gh, 2014). There are two main waste collection companies namely, Zoomlion Company Limited and Alliance Waste Company Limited. Data on the number of waste companies operating within the Kasoa was not readily available. However, data on the number of individuals popularly known as 'kaya bola' who do house to house collection and disposal of solid waste was not readily available at the Municipal Assembly.

3.2.1 Location and Size of the Awutu Senya East Municipality

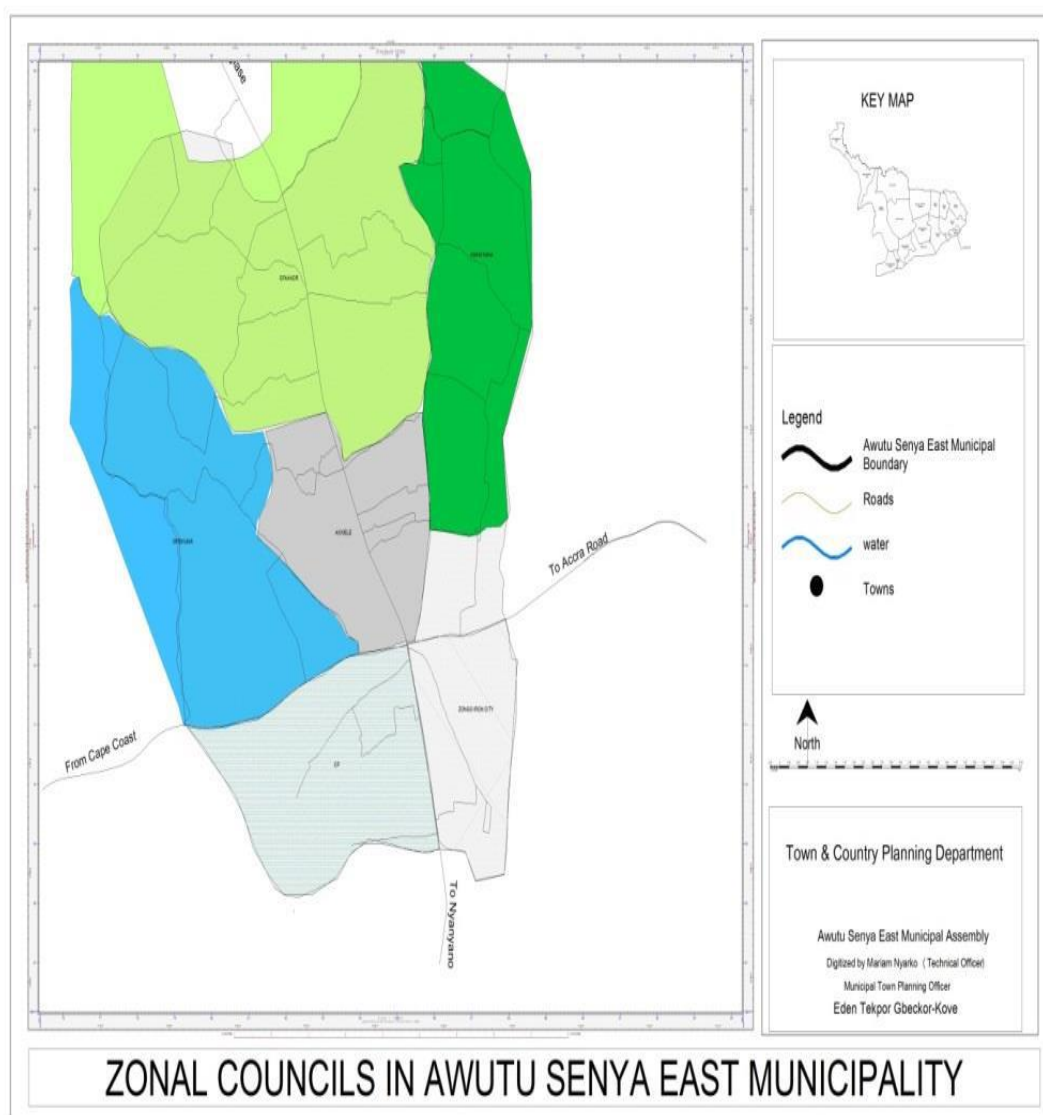
The Awutu Senya East Municipality is located in the Eastern part of the Central Region within Latitudes $5^{\circ}45$ south and $6^{\circ}00$ north and from Longitude $0^{\circ}20$ west to $0^{\circ}35$ East. It shares common boundaries with Ga South Municipal Assembly (in the Greater Accra Region) at the East, Awutu Senya District at the North and Gomoa East District at the West and South respectively. The Municipality covers a total land area of about 180 sq km about 18% of the total area of the Central Region (Ministry of Finance-Government of Ghana, 2013). Figure 3.1 presents Awutu Senya East in regional context.

Figure 3.1: Awutu Senya East in the Regional Context

Source: Ministry of Finance-Government of Ghana, 2014

3.2.2 Zonal Councils/Electoral Areas

Awutu Senya Municipal Assembly has been zoned into six (6) councils which are the same as the electoral areas. These are Kasoa Zonal Council, Kpormetey Zonal Council, Ofankor Zonal Council, Opeikuma Zonal Council, Akwetey Zonal Council and Walantu Zonal Council. These councils have chairpersons or assembly men and women who are responsible for the daily administration of their respective council jurisdiction. These chairpersons reports directly to the Municipal Chief Executive. Figure 3.2 presents the demarcation of the zonal councils.

Figure 3.2: Zonal Councils/Electoral Areas in Awutu-Senya Municipal Assembly

Source: Ministry of Finance-Government of Ghana, 2014

3.2.3 Major Settlements

Kasoa, the Municipal Capital is located at the south-easting part, about 31km off the Accra-Capital. The language mostly spoken is Akan. Other languages spoken include as Hausa, Ga, Ewe and English (the official language). Kasoa is said to be one of the fastest growing community in West Africa (Ministry of Finance, 2014). Other major settlements are Opeikuma, Adam Nana, Kpormetey, Ofankor, Akweley, Walantu and Zongo.

3.3 Research design

In this study quantitative and qualitative approaches were used. This was to ensure that the strengths of the individual methods compensate for the inherent weaknesses in each other (Teye, 2012). For instance the qualitative method enables researchers explain patterns in quantitative data sets (Creswell, 2009). Qualitative research paradigm generally includes methods that rely upon extensive in-depth interviews or focus group discussions that result in the collection of non-numerical data (Labuschgne, 2003), However, Bryman (2001) indicates that qualitative techniques do not allow for generalizations and predictions. On the other hand, quantitative techniques have the potential of providing the researcher with a lot of information obtained from a large sample of individuals at a relatively short period of time (Creswell, 2009). Nevertheless, the anticipated difficulty involved in quantitative technique includes ensuring that the questions are clear and unambiguous in order to get respondents to answer thoughtfully and honestly (Frankel & Alien, 2003). One other weakness in this technique is the fact that it does not provide opportunities for respondents to explain their responses (Bryman, 2001). Consequently, in this study the quantitative approach comprised a questionnaire survey of households whilst the qualitative approach comprised in-depth interviews of key informants namely assembly members, officers of waste management companies and district finance officers in order to understand the context of solid waste management from the perspectives of different stakeholders.

3.4 Data Collection Instruments

The main instruments that were used in the collection of data were a structured in-depth interview guide and a structured questionnaire (refer to appendix 1). The in-depth interview guide comprised questions targeted at collecting non-numerical data which

was used to explain patterns in the questionnaire data. On the other hand, the structured questionnaire comprised both closed and open ended questions. The questions on the questionnaire were answered by representatives of households in the selected community. The questionnaire was used to collect data related to the socio-demographic characteristics and solid waste management among selected households.

3.3 Sources of Data

Both primary and secondary sources of data were employed in this study.

3.3.1 Primary Data

The primary source of data is the type of data that is assembled from firsthand sources. These first hand sources include experiments, literary texts, surveys, artistic works and interviews. Primary sources of data provide the 'raw data' that the individual uses first to test the working hypothesis and then as evidence to support ones claims (Wayne and Booth (2008). In history, for example, primary sources include documents from the period or person you are studying, objects, maps, even clothing; in literature or philosophy, the main primary source is usually the text you are studying, and the data is the words on the page. In order to achieve the objectives of this study, primary source of data was obtained from field investigations through structured questionnaires that were administered to households, assembly members, waste management companies, individual house to house waste collectors and municipal finance officer.

3.3.2 Secondary Data

Secondary data were obtained from books, articles and internet sources to review literature. The secondary data also includes information from the District Medium Term

Development Plan (DMTDP), the 2013 and 2014 composite budget of the Municipal assembly. This data included the assembly's objective, strategies and activities of waste management. It also included the assembly's time frame and implementation, collaborators as well as its indicative cost involved in waste management. Secondary source of data was also obtained from waste management past records of companies and records of the Ministry of Local Government and Rural Development.

3.4 Sample Size

In all, 396 households were surveyed through the administration of questionnaires. The sample size (n) was determined by the mathematical formula:

$$n = \frac{N}{1 + N(\alpha^2)}$$

Where N is the population size = 26,325; α is the margin of error = 0.05 with confidence level of 95%. By substituting the values of N and α into the formula, we have:

$$n = \frac{26,325}{1 + 26,325(0.05^2)}$$

Hence the sample size, n = 394 households representatives. However, 396 households were sampled for the study.

A total of nine key informants were interviewed by in-depth interviews. These included six (6) assembly members, the municipal finance officer, and two officers each from Zoomlion Company Limited and Alliance Waste Company Limited.

3.5 Sampling Techniques

The following sampling techniques were employed to select the respondents for the study. These are: cluster, purposive, systematic and accidental sampling. The study area

is zoned into six electoral areas which were Zongo electoral area, Beakoye (CP) electoral area, Opeikuma Zonal Council, Otamins Zonal Council, Down Town electoral area and Walantu Zonal Council. These electoral areas for the purpose of this study are regarded as a cluster. The purposive sample was used to select the six assembly men responsible for each of these zones. Furthermore, systematic sampling technique was used to select houses in each area. The convenience sampling technique was employed to select the individuals within households to participate in the study. This sampling technique involved selecting respondents primarily on the basis of their availability and willingness to participate in the study. Also called accidental sampling/opportunity sampling, convenient sampling is a type of non-probability sampling technique which entails the sample being drawn from that part of the population which is close to hand. That is, the selected participant is readily available and it is convenient for both the researcher and the participant. The convenience sampling approach was employed because it is less time consuming and less burdensome to carry out. That is, the first adult to be contacted in each selected house will be made to complete the questionnaire for households. If the first adult contacted was not ready, the next available adult contacted was interviewed. Since some of respondents may not understand English language, people who understood both the English and Twi or Gawere trained and employed to help in the administration of the questionnaires.

3.6 Procedure

The selected participants (household members, assembly members, waste management companies, municipal finance officer and house to house waste collectors) were briefed on what the study was about. The briefing was done to ensure better understanding of the research by the participants. Participants were assured of the confidentiality of their

responses and they were told that the research was for academic purposes only. This helped to ensure that the participants gave as much as possible very honest answers. Additionally, the participants were informed that they can withdraw from the study even after consenting to participate. After the participants agree to participate in the study, they were handed the questionnaire to complete. For the participants who cannot read and write in English language, various research assistants were employed to translate the questions or statements within the questionnaires into a language that they understand best.

3.7 Ethical Considerations

As applicable in physical science research, social science research demands that the researcher should be ethically conscious. In the present research, the researcher ensured that ethical requirements are met. The researcher made sure that all participants of the study are informed of the purpose of the study. Their freedom to choose whether to participate or withdraw from the study will be assured. The identities of all participants in the study were also protected to ensure anonymity. Confidentiality of all participants was equally guaranteed. Furthermore, all sources of information that are used in the study were as much as possible acknowledged to avoid plagiarism.

3.8 Data Processing and Analysis

The administered questionnaires were cross-checked to ascertain their completeness and the accuracy of information provided to eliminate errors and take care of inconsistencies. The data was analyzed using Statistical Package for Social Sciences and Micro Soft Excel Software. Descriptive statistical tools such as mean, frequencies and descriptive

diagrams and tables were used in analyzing the data collected. The results are presented in frequency tables, bar charts, pie charts among others.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Introduction

This chapter presents results obtained from the analyses of the data. Descriptive statistical methods such as pie charts, bar graphs and frequency tables were used in the analyses of the data. The data collected sought to obtain information about types of solid waste generated in the Municipal Assembly, how people dispose of domestic waste, how frequently waste is collected and disposed-of, the cost involved, the resources that are available in collecting the waste generated and challenges faced by ASEMA when it comes to solid waste management.

4.2 Demographic characteristics of Respondents

The demographic characteristics of the respondents such as sex, educational background, location of stay within the municipality and occupation were investigated. Table 2 below presents a summary of the demographic characteristics of the respondents.

4.2.1 *Location of House*

The respondent households were drawn from six communities within the Awutu Senya East Municipal capital, Kasoa. The communities were Down Town, Opeikuma, Beakoye (CP), Wallantu, Otamens and Zongo. The number of household or respondents selected from a particular locality depends on the estimated population of the area. As illustrated in Table 4.1, the highest number of respondents was drawn from the Beakoye CP locality (35%), followed by Down Town (20%) with the least number of participants selected from Otamens (5%).

Table 4 1: Demographic Characteristics of Respondents

Location of House	Frequency	Percent
Down Town	80	20
Otamens	20	5
Opeikuma	26	7
Beakoye (CP) Kasoa	140	35
Walantu	60	15
Zongo	70	18
Total	396	100.0
Age	Frequency	Percent
20-29	81	20
30-39	147	38
40-49	129	31
50-54	39	10
Total	396	100.0
Occupation	Frequency	Percent
Farming	12	3
Petty trading	176	44
Business	143	36
Public Servants	62	16
Other, specify	3	1
Total	396	100.0
Sex	Frequency	Percent
Male	82	21
Female	314	79
Total	396	100.0

Source: Field work, September 2014

4.2.2 Age

The ages of the respondents range between 20 to 54 years. The ages were grouped into four groups: 20-29, 30-39, 40-49 and 50-54 as presented in Table 2. It observed that 37% of the respondents are aged between 30-39 years, 33% are aged between 40-49 years while 20% are aged between 20-29 years. A few of the respondents (10%) are aged between 50-54 years.

4.2.3 Sex

As illustrated in Table 2, higher percentages (79%) of respondents were females. This is because within the Ghanaian cultural setting, more females turn to deal with issues of sanitation and its related problems than their male counterparts. This obviously explains why most households selected preferred that female members answered the questionnaires that were circulated. In a related study undertaken in the WA municipality by Bowan et al (2014), it was found out that domestic waste management was perceived to be the responsibility of women in low and middle income residential areas,

4.3 Types of solid waste generated in Awutu-Senya Municipality

The households were asked to indicate the most generated type of solid waste in their homes. Adequate knowledge on the types of solid waste generated in the municipality will give the municipal waste management department and the various waste management companies a clear idea about the appropriate methods to be used for the management of waste. According to (USPS, 2000) the components of the waste stream would enable waste managers to know whether to use the integrated waste management model comprising reduce, recycle and reuse, combined with incineration and some level of land filling or source separation and composting. In order to investigate the types of

waste that is generated most in the homes the respondents were asked the following question “Which of the following types of waste do you generate most in your home?” From the responses the components of domestically generated solid waste include food waste, plastic waste, paper, wood, ashes, and grasses among others. Similarly, Eshun (2013) in a study in the KEEA Municipality pointed out that about 57% of respondents were of the view that plastic waste generation accounted for more than half of the total solid waste generation in the Municipality. The Table 4.2 presents the summary of responses given by the respondents.

Table 4.2: Summary of the most Domestic Solid Waste Generated in Awutu-Senya Municipality

Types of waste	Frequency	Percent
Plastics	238	60.1
Food Waste	43	10.9
Wood	37	9.3
Ashes	27	6.8
Grass	23	5.8
Glass	7	1.8
Paper	21	5.3
Total	396	100.0

Source: Field work, September 2014

It is seen from Table 4.2 that out of the 396 respondents, 238 constituting 60.1 %, stated that the most domestically generated waste is plastics whereas 43 (10.9 %) stated that food waste. Small proportions of respondents indicated respectively that paper (5.3 %),

grass (5.8 %), ashes (6.8 %), wood (9.3 %) and broken bottles or glass (1.8 %) respectively constituted the main components of their domestically generated waste. In his work, Oteng-Ababio (2011a) emphasizes that a study conducted regarding waste composition between 1989 and 1999 was consistent with existing literature which has organic material (such as food, yard trimming) being the most prevalent comprising about 67% of waste in the three research localities in Accra and Tema. Plastic material (such as plastic bottles and sachet bags) accounted for about 20%. Significantly, comparing the waste composition of Tema and Accra between 1989 and 1999 shows a reduction of organic waste content from 73% to 60% in 2000-2009 whilst plastic waste content surged from 3% to 8% within the same period (ibid). Perhaps this sharp contradiction can be attributed to the population increase of the area combined with the excessive use of plastics with little or no governance system put in place to check the usage, collection and disposal of waste in the municipality. Scouting through the municipal capital, Kasoa, one would see skips and other open spaces, especially the market area full of heaps of solid waste mostly plastic. It is confirmation that plastics bags is the most common product used in the packaging items including groceries, food toiletries within the municipality. However, a study done by Asase et. al. (2009) indicates plastic waste generation of 4% in the Kumasi metropolis which is in sharp contrast with 60% of domestically generated plastic waste in the Awutu Senya Municipality. This difference in plastic waste composition may be attributed to the population size and the level of activities of the inhabitants of these two areas. The composition of waste is also confirmed by observation made by Tchobanoglous et. al. (1993) and the Centre for Environment and Development (2003) that household solid waste largely includes the following items: food waste, rubbish, ashes and residues among others. This also confirms the Dhaka City Corporation (1999) study which found

that solid waste components, although vary widely with the location and season of the year, include food wastes, paper, plastic, cloths, metal, glass, construction materials and others. The composition of waste is mostly a mixture of various materials and Asase et al (2009) clarifies that the composition of waste in Kumasi is predominantly made up of biodegradable and a high percentage of inert materials as well which corroborate with the composition of waste in the Awutu Senya Municipality.

4.4 Waste Management methods: Separation and Reuse

The respondents were asked to indicate whether they separate and reuse the solid waste that they generate domestically. All the household respondents indicated they do not separate waste into various forms by responding “No” to the question “Do you separate the waste generated in your household into various forms?” This means that among all households sampled, none of them separate solid waste into plastics, wood, metals, food waste and glass or broken bottles, grass and wood waste. In a similar study conducted at the Ga East municipality (comprising Madina, Danfa, Taifa, and Dome) in Accra, Yoda et al (2014) attest that about 83% of respondents do not separate their waste before disposal. According to Fei-Baffoe et al (2014) solid waste ,mostly disposed in the Sekondi-Takoradi Metropolis does not go through any form processing or treatment because waste generated at the various households or point are of generation are bundled together without undergoing any form of waste separation.

The respondents were further asked whether they reuse some of the waste that is generated domestically. This is summarized in Table 4.3

Table 4.3: Distribution of Respondents Reuse of Solid Waste

Response	Frequency	Percent
No	350	88
Yes	46	12
Total	396	100.0

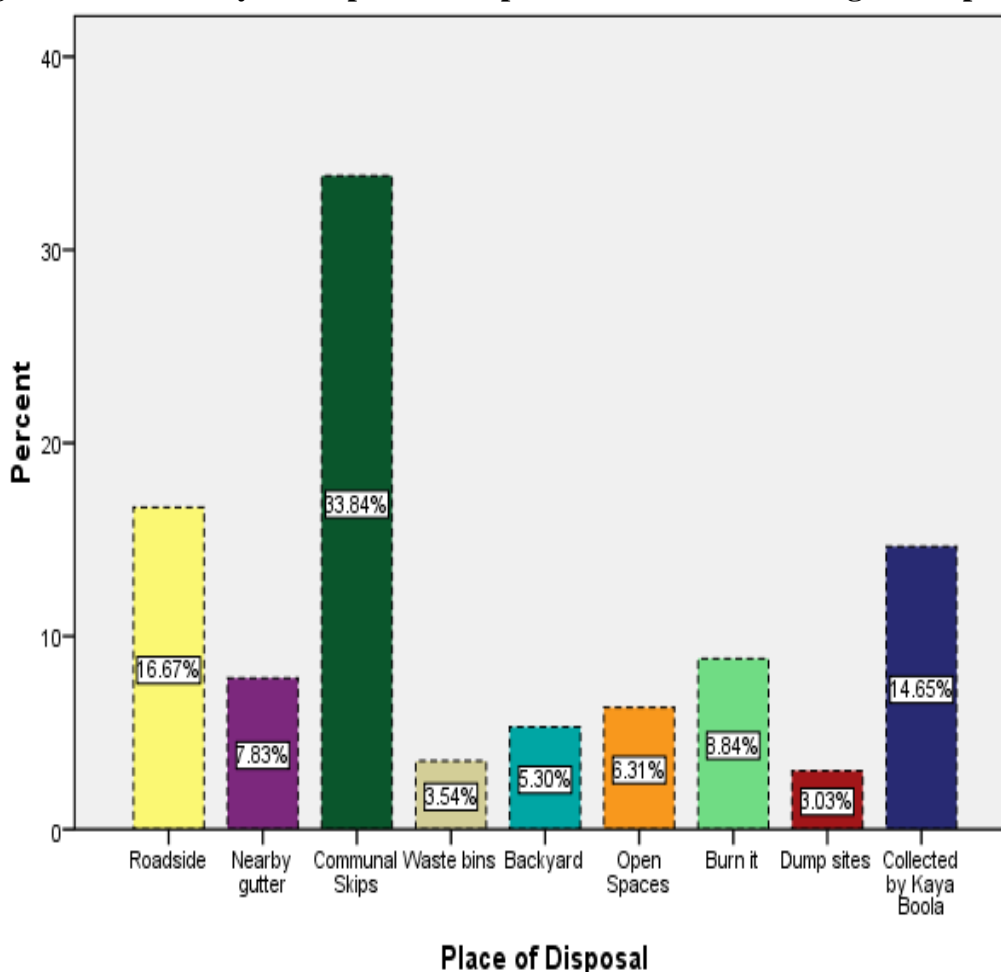
Source: Field work, September 2014

It is observed from Table 4.3 that significant number of the respondents (88%) do not reuse the solid waste generated. It is only 12% that reuse some of the waste generated. This implies that all the solid waste generated by households is disposed off either by burning in open spaces, drains, communal skips and other methods indicated in the next section. This observation is not in conformity with Read (2003) who proposed that in practice solid waste management must combine many different methods based on an integrated system. The organic aspects of the solid waste for instant could be used for composting instead of buying inorganic fertilizers for their backyard gardens which some of the residents use for the cultivation of vegetables. It implies that many of such organic waste may end up being dumped in open spaces or gutters resulting in choky gutters. The current results also do not support the observation by Tsiboe and Marbel (2004) that for efficient waste management, households should separate their domestic solid waste into glass, paper, plastic categories; thereby enabling easy collection and consequently reuse. This effectively minimizes solid waste generation through source reduction. In a related study, Oteng-Ababio (2011b) found out that the system of household solid waste collection in the Greater Accra Metropolitan Area (GAMA) does not encourage source separation.

4.5 Place of solid waste disposal by households

One important aspect of solid waste management is the process of disposal of the solid waste generated by household. Positive externalities exist in proper solid waste disposal, since the whole community receives health and safety benefits from the proper disposal by others. Knowledge of where the households dispose of their domestic solid waste provides a clear indication of the kind of management system that is in place for solid waste management. Figure 4.1 presents a summary of the place of disposal of solid waste among the respondents.

Figure 4.1: Summary of the place of disposal of solid waste among the respondents



Source: Field work, September 2014

It is observed from Figure 4.1 above that 34% of the respondents stated that they dispose of their domestically generated waste in communal skips. The use of skips according to Puopiel (2010) (in a research conducted in the Tamale Metropolitan Assembly) is highly popular and patronized by residents of low class areas. Similarly, the findings in the Awutu Senya Municipal also indicate that places like Kasoa which is densely populated conform to the use of skip for their waste disposal. However, 17% disposed-of their waste along the road side, 15% said their waste is collected by mobile waste collectors “kaya bola”. Other places or methods of disposal by the respondents included nearby gutter (8%), burn it (9%), open spaces (6%), backyard (5%), waste bins (4%) and dump sites (3%). Indeed these trends of waste disposal has been emphasized by various scholars including The result show that less than half of the respondents (40%) disposed-of their waste appropriately in places as like in communal skips, waste bins and dump sites. They dispose of their waste in open spaces, gutters, road sides, backyards or by burning it. This explains why many parts of the municipal capital, Kasoa are littered with solid waste making these parts very filthy, unsightly and unhealthy. Plate 1 shows on-street dumping of solid waste within the Down Town Community in Kasoa.

Plate 1: Plate Showing On-Street Dumping of Solid within Kasoa Township



Source: Field work, December 2014

This finding is consistent with the observations of Momoh and Oladebeye (2010) showed the methods of solid waste disposal include dumping of waste in gutters, drains, by roadside, unauthorized dumping sites and stream channels during raining season and burning of wastes on unapproved dumping sites is a common place in many towns and cities in Nigeria. This situation is emphasized Plate 2 also shows indiscriminate dumping of waste which resulted in choking of a storm drain within the Kasoa Township.

Plate 2: Indiscriminate Waste Dumping resulting in Choking of Storm Drain by Solid Waste in Kasoa Township



Source: Field work, December 2014

Usually, the indiscriminate dumping is disguisedly done usually at night, though in some cases it could even be done during the day. Indiscriminate dumping of solid waste is seemingly becoming the order of the day as it is practiced by many people. There seems to be little care taken by people when it comes to where solid waste should be disposed of. The respondents revealed that for some people, any open place under no activity is taken to be a potential place for dumping of solid waste. The people continuously dump their solid in unapproved location. Even when prohibitive notices are placed at these sites, the people continue to dump the waste there when they are not seen. Some of the residents also feel that once the municipal authorities have employed sanitation workers, popularly known as “Zoom Lion”, they have the mandate to keep the municipality clean and not the residents themselves. The structures for enforcement of sanitation regulations are also with no one to ensure the culprits are fined. The concerned community members

do not have the authority to arrest and punish those who break the norms for proper solid waste management. This may explain why illegal solid waste dumping sites continue to be a common phenomenon. Residents are not obliged to police the area, once a dumping site is not in proximity to their properties. Plate 3 shows one of the indiscriminate disposal sites in an open space in Opeikuma community in Kasoa.

Plate 3: Indiscriminate disposal of solid waste in Opeikuma Community Kasoa



Source: Field work, September 2014

Nogarh (2007) indicated that the incidence of many infectious and transmittable diseases in our communities is attributable to the deplorable state of waste management in the country. The unhygienic state of many town and cities in Ghana, where solid waste have accumulated virtually everywhere, underscores great weakness in the solid waste management system. Diseases such as cholera, malaria diarrhea that can be prevented these days are on the increase because of poor sanitation (Nogarh, 2007).

4.6 Availability of domestic waste management facilities

The availability of facilities has a very strong correlation with the level of services that can be provided by the waste management department of the municipality or the waste management companies hired by the municipal assembly. In that vein assessing the capacity of the Waste Management Department of the municipality will enable conclusions to be drawn on their effectiveness. This is assessed by the number of communal waste containers or skips, waste bins available each of the communities. Six assembly members of the municipality and the personnel of municipal waste management department (MWMD) were interviewed for the availability and adequacy of communal waste collection facilities.

Table 4 4: Distribution of Communal Skips within the Municipal Capital

Locality	Number of Communal Skips	Number required as Stated by MWMD
Otamens	0	10
Zongo	2	8
Wallantu	-	5
Down Town	1	7
CP Kasoa or Beakoye	4	6
Opeikuma	0	6
Total	6	42

Source: Field work, September 2014

From Table 4.4, it is seen that all communities within the municipal capital do not have the required number of skips that would ensure proper disposal of solid waste. This table goes further to explain why almost 60% of the respondents who represented their respective households dispose of their domestic waste indiscriminately. Follow up

interviews conducted disclosed that most residents would prefer to dispose their waste properly, as most lament the nuisance caused by the filth within the municipal capital.

Since there are no legal places to dump solid waste, people find solace in dumping at any open place they find convenient. The municipal authorities seems to face a setback in deterring this illegal dumping because they would have to present an alternative place to the public, which is not available up to now. It is quite clear from the findings that the preferred type of waste management that is convenient to residents of Kasoa would be land filling. However, this is yet to be put in place leaving a dire need for such facilities at the moment. This means that there is little consideration for the first activities in the integrated strategy for solid waste management as outlined by USEPA (2002) but rather the last which is land filling. The people want communal waste containers stationed at strategic places so they can dump their waste in such bins, so the municipal waste management department trucks can pick them when they are full and take them to the landfills.

Obviously, if the skips were available, the discarded waste could be contained by disposing into skips. Plate 4 shows the open dumping of waste close to residential areas as a result of lack of skips.

Plate 3: Picture showing the practice of open dumping of solid waste at Ofankor, Kasoa



Source: Field work, September 2014

Residents of Ofankor and their assembly man indicated that this location formerly had a communal collection skip but was later moved for no apparent reason. This notwithstanding, residents continue to dump solid waste in the same location.

4.7 Influence of Place of Residence on Methods of Waste Disposal

The researcher investigated the location of house and methods of waste disposal used by residents. As presented in Table 4.5 there are differences in the location of the respondents and the methods they use for disposal of their solid waste. Among the 66 respondents who disposed of their waste at the road side, majority (65%) are from, Down Town. Additionally, 13% and 1% respectively dispose of their waste in the waste containers and waste bins. This may be largely because, there is only one communal skip

for a large area and there are also no waste bins in the community for them to dispose of their waste. It is also observed that about half (49%) of the respondents who live at CP Kasoa/Beakoye appropriately either in communal skips or waste bins. A chi square test was done to determine if the location of the residents has statistically significant influence on the methods of disposal.

The result is presented in Table 4.5.

Table 4.5: Cross tabulation of Place of Residence and disposal of waste by households

			Where do you dispose of your waste?								Total	
			Roadside	Nearby gutter	Communa l Skips	Waste bins	Backyard	Open Spaces	Burn it	Dump sites		Collected by Kaya Boola
Location of House	Down Town	Count	52	6	10	1	2	3	2	2	2	80
		% within Location of House	65.0%	7.5%	12.5%	1.2%	2.5%	3.8%	2.5%	2.5%	2.5%	100%
	Otamans	Count	3	3	9	0	1	0	0	2	2	20
		% within Location of House	15.0%	15.0%	45.0%	.0%	5.0%	.0%	.0%	10.0%	10.0%	100%
	Opeikuma	Count	1	1	12	0	1	2	0	1	8	26
		% within Location of House	3.8%	3.8%	46.2%	.0%	3.8%	7.7%	.0%	3.8%	30.8%	100%
	CP Kasoa	Count	5	7	54	14	11	5	18	1	25	140
		% within Location of House	3.6%	5.0%	38.6%	10.0%	7.9%	3.6%	12.9%	.7%	17.9%	100%
	Walantu	Count	0	10	13	1	2	12	10	3	9	60
		% within Location of House	.0%	16.7%	21.7%	1.7%	3.3%	20.0%	16.7%	5.0%	15.0%	100%
	Zongo	Count	5	4	34	0	4	3	5	1	14	70
		% within Location of House	7.1%	5.7%	48.6%	.0%	5.7%	4.3%	7.1%	1.4%	20.0%	100%
Total		Count	66	31	132	16	21	25	35	10	60	396
		% within Location of House	16.7%	7.8%	33.3%	4.0%	5.3%	6.3%	8.8%	2.5%	15.2%	100.0%

Table 4.6: Chi-Square Tests on the influence of Place of Residence and method of waste disposal by households

Test	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)
Pearson Chi-Square	256.167a	40	.000	.000
Likelihood Ratio	232.351	40	.000	.000
Fisher's Exact Test	.000			.000
Linear-by-Linear Association	40.105b	1	.000	.000
N of Valid Cases	396			

The minimum expected count is 51.

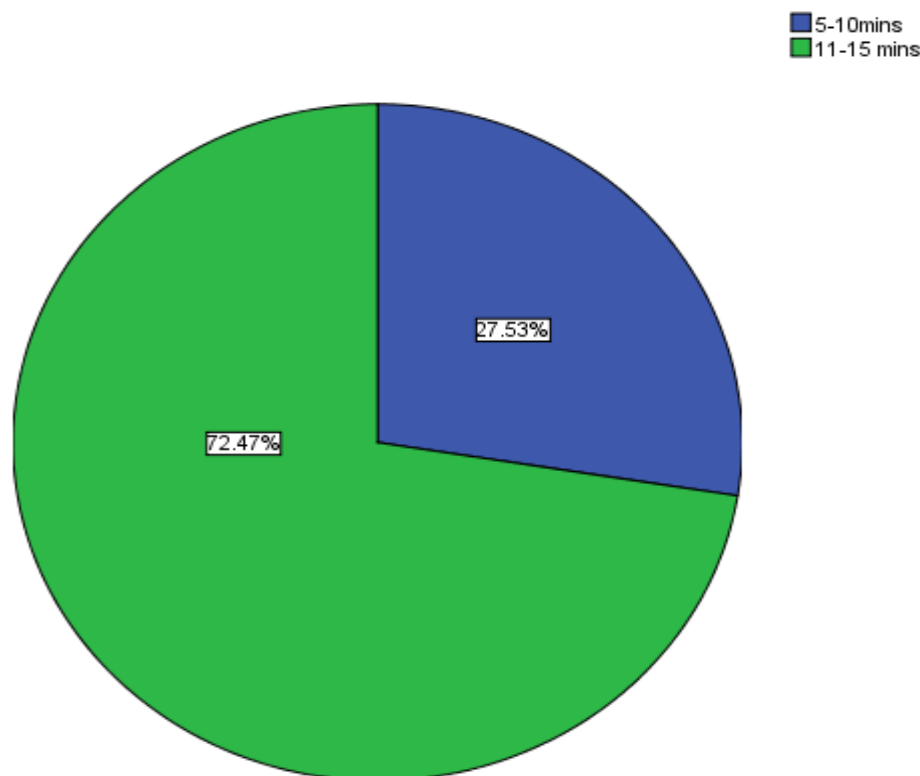
The Chi square test, as presented in Table 4.6 shows that place of residence has significant influence on the method of waste disposal χ^2 (df=40)=256, $p<.05$). As observed in Table 4.5 earlier, more than half (78 %) of the respondents who reside in Down Town and Walantu (65 %) respectively dispose of waste inappropriately while 46 % of respondents from Otamens and 42 % from Opeikuma respectively dispose of waste inappropriately. However, only 8 % of respondents who reside in residences CP Kasoa and 18 % of those in Zongo were found to dispose of waste inappropriately.

4.8 Time spent to dispose-off waste

The amount of time spent to dispose-off refuse is also likely to have significant influence on the behaviour of people. For instance, if the locations of communal skips are further away from houses, it creates a lot of inconvenience. People are therefore likely to dump at places they find convenient to them. The responses of the participants with respect to how long it

takes to dispose-off refuse in the skip containers available have been summarized in Figure 4.2.

Figure 4.2: How long it takes to dispose-off refuse in the skip containers



Source: Field work, September 2014

The Figure 4.2 above shows that 72.% of households who dump their waste in the communal skips spend between 11 to 15 minutes while 28% spend up to about 10 minutes to get to the skips. This clearly shows that most of the skip containers are not within acceptable walking distance from them. This is likely to create inconvenience for the residents and hence the likely to resort to indiscriminate dumping of solid waste. In addition, about 30 percent of the respondents have waste bins allocated to their household. The waste bins are allocated by the municipal waste management department on request by the individual households. However, those who have the bins indicated that even though the waste is supposed to be lifted every

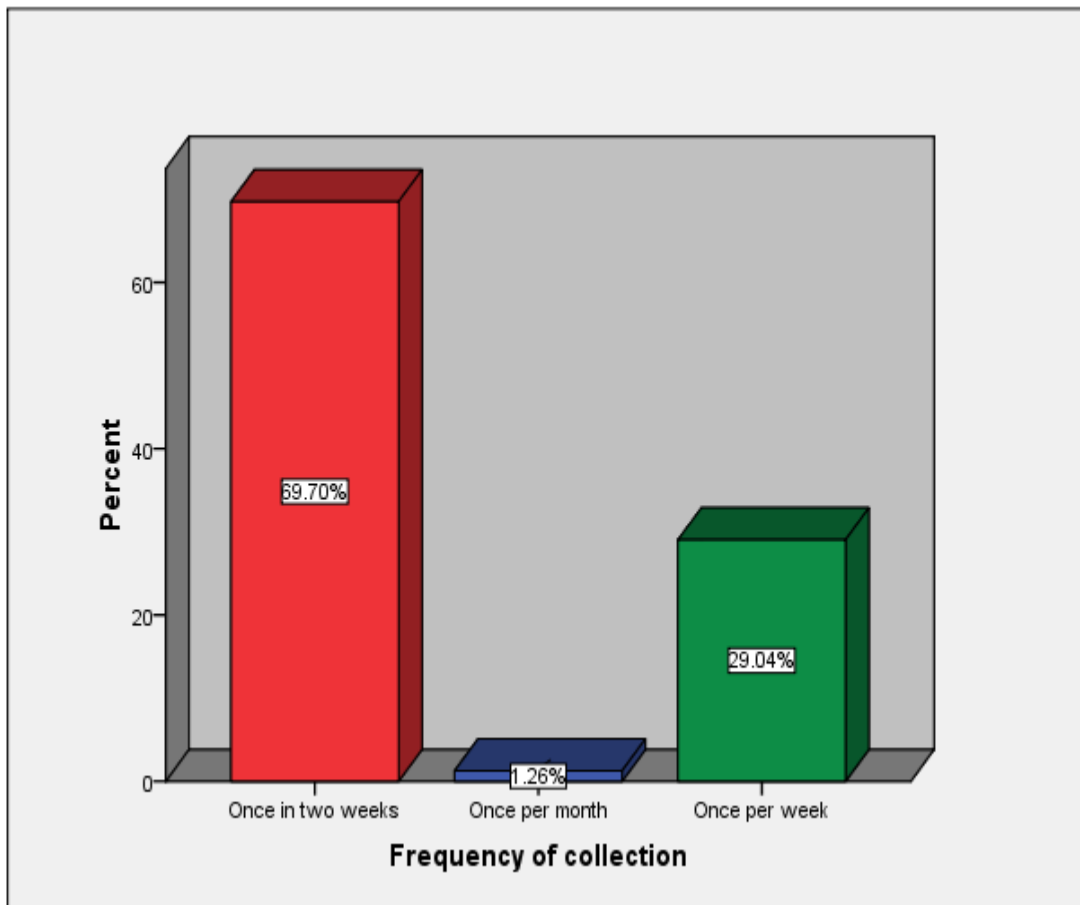
week, sometimes it takes up to about a month before the waste is lifted from their homes. This discouraged many residents not to apply for the bins for their households. The practice of leaving solid waste in the households for as long periods is unhygienic and poses very high health risks to the residents.

4.9 Door to Door waste Collectors (Kaya Bola)

There is the practice whereby individuals, referred to in the local parlance as “Kaya Boola” move from house to house in some localities to collect waste. They collect their waste using either mechanized tricycles or hand drawn trolleys and charge the households or individuals some fee. Majority of them use improvised non-mechanized trolleys and hence exert a lot of manual power to move them. Usually they charge the fee based on the volume of the waste to be lifted at a particular time. It is important to note that these individual mobile waste collectors end up dumping the waste at the communal skips. This is because it is very difficult to hand pull or push the waste to the land fill sites which are more than two kilometers away. Some residents also observed that some of the ‘kaya boola’ also end up illegally disposing of the waste they collect from the various homes.

4.10 Regularity of collection

The regularity of collection is an important component of solid waste collection. Factors such as availability and capacity of skips, population of the area among others need to be considered in determining how regular the waste is collected.

Figure 4.3: Regularity of waste collection

Source: Field work, September 2014

It is illustrated in Figure 4.3 that 70% of respondents stated that waste is collected from their community once every two weeks, while 29% stated that waste is collected once per week. A very small proportion, 1% stated that waste is collected once per month. The author did a follow up with the municipal waste management department to investigate reason behind this pattern of waste collection (emptying of communal skips). The authorities stated that there were no sufficient funds to ensure frequent collection of the waste. This situation is likely to lead to distasteful behaviors from the people. Some of these behaviors include dumping on the ground, instead of inside the container, and burning of the refuse in the containers, which were evident, especially in Market area which is presented in plate 5. The picture shows two skip containers within the Kasoa Market area which are overflowing with waste.

Plate 4: Photograph Showing Overflowing Skips at the Kasoa Market Area



Source: Field work, September 2014

4.11 Challenges facing Solid Waste Management

As part of the objectives of the study, the challenges facing solid waste management within the municipality was investigated. From the structured interviews conducted with the municipal waste management personnel, it was observed that the challenges facing the municipality with regard to solid waste management include:

1. Limited accessible roads to and from landfill sites,
2. Limited financial resources,
3. Low number of sanitation workers and
4. Limited equipment and waste management materials.
5. There is also limited dumpsite and hence the waste trucks have to travel far to other municipalities to offload the waste.

The waste compacting vehicles are very heavy. Municipal waste management personnel indicated that because of lack of motorable roads to landfill sites sometimes the waste

collection vehicles get stuck in mud, especially during rainy season. Sometimes it takes up to about two months to be towed out. For that reason, during rainy season the truck drivers avoid plying waterlogged roads and hence have to travel for farther distance to discharge the waste and this adds additional cost to the expenditure. There are limited financial resources for solid waste management in the municipality because it is quite a young one. This makes it hard to employ more sanitary workers and purchase modern equipment and materials for the purposes of waste management. Investigations reveal that the municipality has two aged waste collection vehicles and one of them was broken down and was at the mechanic shop at the time of the interview. This is consistent with the findings of Ogawa (2005) who indicated that very limited funds are provided to the solid waste management sector by governments in developing countries and hence the levels of services required for protection of public health and the environment are not attained.

4.12 Willingness to pay for Disposal

The willingness of the respondents to pay for waste management services was also assessed. All respondents also indicated that they have ever paid or they know others who have paid for their waste to be lifted by the municipal waste management department or door to door waste lifters. It is important that the recently introduced National Sanitation Day policy is implemented strictly to complement other by-laws of the municipal assembly to totally halt the indiscriminate disposal of refuse. Offenders should also be severely punished to serve as deterrent to other potential offenders. According to Baabereyir (2009), a study in Accra and Sekondi-Takoradi point out that there are few uniformed task force officers who seem to make little impact in preventing indiscriminate waste disposal in the two cities. “Even in their presence, people litter the streets without being arrested. At best, an offender will only be shouted at and asked to pick what he/she has dropped, an order most offenders do not obey”

(ibid). In the same study, it was found out that the assemblies have no special courts for waste disposal offences thereby relying on the regular courts to enforce the by-laws who however seem to regard waste disposal offences as trivial to merit attention.

The municipal authorities should also take advantage of the willingness of the residents to pay to effectively introduce the “pay as you dump” (PAYD) policy. This would help to generate more finance resources to augment the meagre resources of the municipality. A similar policy introduced in James Town, Ussher Town, and Zongo where charges were levied depending on the size of one’s bucket did not work thereby encouraging people to dump their solid waste into gutters and drains and eventually leading to the system being abolished (Tsiboe et al 2004).

4.13 Summary of Findings

From the results presented above it is observed that the number of communal waste collections containers is woefully inadequate. Many of the residents also do not dispose of their waste in appropriate manner. They burn, bury or throw the garbage into drainages and other unapproved places. This is mainly responsible for insanitary conditions within the district capital. This then raises the question of governance and waste disposal problems in almost every region across the country. A study by Tsiboe et al (2004) in Accra revealed that the municipal authorities have not been able to keep pace with the rapid accumulation of waste resulting in waste being found in gutters, drains, and rivers in Accra.

A report by the Environmental Protection Agency (EPA, 2004) states that, “municipal solid waste has been disposed of anywhere anyhow without regard to the nuisance and harm caused to the environment. All kinds of waste, regardless of their nature are being dumped indiscriminately into depressions, sand pits, old quarries, beaches, drains and even in certain areas along streets”. Indeed, this is an indication that the problem of waste disposal is a

national issue as the same pattern of disposal is observed between Accra municipality and the Awutu Senya municipality.

It was also observed that sometimes the containers overflow, allowing residents to dump their waste on the surrounding environment which sometimes became an eye sore. In addition, domestic animals and birds like cattle, dogs, fowls and pigs go to the place to feed on the waste. It was also observed that the location of households within the municipal capital significantly influence the methods used for waste disposal. Locations such as Zongo, Downtown and Walantu residents were found to inappropriately dispose of waste.

Finally, borrowing the words of Zia and Devadas (2007) it is concluded that to achieve financial sustainability, socio-economic and environmental goals in the field of municipal solid waste management, there is a need to systematically analyze the strengths and weaknesses of the community as well as the municipal assemblies capacities, based on which an effective decentralized system can be evolved with the participation of various stakeholders in Awutu Senya East Municipality

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary of findings

This study sought to critically assess the types of solid waste generated in the Awutu Senya Municipal Assembly. It also sought to identify how people dispose of domestic waste, how frequently waste is collected and disposed-of, the resources that are available in collecting the waste generated and challenges faced by ASEMA when it comes to solid waste management. In this chapter, a summary of main findings are presented. Also, the chapter draws conclusions from the main findings and makes some recommendations.

The study revealed that communal skip containers were woefully inadequate in Awutu Senya East Municipal Assembly Capital, Kasoa. This culminates into indiscriminate disposal of refuse. Indeed, as many as 59.59 % of the households resort to illegal methods of disposal. These include dumping refuse in open depressions, open spaces in front of their houses and their backyards, drains and also by burning it.

It is also observed that that a few skip containers are available for disposal and are in most occasions far (about 11 to 15 minutes' walk) from most households. Seventy-two percent of the respondents in the neighborhoods where skips were available reached the sites for between 11 to 15 minutes' walk and can inconvenience them. It was also observed that all respondents do not engage in separation and only a few (11 %) reuse the waste they generate. It means that the volume of the waste available for disposal is higher than it would have been if they had engaged in the separation and higher reuse of the waste generated.

It was also observed that solid waste management within the ASEMAs faces challenges such as inadequate financial resources, low number of sanitation workers, outdated and limited number of solid waste management and equipment. Since all respondents are willing to pay for improved sanitation services, this would serve as a good source of finance for the municipal authorities to upgrade their equipment and solid waste management materials.

5.2 Conclusions

The results obtained from the data collected from the research field established that there is serious solid waste management problem within the metropolis, the major causes being inadequate financial resources by the metropolitan assembly to provide the necessary waste resources which has led to indiscriminate disposal of garbage within the metropolis.

Many households and individuals burn, bury their garbage and throw the garbage into drainages and other unapproved places. Sanitation related diseases such as cholera and malaria affect most residents with malaria being the highest. The preferred method for garbage disposal is recycling (Zia and Devadas, 2007). It was also observed that sometimes the containers became overfull, allowing residents to dump their waste on the surrounding environment which sometimes became an eye sore. In addition, domestic animals and birds like cattle, dogs, fowls and pigs go to the place to feed on the waste.

Borrowing the words of Zia and Devadas (2007) it is concluded that to achieve financial sustainability, socio-economic and environmental goals in the field of municipal solid waste management, there is a need to systematically analyze the strengths and weaknesses of the community as well as the municipal assemblies capacities, based on which an effective decentralized system can be evolved with the participation of various stakeholders in Awutu

Senya East Municipality. Sensitization of the community members is also essential to achieve the above objective. The public apathy can be altered by awareness building campaigns and educational measures. There is the need to act and act fast as many communities within Ghana today are already a hotbed of many contagious diseases (cholera, malaria, typhoid), most of which are caused by ineffective waste management. To prevent any epidemic and to make the communities healthy places-economically and environmentally, there is an urgent need for a well-defined strategic waste management plan and a strong implementation of the same.

5.3 Recommendations

In light of the findings the study makes the following recommendations:

1. The Awutu Senya East Municipal Assembly (ASEMA) should consider as a matter of priority the use of other methods of waste disposal and reduction strategies such as the use of food waste and other organic components of waste to generate compost for use in agriculture and incineration.
2. Furthermore, ASEMA should embark on a vigorous campaign for waste segregation since reusable or recyclable articles are not waste and can be used again and again before discarding. This can commence with institutions such as first and second cycles, tertiary institutions and in offices.
3. The ASEMA should widen the polluter pays principle in waste management where waste generators are made to pay for the disposal cost of the waste they generate by volume in the municipality. This will be a very useful waste management tool which when properly applied can generate sustainable funds while creating economic incentives for waste minimization at source.

4. Even though, this study endeavoured to cover most of the relevant aspects of the theme, solid waste management is a very broad and can therefore not be exhausted in a single research. For that matter, it is recommended that future research for instant should look at public private partnerships in solid waste management.
5. Though 'kaya boola' also served as a job creation opportunity, bad roads and uncollected skips where these 'kaya boola' are to dump their collections make them do otherwise; dislodging their wastes in uncompleted structures of individuals and in bushes later in the nights when most inhabitants in the communities are asleep.
6. Finally, it is recommended that the Municipality should embark on a vigorous public education on the health and social impact of poor waste management.

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APPENDIX: QUESTIONNAIRES**INSTITUTE OF STATISTICAL, SOCIAL AND ECONOMIC RESEARCH****UNIVERSITY OF GHANA****Topic: Sanitation Management in Awutu-Senya East Municipality****Introduction:**

I am investigating waste management in the Awutu Senya East Municipality. I will be very grateful if you could spend some minutes to complete this questionnaire. The research is mainly for academic purpose only and therefore responses given by you will be kept confidential. Thank you.

Questionnaire for Households

Location of House:

House Number (if available):

Date of Interview:.....

Questionnaire Number:

SECTION A**Background Information**

1. How old are you?
2. What is your highest level of education? [] None [] Primary [] Middle/J.S.S/J.H.S []
Secondary/Technical [] Vocational [] Training College [] Tertiary
3. What is your major Occupation? [] Farming [] Petty Trading [] Business []
Public servant [] Other, specify.....

4. What is the name of your locality.....

Please tick ONLY THE BOX of the response given or state responses briefly for questions/statements for which answers are not provided.

SECTION B

Place of Disposal of Household Waste

5. Which of the following types of waste do you generate in your home? (You can tick more than one answer) Food wastes Rubbish Ashes Other, specify:

.....

6. Do you separate the waste generated in you household into various forms?

Yes No

7. Do you reuse some of the waste items? Yes No

8. Where do you dispose-off your waste? Roadside

Nearby gutter Skips Waste bins Backyard

Open spaces Burn it Dump sites Collected by waste company or

“Kaya Boola” Other, specify:

9. If waste is collected by waste management company or “kaya boola”, do you pay as waste is collected? Yes No

10. If yes, on average how much are you charged per month? 5 Cedis

10 Cedis 15 Cedis 20 Cedis Other, specify:.....

11. Have you ever dumped your refuse at unapproved sites (anywhere else) because you did not have money to pay? Yes No

12. If waste is dumped in skip, approximately, how many minutes does it take

you to get to the site? 5-10mins 11-15mins 16-20mins 21-25 mins
More than 25mins.

13. If you travel more than 10mins to dispose-off the waste, does it inconvenience you? Yes No (If No, go to Q8)
14. If yes, what do you do with the waste? I dump them in..... Nearest Available space Nearest gutter Burn them Bury them Other, specify.....

SECTION C

Waste Collection by Waste management Institutions

15. Which waste management institution collects waste in your area for disposal
 Management Department (Metro. Assembly) Zoomlion
 None don't know (If none or don't know, skip to Q18) other, specify:
.....
16. How many times is the waste collected in a week? Not at all four times
 Once Twice Thrice Five times Throughout
17. What is the mode of collection of waste in your area?
Door-to-door Communal Curb Other, (specify):.....
18. If any of the modes, how many times a week? Not at all
Four times Once Twice Thrice Four times Throughout
19. Are you charged for the collection? Yes No
20. If yes (to question 13) How much? Indicate the amount in GH¢.....
21. Are you willing to pay for the disposal of the waste you generate?
 Yes No
22. If yes, how much are you willing to per for the waste you generate per month

2 Cedis between 3 to 5 Cedis between 6 to 10 cedis between 10 to 15 cedis Other, specify.....

23. If no to question 15, why? Briefly state.

24. In your own view, suggest methods or ways in which waste disposal can be effectively managed in your area (You can tick more than one answer)

Contributing to buy waste containers Paying for the disposal and collection of waste Stop dumping waste any how

Other (specify):.....

25. Are you able to do any of these? Yes No

26. If yes, mention those that you are able to carry out.

Contributing to buy waste containers Paying for the disposal and collection of waste Stop dumping waste any how

Other specify:

INSTITUTE OF STATISTICAL, SOCIAL AND ECONOMIC RESEARCH**UNIVERSITY OF GHANA****Topic: Sanitation Management in Awutu-Senya East Municipality****Introduction:**

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Questionnaire for Assembly Members

Name of Electoral Area.....

Location:

Date of Interview:

SECTION A

Please record answers in the spaces provided

Solid waste collection and disposal

1. What is the estimated population in the area (in figures):
2. Availability of dustbins and skips

Bins/Skips	Number Available	Number Required
Dustbins		
Skips		
Others:		

3. Are the skips and bins adequate? [] Yes []No

4. If the skips provided are not adequate, what happens to waste generated from households?

.....

5. Which waste management institution(s) manages the waste in the area? (If there is more than one mention all)

.....

6. How many times does the collection take place in a week?

.....

7. What is the mode of collection and the number of times waste is collected per week in the following listed sections in the municipality?

Name of Area	Mode of collection	Number of Waste bins required
Kasoa		
Kpormetey		
Walantu		
Ofankor		
Akertey		
Opeikuma		

8. Do the people pay for the cost of collection? []Yes []No

9. If yes, indicate the amount per house/household in GH¢

10. What is the mode of payment?

-
11. Are the people able to pay? []Yes []No
12. If No, what are the reasons?
- 1.....
- 2.....
- 3.....
- 4.....
13. What happens to the waste if the residents are not able to pay?
-
-
14. In your own view, what are some of the factors affecting effective waste management in the area?
- 1.....
- 2.....
- 3.....
- 4.....
15. Do you have any other relevant information regarding solid waste management in the area? (State them briefly).
- 1.....
- 2.....
- 3.....
- 4.....
16. Do you segregate the waste that is collected? [] Yes []No
17. Do reuse some of the waste that is collected? [] Yes []No
18. Do you recycle all or some of the waste that is collected []Yes []No
19. What do you do with the waste that is not reused or recycled
- Incinerate [] Dump at landfill site []

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Questionnaire for Revenue Officer/Accountant of the ASEMA**SECTION A**

Position of Respondent:

Date of Response:

SECTION B

Please record answers in the spaces provided

Revenue and solid waste management

1. How much revenue do you generate in a month? GH¢.....
2. How much do you spend on waste collection? GH¢.....
3. How much do you spend on acquiring waste management equipment?
GH¢.....
4. Amount spent on maintaining waste management equipment.
GH¢.....
5. How much common fund did you receive last year? GH¢.....

6. How much of that is spent on waste collection? GH¢.....
7. How much of that is spent on acquiring waste management equipment?
GH¢.....
8. How much was on maintaining waste management equipment?
GH¢.....
9. What are some of the challenges of managing solid waste in the municipality?
 - 1.....
 - 2.....
 - 3.....
 - 4.....
10. How can these challenges be overcome? (State them briefly)
 - 1.....
 - 2.....
 - 3.....
 - 4.....

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Questionnaire for Waste Management Department or Waste Collection Institution(s)

Position of Respondent:

Date of Response:

SECTION A

Please record answers in the spaces provided

Waste collection and disposal

1. What is the most common type of waste regularly generated in the area?
 Food waste Plastic waste Agricultural and animal waste Glass waste
 Wood Metal
 Other, specify
2. On the average, how many waste compactor truckloads of waste do you collect in your area of operation in a day. (In figures):
3. Do you segregate the waste before disposal? (Example plastics, woods, metals, glass, food waste among others) Yes No

4. If yes, indicate the reasons.
 - 1.....
 - 2.....
 - 3.....
 - 4.....
5. If no, why?
6. What are the major components of waste generated in the area? (Indicate by ranking using the scale 1st , 2nd 3rd, 4th 5th and 6th.

Major Component	Rank
Plastic	
Glass	
Wood	
Metals	
Food Waste	
Others.....	

7. What is the cost of collection per week? GH¢.....
8. Where do you dispose-off the waste collected from the various sections? Final disposal site)
9. What is the distance covered to final disposal site in kilometers?
.....
10. Is the distance a problem? []Yes []No
11. If yes, indicate the problems
 - 1.....
 - 2.....

3.....

4.....

12. How do these problems affect the frequency of waste disposal at the site?

1.....

2.....

3.....

4.....

13. What methods do you use in managing the solid waste generated in the area?

(If more than one indicate them) Composting

Recycling Incineration ISWM (Reduce, Reuse and Recycle/landfill/incinerate)

None

Other, (specify):.....

14. Why do you choose to use any of the method(s) for managing solid waste above? (Indicate the reasons in the spaces provided below).

1.....

2.....

3.....

4.....

SECTION B**Availability of Resources for Managing waste**

15. Waste collection and disposal equipment (Indicate the number available and the number needed)

Equipment	Number Available	Number Required
1.Dustbins		
2.Skips		
3.Obofo tricycle		
4.Motorist tricycle		
5.Graders		
6. Skip Loaders		
7.Compaction trucks		
8.Roll on/Roll off trucks		
9.Bulldozers		
10. Road sweepers		
11.Bulldozers		
12.Road sweepers		
14. Others:		

16. Availability of qualified personnel for managing waste (Technical Staff)

Technical Staff	Number	Qualification

17. In your view what are some of the problems facing the department in terms of managing waste? (List the most relevant four)

1.....

2.....

3.....

4.....

18. How can the problems be solved? (State them briefly)

1.....

2.....

3.....

4.....

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Questionnaire for Kaya Boola

Position of Respondent:

Date of Response:

SECTION A

Please record answers in the spaces provided

Waste collection and disposal

1. What is the most common type of waste regularly generated in the area?
 Food waste Plastic waste Agricultural and animal waste Glass waste Wood Metal
 Other, specify
2. On the average, how many waste compactor truckloads of waste do you collect in your area of operation in a day. (In figures):
3. Do you segregate the waste before disposal? (Example plastics, woods, metals, glass, food waste among others) Yes No

4. If yes, indicate the reasons.

1.....

2.....

3.....

4.....

5. If no,

why?.....

6. What are the major components of waste generated in the area? (Indicate by ranking using the scale 1st , 2nd 3rd, 4th 5th and 6th.

Major Component	Rank
Plastic	
Glass	
Wood	
Metals	
Food Waste	
Others.....	

7. What do pay to for the final disposal of the waste you collect from households? []Yes []No

8. If yes what is the cost of collection per week? GH¢.....

9. Where do you dispose-off the waste collected from the various sections?.....

10. What is the distance covered to final disposal site in kilometers?
.....

11. Is the distance a problem? []Yes []No

12. If yes, indicate the problems

1.....

2.....

3.....

4.....

13. How do these problems affect the frequency of waste disposal at the site?

1.....

2.....

3.....

4.....

14. What methods do you use in managing the solid waste generated in the area?

(If more than one indicate them) []Composting []Recycling []Incineration [

]ISWM (Reduce, Reuse and Recycle/landfill/incinerate) []None []Other,

(specify):.....

15. Why do you choose to use any of the method(s) for managing solid waste

above? (Indicate the reasons in the spaces provided below).

1.....

2.....

3.....

4.....