UNIVERSITY OF CAPE COAST

SOLID WASTE MANAGEMENT PRACTICES IN THE CAPE COAST METROPOLIS

BY

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UNIVERSITY OF CAPE COAST

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2010

DECLARATION

Candidate's Declaration

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

Candidate's Signature: …… Date: ……

Name: Michael Addo

Supervisor's Declaration

I hereby declare that the preparation and presentation of the dissertation were supervised in accordance with the guidelines on supervision of dissertation work laid down by the University of Cape Coast.

Supervisor's Signature:…… Date: ……

Name: Mr. Alex Somuah Obeng

ABSTRACT

This work examines solid waste management practices and the underlying factors responsible for the state of environmental sanitation in the Cape Coast Metropolis.

In all, 240 respondents were targeted for the study. These included opinion leaders, as well as other residents of the metropolis. Multi-stage sampling procedures were applied to generate the sample for the study. The main tools employed in gathering the data were well structured questionnaires and personal observation.

The outcome of the study revealed that increasing solid waste generation in the Cape Coast metropolis has not been accompanied with adequate sanitation facilities and management programmes. Notable among the waste management problems is inadequate operational funding from the assembly's budget allocation for the collection and disposal processes. As a result, most residents disposed of garbage indiscriminately.

The study recommended that to help improve the solid waste management situation; the Cape Coast Metropolitan Assembly should provide enough transfer stations in the various communities to minimize indiscriminate dumping of garbage.

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DEDICATION

This project work is dedicated to my family.

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LIST OF ACRONYMS

CCMA	Cape Coast Metropolitan Assembly
EPA	Environmental Protection Agency
FREQ	Frequency
IETC	International Environment Technology Center
GH¢	Ghana Cedi
GLSS	Ghana Living Standards Survey
MSW	Municipal Solid Waste
MSWM	Municipal Solid Waste Management
NEMA	National Environmental Management Authority
NIMBY	Not In My Backyard
NGO	Non-Governmental Organizations
OPD	Out Patient Department
SPSS	Statistical Product and Service Solution
SWM	Solid Waste Management
SW	Solid Waste
UN	United Nations
UNDP	United Nation Development Programme
UNEP	United Nations Environmental Programme
USEPA	United States Environmental Protection Agency

CHAPTER ONE

INTRODUCTION

Background to the study

The term Solid Waste (SW) may be used to refer to municipal waste and can be categorised into seven groups. They are residential (household or domestic waste), commercial, institutional, street sweeping, construction and demolition, sanitation and industrial wastes (Rushbrook and Pugh, 1999). While municipal solid waste refers to solid waste from houses, streets and public places, shops, offices, and hospitals which are very often the responsibility of municipal or other governmental authorities, solid waste from industrial processes are generally not considered “municipal”.

However, it should be taken into account when dealing with solid waste as they often end up in the municipal solid waste stream. Synonymous to solid waste are terms such as “garbage”, “trash”, “refuse” and “rubbish” (Zurbrugg, 2003).

The problem of solid waste management is not exclusively a Third World problem. The problem has attracted considerable attention in the United States of America. According to Brown (1980), “a key indicator of the United States’ material affluence is its volume of junk, garbage and other forms of solid waste. Most of it is in the form of agricultural, mineral and industrial waste.”

Figures from United States Bureau of the Census Statistical Abstract of United States (1994) revealed that in 1960, U.S. Municipalities accumulated 87.8 million metric tones of waste from residential, commercial and institutional disposers. These figures more than doubled to 195.7 million metric tones in 1990. In that year, municipalities accumulated 4.3 pounds of waste per person per day.

Currently, United States produces about 220 million tones of municipal solid waste each year. This equates to about 2 kilograms of trash per person per day or 0.73 tones per year (Enger and Smith, 2000). Paper, glass and plastics account for over half of the waste generated. While recycling efforts have been on since the 1980s, only a small percentage of municipal waste was recovered by recycling.

Rathje, Hughes, Willson, Tani, Artcher and Hunt (1992), found out that the garbage of nine out of ten houses sampled from Phoenix, USA contained aluminum cans, glass bottles, newsprint, and other easily recyclable materials. With extrapolating to the whole city, Rathje et al (1992) estimated that $2 million invaluable materials were being buried in landfills every year. Newsprint makes up the largest single item in the trash accounting for 16 per cent of what is discarded in a typical city. Together with cardboard, office paper and other related paper products account for about 38 per cent of the waste stream (Cunningham & Cunningham, 2002).

There are problems related to waste and its management all over the world. Waste that are not properly handled can habour disease carrying agents,

become air and water pollutants and pose serious health hazards both for the general public and for professionals engaged in waste collection and processing .

The Public Health Service of the United States of America (1999) has identified twenty-two human diseases that can be associated with solid waste. Examples include typhoid fever, cholera, dysentery, various diarrhoea, anthrax, tuberculosis, trachoma, plague, murine, leptospirosis, rickettsial pox, malaria, yellow fever, dengue, encephalitis filariasis and trichinosis among others. Trichinosis a parasitic infection of humans transmitted by pork was especially prevalent in the United States until laws began to prohibit the feeding of unsterilised garbage to hogs.

According to the United States Environmental Protection Agency (1997), there are many ecological damages caused by waste and its disposal. Among these are damages caused by incinerator emissions and outbreaks. Incinerator emissions and fire outbreaks contain dioxins and the oxides of sulphur and nitrogen, which are systemic toxins and can result in lung and respiratory diseases. Widespread pollution of surface and ground waters by leachate from land disposal sites have also been documented (U.S. EPA, 1977).

In developing countries, governments are still grappling with fundamentals of waste management. The problem with domestic waste is that they are produced in large quantities because of population growth, urbanisation and rising standards of living as the economy grows. The World Bank Report (1994) described the solid waste services in most developing countries as being

rudimentary. It was noted that most of the systems were virtually broken down and many areas were receiving no service or only periodic service.

According to Cunningham and Saigo (1997), Third World cities have enormous garbage disposal problems. Mexico City, the largest city in the World, generates some 10,000 tons of trash each day. Until recently, most of these torrents of waste were left in giant piles, exposed to the wind and rain, as well as rats, flies and other vermin. Manila in the Philippines has at least ten huge open dumps. The most notorious is called Smoky Mountains because of the constant smoldering fires. Thousands of people live and work on this 30- meter high heap of refuse. They spend their days sorting out the garbage for edible or recyclable materials. Health conditions are abysmal, but these people have nowhere to go.

Only 50% to 70% of urban residents in developing countries receive collection service despite the fact that solid waste management typically absorbs 20% to 50% of municipal revenues. Moreover, only 60% to 70% of the refuse is collected (Bartone and Janis, 1993). Thus, each year, over 100 million tons of waste accumulates in the cities of developing countries.

According to a United Nations Development Programme survey of 151 mayors of cities from around the world, the second most serious problem that city dwellers face (after unemployment) is insufficient solid waste disposal (UNDP 1997). Urban dwellers generally consume more resources than rural dwellers, and so generate large quantities of solid waste and sewage. For example, solid waste disposal is a major problem in urban African centres where more than half the populations now live.

Northern Africa is the most urbanized, while in Southern, Western and Central Africa urbanisation levels are still lower (about 33-37 percent). East Africa is the least urbanised sub-region with 23 percent (United Nations Populations Division, 2003). Solid waste management encompasses generation, collection, transportation and disposal of urban waste. Urban authorities have the responsibility to ensure safe, reliable and cost effective removal and disposal of solid waste, which takes up a large proportion of available resources, which are not adequate to cope with the magnitude of the problem (NEMA, 2001).

Unfortunately, public agents and urban authorities do not have adequate capacity to handle the increased solid waste mainly due to limited public budgets. Consequences of failure to remove solid waste finally are health hazards like tetanus, water and sanitary as well as environmental problems such as contamination and pollution in Uganda especially in urban centres (NEMA, 1998). The story in Ghana is not different; the expansion of towns and cities because of the increase in population and continuous rural-urban migration has led to the generation of large volumes of waste. Waste disposal constitutes serious problems in the towns and cities today.

In terms of sanitation, the UNDP Human Development Report (1996) ranked Ghana 129th out of 174 developing countries, where 9.5 million of her estimated 18 million populations were without access to good sanitation. This finding by the UNDP, has been confirmed by a recent report by Ghana Human Development Report 2007, which said; “Both solid and liquid waste disposal have been a source of concern as they contribute to a great deal of unsanitary

conditions in cities in Ghana. Nationally, about 58 percent of households dispose of their refuse at public dumpsites. About a quarter of households dispose of their solid waste elsewhere into valleys, pits, bushes, streams or river sides, open gutters or on undeveloped plots of land. About 8 percent burn, 4 percent bury while only about 5 percent of households have their solid waste collected in an organised way" (Ghana Human Development Report, 2007).

The World Bank and the Environmental Protection Agency (EPA), (1995), note that in the city of Accra alone an estimated 89 per cent of the population have no home garbage collection and 48 per cent share toilet facilities with more than 10 other households. In 1997, the Accra Metropolitan Assembly was compelled to cart heaps of refuse from 40 dumpsites in and around the metropolis to a landfill site. An estimated 14,470 metric tons of garbage was cleared from the dumpsites, some of which had not been cleared for over seven years. The exercise dubbed "Operation Clears All" was completed in three months at the cost of ¢300 million, which was a huge drain on the Metropolitan Assembly's finance (Mezikpi, 1997).

Aryeetey-Attoh (1998), observed that in 1998, only 3 per cent of solid waste in Accra ended up in the landfill. The remaining 97 per cent were either burnt by households or dumped elsewhere. One cannot help but be overcome by the strong stench emanating from the open gutters and heaps of garbage, visible along drains and streets, in the neighbourhoods, schools and commercial places. It was contented that the waste management Department of the Accra Metropolitan Authority needed funding and had to be resourced effectively to

cope with the waste management problem confronting the city (Buabeng and Okyere, 1997).

The proliferation of plastics, polyethylene and Styrofoam products in domestic and commercial activities has given a new dimension to the sanitation problem. The rising standard of living in Ghana for example has moved people from the use of environmentally friendly and biodegradable materials such as straw mattresses, paper carrier bags, 'leave wrappers', cane settees and stools to more complex substitutes. Foam mattresses, plastic chairs, polyethylene carrier bags, sachets for water containers and 'take–away' boxes, and other plastic packaging materials are widely in use. The extent of their usage and the indiscriminate and irresponsible disposal of these non-degradable materials have contributed immensely to the environmental hazards and health problems, as these serve as breeding grounds for mosquitoes and other vermin.

Cape Coast is a medium sized metropolis with a population of 118,106 (Ghana Statistical Service, 2002). It was the first national capital of the then Gold Coast (now Ghana).The removal of the seat of Government to Accra in 1877 marked the beginning of the economic decline of Cape Coast, a trend that has continued to this time. Cape Coast which used to be the third largest town in Ghana in 1960, declined to the sixth in 1970, the ninth in 1984 and the tenth in 2000.

Correspondingly, the population growth rate of the town, which was 1.8 per cent between 1970 and 1984, reduced to 1.39 per cent between 1984 and

2000, far lower than both the national urban growth rate and the general population growth rate (Ghana Statistical Service, 2002).

Kendie (1998) acknowledged that the low population growth rate of the town results from out-migration of the active labour as a result of poor economic base of Cape Coast and cannot be attributed to fertility decline. This creates a high dependency ratio, which in the face of few opportunities for employment entrench poverty. Certainly, this issue of poverty has grave consequences for environmental sanitation of the area.

Statement of the problem

Poor environmental sanitation in the Cape Coast Metropolis continues to pose a challenge to the Metropolitan Assembly. According to Sey-Haizel (1999), symptoms of the problem in Cape Coast are:

- A high incidence of defecation on beaches as well as disposal of refuse into the sea, the Fosu Lagoon and its surrounding wetlands.
- Tipping of raw human excreta into the sea by both Municipal Assembly and conservancy labourers and
- Indiscriminate dumping of refuse on the landscape.

The sanitation situation of Cape Coast even during the colonial era was nothing to write home about and colonial office records revealed that a major factor leading to the movement of the seat of government to Accra was Accra's reputation as the healthiest spot in Gold Coast at that time (Kendie, 1998).

Objectives of the study

This work aimed at examining the solid waste management practices in the Cape Coast Metropolis and the underlying factors responsible for the state of environmental sanitation in the Cape Coast Metropolis. The specific objectives were to:

- Examine current solid waste management practices in the Cape Coast Metropolis
- Assess the respondents' attitude towards solid waste management options.
- Identify problems associated with the current solid waste management practices
- Recommend ways that will improve and yield benefits in solid waste management process in the metropolis.

Research questions

The following research questions were addressed:

- What are the current solid waste management practices in the Cape Coast Metropolis?
- How do respondents' react to solid waste management options?
- What are the challenges/ problems associated with solid waste management practices in the Cape Coast Metropolis?
- Which ways can be used in solving the solid waste management problem in the metropolis?

Scope of the study

The study geographically, covered the area within the demarcated zone designated as the Cape Coast Metropolitan Area. It looked at solid waste management options being practiced by residents in the metropolis. It also looked at major factors affecting solid waste management within the Metropolis, namely, perceptions of the solid waste management problem within the metropolis, attitude towards various waste management options, income levels, and willingness to pay for waste management services in order to improve the situation. Finally, health implications of the condition on the residents and the way forward to solve the problem.

Significance of the study

The study provides information on solid waste management practices in the Cape Coast Metropolis. It is hoped that the findings of this study will help increase the awareness on issues pertaining to waste management for the community and policy makers especially at the local level. This awareness will help build initiatives to reduce the problem.

It will also serve as a reference point for District, Municipal and Metropolitan Assemblies and other organisations concerned with waste management. As it offers practical solution to the problems of waste management. Last, but not the least, it will also serve as a source of information by adding to existing knowledge.

Delimitation

There are many areas to research into when it comes to the issues of waste management. These issues may range from waste refinery governmental and individual support in waste management. In this study, however, the researcher focused on the solid waste management practices in the Cape Coast Metropolis. The finding of the research cannot be used to draw a generalized conclusion but can be used as basis for an introduction to further research.

Limitation

Limitations identified were time and finance constraints. Financing is an important part of every research work; it determines the pace at which programmes would run as well as the success of the project. Financing therefore constituted a major limitation to the study and prevented the coverage of a wider area for the study. In view of the above factors, the scope of this study was restricted to selected areas within the metropolis. This definitely affected the degree of accuracy of the generalisation and representativeness of the findings.

Again, since the data were collected with structured questionnaire and interview schedules, the problem of bias normally associated with all research, based on questionnaire and interview schedule could not be ruled out completely. For example, respondents could fake responses where their competence was at stake. Also worth mentioning, is that, the lower income class of residents seemed to be over-represented while the high-income group was under represented. This

was due to the low number of residents within high income and high number of residents within the low-income category in the study area

Organisation of the study

The dissertation is organised in five (5) chapters. Chapter one (1) deals with the background to the study and, statement of the problem, general and specific objectives of the study, statement of research questions, scope of the study, significance of the study, limitations of the study and ends with the definition of terms. Chapter two (2) deals with the review of related of literature and conceptual framework related to the topic under study. Chapter three (3), which deals with the methodology, discusses the methods used to collect data, sample size and methods used in selecting the sample from the population. Chapter four (4) focused on analysis and discussions, and Chapter five (5) discussed the summary of findings and presented conclusions and recommendations.

Definition of terms

Domestic Wastes – wastes generated in homes and may consist primarily of vegetables and other putrescible matter, paper, metals, textiles, plastics, glass etc.

Environment – the physical surroundings including air, water, land, natural resources, flora, fauna, humans and their interrelationships.

Industrial Wastes – solid wastes resulting from industrial processes and may include textile rejects, fish and canning wastes, wastes from demolition and construction activities, and agricultural farm wastes.

Refuse – domestic, urban and industrial solid waste not disposed of by water as the carrying capacity to differentiate it from liquid waste.

Waste management - collection, transportation, treatment, recycling and final disposal of wastes

Income categories - For the purpose of this study, Low income class refers to respondents whose net monthly income were below one hundred Ghana cedis (Gh¢ 100.00) in 2007. Middle-income category involves respondents whose net income were from Gh¢ 100.00 Gh¢ 150.00 and High income group refers to respondents with monthly income above Gh¢ 150.00 also in 2007.

CHAPTER TWO

REVIEW OF LITERATURE

Introduction

This section deals with review of available literature that was relevant to the subject matter. Specific areas reviewed included, general over view of solid waste management problem, types and sources of solid waste, problems and the challenges of waste management, strategies and options for sound waste management, factors influencing solid waste management in developing countries and policies on environmental sanitation in Ghana.

General overview of solid waste management problem

Municipal Solid Waste (MSW) management has become a major issue of concern for many developing nations. The problem has been compounded by rapid urbanisation rapidly taking place in many developing countries where 30-50% of populations are urban (Thomas-Hope, 1998). The management of solid waste is one of the challenges facing many urban areas in the world. Where there is an aggregation of human settlements with the potential to produce a large amount of solid waste, the collection, transfer and disposal of the waste has been generally assumed by municipal authorities in the developed world.

However, the format varies. In most urban areas, garbage is collected either by a government agency or by a private contractor, and this constitutes a basic and expected government function in the developed world (Zerbock, 2003).

Indeed the overall problem of MSW is multi-faceted. Many organizations, including the United Nations (UN) and various non governmental organisations (NGOs) advocate for an integrated approach to MSW management by identifying key stakeholders, specific issues which comprise important "stumbling blocks", and making recommendations based on appropriate technologies, local information, and pressing human and environmental health concerns (UNEP, 1996; Senkoro, 2003; Thomas-Hope, 1998).

Municipal solid waste: A growing problem

Lave, Hendrickson, Conway-Scheme and McMichael (1999), described a broad definition of Municipal Solid Waste (MSW) as including all post consumer waste that ordinarily would be sent to landfill. According to Beall (1997), solid waste is the solid or non-liquid, post-consumer and post-production residue from residential households; commercial establishments such as shops and offices; institutions such as schools, hospitals, government offices; market waste and street sweepings; and waste from productive enterprises and industry.

More recent definitions of waste itself stress that waste is a potential resource that has not been safely recycled into the environment or the marketplace (UNEP-IETC, 2003; Vesiland, Worrell & Reinhart, 2002). Resource conservation now includes materials within the waste stream as a potential resource, which requires efficient resource recovery and management through initiatives like

recycling and reuse. Municipal solid waste can be difficult to manage due to its diverse nature, which can vary in the composition of the waste, the range of materials collected (glass, paper, plastics and organics), seasonal variations in waste quantities and type, and differences in geographic location i.e. urban areas to rural areas; and country to country (White, Franke & Hindle, 1995).

The United States of America tends to base its policy making towards waste management and related issues solely on economic considerations unlike the EU which bases its policy making with regard to waste management on economic and environmental factors (ISWA & UNEP, 2002). Cost Benefit Analysis (CBA) plays an important role in establishing the way that waste is handled and until recently, taking waste to landfill was still the most cost effective method of treating municipal solid waste in the United States.

Taylor, (2000) notes that, for most of the twentieth century, the United States treated municipal solid waste management as only collection and disposal. The past two decades has seen the emphasis of municipal solid waste management shift to include the aspect of sustainable waste management in the form of Integrated Waste Management Plans, which include resource recovery.

Most developing countries, Ghana inclusive, have solid waste management problems different from those found in fully industrialised countries; indeed, the very composition of their waste is different from that of ‘developed’ nations. Although developing countries’ solid waste generation rates average only 0.4 to 0.6 kg/person/day, as opposed to 0.7 to 1.8kg/person/day in fully

industrialized countries Blight & Mbande (1996), noted several common differences in the composition of solid waste in developing nations.

Urban solid waste problems

Problem areas of Municipal Solid waste management (MSWM) in developing countries can be identified. These are inadequate service coverage and operational inefficiencies of services; limited utilisation of recycling activities; inadequate landfill disposal, and inadequate management of hazardous and health waste. The quantity of waste arising – solid, liquid and gaseous are generally considered to be growing across the globe as a result of increase in the world's population, increasing industrialisation, increasing urbanisation and rising standards of living (UNEP, 1994).

Moreover, major advances in the development of new materials and chemicals have increased the diversity and complexity of the waste streams. Consequently, waste is taking on a new economic importance, not only in terms of revenues generated by the waste treatment and disposal industry, but also because waste may have a residual value as a secondary raw material that can be recovered or reused.

Population growth and urbanisation

Rapid population growth and urbanisation has seen many authorities unable to expand the growing demand for municipal services, which include waste management (Beall, 1997a; Onibokun & Kumuyi, 2004). The collection of waste is usually only conducted in the city centre or the more affluent areas of the

city. This service can be highly irregular with many parts of the city never actually benefiting from waste management services (Lusugga, 2004). The disposal of waste is often by way of illegal dumping on vacant land, dumping alongside roads or railway lines; into storm drains; or by burying or burning on the premises of the household (Beall, 1997a; Onibokun & Kumuyi, 2004).

The waste management situation in many economically developing countries at present is largely unsustainable. This is due to the lack of resources within urban management systems to tackle the problem of increasing waste generation associated with rapid urbanisation. Wyn (1997), refers to the waste situation in Calcutta, India, as inefficient with 30-40% of refuse collection vehicles being out of operation at any point in time.

Authors on the topic have highlighted many reasons for the mismanagement of waste within developing cities (Beall, 1997a; Haan, Coad & Lardinois, 1998; Lusugga, 2004; Onibokun & Kumuyi, 2004; Wyn, 1997). Problems include; the rapid increase in urbanisation, poor infrastructure (including vehicles), corruption of government officials, lack of finances, apathy of the people towards waste issues and lack of resources to pay for waste services, lack of planning, and general poor management. Open dumping is the most used method of disposing of waste within developing countries like Africa, Asia and Latin America (Johannessen & Boyer, 1999).

Recycling is conducted within developing cities as a means of a livelihood strategy for many poor people. This is largely in the form of informal recycling and waste picking from illegal dumps and landfill sites (Lusugga, 2004). Whilst in

developed countries waste salvagers do not feature in the waste sector; in developing countries, waste salvagers are considered to play a very important role in the recovery of recyclable materials and an important livelihood strategy for many people in urban environments living in poverty (Pacheco, 1992; Beall, 1997a).

Waste salvagers in economically developing countries are important because they lessen the burden on municipal authorities to collect and dispose of solid waste. Examples of this can be seen in Mexico and Karachi, where informal waste salvagers remove 10% of solid waste while in Bangalore it is 15% (Bartone, 1991 as cited in Beall, 1997a).

The status of waste workers within developing countries is very low and the work they do is considered a nuisance by other people and the government authorities (Drakakis-Smith, 1995). This is especially the case in caste class systems like those in India and Pakistan (Beall, 1997a; Furedy, 1992). It is not only the quantity of waste that is putting pressure on current waste management systems but also the composition of waste. The composition of waste appears to change with the economic situation within the area, city or country.

According to Drakakis-Smith (1995), as economic growth occurs, so the amount of waste generated per person increases, but increased economic wealth does not always translate into adequate waste treatment or disposal facilities. There are distinct differences in waste composition and waste disposal facilities between economically developed countries and economically developing countries. The former tends to have higher volumes of packaging waste and an

efficient waste management system, while the latter tends to have higher percentages of organic type waste (including ash, faeces and food waste) and a poor waste management system (Johannessen & Boyer, 1999). The Organisation for Economic Cooperation and Development (2004) and other organisations and authors are in agreement with the earlier statement by Drakakis-Smith that economic growth coupled with higher incomes per capita lead to higher consumption rates and waste generation (UNEP-IETC, 2003).

Many other factors are also thought to influence the increase in waste generated and the composition of this waste. Rapid population growth and population structure seems to have an effect on the amount of waste generated. Turkey is considered an economically developing country with the associated waste management system problems of other middle-income nations (Kocasoy, 2000). It is estimated that the amount of waste produced per person per day is about 0.95 kilograms, which has a high percentage of organic material (Metin, Erozturk & Neyim, 2003). The high organic content and moisture content of the waste received at open dumps cause high generation rates of leachate and associated gases like methane.

In 1991, the Solid Waste Control Regulation of Turkey was promulgated and sought to upgrade many of the open dumps around Turkey. The aim was to close down many of the open dumps and to build sanitary landfill sites in their place (Metin et, 2003).

Increases in population and consumption

Rapid urbanisation is troublesome from the perspective of the associated increase in solid waste. Understanding cities from a purely metabolic type output adds an interesting slant to the current discussion. Cities depend on outside sources (e.g. materials for shelter, food for consumption, energy for warmth and light) and sinks to assimilate waste materials from continuous production and consumption activities. Wolman (1966) attempted to quantify the flows of energy and materials into and out of an urban system and referred to the system as having an 'urban metabolism'. Alberti (1996) stated that the systematic analysis of urban sustainability needs to consider the direct transformation of the physical structure and habitat that the urban system is on; the use of natural resources both renewable and nonrenewable; the release of emissions and waste; and human health and well-being. Essentially, larger cities require larger sinks.

Over a period of almost 40 years the concept of 'city metabolism' has been developed and refined by authors like Wolman (1966) and Ayres and Simonis (1994). Metabolism in a biological sense refers to the internal processes of a living organism and natural ecosystems.

The natural ecosystem is situated in a larger natural environment that acts as a metabolic source and a metabolic sink and works in a series of energy flow linkages and the cycling of materials (Gasson, 2002). Metabolic sources refer to energy, materials and food required to sustain a population, and metabolic sink refers to the ability of the surrounding environment to assimilate and regenerate from the associated waste from producers and consumers within the natural

ecosystem. It uses self-regulatory mechanisms to keep populations in check and there is little waste within the natural cycle as all matter is used and re-used by organisms within the cycle (Linville & Davis, 1976).

The urban ecosystem, however, is not constrained by limited supply as the natural system might be. It can import what it needs from anywhere in order to meet the needs of the inhabitants (Mirage, 2003). Current urban systems are not cyclical, but linear in that waste materials are discarded and not re-introduced into the system as in natural cycles. It is this linear structure together with factors like improper urban management and planning which makes rapid urbanisation such a real threat when considering the damage on the urban and surrounding environment especially in terms of waste.

In economically developing countries, the increasing waste generation rates are mostly attributed to rapid urbanisation and population growth in the cities; and waste management systems that are inefficient to cope with increasing amounts of wastes in addition to the lack of appropriate technology to treat or dispose of the waste in an environmentally and economically sustainable manner (Johannessen & Boyer, 1999). It is also clear that the composition of waste in lower income countries is different from higher income countries in that the former contains a greater percentage of organic waste (Cooper, 2002). Although generation rates and the composition of waste within economically developing countries are different from that of economically developed countries, it does not mean that waste management is not a high priority. Poor waste management

practices are the cause of many environmental and social problems, which need to be addressed through an appropriate waste management system.

Inadequate coverage

Solid waste collection schemes of cities in developing countries generally serve only a limited part of the urban population. The majority of the people especially in slum areas remain without waste collection services. These are usually the low-income earners living in poor conditions in peri-urban areas. One of the main causes of inadequate collection services is the lack of financial resources to cope with the increasing amount of waste generated (Zurbrugg, 2003).

Operational inefficiencies

Operational inefficiencies are due to inefficient institutional structures, inefficient organisational procedures, or deficient management capacity of the institutions involved as well as the use of inappropriate technologies. With regard to the technical system, often the “conventional” collection approach, as developed and used in the industrialised countries, is applied in developing countries.

The vehicles used are sophisticated, expensive and difficult to operate and maintain thereby often inadequate for the conditions in developing countries. After a short time of operation, usually, only a small part of the vehicle fleet remains in operation. Transport also relies on operational vehicles, and frequent

breakdowns coupled with parts shortages immobilise collection vehicles for extended periods. For example, UNEP (1996) estimated that in cities in West Africa, up to 70% of collection/transfer vehicles might be out of action at any time.

Human health risks issues

There are some human health risks associated with solid waste handling and disposal in all countries to some degree, but certain problems are more acute and widespread in underdeveloped nations. Cointreau (1993), has classified these into four main categories; (1) presence of human faecal matter, (2) presence of potentially hazardous industrial waste, (3) the decomposition of solids into constituent chemicals which contaminate air and water systems, and (4) the air pollution caused by consistently burning dumps and methane release.

Human faecal matter is present in every solid waste system; in developing nations, the problem varies with the prevalence of adequate sanitary disposal systems such as municipal sewerage or on-site septic systems and outhouses. In areas where such facilities are lacking (especially shantytowns and over-crowded municipal districts), the amount of human faecal matter present in the solid waste stream is likely to be higher.

This presents a potential health problem not only to waste workers, but also to scavengers, other users of the same municipal drop-off point, and even small children who like to play in or around waste containers. Waste pickers are highly susceptible to disease. A proposal has been made to provide low cost or

free protective gear, such as gloves, boots, and clothing, to prevent contact injuries and reduce pathogens. Experience in Calcutta, India, however has shown that most gears are simply sold by the workers for cash, and they continue to work as before (UNEP, 1996). Provision of basic health care, especially immunisations, seem to be more promising.

Environmental issues

The decomposition of waste into constituent chemicals is a common source of local environmental pollution. This problem is especially acute in developing nations where very few existing landfills would meet acceptable environmental standards due to limited budgets.

The issues associated with rapid urbanisation again compound the problem. As land becomes scarce, human settlements encroach upon landfill space and local governments in some cases encourage new development directly on top of operating or recently closed landfills. A major environmental concern is gas released by decomposing garbage. Methane is a by-product of the anaerobic respiration of bacteria, and these bacteria thrive in landfills with high amounts of moisture. Methane concentrations can reach up to 50% of the composition of landfill gas at maximum anaerobic decomposition (Cointreau-Levine, 1996).

The urban solid waste challenge

The continual increase in municipal solid waste is not sustainable with the traditional urban waste management techniques. Appropriate waste management

systems are incredibly important from a health and safety perspective of the urban population. Literature available recognises that globally, there is an urban solid waste challenge.

Solid waste is a persistent global problem. Environmentally sound management of increasing amounts of solid waste is a major concern in all cities. In terms of treatment options, it is necessary to categorise the waste stream into the various sectors that produce waste, but an integrated approach to waste management is necessary. Waste sectors include agriculture and forestry; mining activities; manufacturing industries; energy production activities; water purification and distribution; construction; and municipal waste (OECD, 2002).

In most industrialised countries, the manufacturing sector produces the largest volume of waste. Japan's total waste tonnage is 451250 thousand tons; with the manufacturing sector contributing 26% (thousand tons) and the municipal waste sector contributing only 11% (51 450 thousand tons). Household waste may not generally constitute a large portion of waste that is produce, but it is still an important aspect of the waste stream due to its heterogeneous nature.

Waste is continually dumped onto the surrounding environment, concerns have been raised over the biosphere's ability to assimilate the constant and increasing volume of liquid, gaseous and solid waste, which has led to the build up of pollution in many parts of the world (White et, 1995). Municipal solid waste is among the waste that is raising the awareness of the associated problems of inadequate waste management systems. The problems associated with the mismanagement of municipal solid waste are numerous and affect social

dimensions, financial and environmental spheres (White et, 1995; Johannessen & Boyer, 1999).

Social dimensions of the mismanagement of waste

An appropriate waste management system is deemed important from a health and safety perspective in keeping the society free of disease spreading vermin and other health risks associated with the uncontrolled accumulation of waste (Addo-Yobo & Ali, 2003; White et al, 1995; Johannessen & Boyer, 1999). Historically, local municipalities (Massoud, El-Fadel & 2003) have provided urban solid waste services.

As the generation of solid waste has increased and the composition of waste diversified within cities around the world, municipalities have included private companies to help manage urban waste and waste related issues (Massoud et al, 2003). The success and failures of private-public partnerships is a hotly debated topic by many authors (Miraftab, 2004; Haan et al, 1998; Qotole, Xali & Barchiesi , 2001).

The situation in many economically developing countries is very different and urban residents depend on municipalities to manage the waste generated, or have no waste management system at all, relying on waste pickers or dumping to rid their residence of waste. The public service sector within economically developing countries do not have the resources to cope with increasing waste, which leads to a situation of the accumulation of waste in or close to urban areas in an uncontrolled manner.

The direct implications of mismanaged waste within an urban environment on a social level include the spread of diseases by rats and flies, odours from putrefying waste and the contamination of drinking water through the penetration of leachate into water resources.

Waste pickers and salvagers are common in developing countries and survive by collecting recyclables and other reusable items from the waste stream. In so doing, they play an important role in waste reduction within urban centres. However, they are seldomly protected from direct contact and injury from municipal waste, which can at times include hazardous waste, faecal waste and medical waste as all waste is generally treated in the same way and dumped in open dumpsites (Johannessen & Boyer, 1999). Besides the direct health implications of their work, the communities in which they live also stigmatise them as having a lower status (Pacheco, 1992; Furedy, 1992). Social dimensions of the mismanagement of waste are linked to the financial resources available for residents to pay for the waste removal service and municipal authorities to generate enough income and resources in order to provide the necessary waste services to the community.

Financial dimensions of the mismanagement of waste

Municipalities in low and middle-income countries allocate the majority of their solid waste management budget to collection and transportation services (Johannessen & Boyer**,** 1999). Final disposal costs are minimal because waste is usually discarded in open dumps. The city of Ahmedabad, India, spends 86% of

its solid waste budget on collection, 13% on transportation and only 1% on final disposal (Jain & Pant, 1994 as cited in Johannessen & Boyer, 1999).

Typically, 90% of Indonesian solid waste management budgets are allocated for activities related to collection: street sweeping, transportation and vehicle operation and maintenance. The financial implications of improving waste management systems can be a burden on the budgets of municipalities (ISWA, 2002; White et al, 1995; Gray, 1993). The cost is associated with 'end-of-pipe' solutions, which include the closure and remediation of unmanaged dumpsites and the construction of sanitary landfill sites and / or the construction of waste incinerators in the form of waste reduction strategies and recycling initiatives.

Environmental dimensions of the mismanagement of waste

Municipal solid waste management systems have dealt with the waste that society produces conventionally by dumping or burning. As societies have evolved and the waste generated changed with the changing lifestyles, traditional methodologies for waste handling have demanded a paradigm shift with regard to treatment. Environmental problems associated with mismanaged dump sites or landfill sites are leachate generation, odours, greenhouse gases (e.g. methane) and disease spreading vectors (e.g. flies and rats). Mismanaged dumpsites are very common in economically developing countries (White et al, 1995; Drakakis-Smith, 1995).

The high organic content and moisture content of the waste received at open dumps in developing countries can cause high generation rates of leachate

and associated gases like methane. Leachate and gases that are not controlled can lead to accidents. An example of this is seen in Turkey where accidents have occurred at two dumpsites around Istanbul. A dump slide covered a road adjacent to the site; and an explosion at another dumpsite killed 39 people (Kocasoy, 2000; Metin et al, 2003). Stricter controls and regulations in many economically developed countries like the European Union and the United States, have called for the closure of mismanaged dumpsites and the construction of sanitary landfill sites, which adhere to leachate controls and gas management procedures to mitigate possible impacts from the site (European Union, 2004; European Commission, 1999).

Solid waste management in Ghana

The high population and its associated increase in urbanisation and economic activities in Accra has made the impact of the society's solid waste very noticeable. The urban areas of Accra produce about 760,000 tons of municipal solid waste (MSW) per year or approximately 2000 metric tons per day (EPA, 2002). According to the EPA (2002), by 2025, this figure is expected to increase to 1.8 million tons per year, or 4000 metric tons per day. These estimates and real values are probably more than these quantities. According to the Government of Ghana (2003), the Accra Metropolitan Assembly (AMA) spends about two billion cedis per month (about $227,000) on waste collection alone and about 12 billion cedis per year on urban solid waste management. This amount does not however cater for about 30 per cent of solid waste in the metropolis (EPA, 2002).

Johannessen and Boyer (1999) observed that the design and optimisation of solid waste management technologies and practices that aim at maximising the yield of valuable products from waste, as well as minimizing the environmental effects have had little or no consideration in the Africa region. They also noticed that while there is potential for productive uses of landfill gas for instance, most landfills in Africa do not practice gas recovery except one landfill in South Africa where active pumping and flaring of landfill gas is practiced.

Johannessen and Boyer (1999) again found out that in the major cities of Ghana (Accra, Kumasi, and Takoradi) 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 these three major cities (Government of Ghana, 2003). The inadequate information on quantification and characterisation of waste; health, social, economics and environmental impact of municipal solid waste management is a common occurrence in Ghana.

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), municipal solid waste disposal practices in the country have not been environmentally friendly.

Problems associated with utilities such as water, electricity and communication services are treated with importance so that society may have clean and adequate water, constant energy flow at homes and offices and constant communication for effective business. Nevertheless, the problems associated with solid waste have not been handled in a similar manner (Anomanyo, 2004).

Röhrs, Fourie and Blight (1999), identified that in addition to the low level of infrastructure in developing countries, waste management is perceived to be less important than the provision of other municipal services. Waste management is one of the public infrastructure that is based on a specific type of physical infrastructure to provide the goods or services, and in this respect, it resembles the electricity, natural gas, and water sector (Dijkema, Reuter & Verhoef , 2000).

The problem of solid waste in Cape Coast has been characterised by single and ad hoc solutions such as mobilising people to collect waste and desilt chocked gutters after a flood disaster or for an occasion; temporal allocation of waste collection contracts and dumping. Read (2003), observed that solid waste management is characterised by ready-made prescribed answers, with single-issue interest groups promoting a single solution, at the expense of others. The truth, he contended, is that no single solution can manage society's waste adequately.

The AMA is also faced with the problem of land acquisition for citing landfills as residents reject the citing of this facility – the 'Not In My Back Yard' or 'Build Absolutely Nothing Anywhere Near Anything' attitudes (Morrissey and Browne, 2004). This makes the sitting of waste treatment facilities quite difficult. With the gradual exhaustion of 'formal' dumping sites at Mallam, Djanman and

Oblogo, and the ever-increasing waste generation in the Accra metropolis, the AMA saw the need for the development of a landfill to cater for the solid waste. However, this landfill development at Kwabenya has resulted in public protestation that has kept the project on hold.

It is time therefore to establish a paradigm of waste management with a necessity of an integrated waste management system whereby collection/sorting, bioreactor treatment, recycling and composting of the municipal solid waste are incorporated. Read (2003) proposes that in practice solid waste management must combine many different methods based on an integrated system.

Environmental sanitation policy in Ghana

Due to the reason that the environment is the only source of livelihood for humans and animals as well, several policies are made to ensure its protection. In Ghana, such policies include National Environmental Policy (NEP) the National Environmental Action Plan (NEAP) and Environmental Sanitation Policy (ESP). The policy statement of the National Environmental Policy is that Environmental Protection in Ghana should be guided by preventive approach with the recognition that socio-economic development must be undertaken in such a way as to avoid the creation of environmental problems (Environmental Sanitation Policy 1999).

The purpose of these policies is to develop and maintain a clean, safe and pleasant physical environment in all human settlements, to promote the social, economic and physical well-being of all sections of the population (Ministry of

Local Government and Rural Development, (1999). The body that is charged to supervise the implementation of those policies is the Environmental Protection Agency of Ghana (EPA).

It is a recognised problem that less than 40% of urban residents in Ghana are served by solid waste collection services and even at places where the waste is collected; major part of the waste is disposed of in an insanitary manner, which is a threat to human health. In addition, less than 30% of the population has an acceptable household toilet facility (Ministry of Local Government and Rural Development, 1999).

These problems are mainly due to lack of a comprehensive policy that will assign responsibilities to various actors within the environment, weak and outdated, poorly enforced environmental sanitation regulations, inadequate allocation of resources for environmental sanitation service at the national, and district levels. Again, the professional workers like engineers, planners and administrators needed for effective planning, policy formulation and implementation are not adequate.

These shortcomings have necessitated the formulation of the Environmental Sanitation Strategy. The strategy provides for the establishment of a National Environmental Sanitation Day, which is to be observed one day in a year by all citizens. The strategy also involves the promotion of research to review sanitation technologies and adoption of cost recovery principles in planning and management of environment sanitation services (Ministry of Local

Government and Rural Development, 1999). The target is that the strategy will help achieve the following by the year 2020.

- That all solid waste generated in urban areas will be regularly collected and disposed of in adequately controlled landfills or by other environmentally acceptable means.
- That all excreta will be disposed of in a hygienically approved method by collection, treatment and off-site disposal system.
- All pan latrines will be phased out by the year 2010.
- At least 90% of the population should have access to acceptable domestic toilet and the remaining 10% should have access to hygienic public toilets.
- Hygienic public toilets would be provided for the transient population in all areas of intense public activities.

Solid waste management measures for district assemblies in Ghana

It is the primary responsibility of the District Assemblies to manage solid waste in the district though they can enter into contract or franchise agreement with private partners. They are to make sure that premises within their areas of control have primary storage facilities like dust bins to keep waste (refuse) and they are to provide collection services to areas within their domain, based on the principle of cost recovery depending on the household incomes, housing patterns and the infrastructure of the area. Where the peoples' ability to pay is low, service charge may be targeted as the recovery of operation and maintenance cost. Where it is not possible to render a house-to-house collection service the

assembly is to provide fixed or movable containers to serve as communal storage sites for the communities. The waste is to be collected at least twice a week.

Ministry of Local Government and Rural Development (1999) recommends the use of management alternative. It provides that, technology used for solid waste management should include sanitary landfill as it is a cost effective method of solid waste disposal and the use of controlled dumping with cover, as the most basic method and also the minimum requirement for all districts.

Incineration may also be used with or without energy recovery as a treatment option for clinical and other hazards or noxious waste. This should be consistent with sustainable operation under prevailing conditions. Composting is also recommended. It can be used at both district and domestic levels, where possible and recycling of items like plastics, bottles, papers, metals and glass can be used. This is the integrated waste management approach.

Hazardous waste including clinical waste materials is to be kept by the generators of such waste, but such waste is to be treated before storage where possible and the District Assembly or any other body approved by the Assembly shall collect such waste to be transported using closed non- compaction vehicles which shall be cleaned or disinfected at the end of every collection day. Such hazardous and or clinical waste is to be incinerated or buried in designated sectors of landfills or any other approval waste disposal sites.

Conceptual framework

In order to handle growing volumes of waste, the proper policies need to be enacted and implemented. In the developed world, the approach to waste management regarded as the most compatible with environmentally sustainable development is called “Integrated Waste Management.” This approach consists of a hierarchical and coordinated set of actions that reduce pollution, seeks to maximise recovery of reusable and recyclable materials, and protects human health and the environment. Integrated Waste Management aims to be socially desirable, economically viable and environmentally sound. The Integrated Waste Management approach, however, should be adapted to the local conditions when implemented in Third World cities. Integrated Waste Management has the following structure:

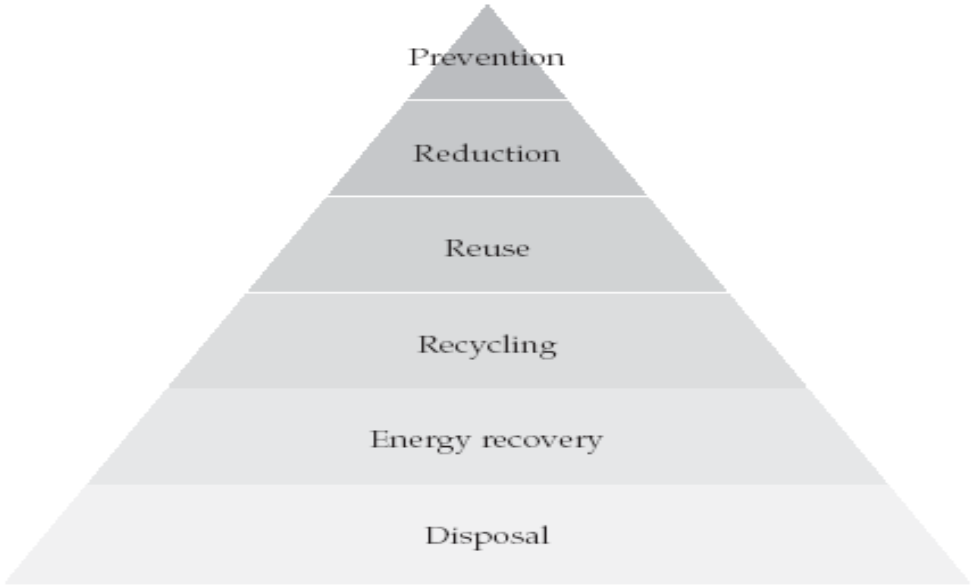

Figure 1: Integrated waste management hierarchy

Source: Sandec, 2004

Prevention/Reduction

Waste prevention is given the highest priority in Integrated Waste Management. This preventive action seeks to reduce the amount of waste that individuals, businesses and other organisations generate. By not creating waste, fewer collection vehicles and a fewer number of refuse collectors would be needed; fewer and smaller waste handling facilities would be required, and it would extend the life of the landfills. Society as a whole would benefit from a successful implementation of a waste prevention programme.

Reuse

Once the waste prevention programme has been implemented, the next priority in an Integrated Waste Management approach is promoting the reuse of products and materials. Reuse consists of the recovery of used items to be used again, perhaps after some cleaning and refurbishing. Reusing materials and products save energy and water, reduces pollution, and lessens society's consumption of natural resources compared to the use of single-use products and materials.

Reuse of materials and products is regarded as more socially desirable than recycling the same materials. Cardboard boxes that are used for shipping products, for example, can be folded and sent back to the manufacturer to be reused for shipping the same or other products. Cardboard boxes can also be recycled at paper mills, but in order to recycle the boxes, water and energy are required. Paper recycling also generates sludge in the process which needs to be disposed of.

Beverage bottles –soda or beer bottles– can be disposable, returnable (reusable) or recyclable. Reusable bottles have the lowest environmental impact of the three, while disposable bottles require the most energy, water and generate the largest amount of waste and pollution. Products such as office furniture and appliances can also be reused.

Recycling

After the reuse of materials and products, recycling comes next in the Integrated Waste Management hierarchy. Recycling is the recovery of materials for melting them, pulping them and reincorporating them as raw materials. It is technically feasible to recycle a large amount of materials, such as plastics, wood, metals, glass, textiles, paper, cardboard, rubber, ceramics, and leather. Besides technical feasibility and know how, demand determines the types and amounts of materials that are recycled in a particular region. Areas with a diversified economy and industrial base usually demand more different types of raw materials that can be recycled. In many African countries, artisans also constitute a significant source of demand for waste materials. African artisans and micro-entrepreneurs manufacture consumer products from waste materials, such as sandals, lamps, pots and pans.

Recycling can render social, economic, and environmental benefits. It provides an income to the scavengers who recover recyclable materials. Factories that consume recyclable materials can be built for a fraction of the cost of building plants that consume virgin materials. Recycling saves energy, water, and

generates less pollution than obtaining virgin raw materials, which translates into lower operating costs. Recycling also reduces the amount of waste that need to be collected, transported and disposed of, and extends the life of disposal facilities, which saves money to the municipalities. Recycling can result in a more competitive economy and a cleaner environment, and can contribute to a more sustainable development.

Composting

Composting is the process of aerobic biological decomposition of organic materials under controlled conditions of temperature, humidity and pH so that the result is a soil conditioner that can be used in landscaping, agriculture and horticultural projects. Considering the high proportion of organic matter in the waste generated in Third World cities (typically over 30%), composting can be an option to reduce the amount of waste that are land filled, thus extending their lifespan. When composting is conducted under controlled conditions, it does not generate odours and does not attract flies or other animals. Composting recycles nutrients by returning them back to the soil.

Incineration

In an Integrated Waste Management approach, incineration occupies the next to last priority, after waste prevention, reuse, recycling and composting have been undertaken. Incineration is the burning of waste under controlled conditions

usually carried out in an enclosed structure. Incineration may include energy recovery.

Sanitary land filling

Final disposal of waste at sanitary landfills is given the lowest priority in an Integrated Waste Management approach. A sanitary landfill is a facility designed specifically for the final disposal of waste that minimises the risks to human health and the environment associated with solid waste. Sanitary landfills commonly include one, two or three different liners at the bottom of the disposal area, in order to prevent leachate from polluting near by surface water or aquifers. Liners also prevent the underground movement of methane. Waste arriving at landfills is compacted and then covered with a layer of earth, usually every day. This prevents animals from having access to the organic matter to feed on.

Sanitary landfills may also include other pollution control measures such as collection and treatment of leachate and venting or flaring of methane. It is possible to produce electricity by burning the methane that landfills generate.

Disposing of all municipal waste collected at landfills is not desirable from a social, economic and environmental point of view. Sanitary landfills require significant investments and they often present political obstacles for their construction, due to local opposition. Residents who live near a proposed landfill may oppose its construction. This opposition is termed “Not in my backyard” Or NIMBY syndrome. Extending the life of landfills as much as possible by waste prevention, reuse, recycling and composting can make economic sense. Diverting

materials from landfills can also create jobs, reduce poverty, improve economic competitiveness, reduce pollution and conserve natural resources.

Sanitary landfills are necessary for final disposal of the waste that could not be prevented, reused, recycled or composted. Ideally, sanitary landfills should be used primarily for non-reusable, non-recyclable and non-compostable residues. Sanitary landfills constitute a dramatic improvement over disposal of waste in open dumps. Sanitary landfills greatly reduce pollution and risks to human health and the environment compared to open dumping.

Conclusions

Exploring the literature of urban waste management system highlights two major themes. Firstly, that there is an urban waste management problem in many cities of the world and problems associated with waste manifest themselves in different forms and in different places.

Secondly, that the urban waste problem is getting worse everywhere for a variety of reasons which are city or region specific. Clear distinctions and similarities can be noted between waste management systems in economically developed and developing countries. Distinctions include the amount of waste that is produced, the composition of the waste produced and the waste management system that is in place to deal with the waste generated. Similarities include rapid urbanisation and the increasing waste generation. Conventional ways and methods of managing waste are not sustainable.

In conclusion, all the problems and challenges identified in solid waste management in the literature reviewed above are also pertaining in the Cape Coast Metropolis.

CHAPTER THREE

METHODOLOGY

Introduction

This chapter deals with the description of the study area, research design, the target population, sources of data, the sampling procedure, data collection techniques and the duration for the data collection. It also looks at the pre- test strategy, the data processing and analysis, ethical consideration and the limitations of the study.

The study area

The Study area is Cape Coast Metropolitan Area (figure 2) in the Central Region of Ghana and it is one of the one hundred and seventy (170) administrative districts in Ghana. It serves as both a district capital of the Cape Coast Metropolitan Area as well as the Administrative capital of the Central Region. It was the first national capital of the then Gold Coast (now Ghana).The removal of the seat of Government to Accra in 1877 marked the beginning of the economic decline of Cape Coast, a trend that has continued to this time. Cape Coast which used to be the third largest town in Ghana in 1960, declined to the sixth in 1970, the ninth in 1984 and the tenth in 2000.

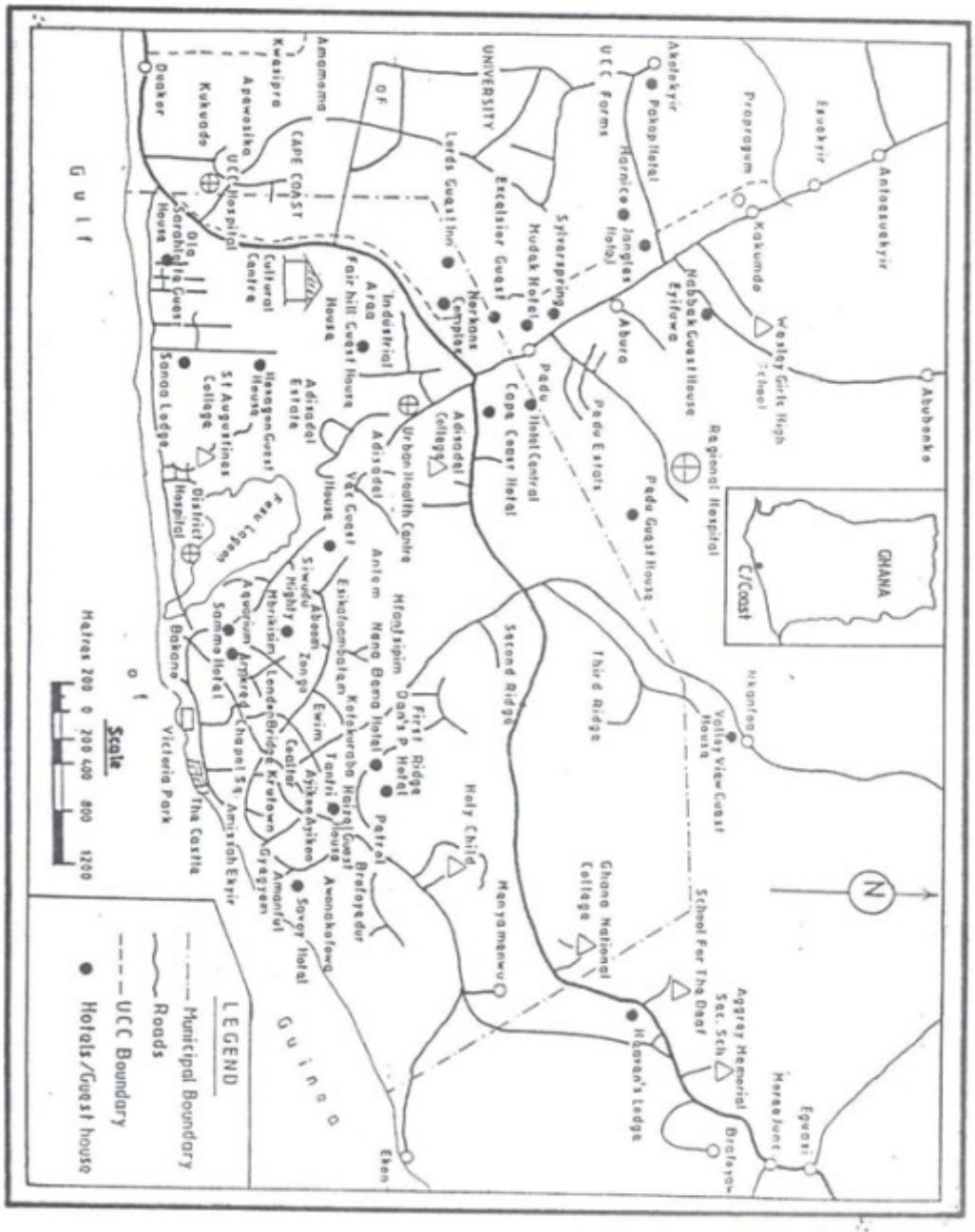

Figure 2: Map of Cape Coast Metropolitan Area showing the study area

Source: Department of Geography and Regional Planning, U.C.C. 2009

Correspondingly, the population growth rate of the town, which was 1.8 per cent between 1970 and 1984, reduced to 1.39 per cent between 1984 and 2000, far lower than both the national urban growth rate and the general population growth rate (Ghana Statistical Service).

According to Kendie (1998), the low population growth rate of the town results from out-migration of the active labour as of poor economic base of Cape Coast and cannot be attributed to fertility decline. This creates a high dependency ratio, which in the face of few opportunities for employment entrenches poverty. Certainly, this issue of poverty has grave consequences for environmental sanitation of the area.

The Metropolis, which occupies an area of 1700 square kilometers, is made up of 79 settlements. In 2000 the metropolis had a total population of 118,106 comprising 57,367 males (48.6%) and 60,741 females (51.4%) with a growth rate of 1.4 per cent, (Ghana Statistical Service, 2002).

A large floating student's population because of existence of many educational institutions and a seasonal influx of tourist compound the problem of insanitary conditions in the metropolis. These facilities include nine senior high schools, one technical institute, one polytechnic, one teacher training college, two nursing training colleges and a university. Also, there are two large castles that mirror the historical development of this country and which are classified by UNESCO as world heritage monuments. Increasing population adds to the problems of providing adequate sanitation. The student population adds up about

25,000 people to the metropolis' own population of 118,106 (Ghana Statistical Service, 2002).

The Metropolis is located 145 kilometers west of Accra and 84 kilometers, east of Takoradi. It is bounded on the south by the Gulf of Guinea and on the north by Twifo Heman –Lower Denkyira District. It is bounded on the west by Komenda-Edina-Eguafo-Abrem District and on the east by Abura-Asebu-Kwamankese District.

With its location, the Metropolis experiences relatively high temperature throughout the year and this has some implications for the Metropolis in its efforts to manage waste. The high temperature, coupled with the high relative humidity means increased rate of decomposition. Under such conditions, delayed disposal of waste which in most cases are highly organic in nature, and among other things would have disastrous effects on the quality of air and ultimately on health status of residents. In addition, the undulating nature of the topography of the area makes the spread of waste management facilities difficult.

Research design

The study is exploratory. Exploratory research is appropriate when there is not enough information available about the research subject. The design was chosen because considering the general objective of the study; it was the most appropriate design, which could lead the researcher to achieve the purpose and to draw a meaningful conclusion from the study with respect to solid waste management practices in the Cape Coast metropolis.

The target population

The study had as its target population all households in the Cape Coast metropolis. Individual members of the households who were eighteen years and above constituted the units of analysis. Also, within the target population were the workers of CCMA, Zoom Lion Ghana Limited and the Metropolitan Coordinating Director and the Metropolitan Chief Executive**.** The population size of the Metropolis by 2000 was 118,106 (Ghana Statistical Service, 2002). With an average household size of five (5), the total number of households in the Metropolitan area was estimated to be 23,621.

Residents of low income, middle and high-income classes within the seventy-nine (79) settlements in the metropolis occupied these households. Currently the population in the metropolis is estimated to be over 250,000 considering the growth rate of 1.4% with 44.6% of the population being above 18years.

Sources of data

The research involved the collection and analysis of data from both primary and secondary sources. The primary data was obtained from field studies undertaken in Cape Coast Metropolis using instruments such as questionnaire, structured interview schedule and personal observation. The main sources were residents of the Cape Coast Metropolis, Assembly Members and Opinion Leaders. Others were workers of Environmental Protection Agency (EPA), Cape Coast

Metropolitan Assembly (CCMA), Zoom Lion Ghana Limited as well as the Metropolitan Coordinating Director and the Metropolitan Chief Executive.

The sources of secondary data may be classified into two categories. The first source was data obtained from library materials, reports and records from institutions such as Kwame Nkrumah University of Science And Technology (Kumasi), University of Cape Coast (Cape Coast) and University of Ghana (Legon, Accra)

The second source constitute records obtained from the Cape Coast Metropolitan Assembly and Zoom Lion Ghana Limited on existing infrastructure, methods of waste management, revenue generation and expenditure, and labour force and equipment. Other data from these same sources were information on the type of facilities for the management of solid waste in the metropolis, for instance, transfer stations and disposal sites for solid waste. In addition, secondary data was obtained from the epidemiological unit of Ministry of Health, Cape Coast on records of patterns of diseases in the metropolis. Added to these, was a structural map that shows the direction and development pattern of Cape Coast.

Sampling procedures

Multi-stage sampling procedures were applied to generate the sample for the study. All residents who were 18years and above in the 79 communities in the metropolis, served as the population from which the sample was derived. According to Kendie, Ghartey and Akantapulsi (1997) “the Metropolitan area has become urbanised because of the rapid population increases of contiguous

settlements such as Abura, Pedu and Ekon and more recently Apewosika, Amamoma and Akotokyire".

Considering the heterogeneous occupational characteristics of the various settlements in the Metropolis, this research stratified the Metropolitan Area into five zones to reflect the dominant occupations of the inhabitants. The zones that were originally demarcated by Kendie, Ghartey and Akantapulsi (1997) were adopted. The five demarcated zones are namely: "Zone A, which comprises villages in the Northwestern reaches of the metropolis from Nyinasen to Kakomdo. This zone represents the predominantly farming communities in the metropolitan area. Zone B consists of communities along the Cape Coast –Jukwa road from Ayifua through Abura to Bakano. These communities provide accommodation for urban workers in the formal and informal sectors and many unemployed people. Zone C is made up of all communities along the coast from Ekon to O.L.A which represents the fishing communities in the metropolis. Zone D is made up of all satellite communities from Apewosika through the University of Cape Coast and Kwaprow to Nkanfua and the ridges. This zone represents a mix bag of high –class residential areas and largely working class and farming villages. Zone E covers the Mfantsipim, Kotokuraba and Tantri areas, which are the commercial sector of the Cape Coast Metropolis.

People who have different educational and occupational background, different sources and levels of income and therefore different expenditure patterns which make them homogenous, occupy these zones".

According to Kendie (2002) to keep within the boundaries of scientific enquiry, three factors are assumed to influence the selection process: the level of confidence desired the level of precision and the variability of the population. It is known that 44.6 per cent of the population were 18 years and above in the metropolis. A normal distribution curve of the population was assumed with a 95 per cent confidence level and an error tolerance level of 0.05. The sample size was determined using the formula:

$N= (z/e)^2 (p) (1-p)$

Where:

N= sample size

Z= standard score at 95 per cent confidence (1.96)

e= proportion of sampling error (0.05)

p= estimated proportion of incidence of cases (44.6%)

$N= (1.96/0.05)^2 (0.446)(0.554) = 380$

Thus, 380 respondents were supposed to be sampled but because of financial constraints 240 respondents were sampled.

With the help of research assistants, each of the five zones was divided into four sections, given twenty (20) sections. The houses within each of the four sections of the five zones were numbered.

In selecting the house for the study, the systematic sampling procedure was used to choose a house at specific intervals from an ordered arrangement until the sample size was achieved from each four (4) sections of the five zones. The numbers assigned to each house in the sections constituted the frame. The

first step was to determine the sampling interval (i). The total number of houses (N) was divided by the sample size (x), that is 'i' item = N/x..

The first house from each section was selected through lottery method by using the last two digits of random numbers generated with a calculator. The remaining houses were chosen from positions in the sampling frame obtained by adding multiples of "i" to the number drawn by the lottery method. Hence 2^{nd} house position is at (k + i)th position , 3^{rd} (k + 2i)th position, 4^{th} (k + 3i)th position. Where 'k' is the position of the first house selected from the sampling frame. This was continued until all the required number in each section was obtained.

Twelve (12) houses were selected from each section making a total of 48 from each zone and a total of 240 houses sampled from the five zones within the metropolis. In a selected house occupied by a number of households, only one household was randomly selected through the lottery method. This sampling method was used because it was easier and quicker to apply and errors could be detected easily.

Purposive sampling, a procedure that involves intentional selection, was also employed mainly to select and interview state officials and opinion leaders to give information on specific areas of interest. Specifically the Metropolitan Chief Executive and the head of the metropolitan environmental and sanitation unit, the Sanitary Superintendent of University of Cape Coast Sanitary Department, a worker of EPA, 5 assembly members and 2 market queens and regional supervisor of Zoom Lion Ghana Limited were purposively selected.

Instrumentation and data collection

Detailed questionnaires with both closed and open-ended questions as well as personal observation were the main instruments for the collection of information for the study. Questionnaires were administered to officials of CCMA, EPA, Zoom Lion Ghana Limited; the Sanitary Department of UCC .The administration was done during working hours in order to meet the respondents at their work places.

The administration of questionnaires in the households were mostly done in the evening because most of the respondents were farmers, traders and civil servants. Non-participant observation was employed to capture useful information in their natural settings, thereby adding the merit of crosschecking on the facts that would be compiled through the other methods. Five trained research assistants were engaged mostly to assist the researcher in the collection of data from the households.

Pre-testing

In order to ensure that questionnaires and interview schedules were meaningful and easily understood by the respondents, discussion and pre-test of the research instruments were carried out in Moree Junction area in Abura Asebu-Kwamankese District. In addition, the pre-test enabled the researcher to revise the contents of the questionnaire and the interview schedule there by shaping the instruments; thus, achieving the reliability and validity standards required in scientific research.

Data processing and analyses

Since the study was both qualitative and quantitative, the following steps were taken to ensure that questionnaires issued out to research assistants talled with those they returned:

- All questionnaires were numbered.
- Completed questionnaires were collected and cross-checked for consistencies at the end of each day.

This enabled the researcher to check lapses on the part of the research assistants for an early remedial action to be taken. The field data collected were first edited, coded and then computerised. The SPSS software was applied to the data. Descriptive statistics were used in the data analyses and the data were summarised in the form of cross tabulation, frequencies and percentages. Tables were employed in describing variables, and most of the variables were measured at the nominal and ordinal levels.

In all 240 respondents were targeted and all responded positively. The responses collected were cross tabulated against income categories (low, middle and high income classes). This was to enable the researcher to assess how the various income groups reacted towards solid waste management practices and its associated problem in the Metropolis.

Ethical consideration

It was necessary to take measures not to jeopardies the quality of the data collected since some of the respondents within the target population would be

sensitive to some of the issues (questions) raised in the questionnaire. The following measures were taken. Reconnaissance survey was undertaken and the purpose was explained to elders and opinion leaders. Official permission for the study was sought from the elders for the administration of the research instruments. The respondents were assured that any information given would be used only for the purpose of the study.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

Introduction

This chapter delves into solid waste management practices within the metropolis; it examines socio-demographic characteristics of respondents and the perception of residents on solid waste management situation in the metropolis.

In addition, it finds out solid waste management practices of residents within the Cape Coast Metropolis; attitude of residents towards waste separation, willingness to pay for waste collection services and effects of poor solid waste management on the citizenry. This section also looks at recommended garbage disposal methods and finally analizes the suggestions made by respondents towards improved solid waste management in the metropolis.

Socio-demographic characteristics of respondents

This section presents the socio-demographic background of the respondents contacted for this study. The issues covered are gender, educational attainment, occupation, monthly income and length of stay in the metropolis. The variables have important implications in waste management process. Higher percentages (63.3%) of respondents were females. This is because more females turn to deal with issues of sanitation and its related problems than their male counterparts. This was when most households selected wanted the females to

speak. Table 1 shows the levels of educational attainment of respondents within the three income categories.

Table 1: Levels of educational attainment of respondents against income class

	Income class categories							
Level of education	Low income class		Middle income class		High income class		Total	
	Freq.	%	Freq.	%	Freq.	%	No	%
None	15	10.6	0	0.0	0	0.0	15	6.3
Basic	92	64.8	20	35.1	4	9.7	116	48.3
Secondary	25	17.6	30	52.6	12	29.2	67	27.9
Tertiary	10	7.0	7	12.3	25	61.0	42	17.5
Total	142	100.0	57	100.0	41	100.0	240	100.0

Source: Field survey, 2008

Table 1 indicates that majority of the respondents from the low-income class attained educational level up to the basic level that is 64.8 per cent. While 52.6 per cent and 12.3 per cent of respondents in the middle-income category attained education up to secondary and tertiary levels respectively. In addition, 29.2 percent of respondents from high income categories had up to secondary level while 61.0 per cent attained tertiary level of education, in a whole 48.3 per cent of the respondents had attained education up to the basic level.

This is the basic level of education one can attain in Ghana. Since education influences individual perception and attitude towards whatever he/she does. This means that those with higher educational background are conscious of environmental cleanliness and proper waste disposal. Also they have broader knowledge on effects of poor sanitation on the environment.

Table 2: Occupational types of respondents against income categories

	Income class categories							
Occupation	Low income class		Middle income class		High income class		Total	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Student	14	9.8	1	1.8	0	0.0	15	6.3
Public /civil servant	19	13.4	24	42.1	35	85.4	78	32.5
Agric/self employed	91	64.1	32	56.1	6	14.6	129	53.8
Unemployed	18	12.7	0	0.0	0	0.0	18	7.5
Total	142	100.0	57	100.0	41	100.0	240	100.0

Source: Field survey, 2008

From Table 2, 85.4 per cent of the respondents from high-income class were public / civil servants as well as 42.1 per cent from middle-income class are public /civil servants and the low-income class had only 13.4 per cent being

public /civil servants. On other hand, 64.1 per cent of respondents from the low-income category were into agriculture or self-employed.

Also, 12.7 per cent of respondents within the low-income category were unemployed while 9.9 per cent were students. Conversely, none of the respondents from the middle and high-income group was unemployed but 1.8 percent of the respondents from the middle income were students and none being a student in the high-income group.

In general, 53.8% of respondents were either into agriculture or self employed and these groups of people mostly generate organic waste which rapidly decays and it does have an effect on the environment if not managed well.

Table 3: Monthly income levels of respondents against income categories

	Income class categories							
Monthly income (GH¢)	Low income class		Middle income class		High income class		Total	
	Freq.	%	Freq	%	Freq.	%	No	%
Less than 100	142	100.0	0	0.0	0	0.0	142	59.2
101-150	0	0.0	57	100.0	0	0.0	57	23.8
151 -200	0	0.0	0	0.0	11	26.8	11	4.6
More than 200	0	0.0	0	0.0	30	73.2	30	12.5
Total	142	100.0	57	100.0	41	100.0	240	100.0

Source: Field survey, 2008

From Table 3, it could be seen that 100 per cent of respondents in the low income class earned monthly income less than GH¢ 100 or up to GH¢100. With regard to middle income class, 100 percent of them earned between Gh¢101 and GH¢ 150, while those in high income group earned above GH¢150 with majority 73.2 per cent earning more than Gh¢200. In addition, the remaining 26.8% earn between GH¢151 and GH¢200.

The length of stay of respondents in their communities within the metropolis was assessed in order to assess the extent to which one can rely upon residents' perceptions as a true reflection of what prevails within their communities. The results are shown in Table 4.

Table 4: Length of respondents' stay within the metropolis against income class

Length of stay	Income class categories: Low income class		Middle income class		High income class		Total	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Less than 1 year	5	3.5	3	5.3	0	0.0	8	3.3
1 – 5 years	26	18.3	12	21.1	17	41.5	55	22.9
6 -10 years	19	13.4	7	12.3	6	14.6	32.	13.3
11 – 15 years	9	6.3	8	14.0	2	4.9	19	7.9
16 yrs or more	20	14.1	10	17.5	7	17.1	37	15.4
Born here (native)	63	44.4	17	29.8	9	22.0	89	37.1
Total	142	100.0	57	100.0	41	100.0	240	100.0

Source: Field survey, 2008

From Table 4, a substantial percentage of all the three income classes have stayed long enough within the metropolis to enable them comment objectively on the solid waste management situation within the metropolis. About 78.2 (13.4 + 6.3 +14.1 + 44.4) percent of the low-income class, 73.6 (12.3 + 14.0 + 17.5 +29.8) percent of middle-income class and 73.7 (13. 3 +7.9+ 15.4 +37.1) percent of high-income class were identified to have stayed in the metropolis for a period of at least 6 years. This gave the indication that their assessment can be relied on.

Perception of residents on solid waste management situation in the metropolis

To assess residents' perception on solid waste management problem in the metropolis the question "How do you perceive the magnitude of solid waste problem in your community" was asked. Table 5 gives the details of the responses.

It could be seen that 91.5 (50.0 +41.5) percent of respondents from low-income class, 94.4 (50.9+ 43.9) percent of respondents from middle-income class and 92.7 (36.6 +56.1) percent from high-income category perceived the solid waste management a serious problem. In conclusion, the general perception, irrespective of income category was that solid waste management is a problem in the metropolis. Thus, differences in income levels did not influence the way individuals perceived the waste management situation in the metropolis.

Table 5: Perception on solid waste management situation in Cape Coast metropolis against income category

Perception	Income class categories							
	Low income class		Middle income class		High income class		Total	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Extremely serious	71	50.0	29	50.9	15	36.6	115	47.9
Quite serious	59	41.5	25	43.9	23	56.1	107	44.6
Slightly serious	12	8.5	3	5.3	1	2.4	16	6.7
Not at all serious	0	0.0	0	0.0	2	4.9	2	0.8
Total	142	100.0	57	100.0	41	100.0	240	100.0

Source: Field survey, 2008

In response to factors that might have contributed to the perceived problem, it was revealed that 50.8 per cent of respondents from the three categories are of the view that solid waste menace in the metropolis is as a result of inadequate funds on the part of the Metropolitan Assembly to manage the waste. Also 42.8 percent of the respondents in all the three income categories ascribed the problem to the Assembly's, lacking logistics for proper solid waste management, as depicted in Table 6. This means that people's attitude coupled with inadequate funding and logistics are perceived to be factors responsible for the state of environmental sanitation in the metropolis and if concrete efforts are not made to address the issues, the problem will continue to exist.

Table 6: Perceived factors responsible for solid waste management problem in Cape Coast metropolis against income category

Contributing factor	Income category						Total	
	Low income class		Middle income class		High income class			
	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Bad attitude of residents	11	5.1	6	5.7	8	12.1	25	6.4
Inadequate logistics	92	42.4	48	45.7	26	39.4	166	42.8
Inadequate funding	114	52.5	51	48.6	32	48.5	197	50.8
Total	217	100.0	105	100.0	66	100.0	388	100.0

Source: Field survey, 2008

Note: Some respondents mentioned more than one factor.

This confirms the assertion made by Lusugga (2004), Onibokun &Kumuyi (2004) and Wyn (1997) that poor infrastructure (including vehicles), lack of finances, apathy of the people towards waste issues and lack of resources to pay for waste services accounts for poor waste management within developing cities.

Solid Waste Management Practices of Residents within the Cape Coast Metropolis

Volume and disposal methods of garbage generated by respondents

To assess the volume of solid waste (refuse) generated by households within the metropolis, respondents were asked to indicate the volume of solid waste generated daily in their households. The responses are shown in Table 7.

Table 7: Volume of solid waste generated daily in households against income categories

No. of bucketful (Size 34)	Income category: Low income class		Middle income class		High income class		Total	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%
¼	45	31.7	9	15.8	18	43.9	72	30.0
1/2	31	21.8	21	36.8	10	24.4	62	25.8
¾	19	13.4	18	31.6	8	19.5	45	18.8
1	47	33.1	9	15.8	5	12.2	61	25.4
Total	142	100.0	57	100.0	41	100.0	240	100.0

Source: Field survey, 2008

Note: One bucketful of domestic refuse weighs about 2 kilograms.

From Table 7, it could be seen that volume of solid waste generation from the households is generally low. The maximum volume generated was one (Size 34) bucketful of refuse per household in a day. One bucketful of domestic refuse weighs about 2 kilograms, by calculation, it came to light that, the 240 households sampled generated a total of 287.5 kilograms of refuse daily averaging 1.20 kilograms per household in a day. Of the 287.5 kilograms of solid waste generated, the low-income class generated 176 kilograms with an average of 1.24 kilograms per household in a day. The Middle-income group generated 70.5 kilograms with an average of 1.24 kilograms and the High-income category generated 41 kilograms averaging 1.0 kilogram per household per day. The

conclusion is that households within the low income category generate more refuse than middle and high income categories with average of 1.24 kilograms more than group average of 1.20 kilograms.

Table 8: **Storage of household waste against income category**

Method of storage	Income category: Low income class		Middle income class		High income class		Total	
	Freq.	%	Freq.	%	Freq.	%	No	%
Closed container	62	43.7	42	73.7	30	73.2	134	55.8
Open container	62	47.2	10	17.5	6	14.6	83	34.6
Do not store in the home	13	9.1	5	8.8	5	12.2	23	9.6
Total	142	100.0	57	100.0	41	100.0	240	100.0

Source: Field survey, 2008

In response to how the waste generated is stored in the home before it is finally disposed of, 55.8 per cent of respondents in all the three income categories said they stored their waste in closed containers. Also 47.2 per cent of the respondents in the low-income class did not cover their waste collection bins. Few respondents, 9.6 per cent from all the three income categories did not store their waste in their homes before disposing them of as depicted in Table 8.

In conclusion, the higher number of respondents who covered up their waste collection bins was an indication that most of them were aware of the

implications of not covering their waste bins. For example, attraction of flies and cockroaches which are all disease-transmitting vectors.

To find out how respondents disposed of refuse collected in their households; a number of disposal methods were given from which respondents were asked to select the method being used in their households. Table 9 gives the details about refuse disposal methods.

From Table 9, it is shown that 35.4 per cent of respondents from the three income categories disposed of their garbage indiscriminately. Within the income groups, 43.7 per cent from low-income class disposed of refuse indiscriminately against 29.8 per cent and 14.6 per cent from middle and high-income classes respectively. This result confirmed the observation made by Onibokum &Kumuyi, (2004), that in the developing countries the disposal of waste is often by way of illegal dumping on vacant land, dumping alongside roads or railway lines, into storm drains, or by burying or burning on the premises of the household.

In addition, 27.5 per cent of respondents in all the three income categories said they disposed of their refuse at the transfer stations within their communities. A1so, 7.9 per cent of the respondents in all the three income categories disposed of their refuse at public dumps which were normally located at swampy areas or on waterways. Typical examples can be found at Kakumdo and Essuekyir, where they dump refuse along the course of river Kakum to prevent it from over flowing its banks. Composting was the least used disposal method being practiced by people within the metropolis representing 0.4 per cent.

Table 9: Household refuse disposal methods against income category

Refuse disposal method	Income category: Low income class		Middle income class		High income class		Total	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Transfer station (public bin)	44	31.0	9	15.8	13	31.7	66	27.5
Open burning	11	7.7	10	17.5	11	26.8	32	13.3
Composting	0.	0.0	0.	0.0	1	2.4	1	0.4
Dig hole and dump it inside	2	1.4	4	7.0	7	17.1	13	5.4
Indiscriminate dumping	62	43.7	17	29.8	6	14.6	85	35.4
Dump in community dump site	23	16.2	17	29.8	3	7.3	43	17.9
Total	142	100.0	57	100.0	41	100.0	240	100.0

Source: Field survey, 2008

Respondents were also asked to indicate whether they had waste collection points within their communities. Most respondents indicated that they did not have communal refuse containers or transfer stations in their localities. Only 26.3 per cent of respondents had access to these facilities. This confirmed to the fact that there were only twenty two (22)-collection points in the metropolis, which were managed by Zoom Lion Ghana Limited.

Respondents with transfer station within their vicinity were asked the number of times these containers were emptied. Table 10 shows their response. It was revealed that 16.3 per cent of respondents said that public bins within their vicinities were emptied when they were full within all the three income classes, while 4.6 per cent from all income classes claimed the bins were emptied every day.

In conclusion, if the current system is maintained, it may result in the spread of epidemics since most of the household's waste are putrescible. It was also observed that sometimes the containers became overfull, allowing residents to dump their waste on the surrounding environment which some times became an eye sore. In addition, domestic animals like dogs, goats, pigs etc. went to the place to feed on the waste. For the public bins, most waste pickers did not go there like the public dumpsites.

Attitude of respondents towards separating waste in the Cape Coast Metropolis

The success of any solid waste recycling and reuse strategy depends on the vigilance with which the generators of the waste are willing to sort it at the point of generation. This permits easy salvage and identification of items that can be reused and recycled while saving time and costs of transportation, treatment and disposal of the waste.

Table 10: **The number of times the public bins (containers) were emptied against income category**

	Income category							
Number of times Public is emptied	Low income class		Middle income class		High income class		Total	
	Freq.	%	Freq.	%	Freq.	%	Freq	%
Once a week	2	1.4	0.	0.0	1	2.4	3	1.3
Twice a week	1	0.7	0	0.0	0	0.0	1	0.4
Thrice a week	7	4.9	3	5.3	1	2.4	11	4.5
Every day	8	5.6	0	0.0	3	7.3	11	4.6
When it is full	27	19.0	4	7.0	8	19.5	39	16.3
Not applicable	97	68.3	50	87.7	28	68.3	175	72.9
Total	142	100.0	57	100.0	41	100.0	240	100.0

Source: Field survey, 2008

Waste separation is also bound to succeed if a market for the sorted out items exists, otherwise, there is often a risk of non-compliance by waste generating communities in cases where no economic value or direct reuse value exists for such items.

In order to get an insight of the peoples' attitude towards waste separation, respondents were asked what they did to organic waste such as food, leaves and other decomposable waste. Table 11 depicts the responses.

Table 11: **Usage of organic waste against income category**

Usage of organic waste	Income category: Low income class		Middle income class		High income class		Total	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Compost	3	2.1	0	0.0	0	0.0	3	1.2
Apply directly on farm garden	4	2.8	2	3.5	0	0.0	6	2.5
Throw away with other waste	91	64.1	39	68.4	35	85.4	165	68.8
Burn	17	12.0	8	14.0	3	7.3	28	11.7
Giving to animals as feed	27	19.0	8	14.0	3	7.3	38	15.8
Total	142	100.0	57	100.0	41	100.0	240	100.0

Source: Field survey, 2008

It was revealed that 68.8 per cent of respondents threw their organic waste away which could have been used for other purposes with other waste in all the three income categories. In addition, 15.8 per cent said they gave it out as animal feed. While 11.7 per cent burned them, 1.3 per cent and 2.5 per cent from all the three income groups said they used them for compost and applied them directly on their farm or garden respectively.

In conclusion, this result 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. As most respondents did not make use of their organic waste which could have been used for composting instead of buying inorganic fertilizers for their backyard gardens.

In response to whether they were willing to separate waste into various constituents before disposing them of, 62.7 percent of respondents said they were not willing from all the three income groups. Also 37.9 percent from all the three income groups said they would like to separate their waste into various constituents before finally disposing it of.

When asked reasons why they were not willing to separate their waste into constituents, respondents gave two reasons. 52.3 percent of them said they found it to be a difficult exercise. Within the income categories 51.5 per cent, 58.1 per cent and 47.6 per cent from low, middle and high-income classes respectively said they found it to be a difficult exercise to separate their waste, which had resulted in many recyclable materials ending up at the dumpsites causing many hazards.

Also, 47.7 percent of respondents from all the three income categories said they would not separate waste because they have no use for the waste, this shows that these respondents are not aware that their waste can be used as a resource. In conclusion, most people were not willing to separate waste because they saw it be difficult exercise and had no use of it.

Willingness to pay for waste collection services

As at then, no service fee was charged for waste collection in the metropolis. In response to whether they were willing to pay for waste collection services provided by the waste management companies, fifty three point three per cent of respondents from all the three income categories said they were willing to pay for waste management services in the Metropolis.

Respondents who were willing to pay for waste management services by the Metropolitan Assembly and its allied agencies were asked how much they were ready to pay in a month. Out of the 53.3 per cent who said they were willing to pay for waste management services, 43.8 per cent from all the three income categories said they were prepared to pay GH¢3 every month.

In addition, 7.0 per cent, 1.7 per cent and 0.8 per cent from all the three income categories said they were willing to pay GH¢4, GH¢5 and GH ¢5 or more respectively every month. In conclusion, it could be seen that majority of the respondents were willing to pay GH¢3 every month. This means that despite one's income level they were not ready to pay more for waste management services as majority of respondents from both the high and middle income groups said they could only afford to pay GH¢3 every month towards waste management services.

Effects of poor solid waste management on the citizenry

In order to assess the effects of poorly managed solid waste in the metropolis on the citizenry, respondents were asked to indicate the number of

members of their households (including, themselves) who had suffered from malaria, diarrhoea, typhoid fever and cholera in the last 12 months. Table 12 depicts the responses.

It could be seen from Table 12 that 95.8 per cent of members of their households had suffered from malaria within the last twelve months. Also 52.0 per cent, 20.8 per cent, 11.25 per cent were affected by diarrhoea, typhoid and cholera respectively. Also, higher proportions of respondents from all the three income categories had suffered from malaria with 95.8 per cent, 100.0 per cent, and 90.2 per cent from low, middle and high-income classes respectively.

It was also established that 52.1 per cent and 56.1 per cent suffered from diarrhoea in low and middle-income classes respectively as against 46.3 per cent from the high-income group. Even though fewer percentages of respondents' household members had suffered from typhoid fever, 24.6 per cent were down from middle income as against 21.1 per cent, and 14.6 per cent from low and high-income classes respectively. Further more 11.2 per cent of respondents indicated that their household members were affected by cholera in all the income categories.

In conclusion, most of the respondents had their household members suffering from malaria than any other disease; this confirms the statistics from the Epidemiological Department of Ministry of Health. See Table 13.

Table 12: Number of members of household that suffered from diseases against income category

Disease		Income category: Low income class		Middle income class		High income class		Total	
		Freq	%	Freq	%	Freq	%	Freq	%
Malaria	None	6	4.2	0	0.0	4	9.8	10	4.2
	One	19	13.4	6	10.5	6	14.6	31	12.9
	Two	36	25.4	24	42.1	12	29.3	72	30.0
	Three or more	81	57.0	27	47.4	19	46.3	127	52.9
Diarrhoea	None	68	47.9	25	43.9	22	53.7	115	47.9
	One	56	39.4	26	45.6	12	29.3	94	39.2
	Two	9	6.3	4	7.0	7	17.1	20	8.3
	Three or more	9	6.3	2	3.5	0	0.0	11	4.6
Typhoid	None	112	78.9	43	75.4	35	85.4	190	79.2
Fever	One	22	15.5	14	24.6	5	12.2	41	7.1
	Two	5	3.5	0	0.0	0	0.0	5	2.1
	Three or more	3	2.1	0	0.0	1	2.4	4	1.7
Cholera	None	128	90.1	51	89.5	34	82.9	213	88.8
	One	10	7.0	5	8.8	5	12.2	20	8.3
	Two	1	0.7	0	0.0	1	2.1	2	0.8
	Three or more	3	2.1	1	1.8	1	2.4	5	2.1

Source: Field survey, 2008

Table 13: Incidence of sanitation related diseases among the top ten morbidity O.P.D. cases within the metropolis

Diseases	Year				
	2003	2004	2005	2006	2007
Malaria	50,417	61,711	53,186	56,902	57,313
Diarrhoea	4,714	4,477	2,177	5,037	4,067
Cholera	55	13	110	687	0
Typhoid Fever	846	846	1,028	525	776
Intestinal Worms	1,827	1,923	1,424	2,307	1,918

Source: Ministry of Health Epidemiological Department Annual statistical report, 2008

Factors responsible for the assembly's inability to carry out its function of solid waste management

The Cape Coast Metropolitan Assembly is responsible for managing all types of waste generated within the metropolis. Respondents were asked whether they were satisfied with solid waste management services provided by the waste management companies and the Metropolitan Assembly. Sixty four point six per cent said they were not satisfied with the solid waste management services being provided by the Metropolitan Assembly.

Respondents were further asked to give factors, which might have contributed to this situation. Table 14 gives the results.

From Table 14, majority of respondents, that is, 44.0 per cent in all the three income categories said the problem of solid waste management in the

metropolis is because of inadequate financial resource to manage the waste, 22.8 per cent said the indifferent attitude of the people towards proper solid waste management, also contributed to the problem.

Table 14: Contributory factors to waste management deterioration against income category

Factors	Income category							
	Low income class		Middle income class		High income class		Total	
	Freq	%	Freq	%	Freq	%	Freq.	%
Logistics	56	23.2	28	19.7	11	13.6	95	20.5
Finance	101	41.9	65	45.8	38	46.9	204	44.0
Inadequate personnel	33	13.7	12	8.5	14	17.3	59	12.7
Attitude of the citizenry	51	21.2	37	26.0	18	22.2	106	22.8
Total	241	100.0	142	100.0	81	100.0	464	100.0

Source: Field survey, 2008

*There were multiple responses.

Also, 20.5 percent of respondents in all the three income categories said the problem is organisational difficulties, 22.8 per cent and 12.7 percent for non – collaboration of parties and inadequate personnel respectively. With regard to inadequate financial resources 25.7 percent, 35.4 percent and 29.6 per cent from

low-income class, middle income and high-income classes respectively said the problem is inadequate financial resource base of the Assembly.

In conclusion, most respondents claimed that the problem militating against solid waste management in the metropolis is inadequate budgetary allocation for waste management. This confirms (ISWA, 2002; White et al, 1995; Gray, 1993) assertions 'that financial implications of improving waste management can be a burden on the budgets of municipalities'. This also agreed with earlier assertion made by Zurbrugg (2003), that one of the main causes of inadequate collection services is lack of financial resources to cope with the increasing amount of waste generated.

Recommended garbage disposal method

Respondents were asked to indicate the best method of disposing of garbage in the Metropolis, Table 15 depicts the results. From Table 15, 31.3 per cent of respondents recommended recycling as a proper method of disposing solid waste. 27.5 per cent, 22.1 per cent, 15.4 percent, 3.3 per cent and 0.4 per cent recommended composting, open burning land filling and indiscriminate dumping respectively in all the three income categories.

In conclusion, majority of respondents said recycling of waste should be the best method of disposing of garbage, because recycling has the advantage of bringing back the materials to the system again and also reducing costs of the disposal facilities, prolonging the life span and reducing the environmental impact

of disposal sites as the organics are largely to blame for producing leachate and methane.

Table 15: Recommended garbage disposal methods against income category

	Income category							
Garbage disposal method	Low income class		Middle income class		High income class		Total	
	No	%	No	%	No	%	No	%
Open burning	42	29.6	6	10.5	5	12.2	53	22.1
Incineration	5	3.5	0	0.0	3	7.3	8	3.3
Composting	31	21.8	24	42.1	11	26.8	66	27.5
Recycling	35	24.7	21	36.8	19	46.3	75	31.3
Land filling	28	19.7	6	10.5	3	7.3	37	15.4
Indiscriminate dumping	1	0.7	0	0.0	0	0.0	1	0.4
Total	142	100.0	57	100.0	41	100.0	240	100.0

Source: Field survey, 2008

Recommendations towards improved solid waste management in the metropolis

Respondents were given a number of strategies of which they were asked to select suitable options for the improvement of the solid waste management

services in the metropolis. Table 16, shows the details of respondents preferred strategy.

Table 16: Respondents preferred strategy for improve solid waste management services against income category

Strategy	Income category							
	Low income class		Middle income class		High income class		Total	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Full privatisation	80	56.3	32	56.2	26	63.4	138	57.5
Partial privatisation	47	33.1	17	29.8	7	17.0	71	29.5
Payment of service charges	15	5.6	8	14.0	8	19.6	31	13.0
Total	142	100.0	57	100.0	41	100.0	240	100.0

Source: Field survey, 2008

From Table 16, it became evident that greater percentage (57.5 per cent) of respondents from various income categories preferred full privatisation of solid waste management in the Metropolis. This was made up of 56.3 per cent, 56.2 per cent and 63.4 per cent of the total respondents from low, middle and high-income classes respectively. This might be due to the involvement of Zoom Lion Ghana Limited in management of waste in the metropolis, which has proven to be more

effective than before. Also 29.5 per cent of respondents in all the three income categories said they preferred partial privatisation where by the Assembly would work hand in hand with the private companies to manage the waste the metropolis.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Introduction

This chapter summarises the findings of the study and conclusions based on the findings. It recommends intervention that can be used to address the flaws that were discovered. It finally ends with suggested areas of potential further research that were identified but could not be handled.

The main objective of the study was to develop an in depth understanding of solid waste management practices in the Cape Coast metropolis and the underlying factors responsible for the state of environmental sanitation in the Metropolis. Specific objectives were:

- To examine current solid waste management practices in the Cape Coast Metropolis
- To assess the respondents attitude towards solid waste managements options
- To identify problems associated with the current solid management practices in the Cape Coast Metropolis
- To recommend ways to improve and yield benefits in solid waste management process in the metropolis.

The study relied on both primary (from field) and secondary data. The primary data was collected from two hundred and forty (240) respondents who were selected from the metropolis. A multistage sampling procedure was used for the selection of the subjects. The survey instruments used for the data collection consisted of a questionnaire and interview schedule. In the analysis, various computer softwares like SPSS and Excel were used. The responses collected from 240 respondents were cross – tabulated against three economic strata namely low income group (142), middle class (57) and high income category (41) to generate arguments leading to valid conclusions.

Summary of findings

The literature review, field study and the analyses that were undertaken have led to interesting findings that are summarised as follows:

- An average of 1.20 kilograms of garbage was generated daily by households with the low and middle-income classes generating 1.24 kilograms, higher than the groups average, whilst the higher income class had the lowest with an average of 1.0 kilogram per household.
- Most residents stored their refuse in old plastic buckets, which were mostly covered and are emptied daily.
- Out of the 79 communities in the metropolis, only 22 of them had transfer stations (communal containers). As a result, only 27.5% of respondents interviewed have access to the transfer stations, this means most solid waste in the Cape Coast Metropolis ended up not properly disposed of.

- The study indicates that most residents (92.5 per cent) from all income groups were of the view that the solid waste management problem in the metropolis is very serious, because of logistical and financial constraints faced by the Metropolitan Assembly.
- It was evident that 35.4 per cent of the residents from the three income groups disposed of their garbage indiscriminately because of non-availability of transfer stations (communal containers).
- Most residents (62.7 per cent) were not ready to separate their waste into various constituents from all the three income groups, because they found it to be difficult and had no use for the waste.
- It was established that most residents, 53.3 per cent were willing to pay for waste management services with 43.3 per cent ready to pay GH¢3 every month.
- Incidence of malaria was very high with 95.5 per cent of members of households sampled, suffering from it in the past twelve months more than any other disease.
- Most respondents said recycling of waste should be the proper method of disposing garbage since this method brings back the waste for another use.
- Most respondents said solid waste management could be improved by full privatisation of waste management functions of the Assembly.

Conclusions

Based on the results of the study, the following conclusions were drawn:

The study established that there is serious solid waste management problem within the metropolis, the major causes being, inadequate financial resources by the metropolitan assembly, which has led to indiscriminate disposal of garbage within the metropolis.

The Public burns, buries their garbage and throws the garbage into drainages and other bodies especially the sea. Sanitation related diseases in the metropolis affect most residents with malaria being the highest. The preferred method for garbage disposal is recycling.

Privatisation of waste management in the metropolis was advocated as the best way of curtailing the problem, since this will allow the private contractors to bring in more logistics and expertise to manage the waste effectively.

Recommendations

Based on the findings and conclusions of the research, the following recommendations can be made to help improve the solid waste management problem situation in the metropolis to promote sound environmental conditions in order to improve health situations and the socio-economic well-being of the metropolis.

- There is the need For the Cape Coast Metropolitan Assembly to introduce integrated solid waste solid waste management approach, which involves waste prevention, reduction, reuse, recycling, energy recovery and finally disposal.

- The Cape Coast Metropolitan Assembly should provide more transfer stations at least one within a community in the metropolis to enable more residents have access to them. This should be done in consultation with the people in the community, as most communities are not having transfer stations, enough of these stations and frequent transportation to the final disposal site will improve waste management in the metropolis.
- Plans to set up composting plant or adopt waste to energy technologies must be considered. Currently, Cape Coast Metropolitan Authority has no immediate plans to convert the waste generated in the metropolis into any meaningful resource as the waste can be used to generate electricity and compost for farmers within and beyond the metropolis.
- The crude dumping of waste being practiced by the Metropolitan Authority should be stopped and instead identify a suitable land for the construction of engineered landfill that conforms to international standards.
- The Cape Coast Metropolitan Assembly should improve upon its revenue mobilisation efforts to enable it generate more revenue from its own internal sources. This can be done through property and house taxes, city cleaning tax, fees for passing building plans, levies on advertisement through hoardings, signboards and so forth, fees from license for various trades, and rents from metropolitan properties. The existing rates and charges should be abreast of current cost of services.

Recommendation for further studies

Much as the study endeavoured to cover most of the relevant aspects of the theme, solid waste management is too diverse to be exhausted in a single research. Therefore, further research into the following will enrich this field with more knowledge:

- Assessing private sector involvement in municipal solid waste management.
- Assessment of constructing engineered landfill with potential of generating energy in the metropolis

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APPENDICES

APPENDIX A

QUESTIONNAIRE ON SOLID WASTE MANAGEMENT FOR RESPONDENTS

The purpose of this Questionnaire is to find out the solid waste management practices of residents in the Cape Coast Metropolis and ways of improving upon such practices .All answers will be treated confidential. Please answer all questions in your honest opinion.

Serial Number…….

Location……

Date……

Background Information

1. Sex: 1. Male [ ] 2. Female [ ]

2. Age: 1. 18-25 [ ] 2. 26-35 [ ] 3. 36-40 [ ] 4. 41 and above [ ]

3. How many years have lived in your present community?

(a).Less than 1 year [ ] (b). 1-5 years [ ] (c) 6-10 years (d).11-15 years [ ]

(e) 16 years or more [ ] (f) Born here (Native) [ ]

4. Level of education

(a) None [ ] (b) Basic [ ] (c) Secondary/Vocational [ ]

(d) Tertiary [ ] (e) others (specify)…….

5. Marital status?

(a) Married [ ] (b) Single [ ] (c) Divorced [ ]

(d) Widowed [ ] (f) Separated [ ]

6. Occupation/Profession?

(a) Student [ ] (b) Public Servant / Civil [ ] (c) Agric/Self-employed [ ]

(d) Unemployed [ ] (e) Others (specify) ----------

7. Can you please place your net monthly income in one of the following categories?

(a) Less than GH¢100 [ ] (b) Gh¢ 101-GH¢1500 [ ]

(c) Gh¢151-GH¢ 200 [ ] (d) More thanGh¢200[ ]

Perception of the Waste Disposal Problem

8. How do you perceive the magnitude of the solid waste problem in you community within the Municipality?

(a)Extremely serious [ ] (b) Quite serious [ ] (c) Slightly serious [ ]

(d) Not at all serious [ ] (f) Do not know [ ]

9. If your answer to question (9) is **a** or **b** above, what do you think might be the contributing factor?

(a). Bad attitude of residents [ ] (b) Inadequate Logistics [ ]

(c). Inadequate funding [ ]

10. To what extent have you personally given the waste disposal problem in you community a thought?

(a). Very high degree [ ]. (b)Fairly high degree [ ] (c) Only somewhat [ ]

(d) Not at all [ ]

11. How do you expect the solid waste disposal problem to be in your community over the next five years?

(a) More serious [ ] (b) The same [ ] (c) Less serious [ ] (d) Don't know [ ]

12. In what type of container do you collect your waste into in the house?

(a). Carton ( ) (b) Basket ( ) (c) Old bucket ( ) (d) Plastic bag ( )

(e)Tin/Can ( )

13. How do you store your waste in the home ?

(a). Closed container ( ) (b) Open container( ) (c) Do not store in the home ()

(d) Others, specify_____

14. What is the volume of solid waste generated daily in your household?

(i) ¼ (34size) bucket ( ) (ii) ½ (34 size) bucket ( )

(iii) ¾ (34 size bucket) ( ) (iv) 1 (34 Size) bucket ( )

15. How often is the house waste container emptied? (a) Once a day ( ) (b) Twice a day ( ) (c) Once a week ( ) (d) when it is full ( )

16. Where do you usually dispose of this waste?

(a) In the public bin (transfer station) ( ) (b) Open burning ( )

(c) Composting ( ) (d) Dig hole and dump it inside ( )

(e) Indiscriminate dumping ( ) (f) Land fill ( )

17. Do you have solid waste collection container in your area?

(a) Yes ( ) (b) No ( )

18. How often is the public bin near you emptied?

(a). Once a week ( ) (b) Twice a week ( ) (c) Thrice a week ( )

(d).Everyday ( ) (e) When it is full ( )

19. How would you best evaluate the collection and transportation process of waste at the public bin?

(a) Very good ( ) (b) Good ( ) (c) Average ( ) (d) Fair (e) Bad ( )

20. Are you willing to pay for waste management services? (a) Yes ( ) (b) No ( )

21.If yes, how much would you be prepared to pay in a month

(a)GH¢3 ( ) (b) GH¢4-GH¢5 (c) GH¢6-GH¢10 (d) GH¢10 and above

Reuse

22 .What do you do with the food wastes, leaves, and trimmings that come out of your house?

(a) Make compost ( ) (b) Apply directly on farm/garden ( )

(c) Throw away with other waste ( ) (d).Burn ( )

23. Would you like to separate decomposable food/vegetable waste from non-decomposable manufactured waste.

1 Yes [ ] 2. No. [ ]

24. If No, why would you not like to separate the waste?

1. I have no use ( ) 2. It is a difficult exercise ( ) 3. Others…….

Health Concerns

25. How many of your family members have suffered from the following sanitation related diseases in the past one year

DISEASE	**NUMBER OF TIMES**			
	None	One	Two	Three or More
1. Malaria	( )	( )	( )	( )

2. Diarrhoea	( )	( )	( )	( )
3. Typhoid Fever	( )	( )	( )	( )
4. Cholera	( )	( )	( )	( )

26. Are you satisfy with the waste collection services provided by the Metropolitan Assembly?

1. Yes [ ] 2. No [ ]

27. If No which of these may be the contributory factor to the waste management deterioration and to what degree? (You may choose more than one)

1. Logistics [ ] 2. Finance related [ ] 3. Inadequate personnel [ ]

4. Bad attitude of residents [ ]

Recommended Garbage Disposal Method

28. Which of the following will you recommend as proper method of disposing garbage?

1. Open burning ( ) 2. Incineration ( ) 3. Composting ( ) 4. Recycling ( )

5. Land filling ( ) 6. Indiscriminate dumping ( )

Suggestion for Improve Solid Waste Management

29. Which of the following will you suggest to be the best solution to the solid waste management problem in the municipality?

1. Full privatization of the waste management function of the Assembly ( )

2. Partial privatization of the waste management function of the Assembly ( )

3. The Assembly to introduce economic service charges ( )