

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY
COLLEGE OF ENGINEERING
DEPARTMENT OF MATERIAL ENGINEERING

**HOUSEHOLD WILLINGNESS TO PAY FOR IMPROVED SOLID WASTE DISPOSAL
SERVICES IN KUMASI METROPOLIS**

BY

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JULY, 2012

KNUST

DECLARATION

I hereby declare that this thesis is my own work towards the Master of Science Degree and that, to the best of my knowledge, it contains no material previously published by another person or material which has been accepted for the award of any other Degree by the University or any other University, except where due acknowledgement has been made in the context.

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(Head of Department)

Signature

Date

DEDICATION

This piece of work is dedicated to my sweet wife Rabiata Abubakar for her unrelenting support and prayer towards a successful completion of this work. The work is also dedicated to my dear mother Hawa Krobo for her continuous motivation and prayers

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ACKNOWLEDGEMENTS

The successful completion of this work came about as a result of a massive contribution made by several people; without which the work would not have been materialized. I therefore, deem it necessary to express my profound gratitude first to my dynamic and hardworking supervisor of the Department of Agricultural Economics, Agribusiness and Extension at the Faculty of Agriculture, Dr. Dadson Awunyo-Vitor who did not only encourage me to write on the topic but also, supervised and guided me through at no cost.

My thanks also go to Madam Augustina Adjei-Boateng and J.Y. Donkor of KMA Waste Management Departments who assisted in diverse ways in data acquisition that has contributed to the successful completion of this work.

I also express my gratitude to Mr. Michael Ibrahim, Miss Suzan Bortey and Miss Hanna Agyeiwaah of Kwadaso Agricultural College and all friends who assisted me to administer the questionnaires for this work. To all others whose names cannot be readily mentioned, I am equally grateful to them.

The logo of Kwame Nkrumah University of Science and Technology (KNUST) is centered in the background. It features a yellow eagle with its wings spread, perched on a green shield. Above the eagle is a black mortar and pestle with a red flame. The entire emblem is set against a light grey background with the word 'KNUST' in large, semi-transparent letters at the top.

ABSTRACT

The study seeks to assess households' willingness to pay for improved solid waste management services within the Kumasi Metropolis and the amount they are willing to pay. The motive is to ascertain the feasibility and relevance of the polluter-pays-principle being implemented by the Assembly and recommend how it could effectively be done strategically to raise the needed funds to address the challenges of waste in the city. The research gathered data from two main sources namely: secondary and primary sources. The three main techniques employed in gathering the primary data were: preliminary field investigation, questionnaire survey and face-to-face

interviews. The contingent valuation method was used to determine willingness to pay. The econometric tools used include the logit and tobit regression models. The determinants of factors influencing WTP for improved waste management services using the logit regression model were identified to be education, Length of stay in the area, House ownership, Distance to dumping sites and Gender. The factors influencing the amount respondents were willingness to pay using the tobit model include Age, Income, Education, Length of stay, House ownership, Bags of waste generated and Distance to dumping sites. It was realized that households are WTP average of GHc8.13 more in addition to the GHc11.00 they currently pay for improved services. It is therefore recommended that the Assembly takes advantage of the citizenry's believe that waste management is a shared responsibility and not the sole responsibility of the government and get individuals to pay realistic amount in order to raise the needed funds for improved waste management. Again, the Assembly could surcharge the 1st and 2nd class residential areas to pay relatively more and use the excess amount to subsidize the 3rd class residential areas (because they cannot afford).

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List of Abbreviations / Acronyms

Abbreviation/Acronyms	Full Meaning
EHSDs	Environmental Health and Sanitation Departments
EPA	Environmental Protection Agency
ESP	Environmental Sanitation Policy
GHc	Ghana Cedis
GHp	Ghana pesewas
GSS	Ghana Statistical Service
IGF	Internally Generated Fund
ISWM.	Integrated Solid Waste Management
KMA	Kumasi Metropolitan Assembly
Ltd	Limited
MLGRD	Ministry of Local Government and Rural Development
MMDAs	Metropolitan, Municipal and District Assemblies
MSW	Municipal Solid Waste
NESP	National Environmental Sanitation Policy
PPP	Polluter Pays Principle
SWM	Solid Waste Management
UNEP	United Nations Environmental Programme
USEPA	United States Environmental Protection Agency
WMD	Waste Management Department
WTP	Willingness to Pay

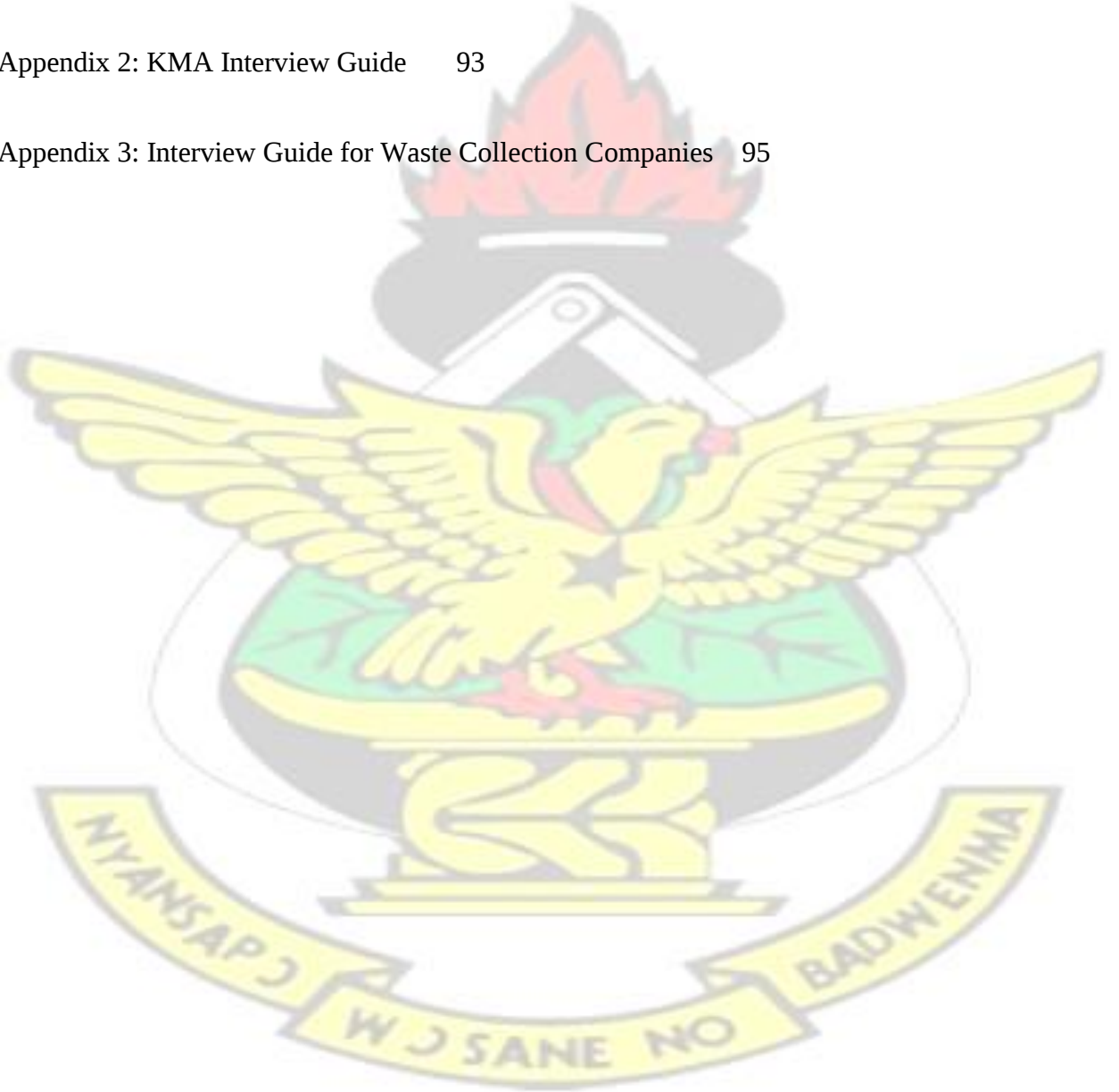
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CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

According to UNEP (2005), waste is directly linked to human development, both technologically and socially. The compositions of different wastes have varied over time and location, with industrial development and innovation being directly linked to waste materials. Some components of waste have economical value and can be recycled once correctly recovered.

Humans generate a great deal of waste as a byproduct of their existence, and they always have, as evidence at dumping pits located in or around archaeological sites can attest. Every task, from preparing a meal to manufacturing a computer etc, is accompanied with production of waste material, which cannot be used for other things and needs to be disposed of effectively. If not contained and handled appropriately, waste can balloon into a huge problem, as for example when garbage ends up in the open ocean where it can make animals and birds sick. (Wilson et al, 2006)

Transportation of waste is a major issue, as appropriate disposal sites may be remote. Frequently, subscription pickup services are available, with people paying a flat fee to have their waste picked up and disposed of, and people can also subscribe to specialty services, like medical waste pickup services, or confidential paper shredding and disposal services.

Waste management practices differ for developed and developing nations, for urban and rural areas, and for residential and industrial producers. For instance, in some cases

management of non-hazardous residential and institutional waste in metropolitan areas is usually the responsibility of local government authorities, while management of hazardous commercial and industrial waste is usually the responsibility of the generator. Developing effective waste management strategies is critical for nations all over the world, as many forms of waste can develop into a major problem when they are not handled properly. Numerous firms provide waste management services of a variety of types, and several governments also regulate the waste management industry for safety and efficacy.

According to the US Environmental Protection Agency (2009), historically the amount of wastes generated by human population in the early ages was insignificant mainly due to the low population densities, coupled with the fact there was very little exploitation of natural resources. Common wastes produced during the early ages were mainly ashes and human and biodegradable wastes, and these were released back into the ground locally, with minimal environmental impact.

In Africa, Municipal solid waste management constitutes one of the most crucial health and environmental problems facing governments of African cities. This is because even though these cities are using 20-50 percent of their budget in solid waste management, only 20-80 percent of the waste is collected. The uncollected or illegally dumped wastes constitute a disaster for human health and the environmental degradation. Not only is their quantities increasing but also the variety, both a consequence of increasing urbanization, incomes, and changing consumption habits fuelled by globalization. This scenario places the already-desperate urban councils in a difficult situation especially as they have to develop new strategies to deal with increasing volumes as well as strange varieties of wastes. Poor waste management practices, in particular, widespread dumping of waste in water bodies and

uncontrolled dump sites, aggravates the problems of generally low sanitation levels across the African continent.

According to the United Nations Environment Programme (UNEP) ((2009), urbanization is on the rise in Africa, and this trend is expected to continue in the future. Of concern is the inability of infrastructure and land use planning methods (including for waste management) to cope with urban growth, (the highest in the world) at 3.5 per cent annually. This is particularly urgent in slum areas, which constitute a big part of many of the cities and towns in Africa. Waste management infrastructure is largely non-existent in rural areas of Africa.

The gap between waste management policy and legislation and actual waste management practices is widening due to perennial capacity constraints and lack of waste management facilities for various waste streams. Access to major investments and acquiring the technical know-how needed to resolve the capacity constraints remain a tall order. Waste generation is expected to increase significantly as a result of industrialization, urbanization and modernization of agriculture in Ghana and for that matter Kumasi. This will further aggravate current capacity constraints in waste management.

Progress has been made in waste management policies and strategies. Biogas and compost production from organic waste fractionation has been widely accepted in Africa as a best practice, and progress is being made in developing and implementing specific projects in various countries. However, the use of economic instruments and implementation of

polluter-pays principles in waste management have yet to mature in most African countries (Carlson, 2005).

The single largest implementation challenge for managing waste policies remains creating sufficient capacity for environmentally sound management, including, where appropriate, recovery and recycling of various waste streams in Kumasi. The effort to do this is constrained by access to finance and technical know-how.

1.2 Problem Statement

Ghana in general and Kumasi Metropolitan Assembly (KMA) in particular, have made several attempts aiming at addressing the waste menace which is on the rise as a result of population hikes, growth in industrialization and consumer attitudes. The city's bye-laws and policies on waste and sanitation seek to address the waste challenge in its entirety on individual basis. The Assembly, among its efforts and strategies has contracted some waste companies to handle waste collection and disposal. It has also been implementing the polluter pays principle to get individuals to pay for waste management services. Furthermore, some effort is being made to educate the public and create some level of awareness to enable members of the public to play a role in reducing waste and handling waste efficiently.

However, the level of achievement of this objective in practice and in reality leaves much to be desired as is evident on piles of wastes on the streets, city centers, homes as well as complaints from the public regarding waste and filth. Waste management still remains a herculean task to the Assembly as it has not been able to manage and deal with waste problems to levels expected of it. This situation according to the KMA, is generally

attributed to inadequate finance to clear the solid waste in the case of both the assembly and contracted companies. Thus, the assumption is that if households pay more then, the services would be improved. However, very little has been done to assess the households' willingness to pay for improved waste management services. The question then is, - Are the households ready to pay more?

- How much more are they prepared to pay?
- What factors determine their motivation to pay and the amount they are willing to pay?

1.3 General Objective.

The general objective of the study is to assess the determinants of households' willingness to pay for improved solid waste management services and the amount they are willing to pay.

1.4 Specific Objectives.

The specific objectives are to:

- Assess respondents' level of awareness and perception of the KMA sanitation bye-laws and sanitation situations within the Metropolis.
- Assess respondents' willingness to pay more for improved solid waste management services.

- To assess the determinants of willingness to pay for the improved services.
- Assess how much more respondents are willing to pay and
- Determine the factors influencing amount respondents are willing to pay for improved waste management services.

1.5 Research Questions

- To what extent are the respondents' aware of the KMA sanitation bye-laws and how do they perceive these bye laws?
- What methods do the respondents use to dispose of their waste and how do they perceive solid waste management services within the Metropolis?
- Are respondents willing to pay for improved solid waste management services and what factors influence their willingness to pay?
- How much more are respondent willing to pay for improved waste management services and what factors influence the amount they are willing to pay for improved solid waste management services?

1.6 Justification

Even though Governments upon Governments, Non Governmental Organizations, Groups and Individuals seem to be concerned and try off their best to address the waste menace in the Metropolis, the result still leaves much to be desired. The enactment of waste policies or bye-laws, the polluter pays principle and inclusion of the private sector in waste management

(waste management companies) looks good on individual basis in addressing the challenge.

However, all put together does not yield the expected result. The question is why?

The results and findings of this study will enable one to ascertain the feasibility and relevance of the current byelaws and principles for waste management and the actual realities that are uncovered and which might need to be tackled if waste management menace is to be addressed to appreciable levels. This study is justified on the grounds that:

- With adequate finance there is high possibility of improved management of solid waste within the metropolis.
- It would also enable the assembly to know the kind of educational programme to undertake to ensure improved solid waste management.
- This study would also give insight into other constraints associated with solid waste management.
- Furthermore, it would enable waste companies to make informed decision on signing contract with the assembly.

The findings will therefore lead to recommendations that will enable authorities fine-tune and streamline their policies and bye-laws on waste management as well as their implementation strategies of the polluter pays principle and furthermore provide direction for future research on more specific issues on waste management.

CHAPTER TWO

LITERATURE REVIEW

2.1 Waste

According to the Oxford dictionary, waste refers to anything that is thrown away because it is not wanted. In a similar manner, the Advanced Learner's dictionary also defines waste as something that is no longer useful and to be thrown away. Wikipedia, the free encyclopedia also defines waste as unwanted or useless materials. The Encyclopedia also indicates that in biology, waste is any of the many unwanted substances or toxins that are expelled from living organisms; such as urea, sweat or faeces. Litter is waste which has been disposed of improperly. Furthermore, waste could be described in other terms as rubbish, trash, refuse, garbage, junk or litter.

The UK's Environmental Protection Act (1990), indicates that waste includes any substance which constitutes a scrap material, an effluent or other unwanted surplus arising from the application of any process or any substance or article which requires to be disposed of which has been broken, worn out, contaminated or otherwise spoiled; this is supplemented with anything which is discarded otherwise dealt with as if it were waste shall be presumed to be waste unless the contrary is proved. This definition was amended by the Waste Management Licensing Regulations (1994) defining waste as: any substance or object which the producer or the person in possession of it, discards or intends or is required to discard but with exception of anything excluded from the scope of the Waste

Directive

Once a substance or object has become waste, it will remain waste until it has been fully recovered and no longer poses a potential threat to the environment or to humans.

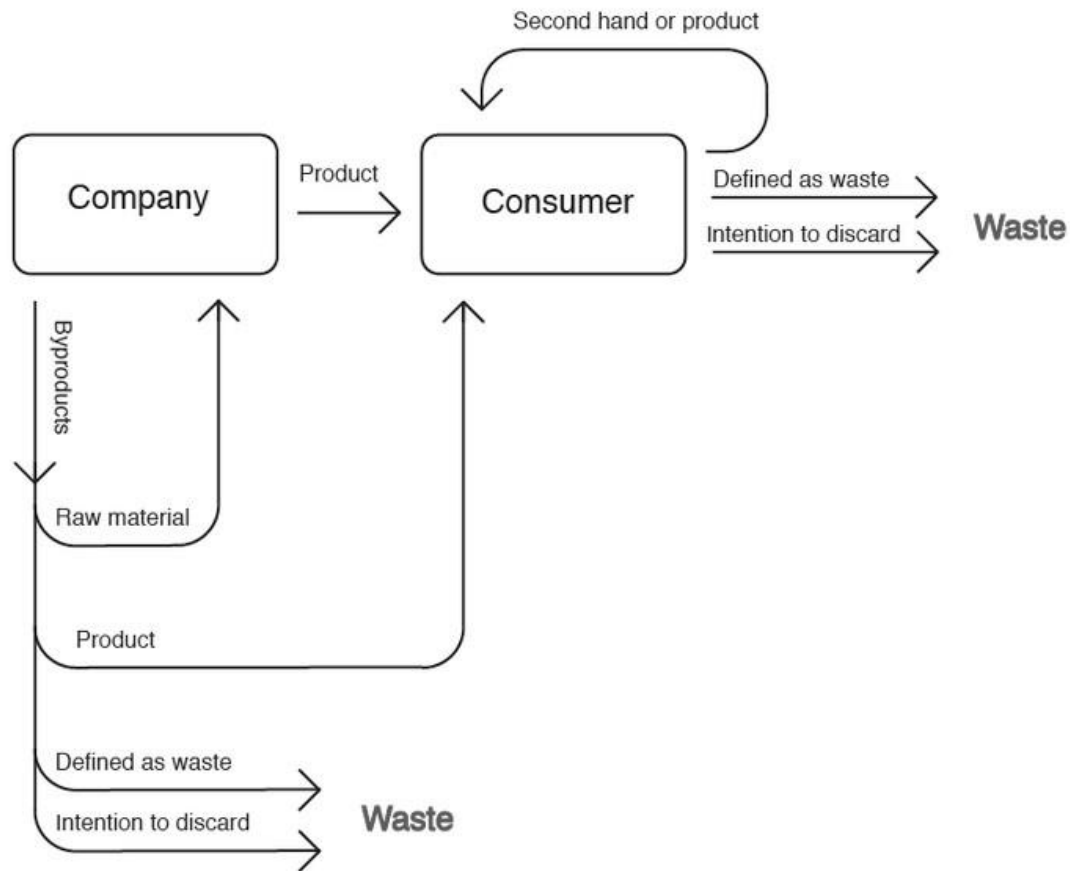


Figure 2.1: Schematic illustration of the EU Legal definition of waste.

With reference to all the above definitions, it is noted that waste is anything that has outlived its life-span or is no more wanted for one reason or the other. It may or may not be new, used or unused; once it is no more required and need to be discarded, becomes a waste.

2.2 Classification of Waste

Waste products differ according to their type and source: household, industry, hospitals, agriculture etc. By classifying them, waste products can be designated so that the various

partners concerned with the production and disposal of waste understand how to effectively handle and deal with it. According to the Council of the European Communities (2001), within this classification list, there are:

- Household waste
- Non-hazardous industrial waste
- Special waste
- Medical waste
- Agricultural waste
- Construction waste
- Radioactive waste

2.2.1 Household Waste

Household and consumer waste is waste produced by households, shopkeepers and trades people. However, it also includes waste from companies and industries when it is not harmful or polluting, such as paper, cardboard, wood, glass, textiles, packaging, etc. This waste is collected by municipal authorities whenever its elimination presents no special technical constraints and is harmless to people and the environment. The breakdown of waste also varies from one country to another, although no strict correlation can be made with the level of wealth. Nevertheless, it can be noted that the proportion of organic material (food, garden waste, etc.) is higher in poorer countries, whereas developed countries show significant proportions of newspaper and packaging in the volumes of waste produced.

2.3 Waste Characteristics

According to the United States Environmental Protection Agency (2010), waste exhibits one of the four characteristics; ignitability, corrosivity, reactivity, and toxicity.

1. **Ignitability** - Ignitable wastes can create fires under certain conditions, are spontaneously combustible, or have a flash point less than 60 °C (140 °F). Examples include waste oils and used solvents.
2. **Corrosivity** - Corrosive wastes are acids or bases (pH less than or equal to 2, or greater than or equal to 12.5) that are capable of corroding metal containers, such as storage tanks, drums, and barrels. Battery acid is an example.
3. **Reactivity** - Reactive wastes are unstable under "normal" conditions. They can cause explosions, toxic fumes, gases, or vapors when heated, compressed, or mixed with water. Examples include lithium-sulfur batteries and explosives.
4. **Toxicity** - Toxic wastes are harmful or fatal when ingested or absorbed (e.g., containing mercury, lead, etc.). When toxic wastes are land disposed, contaminated liquid may leach from the waste and pollute ground water. Toxicity is defined through a laboratory procedure called the Toxicity Characteristic Leaching Procedure (TCLP). The TCLP helps identify wastes likely to leach concentrations of contaminants that may be harmful to human health or the environment.

2.4 Solid Waste Management

Solid Waste Management (SWM) is defined as the control, generation, storage, collection, transfer and transport, processing and disposal of solid waste consistent with the best practices of public health, economics and financial, engineering, administrative, legal and environmental considerations. Solid waste management has three main components: collection and transportation; reuse or recycling; and treatment or disposal (SIDA, 2006).

US EPA (2010) recommends using integrated, hierarchical approach to waste management with four components: source reduction, recycling, combustion, and land filling, to address the increasing volume of municipal solid waste. It ranks source reduction including reuse as the most preferred method, followed by recycling and composting, and lastly, disposal in combustion facilities and landfills.

Developing countries have peculiar solid waste management problems different than those observed in the industrialized countries. Although low-income countries' solid waste generation rates average only 0.4 to 0.6 kg/person/day as opposed to 0.7 to 1.8 kg/person/day in the industrialized countries, indeed, the very composition of their waste is different than that of 'developed' nations. Cointreau (1982), Blight and Mbande (1996) and Arlosoroff (1982) noted developing countries wastes are 2-3 times greater in waste density at the same time 2-3 times greater in moisture content than that of industrialized nations. Developing country wastes also involve large amount of organic waste (vegetable matter, etc.), large quantities of dust, dirt (street sweepings, etc), and smaller particle size on average than in industrialized nations.

Although there might be some potential opportunities which arise from their waste composition, these peculiarities from industrialized nations present additional problems (Cointreau, 1982; Zerbock, 2003). Firstly, a higher solid waste density has many implications for the 'traditional' methods of collection and disposal. The collection and transfer trucks which are able to achieve compression rates of up to 4:1 in industrialized nations may achieve only 1.5:1 in developing countries, and landfill compression technology which averages volume reduction of up to 6:1 in industrial nations may only achieve 2:1 compaction with these increased waste densities. Secondly, the high moisture content and organic composition of wastes in the developing world may lead to problems of increased decomposition rates particularly in areas with high average daily temperatures. A high seasonal or year-round rainfall would also compound these problems, presenting additional challenges with insect populations and conditions conducive to disease. In order to mitigate these problems, developing countries in hot, humid areas must do much more frequent collection, than would be needed in cooler, drier climates, to remove organic wastes before they are able to decompose. Perhaps a biweekly collection of organic material (possibly in conjunction with a municipal composting operation), would be needed to reduce decomposition, if not daily collection.

Collecting, transporting and disposing of MSW presents formidable challenges to many

Third World cities. Waste management represents a large expenditure of these cities and usually accounts for 30-50 percent of municipal operational budgets. In addition, despite these high expenses, cities collect only 50-80 percent of the refuse generated (Medina, 2002). Residents in areas that lack refuse collection, usually low-income communities, tend to either dump their garbage at the nearest vacant lot, public space, creek, river, or simply burn it in their backyards. Uncollected waste may accumulate on the streets and clog drains when it rains, which may cause flooding. Wastes can also be carried away by runoff water to rivers, lakes and seas, affecting those ecosystems. Alternatively, wastes may end up in open dumps –legal and illegal–, the most common disposal method in the Third World. Open dumping of solid wastes generates various

environmental and health hazards. For example, methane and carbon dioxide are greenhouse gases that contribute to global warming. Methane is twenty times more effective at trapping heat than carbon dioxide, and more persistent in the environment (US EPA 1995). Leachate from the landfill can enter ground water systems, leading to increases in nutrient levels that cause eutrophication (El-Fadel et al., 1997). Moreover, bioaccumulation of toxins and heavy metals can occur.

The following conclusions can be drawn from the foregoing review. Firstly, municipal solid waste (MSW) management is serious concern and collecting, transporting and disposing of MSW presents formidable challenges to many Third World countries including Ghana. Secondly, waste management represents a large expenditure of these countries and usually accounts for 30-50 percent of municipal operational budgets. Yet, countries collect only 50-80 percent of the refuse generated, despite these high expenses.

But, more importantly, cost recovery is a serious impediment to efficient and effective solid waste management in these countries. Thirdly, despite their low average rate of per capita solid waste generation per day, developing countries have peculiar solid waste management problems different than those faced by industrialized countries. In particular, the very composition of their waste is different from that of 'developed' nations. These peculiarities from industrialized nations present additional challenges to developing country cities in terms of collection frequencies and equipment demand. Moreover, the relative significance of household socioeconomic, waste and environmental attributes of solid waste separation, collection and disposal of households in major developing country cities have rarely been explored. Therefore, such Willingness to pay study would help finding out sustainable means of funding to improve the solid waste management service

in the cities.

2.5 Municipal Solid Waste Management

Solid waste management is one of the functions that have been devolved to local government in a number of developing countries (Van Dijk, 2006). Its proper handling of this task is often taken as an indicator of the successfulness of urban reform. A number of works have

been finished on solid waste and urban management in Africa. The main issues coming out of the current research are:

- (1) The importance of appropriate policy context, including the necessary regulation,
- (2) A role for the private or NGO sector,
- (3) The introduction of cost recovery mechanisms,
- (4) More efficient organization of waste collection and processing of waste, and
- (5) The possibility of introducing environmentally friendly and more energy efficient technologies.

According to Tchobanglous et al (1993), all wastes arising from human and animal activities that are normally solid and are discarded as useless or unwanted are broadly defined as solid waste. It includes municipal garbage, industrial and commercial wastes, sewerage slug, waste of agricultural and animal husbandry, demolition waste and mining residues. Different individuals have defined municipal solid waste (MSW) differently. Medina (2002) defines MSW as “the materials discarded in the urban areas for which municipalities are usually held responsible for collection, transport and final disposal. It encompasses household refuse, institutional wastes, street sweepings, commercial wastes, as well as construction and demolition debris. For Cointreau (1982), MSW is material for which the primary generator or user abandoning the material within the urban area requires no compensation after abandonment. Cointreau argues, to be qualified as an urban solid waste it should generally be perceived by society as being within the responsibility of the municipality to collect and dispose of.

Based on the sector of the economy responsible for generating them, Enger and Smith (2006), categorized solid waste into four broader kinds as mining, agricultural, industrial, and municipal solid waste. Municipal solid waste are wastes which are no longer needed by people because they are broken, spoiled, or have no longer use including waste from household's, commercial establishments, institutions, and some industries are classified under. Municipal solid waste can further be classified in different ways, vis-a-vis the point of origin of waste material, nature of material, kind of materials and heat contents of the materials. Based on points of origin of the materials there are six types of municipal solid wastes namely: domestic waste, commercial waste, industrial waste, institutional waste, street sweepings and constructions & demolition wastes (Rand et al., 2000).

Based on the nature of waste materials MSW can be classified as organic, inorganic, combustible, putrescible and non-putrescible factions (Cornwell, 1998). Cornwell regarded waste classifications based on the kinds and heat content of the waste materials as the most useful. Domestic waste or household waste derived from residential neighborhoods is the largest component of municipal solid waste.

2.6 Solid Waste Collection Services in Kumasi Metropolis

Solid waste collection services are delivered under 10 Contract Lots based on the ten Sub Metro Areas in the Kumasi Metropolis. Two systems of collection are employed (i.e. House-to-house and Communal) in each of Sub Metro Areas. The house-to-house collection system attracts a fee of GH¢5 per 1st Class, GH¢4 for 2nd Class and GH¢3 for 3rd Class residential

areas respectively. The rates are charged per bin per month. The communal collection component on the other hand attracts 10Gp per head load of waste deposited at the communal storage facility.

Below is the list of the private service providers, assigned to the various Sub Metro Areas and their contact numbers.

Table 2.1: Solid Waste Management Companies and their Respective Sub-Metros

No.	Sub Metro	Name of Contractor	Contact Number
1	SUBIN	Zoomlion Gh. Ltd.	0244690732
2	ASAWASI	Zoomlion Gh. Ltd.	0244690732
3	TAFO	Zoomlion Gh. Ltd.	0244690732
4	BANTAMA	Meskworl Co. Ltd	0243324663
5	MANHYIA	Meskworl Co. Ltd	0243324663
6	ASOKWA	SAK-M Co. Ltd.	0243462132
7	KWADASO	Waste Group Co. Ltd.	0244607880
8	NHYIAESO	Kumasi Waste Management Limited (KWML)	0244603730
9	OFORIKROM	ABC Co. Ltd	0244279958
10	SUAME	Anthoco Co. Ltd.	0275106813

Source: KMA, (2012)

2.7.1 Efforts by KMA to improve sanitation

In exercise of the powers conferred on the KMA by section 79 of the Local Government Act, 1993 (Act 462) to ensure sanitation within the Metropolis, it came up with the Kumasi Metropolitan Assembly Sanitation Bye-Laws, 1995 to guide its operations in order to achieve its mandate. These byelaws are as follows:

1. (1) where the KMA has set aside a place for the disposal of refuse no person shall place, cause or permit to be placed any carrion, filth, refuse or rubbish or any offensive or unwholesome matter on any street, yard, premises, enclosure or open space within the Metropolis.

(2) if any offender under sub-paragraph (1) of this paragraph has not been identified or discovered the existence of any carrion or other substance mentioned in the said section found close to any building shall be presumed to have been placed by the owner or occupier thereof.

2. That occupier of any premises shall clear and keep free from all dirt, underbrush, underwood, weeds, high grass, rubbish, rugs, broken bottles and all offensive matter (filling up holes with stones, gravels or other like materials) the streets or roads at the front, back sides, thereof, with the drains, gutters and channels thereon.

Provided that where two or more houses abound on the streets or roads, the occupier or each shall be responsible for keeping clean only that half of the street or road nearest to his premises.

3. (1) No person shall cause a nuisance in any public or open space.

(2) No occupier of any premises shall by any act, allow the existence of nuisance in his house.

4. (1) the removal of night soil from all premises in which private bucket latrines are kept shall be the responsibility of the house owner or occupier.

(2) Any occupier who fails to remove a bucket of night soil when it is full commits an offence.

5. No food seller shall serve food in anything unless due care has been taken to make sure the food wrappers are hygienic

6. No person shall deposit litter, refuse or other matter which may cause nuisance or block the passage provided for a gutter or drains.

7. Any person who contravenes any of these bye-laws commits an offence and shall be liable on conviction by a court or Community tribunal to a fine not exceeding c50,000 (GHc 5.00) or to a term of imprisonment not exceeding three months.

2.7.2 Fees Approved by KMA for Waste Collection.

The KMA currently approves for waste companies to charge a flat rate of GHc 10.00 per bin per month for all house to house collections and 20GHp per head load of solid waste per each dumping. This is irrespective of the area or the income level of the individual or household. The waste collection companies estimate to require a total of GHc20.00 per bin

per month (for house-house collection) and 50GHp per head load (for communal collection) to enable it effectively carry out its mandate. The difference of GH10.00 and 30GHp for house-house and communal collections respectively is subsidized by the Assembly.

CHAPTER THREE

STUDY AREA AND METHODOLOGY

3.1 Study Area

The study area is the Kumasi Metropolis. According to KMA (2012), Kumasi is the capital city in southern central Ghana's Ashanti region and it is centrally located in the Ashanti Region of Ghana. Its unique central position makes it accessible from all corners of the country. It is the second largest city in the country and the administrative capital of Ashanti. It is a fast growing Metropolis with an estimated population of more than two million people and an annual growth rate of about 5.4%. The physical structure is basically circular with a centrally located commercial area for economics activities.

There are concentrations of economic activities in the city. The first and most important location is the Central Business District (CBD), which embraces the Kejetia Lorry Park, the Central Market and the Adum Shopping Centre. The other economics nodes include the Suame Magazine (Vehicle repair centre) and the Kaase/Asokwa Industrial Area.

It is estimated that 48%, 46% and 60% of the Metropolis are urban, peri-urban and rural respectively, confirming the fast rate of urbanization.

The Kumasi Metropolitan Assembly constitutes the highest political authority in the metropolis. It guides, directs and supervises all other administrative authority in the city.

It is divided into ten (10) Administrative Sub-Metro Council Areas. It has 24 Town Councils and 419 Unit Committees. The Assembly is composed of 87 members with 60 of them elected and 27 appointed by the state.

3.2 Methodology

3.2.1 Research Design

The Survey research design as well as the Contingent valuation methods is used. The survey method is the technique of gathering data by asking questions to people who are thought to have desired information. A formal list of questionnaire is prepared.

Contingent Valuation method was employed to assess Willingness to pay for waste services. It involves directly asking people, in a survey, how much they would be willing to pay for specific environmental services. Contingent Valuation is necessary in this circumstance because according to Carson (1991), the most obvious way to measure nonmarket values is through directly questioning individuals on their willingness-to-pay for a good or service. This is called the contingent valuation method; it is a survey or questionnaire-based approach to the valuation of non-market goods and services.

3.2.2 Instrumentation

The research instruments that were employed include the following:

- Structured and semi- structured questionnaires.

- Structured interviews.
- Document analysis
- Personal observations.

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3.2.3 Study Population

The study population comprises the following:

- Staff of the Kumasi Metropolitan Assembly.
- The waste management companies within the Metropolis.
- Residents / households within three suburbs of the Metropolis.

3.2.4 Sampling procedure

1. With regards to KMA, purposive sampling was used to select relevant authorities / officials for interviews.
2. All the waste management companies were identified and listed and representative sample of 5 was randomly selected. Respondents were queried through the use of structured interviews and questionnaires.
3. Data collected from residents / households of the Metropolis was by stratified random sampling using semi-structured questionnaires as well as face-to-face interviews and focus

group discussions. The stratification classified households into high, medium and low income classes. 70 respondents / households were randomly selected within each stratum constituting a total of 210 respondents. Three areas / suburbs comprising one each of the high, medium and low income areas within the metropolis were selected (i.e.

Ahinsan Estate, Kwadaso and Moshie Zongo respectively).

3.2.5 Data Collection Procedure

All formal interviews were conducted personally by the student researcher. However, some students from the Agricultural Training College in Kumasi were trained to assist in administering the questionnaires.

Data were collected on the following:

- Demographic characteristics of the respondents.
- Economic background or categorization of respondents / citizens.
- Perception of citizens on waste generation and collection □ Factors determining WTP for solid waste management.
- Amount (GHc) paid per household for waste collection.
- Sections of the city (KMA) bye-laws on sanitation.
- Rewards associated with compliance.
- Means of educating the public on the bye-laws.
- Households' level of awareness of the bye-laws, its rewards and punishment.

- Key challenges of the waste management companies.

3.2.6 Data Analysis

Data was analyzed using a combination of tools or models relevant to achieving the specific objectives of the study. Statistical Package for the Social Scientist (SPSS) and the STATA software were mainly used to analyze the data.

Analytical tools used include:

1. Descriptive statistics such as Measures of central tendency, Measures of dispersion, Measures of association, Cross-tabulation, contingency tables and Histogram.
2. Chi-square tests
3. Probit and Logit models
 - The descriptive statistics were used to analyze the levels of waste generation and methods of disposal as well as cost of solid waste disposal to the waste companies.
 - The Chi-square tests and crosstabulation were employed to determine the significance of the relationship between the determinants of willingness to pay for improved waste disposal services.
 - Probit and Logit models were used to examine the determinants of willingness to pay for improved services and maximum amount to be paid.

3.3 Determinants of Willingness to pay for improved waste management services and amount respondents are willing to pay.

3.3.1 Theoretical framework

To determine the factors influencing willingness to pay for improved waste management, the relevant models that were employed are discussed in this section. The models necessary for identifying and determining the factors that influence willingness to pay for improved waste management services and amount respondents are willing to pay are considered. Though there are different qualitative response/binary choice models that could be employed in this study, the most appropriate models are the probit/logit and the tobit models. These models are discussed below

3.3.2 The logit and probit models

The logit and probit models specify a non-linear functional relationship between the probabilities of making a decision such as paying for improved waste management services by households in the Kumasi Metropolis. The logit model has a logistic distribution function and that of the probit has an underlying normal distribution function for the stochastic term, ε . Given equation (3.2), $p(1) = \Phi(\beta X_i)$, for a given regressor

vector, it is expected that

$$\lim_{X_i \rightarrow 1} \text{Prob}(Y = 1) = 1$$

and

$$\lim_{X_i \rightarrow 0} \text{Prob}(Y = 1) = 0$$

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logit model is specified as:

$$\text{logit}(p) = \ln \left(\frac{p}{1-p} \right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_k X_k \quad (3.2)$$

where p is the probability of the event occurring, $\beta_0, \beta_1, \beta_2, \dots, \beta_k$ are the parameters to be estimated, and $X_1, X_2, \dots, X_k$ are the independent variables.

The standard normal distribution function and Λ represents the logistic function.

$$\Lambda(x) = \frac{e^x}{1 + e^x} \quad (3.3)$$

The maximum likelihood estimator (MLE) is usually used and is specified as:

$$\hat{\beta}_0 = \frac{1}{n} \sum_{i=1}^n \ln \left(\frac{p_i}{1-p_i} \right) - \beta_1 \bar{X}_1 - \beta_2 \bar{X}_2 - \dots - \beta_k \bar{X}_k \quad (3.4)$$

$$\frac{prob(Y \neq 1) \prod_{i=1}^n p_i^{x_i}}{(1 \prod_{i=1}^n p_i^{x_i})} \prod_{i=1}^n (p_i^{x_i}) \quad (3.3)$$

Where Φ represents the standard normal distribution function and Λ represents the logistic cumulative distribution function.

$$E[Y] \leq 0[1 - F(\square' X)] + 1[F(\square' X)]$$

$$\square F(\square' X) \tag{3.4}$$
$$InL \sqsubseteq [y_i InF(\Box' X_i) \sqsubseteq (1 \sqcup y_i) In(1 \sqcup F(\Box' X_i))] \quad (3.5)$$

Empirical studies in several cases have observed that the probabilities given by the (logit and probit) are similar and can therefore be used interchangeably. However, the theoretical foundation establishes that the differences between the two should not be ignored (Green, 2003; Cameron and Trivedi, 2005).

A strictly dichotomous dependent variable is however, not sufficient for examining the willingness to pay for improved waste management services, hence the need for another approach, the tobit estimation.

3.3.3 The tobit model

The tobit model was developed by Tobin in 1958 and has been used by a number of researchers including Oladele (2005) and Dankyi *et al* (2005) in various studies. According to Green (2003) and Cameron and Trivedi (2005), if we assumed that Y_i is the willingness to pay for a service, in this case paying for improved waste management services by respondents, p^* is a non-observable latent variable and T is a non-observed threshold level, then,

$$\begin{aligned} Y_i &= X_i \beta \text{ if } p^* \geq X_i \beta + \varepsilon_i \geq T, \\ Y_i &= 0 \text{ if } p^* \leq X_i \beta + \varepsilon_i < T \end{aligned} \quad (3.6)$$

Where X_i is a set of explanatory variables and ε_i is assumed to be an independently and normally distributed stochastic term with zero mean, μ and constant variance, σ^2 .

If there is a perceived utility $U(p)$ from willingness to do something, say to pay for improved waste management services, p and a utility $U(0)$ not making that decision, say

not willing to pay and there is a cluster of the population with no decision to make at the limit (Baidu-Forson, 1999; Oladele, 2005; Dankyi *et al*, 2005), then:

$$P_i = X_i \beta + \epsilon_i \text{ if } X_i \beta + \epsilon_i \geq 0, \text{ positive unobserved latent variable}$$

$$P_i = 0 \text{ if } X_i \beta + \epsilon_i < 0 \text{ in case of decision against } p$$

Where:

$$U(X_{i0}) \geq U(X_{ip}) \quad (3.7)$$

Where $i = 1, 2, 3, \dots, n$ denotes the sample size surveyed; P_i is the dependent variable (amount of money households are willing to pay); X_i represents the vector of independent variables including socio-demographic, house ownership, bags of waste generated; β is a vector of unknown parameters to be estimated. The expected amount households are willing to pay for improved waste management services, $E(p)$ is given as follows:

$$E(p) = X_i \beta + \sigma \int_{-\infty}^{\infty} F(z) f(z) dz \quad (3.8)$$

Where X is the vector of the explanatory variables; $F(z)$ is the cumulative normal distribution of z ; $f(z)$ is the value of the derivative of the normal curve at a given point (i.e the unit normal distribution); z is the Z-score for the area under the normal curve, given as $z = (X\beta - p)/\sigma$; β is a vector of Tobit maximum likelihood estimates; and σ is the standard error of the error term. The relationship between the expected value of all observations, E_p and the expected conditional value above the limit E_p^* is given by:

$$E_p \frac{\partial F(z)}{\partial p} E_{*p} \quad (3.9)$$

The effect of the k th variable of X on p leads to the following decomposition:

$$\frac{\partial E_p}{\partial X_k} \frac{\partial F(z)}{\partial p} = \left(\frac{\partial E_{*p}}{\partial X_k} \right) E_{*p} \left(\frac{\partial F(z)}{\partial X_k} \right) \quad (3.10)$$

This equation (3.10) suggests that the total change in elasticity of p can be disaggregated into two parts namely:

1. The change in probability of the expected level of amount they are willing to pay and
2. Change in the elasticity of being willing to pay.

For the index or unobserved latent variable, the marginal effect of the censored regression or tobit model is calculated as (Green, 2003: 764):

$$\frac{\partial E(p^* | X_i)}{\partial X_i} \quad (3.11)$$

However, the above marginal effect is of no interest because that variable is not observed and cannot be used for policy recommendations. As a result, it is not of interest in the study. To obtain the marginal effect of the observed variable that is of interest in the study, the following formula (Green, 2003: 765) is used:

$$\frac{\partial E(p | X_i)}{\partial X_i} = \frac{\partial}{\partial X_i} \left[\text{prob}(0 \leq p^* \leq 1) \right] \quad (3.12)$$

ΦX_i

According to Green (2003: 767), the log-likelihood of the tobit model is specified as:

$$\ln L = \sum_{y_i > 0} -1/2[\log(2\pi) + \ln\sigma^2 + (y_i - x_i'\beta)^2/\sigma^2] + \sum_{y_i = 0} \ln[1 - \Phi(x_i'\beta)/\sigma]$$

Maximising this likelihood function with respect to β and σ gives the maximum likelihood estimates of these parameters. The STATA software was employed to estimate the parameters by MLE.

3.3.4 Analytical Framework

This section presents a detailed account of the models employed for the analysis, the selected variables and the hypotheses formulated for the study. Firstly, method for computing the willingness to pay for the improved waste management services is discussed. Secondly, the method of estimating the factors that influence the amount respondents are willingness to pay for the improved waste management services is presented.

3.3.5 Determining factors that influence the willingness to pay for the improved waste management services

The logit model was used to identify the factors that influence households' willingness to pay for the improved waste management services. The logit model was selected based on the goodness of fit measures such as the F – statistic, the Likelihood Ratio, the R – squared and the number of significant variables using the t – statistics after the estimation of the model using both Probit and Logit models. The empirical model is specified as:

$$\log\left(\frac{p}{1-p}\right) = \alpha_0 + \alpha_1 X_1 + \alpha_2 X_2 + \alpha_3 X_3 + \alpha_4 X_4 + \alpha_5 X_5 + \alpha_6 X_6 + \alpha_7 X_7 + \alpha_8 X_8 + \alpha_9 X_9 + \alpha_{10} X_{10} + \varepsilon \quad (3.16)$$

Where: $\log\left(\frac{p}{1-p}\right)$ = The log-odds in favour of having access to financial capital

The variable selection was based more on literature and related studies by other researchers such as Niringiye and Omortor (2010). They include the following:

- X_1 = Monthly Income of the Household
- X_2 = Sex of Respondents
- X_3 = Age of Respondents
- X_4 = Education of Respondent
- X_5 = Marital Status of Respondent
- X_6 = Time Spent in the Area
- X_7 = Housing Arrangement
- X_8 = Number of Children in the Household
- X_9 = Quantity of Waste Generated

- X_{10} = Responsibility of Solid Waste Management

3.3.6 Definition of independent variables and Hypothesis

- i. **Income** - This variable refers to the monthly money income of the household in terms of Ghana Cedis. It includes the income of the head from all sources. There is a general agreement in environmental economics literature on the positive relationship between income and demand for improvement in environmental quality (Zerbock, 2003). Therefore, we expect income to affect willingness to pay and its amount positively and significantly.
- ii. **Gender:** This refers to the sex of the respondents as either male or female. This study expects female respondents to be more willing to pay than men, since traditionally it is the role of women to clean the house and dispose of the waste.
- iii. **Age:** This refers to the age of the respondent and it is expected to affect willingness to pay negatively. This is because old people may consider waste collection, as government's responsibility and could be less willing to pay for it. While the younger generation might be more familiar with cost sharing like food, clothing education, health, etc and could be more willing to pay for waste management.
- iv. **Education:** This variable is taken to capture the level of understanding of the respondents about the desirability of proper management of solid waste. Education is expected to have positive and significant effect on waste management with higher levels having higher effects on willingness to pay and its amount.

- v. **Marital Status:** The marital status of the household head is expected to influence the value the individual gives for the proposed change. This is due to the fact that married people are likely to be more responsible to keep the environment clean than single ones because married respondents are likely to have larger family size and hence face higher risks than those not married.
- vi. **Length of stay:** This refers to the number of years the household has been living there. This is expected to influence willingness to pay in the positive direction, since the longer the year the household has been there, the more they would understand the problem of solid waste management of that area, and the more they are expected to pay.
- vii. **Number of Children in the Household:** This refers to the number of children below 15 years of age. This variable is expected to have a positive effect on willingness to pay. This is due to the fact that the more children in the household, the more willingness to maintain a clean environment in the future in which children will grow with lesser risk due to cleaner environment.
- viii. **Quantity of Waste Generated** - This variable stands for the quantity of waste the household generates within a week. For the purpose of this study, the unit of measurement used is a shopping plastic (polythene) bag (30 Ghana pesewas worth), which is common as a convenient means for measurement to most respondents during the survey. The study hypothesizes willingness to pay to be positively related with the quantity of solid waste generated, since the higher the generation, the more would be the problem household's face in storage and taking the waste for collection, and they would be willing to pay more.

ix. **Responsibility for solid waste management** - This variable is taken as proxy to examine the attitude of the respondents towards cost sharing in solid waste management. This study expects positive attitude towards cost sharing to influence willingness to pay in the positive direction.

x. **Tenancy / Housing Arrangement** - Those living in their own houses are expected to be more willing to pay for the improvement. This could be partly explained by the belief some renters have that the owner of the house should pay solid waste charges. The fact that house owners get extra income from renting rooms in their house or extra houses in their compound is also expected to make them more willing than those who pay a good part of their income as house rents.

3.3.7 Goodness of fit test and hypotheses testing for the binary models

The likelihood ratio index (ρ^2) according to Cameron and Trivedi (2005) is used for the purpose of validating the explanatory power of the binary choice models and is specified

as:

$$\rho^2 = 1 - \frac{L(\beta_u)}{L(\beta_0)} \quad (3.17)$$

The likelihood ratio indexes which is similar to the F – Statistic in least squares multiple regression is also used for testing the hypothesis on the slope coefficients. It lies between zero

and one. The hypothesis that all the slope coefficients are zero was tested using the likelihood ratio (LR) statistic (χ^2) which is given as:

$$(3.18)$$

This is analogous with the Chi-square(χ^2) with the degrees of freedom being the sum of all the estimated parameters of the model. The decision criterion is that if the tabulated Chi – square value is greater than the calculated Chi – square value, then the alternative hypothesis that the entire slope coefficients are not zero is rejected in favour of the null hypothesis that, they are zero. The t – test was used to test the significance of the individual variables included in the model.

3.3.8 Estimating factors influencing amount of money respondents are willing to pay

To estimate the amount of money households are willing to pay for improved waste management services, the tobit model was used. The identified factors in section 3.4.3 above that influence the amount of money households are willing to pay for improved waste management services were used for the tobit analysis. The empirical model for the tobit estimation is specified as:

$$(Am) = \alpha_0 + \alpha_1 X_1 + \alpha_2 X_2 + \alpha_3 X_3 + \alpha_4 X_4 + \alpha_5 X_5 + \alpha_6 X_6 + \alpha_7 X_7 + \alpha_8 X_8 + \alpha_9 X_9 + \alpha_{10} X_{10} + \varepsilon \quad (3.19)$$

Where:

Am = The additional amount of money respondents are willing to pay for improved waste management services .The independent variables are as defined above. The t – statistics were used to test the significant levels of the individual exogenous variables and the R – squared used to validate the explanatory power of the model.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.0 Introduction

In this section, information obtained in the survey is analyzed using both descriptive and econometric analyses with STATA software version 10. Aggregation of the willingness to pay amount and interpretation of the results are also made in line with the specific objectives of the study.

4.1 Background information

4.1.1 Gender

Male respondents dominated females and are represented by a percentage of 72.8% and 27.2% males and females respectively as presented in table 4.1:

Table 4.1: Sex of Respondents

Sex	Frequency	Percent
Female	56	27.2
Male	150	72.8
Total	206	100.0

Source: Field Data, 2011.

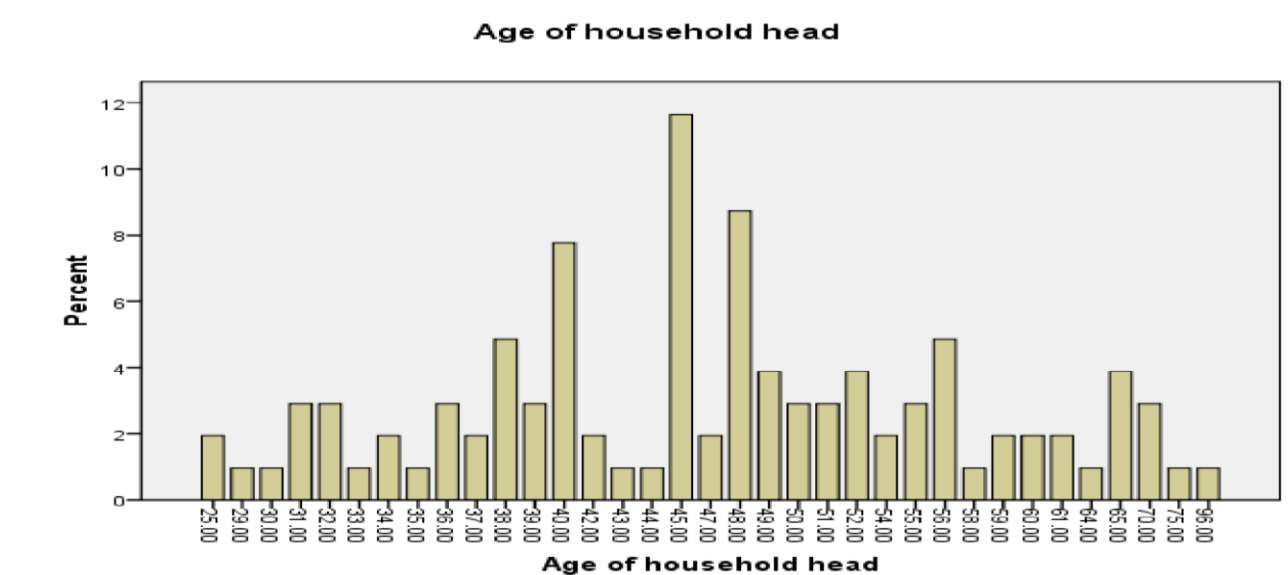
This could be attributed to the fact that, most homes in the Metropolis are owned by men (UNDP-World Bank report, 1992) which is also mainly due to cultural bias against women in ownership of property in most parts of this country.

4.1.2 Age

From the figure below, the mean age is 47 years. The median is 47 years and the mode is 45 years.

Figure 4.1: Age Distribution of Respondents

Source: Field Data, 2011.

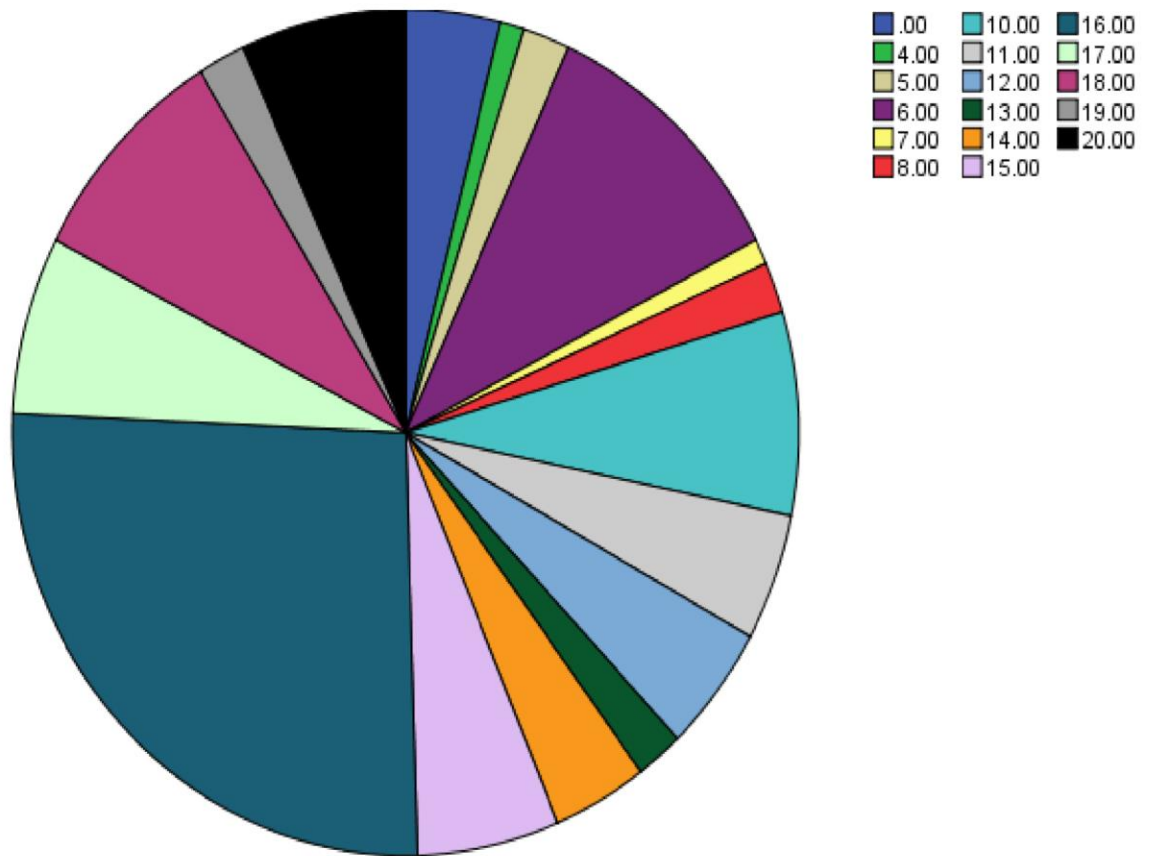


This means that, majority of the respondents (household heads) are matured and range between 45-50 years.

4.1.3 Educational Background

Figure 4.2: represents the educational backgrounds of the respondents.

Educational background of household head



From the results, it could be noted that a greater proportion of the respondents had spent sixteen (16) years in schooling implying that by conversion they have been educated up to the tertiary level and represent about 30% of the entire sample. Very few (3.9%) had no formal education at all.

However, about 40% were educated up to the Primary and Junior secondary school level. Close to 20% had form of secondary education. The implies that, majority of the respondents have received some form of formal education.

4.1.4 Marital status

Table 4.2: presents the marital status of the household respondents as follows:

Marital Status	Frequency	Percentage (%)
Married	174	84.5
Not married	32	15.5
Total	206	100.0

Source: Field Data, 2011.

From the survey data, 84.5% of the respondents were married and the remaining 15.5% are either not married.

4.1.5 Number of children per household

Table 4.3: Number of children per household.

Number of children	Frequency	Percentage (%)
0	30	14.6
1	28	13.6
2	50	24.3
3	38	18.4
4	30	14.6
5	18	8.7
6	2	1.0
7	6	2.9
10	4	1.9
Total	206	100.0

Source: Field Data, 2011.

The number of children (below 15 years) per household ranges from 0 – 10. The mean or average number of children per household is 3 and the mode is 2.

It is assumed that, as the number of children per household increases the amount of solid waste generated is also likely to increase. This is because children could generate more waste as a result of negligence and ignorance to cleanliness.

4.1.6 Housing arrangement Table 4.4: Housing arrangements

Form of accommodation	Frequency	Percentage (%)
Rented	90	43.7
Privately owned	116	56.3
Total	206	100

Source: Field Data, 2011.

It is noted that most of the households are privately owned constituting 56.3% and rented accommodation constitutes 43.7%. House ownership is assumed to affect waste management in the sense that, house owners are likely to be more interested and concerned about waste issues than tenants because the house owners are always the first to be called or summoned in case of suits for breach of waste regulations.

4.2 Level of awareness and perception on the KMA bye laws by the respondents

4.2.1 Level of Awareness

Abrokwah (1998), observed that ignorance, negligence, lack of law to punish sanitary offenders, and low level of technology in waste management are the major causes of waste management problems in Kumasi. He suggested that awareness should be created among residents to manage household refuse and educate them on the hazards that ill-disposed waste could pose to the environment and to them.

The study went on to determine whether or not respondents were aware of the byelaws and table 4.5 summarizes the findings.

Table 4.5 level of awareness of the byelaws

Sequence of bye-laws	Aware	
	Yes	No
1 st bye-law	16	13
2 nd bye-law	12	16
3 rd bye-law	14	15
4 th bye-law	17	12
5 th bye-law	15	14
6 th bye-law	15	14
7 th bye-law	15	14
Total	104	98
Percentage (%)	51.5%	48.5%

Source: Field Data, 2011.

It could be noted from the table that close to 48.5% of the respondents do not know of the existence of the very byelaws that govern their sanitation situation in the Metropolis. The number is significantly huge and threatening because even with those who seem to be aware, there is a challenge in understanding and abiding by it fully. A huge gap is therefore created

when close to half of the population (respondents) claim not be aware of their sanitation byelaws. This implies that, the educational programmes instituted by the

Assembly to educate the public on its byelaws are either very weak or not functioning. According to Agbola (1993), cultural derivatives, beliefs, perceptions and attitudes are learned response sets. They can therefore be modified or changed through education. This point to the fact that people's unconcerned attitudes towards solid waste can be changed for the better through education. According to Pacey (1990), formal education for women is a pre-requisite for change in sanitation behaviour.

With regards to those who are aware of the byelaws, some indicated that they had the information from radio, TV, friends and family members. In fact, a good number of the respondents interestingly could not tell where they got to know of the laws. Further enquiries at the KMA indicated that, they have limited funding for educating the public. In fact, one could not explain why the byelaw which is supposed to be a document for public consumption is not published on the Assembly's website.

4.2.2 Perception of Respondents on the Comprehensiveness of the Byelaws

The study again sought to find the public's perception about the comprehensiveness of the byelaws with regards to its rewards, incentives and punitive measures to ensure its adherence and table 4.6 presents the outcome.

Table 4.6 Comprehensiveness of the KMA bye-laws

Response	Frequency	Percentage
Yes	62	38.8
No	22	13.8
I don't know	72	47.5
Total	160	100

Source: Field Data, 2011.

It could be noted that, a large number of the respondents (47.5%) seem not to have any idea as regards the comprehensiveness of the byelaws. This is particularly so because, a significant proportion of the respondents indicate that they are not aware of the byelaws and even to those who are aware they have very little knowledge regarding the content. Indeed, this cannot be disputed as education of the public on the byelaws is not adequate and moreover, access to the bye-law itself as a document is a huge challenge. It cannot even be found on the official website of the KMA. This is ascertained by the experience of the student researcher when I needed to have access to the Byelaws for the purpose of this research.

However, for those who may be familiar with the byelaws (38.8%) indicate that it is comprehensive and contained the needed rewards and punishment to ensure adherence. However, they were quick to add that even though the byelaw contains a fine for law breaches to serve as deterrent to others, the fine of c50,000 old cedis as at January, 2012 (GHc5.00) is worthless and useless to make any significant contribution in punishing offenders of the law. About 13% think that, it is not comprehensive enough and therefore

suggest that it should be revised to capture specific relevant issues of the city and the penalty of Ghc 5.00 reviewed.

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4.3 Methods of waste disposal and Respondents Perceptions about Waste

Management System in the Metropolis

4.3.1 Methods of Waste Disposal

According to Stirrup (1965), the method of refuse disposal must be related to the nature of the community served, its financial capacity, and the type of materials arising, climatic conditions, the desirability of utilizing materials in certain instances compared with the imperative need to utilize them in order to assist in the provision of vital raw materials. The effectiveness of the selected system will be determined in relation to the immediate disposal requirements and the need to cater to the conditions likely to arise from planned future developments in the area.

In trying to ascertain how households dispose off their solid waste, the respondents were asked to indicate the methods of solid waste disposal. It was realized that, over 40% of the respondents take it to the nearest storage receptacle as presented in table 4.7 below:

Table 4.7: Methods of Waste Disposal

Methods	Frequency	Percentage
Secondary Storage Bins	84	40.7
Refuse dumps	56	27.2
Burning / Dug holes	42	20.4
Private Collectors / house-house collection	17	8.3
Others	7	3.4
Total	206	100.00

Source: Field Data, 2011.

A relatively small proportion of the respondents constituting 8.3% enjoy the services of private waste collectors. These private / house to house collectors include waste companies and individuals who go to homes and doors-steps of their clients and collect their solid waste for a fee which varies from client to client depending on the locality. The final points of disposal for these private collectors also vary ranging from use of the refuse dumps to secondary storage bins and dump sites.

Others (20.4%) indicate that, the only option they have is to dig a hole and bury the solid waste in it around their homes whereas about 27.2% carry their solid wastes to rubbish dumping sites normally created by the residents of the communities. In fact only few (3.4%) stated other reasons which include dumping it on the street or the backyard.

A significant proportion of the respondents do use secondary storage bins (otherwise known as secondary receptacles). The city authority (KMA) and sometimes in collaboration with other waste companies provide solid waste storage bins for keeps by households in front of their homes. In other instances, the storage bins come in a form relatively large enough to be hooked to the rear of the waste transportation vehicles and kept at vantage points in the communities for communal collections. People are expected to keep and store their solid wastes in such bins which are later picked up by the KMA or the designated company for final disposal at appropriate dumping sites.

It was noted from the study that, because most of the households depend on secondary storage receptacles provided by the KMA or waste companies, it puts so much pressure / demand on such receptacles. In fact, the quantity available is not adequate and placement does not follow any regular pattern in terms of accessibility and convenience for all the households. This has a connection to assertion by Edmunson (1981), in his study on refuse management in Kumasi. He pointed out that most sites used for refuse dump are chosen without taking into consideration the distance to be covered by residents. As a result, some are found quite far (sometimes between 200m – 1000m) away from residents of a particular household. Due to the pressure on such storage facilities, they easily and quickly get full and the demand for regular emptying at correct times is quite high.

This notwithstanding, respondents complained and explained that in most cases the receptacles could get full and be left unattended to for days. Even though they may not be emptied, people will keep dumping and soon a pile of solid waste is created. This poses a great danger to residents as they stated some problems associated with that to include the following:

- Collection usually delays and dogs, livestock and other pests / rodents scatter them around.

- Piles of waste in and around the receptacles get rotten and usually give off unpleasant smell, breed mosquitoes and pose many health hazards.
- Not appealing to the eyes when seen giving the entire city an obscene view.
- General pollution of the environment.



Plate 1: Solid waste scattered around residential homes in Kumasi

The study revealed that, the service provided by KMA and waste companies appeared to be a tailor made and could have been the best and most convenient option to residents. However, its execution leaves so much to be desired. Residents explained that, they were made to understand that the solid waste would be collected once every week but this has consistently failed. They are therefore not pleased with the kind of services provided. In some cases, the collection company may fail to turn up for more than a month. When this happens, residents are left with no option than to resort to other unorthodox means of

emptying waste including dumping in gutters and streets. In other instances dogs, rodents and livestock scatter the waste around as could be seen in the picture below.



Plate 2: Dogs and livestock scattering waste supposed to be kept in secondary receptacles

They further explained that, the piles of waste in and around the receptacles get rotten and usually give off unpleasant smell, breed mosquitoes and pose many health hazards. Again it is not appealing to the eyes when seen and hence giving the entire city an obscene view and also leads to general pollution of the environment.

4.3.2 Respondents perception on waste management within the Metropolis

The study seeks to determine the perception of respondents of the Metropolis on the current waste management system in the Metropolis. Respondents were asked how many times waste collectors come to collect their waste from their households per week and whether or not they are satisfied with that. This is necessary because according to NavezBouchaire (1993), the management of household refuse is tied to perceptions and sociocultural practices which result in modes of appropriation of space which are greatly differenced according to whether the space is private or public. Table 4.8 presents the results on number of times waste is collected per week by the city authorized bodies:

Table 4.8: Frequency of waste collection per week

Number of collection	Frequency	Percentage
1	72	76.6
2	18	19.1
3	2	2.1
4	2	2.1
Total	94	100.00

Source: Field Data, 2011.

Majority of the respondents did not have the privilege of getting a waste collection company coming to their homes to collect their waste. For those who had the opportunity, 76.6% indicated that the collection companies only come once a week to collect the waste. Less than 3% of the respondents said their waste is collected more than thrice per week

(four times per week).

Despite the importance of adequate solid waste management to the urban environment, the performance of many city authorities in this respect leaves much to be desired. According to Malombe (1993), irregular services rendered to producers of refuse by municipal councils compel them to find ways of disposing of refuse. It is observed that the main methods adopted by the producers are burning, composting, or indiscriminate dumping.

This is very pertinent in Ghana where waste management services are largely inefficient and ineffective. It is estimated that about 83% of the population dump their refuse in either authorized or unauthorized sites in their neighbourhood, and due to weak capacity to handle solid waste, unsanitary conditions are created (Benneh, Songsore, Nabila, Amuzu, Tutua, & Yaugyuorn, 1993).

Table 4.9: Satisfaction with Waste Services Provided

Satisfied	Frequency	Percentage
Yes	24	30.0
No	65	70.0
Total	94	100.00

Source: Field Data, 2011.

With regards to satisfaction, most of the respondents (70%) indicated not satisfied with the services provided by the waste collection companies (as presented in table 4.6). Issues like; they do not come for the collection on time, they sometimes do not come at all within the

whole week without any explanation to the households, dogs and livestock scatter the litter around, it breeds mosquitoes, releases unpleasant smell, non-appealing to the eyes when seen etc are some of the frustrations raised by the citizenry and reasons given by the respondents to indicate how dissatisfied they are with the services of the waste collection companies.

4.4 Willingness to Pay for Solid Waste Management Services

4.4.1: Willingness to pay for improved solid waste management services by those not currently paying.

One of the key objectives of the study is to determine households' willingness to pay for solid waste management services using the contingent valuation method. Specifically, it seeks to determine household's willingness to pay for solid waste management services and to find out whether or not those who enjoy the services of solid waste collection pay for the service and how much they pay. Again for those who do not enjoy the service, the study went on to ascertain whether or not they are willing to pay when the service is available. Furthermore, for those already paying would they be willing to pay more for improved services. The improved service in this context is as described below:

“the service involves collecting your solid waste by the house twice every week, transport the waste safely to where it is going to be disposed off and the disposal involves making quality compost from decomposable solid waste and manage indecomposable wastes

separately by recycling those which can be recycled and the rest will be land filled properly”.

The study went further to query those not currently paying for waste services to indicate whether or not they are willing to pay for waste management services and table 4.10 presents the results:

Table 4.10: Willingness to Pay by Those Not Currently Paying

Response	Frequency	Percentage
Yes	56	73.7
No	20	26.3
Total	76	100.00

Source: Field Data, 2011.

From table 4.10, it could be realized that, a good proportion of households (73.7%) that are currently not paying for waste management services are willing to pay. This could be attributed to the fact that, many indigenes in the Metropolis realize waste management as a collective responsibility. They are therefore willing to contribute their quota towards achieving the sanitation goal of the city. About 20% rather indicated that they are not willing to and gave the following reasons for their decision:

- There is no waste management service provided in the area.
- Some do dispose their waste in secondary receptors of which they were not charged for.

- They dispose the solid waste in holes dug around their homes.
- It is the responsibility of the government to pay for them.
- It is not necessary to pay for waste when there are other equally important issues.
- Friends and family who are currently paying are not seen to enjoy any special / improved service.
- They cannot trust the authorities because they could take the money and may still not deliver.

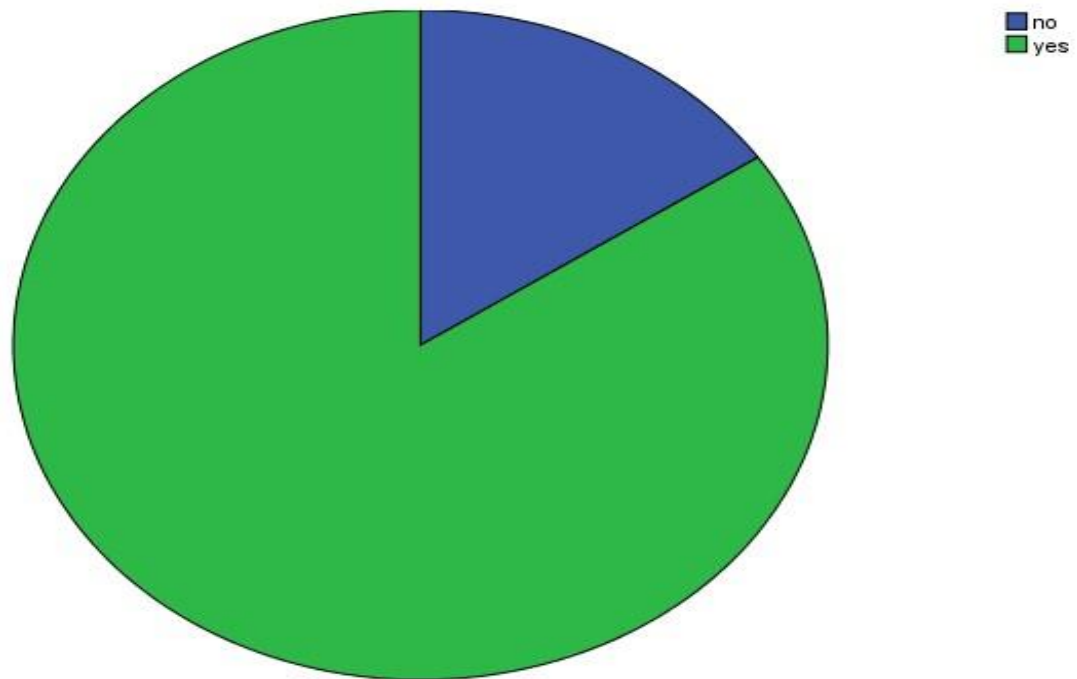
Considering the above reasons, it is clear that more people are currently not paying for waste services because conditions are not created for them to do so. More households could be made to accept to pay for waste services when the necessary conditions are created.

4.4.2 Willingness to Pay for Improved Solid Waste Management by those currently paying for waste management services

The survey aimed at determining households' willingness to pay for improved solid waste management services in the Metropolis and figure 4.3 presents the outcome of the analysis for number of people or respondents willing to pay even though they are already paying:

Figure 4.3: willingness to pay for solid waste management services

Are you willing to pay for improved solid waste mgt services?



Source: Field Data, 2011

It is noted that quite a huge proportion of the respondents are willing to pay for improved solid waste management in the city. Very few seem not to be willing to pay and they gave the following reasons:

- They dispose the solid waste in holes dug around their homes and they are content with that.
- It is the responsibility of the government to pay for them.
- It is not necessary to pay for waste when there are other equally important issues.

- Friends and family who are currently paying are not seen to enjoy any special / improved service.
- They cannot trust the authorities because they could take the money and may still not deliver.

Table 4.11 presents results for the question of whether or not the respondents pay for waste management services:

Table 4.11: Those Currently Paying For Waste Services

Response	Frequency	Percentage
Yes	156	75.7
No	50	24.3
Total	206	100.00

Source: Field Data, 2011.

It could be noted that a significant proportion of the households pay for waste management services in one way or the other. About 75.7% have been paying for waste management services already. It must be emphasized that, this constitutes both households enjoying direct waste collection by private collectors and those using secondary waste receptacles. For the about 24.3% that do not pay at all for any waste services, it was noted to constitute those households that employ other methods of disposal which may include digging and burying in a hole, burning and throwing waste at backyards, gutters and

streets.

A further analysis pointed out that 28.5% of those paying for waste services consist of households enjoying direct waste collection by private collectors. The remaining of over 70% consists of those paying for using secondary waste receptacles. The rates are however varied. The study indicates that, households that use secondary waste receptacles pay Gp 20 (Twenty Ghana Pesewas) per each dumping at the receptacle by an individual.

This amounts to GHc 6.00 per month for using the facility once per day by an individual. In households where individuals do not bulk their refuse but handle it separately, each would have to pay this amount per month for dumping.

With regards to households that enjoy direct waste collection by private collectors, table 4.12 below indicates the amount of money paid by each household per month for waste for solid waste management services:

Table 4.12: Amount Paid Per Month for Waste Services

Amount (GHc)	Frequency	Percentage
< 5.00	18	19.1
6.00 – 10.00	30	31.8
11.00 – 15.00	34	36.3
> 16.00	12	12.7
Total	94	100.0

Source: Field Data, 2011.

It could be noted that over 31% of the respondents pay up to GHc 10.00 per month for waste management services whilst 19.1% pay less than GHc 5.00 per month. Majority of the respondents pay between GHc 11.00 – GHc 15.00. It therefore goes to conclude that the amount paid per month for waste services by households according to the respondents range between GHc 5.00 – GHc 15.00. The mean or average amount in GHc is 11.8723

The KMA categorizes the city into three classes depending on high, medium and low income areas as first, second and third class residential areas respectively. However, when it comes to payment for waste services, the fee is currently a flat rate of GHc 10.00 per bin per month for all house to house collections and 20GHp per head load of solid waste per each dumping. This is irrespective of the area or the income level of the individual or household.

4.4.3 Willingness to Pay More for Improved Services.

For those households that are currently paying, the study sought to find out whether or not they would pay more for improved services as described;

“the service involves collecting your solid waste by the house twice every week, transport the waste safely to where it is going to be disposed off and the disposal involves making quality compost from decomposable solid waste and manage indecomposable wastes separately by recycling those which can be recycled and the rest will be land filled properly”.

It must also be noted that, this hypothetical situation was also presented to those households that do not pay for waste services. The response was that, they cannot trust the authorities as they fear funds misappropriation and inefficiency in their operations.

Table 4.13 presents the results to indicate willingness to pay more for improved waste management services.

Table 4.13: Willingness to Pay More for Waste Services

Response	Frequency	Percentage
Yes	118	75.6
No	28	17.9
Other (undecided)	10	6.5
Total	156	100.00

Source: Field Data, 2011.

It was realized that, over 75% of the respondents accept to pay more than they are currently paying for improved services as described. They cherish beauty and have recognition for environmental safety and would want to have value for their money.

About 17.9% are still unwilling to pay anything extra even the hypothetical situation described. They explained among other things that, they could not trust the city authorities to give them any better service even when they pay more. Others are of the view that, the KMA could do better (if they are willing) even with the current funding system; they fear deceit. Still in contention is 6.5% who are still undecided as whether they would pay more

or not for the hypothetical situation described. They are skeptical and constitute the ‘play-it-safe’ individuals who may want to see the outcome before they believe.

4.5.1 Factors Influencing Willingness to Pay for Improved Waste Management.

The logit regression gave a McFadden R – squared of about 0.64. The log likelihood ratio (LR) statistic is significant at one percent, meaning that at least one of the variables has coefficient different from zero. Therefore, it can be concluded that the logit model used has integrity and is appropriate.

4.5.2 Logit Analysis Results

Table 4.14 Logit regression results of factors influencing willingness to pay for improved waste management services.

Variables	Coefficients	Std Errors	Probability values	Marginal Effect
Education	0.0154351	0.00826	0.062	0.14803
Length of stay	-0.0092587	0.00315	0.003	0.11666
Bags of waste gen.	0.0023743	0.00209	0.255	0.17960
Age	0.0028738	0.00243	0.236	0.48215
House ownership	0.1629996	0.08119	0.045	0.64705
Distance	-0.0002957	0.00017	0.077	0.71353
Awareness	-0.0285162	0.04628	0.538	0.49019
Gender	-0.097459	0.04103	0.018	0.82352
Total income	-0.0002993	0.00969	0.975	0.06490
Satisfaction	-0.0101046	0.04454	0.821	0.33333
Responsibility	-0.023264	0.03553	0.513	0.27254
Goodness of fit measures				

Log likelihood	-39.0401
Restr. log likelihood	-108.6294
McFadden R-squared	0.6406
LR statistic (14 df)	239.1788***

* Significant at 10%

Source: Field Data, 2011.

- a. Education** - shows positive coefficient and significant at 10% confident interval. This result supports the findings of Robson, (1993). The higher ones educational level the higher the probability of the person's willingness to pay for improved waste management services. This may be explained by the opportunity education gives to people to understand the consequence of inadequate solid waste management. From the Marginal effect results one additional year in one's education would increase the probability of person's willingness to pay by about 15%. This result suggests that investing in education of people both formally and informally might help to maintain clean environment.
- b. Length of Stay in the area:** This variable is negative and significant at 10% level of confidence. This can be explained by the fact that the longer people stay in an area, the more they develop other means of collecting and managing their own solid waste such as burning and dumping in dug pits. Short-duration or temporal stay persons may not have adopted other means to dispose off their solid waste and therefore will be more willing to pay for someone to do the collection and dumping for them. Alternatively they may not fully be aware of sanitation problems in the area. An additional year stay in an area within KMA reduces the likelihood of individual willing to pay for improved waste management services by 11.7%.

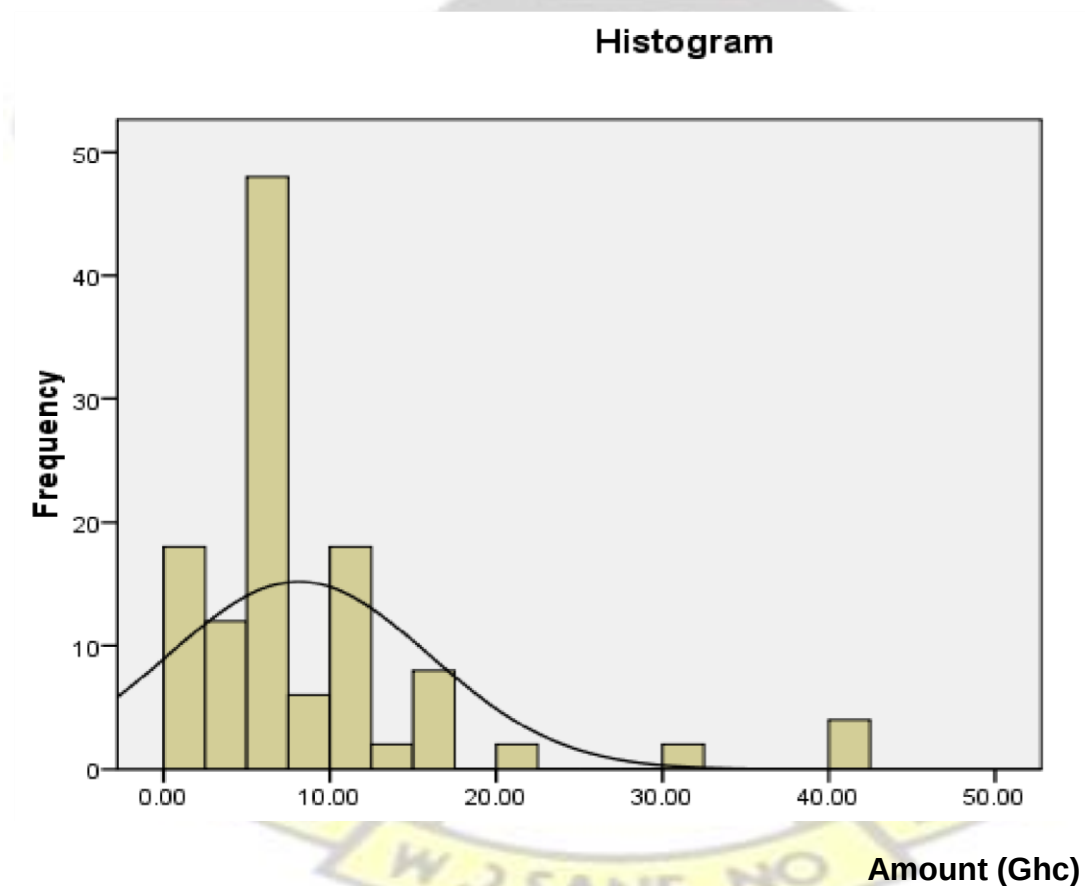
- c. House Ownership:** The probability of housing arrangement is significant at 10% level of confidence and has a positive coefficient. This result indicates that landlords are more willing to pay for improved waste management services. This is particularly so because in Ghana landlords are summoned in case the city authorities have problem with the sanitation and not the tenants.
- d. Distance to Dumping Sites:** This is significant but negative. This means that, the longer the distance to dumping sites, the less likely the probability of willingness to pay for improved waste management. This is because increase in distance increases the problem of disposing of waste as people would have to walk far distances to dispose off waste. This makes it a disincentive for one to walk such long distances and also pay for dumping. People in such situations adopt other means of dumping their solid waste and avoid walking long distances to dump and pay. A one kilometer increase in distance to dumping site reduces the likelihood of individuals' willingness to pay for improved waste management services by 71%.
- e. Gender:** The result contrasts the apriori expectation of the variable Gender. The probability of this variable is significant at 10% confidence level but has a negative coefficient. This result revealed that female respondent have a lesser likelihood of willing to pay for improved was management services as compared to their male counterparts. This is particularly so because in Ghana and for that matter Kumasi, the culture is such that women are mainly responsible for solid waste management in

households. They do not therefore shy from adopting every available means to get their wastes disposed off and hence may not be willing to pay for dumping.

4.6.1 The Extra Amount Respondents Are Willing To Pay For Improved Waste Management Services.

Households that were paying were asked to indicate how much more they are willing to pay and the results were as follows:

Figure 4.4: Additional Amount Households are willing to pay.



Source: Field Data, 2011.
 Mean = 8.13, Std. Dev. = 7.884, N = 120

From the figure above, it could be noted that close to 50% of the households who are currently paying for solid waste management services are willing to pay GHc 5.00 more for the hypothetical situation described for waste management services. Very few (about 6.3%) were willing to pay above GHc10.00 in addition to whatever they are currently paying.

This could be attributed to the fact that, households have a number of activities and items to spend money on (including feeding, education, transportation, utility etc) and this puts a lot of pressure on their already overburdened budget of most households.

It could be noted that, all things being equal majority of the citizenry (24%) is willing to contribute more (GHc5.00) to augment what is currently described as an inadequate amount charged by the KMA. The mean amount one is willing to pay is Ghc 8.13.

The variations emanating from the differences in additional amounts that citizen are willing to pay for improved waste services are largely due to factors that determine one's willingness to pay for an environmental service.

The KMA currently approves for waste companies to charge a flat rate of GHc 10.00 per bin per month for all house to house collections and 20GHp per head load of solid waste per each dumping. This is irrespective of the area or the income level of the individual or household. The waste collection companies estimate to require a total of GHc20.00 per bin per month (for house-house collection) and 50GHp per head load (for communal collection) to enable it effectively carry out its mandate. The difference of GH10.00 and 30GHp for house-house and communal collections respectively is subsidized by the Assembly.

4.6.2 Factors Influencing Amount of Money Respondents are willing to Pay for Improved Waste Management.

To determine which of the factors identified using the logit model influence the amount of money the respondent are willing to pay for improved waste management services, the truncated tobit model was used. The truncation was as a result of the fact that those respondents who are not willing to pay for improved waste management services were excluded from the tobit model analysis. The tobit regression results gave an adjusted R – squared of about 0.67 which implies that at least one of the explanatory variable included in the model has coefficient different from zero. Giving this goodness of fit measure (adjusted R-squared), it can be concluded that the tobit model used is reliable and has the requisite explanatory power. All the included explanatory variables met the apriori expectations.

Table 4.15: Tobit regression results of factors influencing the amount of money respondents are willing to pay for improved waste management services

Independent variable	Coefficient	Std Errors	P>z	Marginal Effect
Age	0.2375704	0.08539	0.005	0.472439
gender	3.03665	2.29077	0.185	0.878049
Marital status	-0.6668483	2.98887	0.823	0.878049
Number of Child.	-0.5198873	0.67644	0.442	0.207317
Income	0.0100276	0.00183	0.000	0.0112
Education	0.5215289	0.23315	0.025	0.146341
Length of stay	-0.5230766	0.1669	0.002	0.0892683
House ownership	6.137612	2.12653	0.004	0.756098
Bags of waste gen.	0.2995888	0.09934	0.003	0.173171
Distance	-0.0171802	0.0059	0.004	0.182854
Goodness of fit measures				
R-squared			0.696206	
Adj. R-squared			0.671440	

* Significant at 10%

Source: Field Data, 2011.

- a. Age:** The probability value for this variable shows that, it is significant at 10% and has positive coefficient. This may be explained by the fact that as people grow old they tend to understand the need for clean environment. In addition, they also know that access to funds by waste management organization can improve their services. As age increases

by one year the amount of money individuals would be willing to pay would increase by 47%.

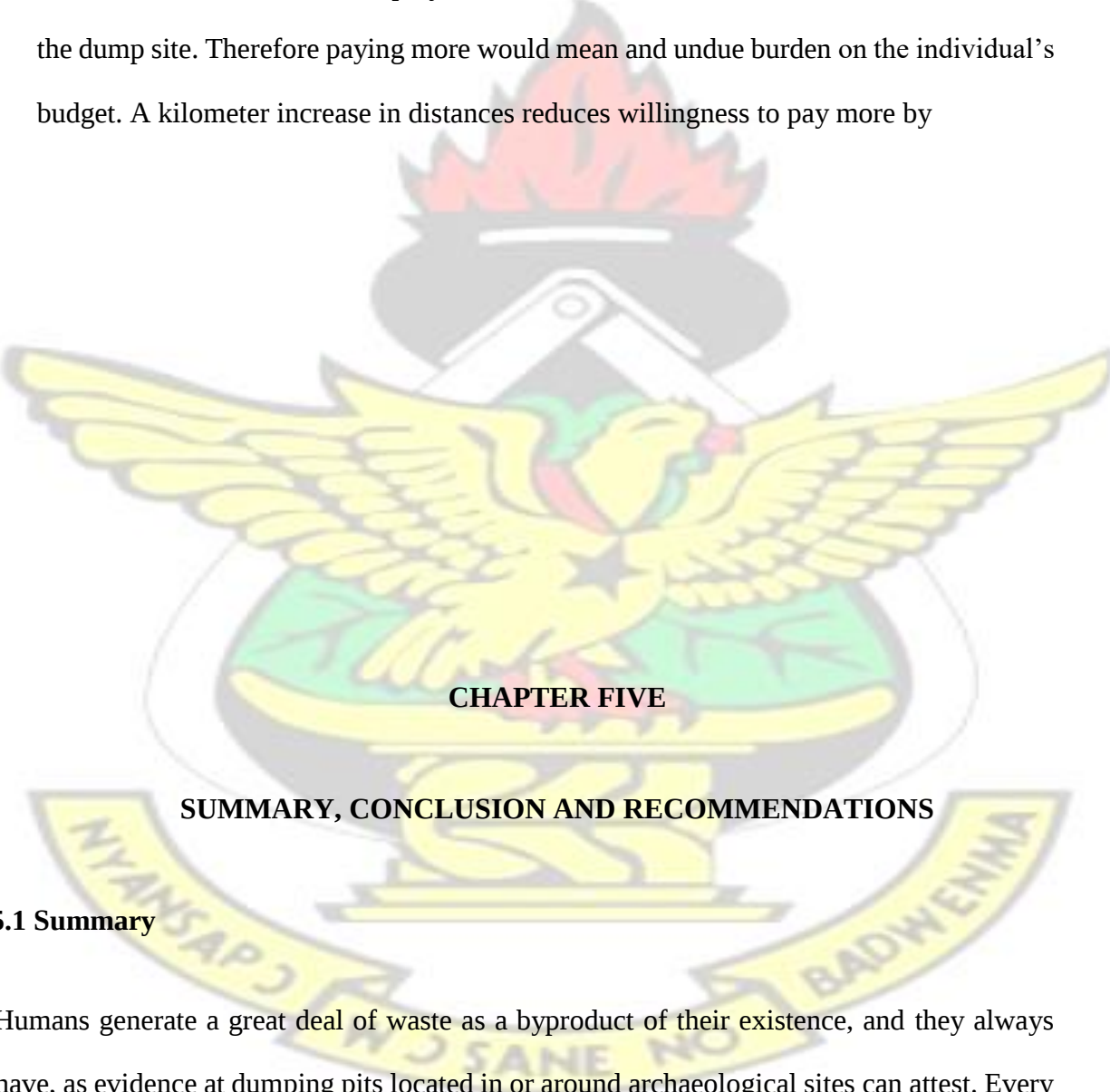
- b. Income:** The probability value for this variable shows that, it is significant at 10% and has positive coefficient. This result is in agreement with environmental economics literature on the positive relationship between income and demand for improvement in environmental quality (Medina, 2002). Therefore, increase in household income increases the amount they are willing to pay for improved waste management services. If the income of the household increases by Ghc1 the amount household will be willing to pay would also increase by 1.12 %.
- c. Education:** shows positive relationship with amount respondents are willing to pay and it is significant at 10%. This result shows that there is a positive impact of education on the amount the respondents are willing to pay towards waste management. This may be explained by the opportunity education gives to people to understand the consequence of inadequate solid waste management. The result of the analysis also indicates that, an additional increase in years of education would increase amount respondents are willing to pay by about 15%.
- d. House Ownership:** This variable is significant at 10% confident interval. The coefficient is positive and implies that, there is a positive correlation between house ownership and willingness to pay more for improved solid waste management. This is particularly so because in Ghana cost of housing is high and moreover, landlords are persons held responsible for an unclean house in case the actual cause of the filth is not

immediately identified. This to some extent can be explained by the income effect of house ownership as landlord normally may have higher income compared to tenants.

e. Length of Stay in the area: This variable is significant at 10% confident interval. The coefficient is however negative and implies that, there is a negative correlation between the amount of money one is willing to pay for improved waste management and length of stay in an area. This can be explained by the fact that the longer people stay in an area, the more they develop other means of collecting and managing their own solid waste such as burning and dumping in dug pits. Short-duration or temporal stay persons may not have adopted other means to dispose off their solid waste and therefore will be more willing to pay more for someone to do the collection and dumping for them. Additional year stay in a house would result in 8.93% decrease in how much more the respondents are willing to pay.

f. Quantity (Bags) of Solid Waste Generated: This has a positive coefficient and significant at 10% confident level. This can be explained by the fact that, those who generate larger volumes of waste would have more problems with disposal hence would be willing to pay more for its disposal. One bag additional generation of solid waste per week would increase the amount they are willing to pay by about 17 %.

g. Distance to Dumping Sites: This is equally significant at 10% and has negative correlation to how much more one is willing to pay. As a result, as the distance to the dumping sites increases the amount the respondents are willing to pay also decreases. This is because increase in distance complicates the problem of solid waste management as people would have to walk far distances to dispose of waste. In cases where the services of other labour are employed, the cost increases with distance from the house to the dump site. Therefore paying more would mean an undue burden on the individual's budget. A kilometer increase in distances reduces willingness to pay more by



CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary

Humans generate a great deal of waste as a byproduct of their existence, and they always have, as evidence at dumping pits located in or around archaeological sites can attest. Every task, from preparing a meal to manufacturing a computer etc, is accompanied with

production of waste material, which cannot be used for other things and needs to be disposed of effectively. If not contained and handled appropriately, waste can balloon into a huge problem, as for example when garbage ends up in the open environment where it can make animals and humans sick.

Waste management practices differ for developed and developing nations, for urban and rural areas, and for residential and industrial producers. For instance, in some cases management for non-hazardous residential and institutional waste in Metropolitan areas is usually the responsibility of local government authorities, while management for hazardous commercial and industrial waste is usually the responsibility of the generator. Developing effective waste management strategies is critical for nations all over the world, as many forms of waste can develop into a major problem when they are not handled properly. The gap between waste management policy and legislation and actual waste management practices is widening due to perennial capacity constraints and lack of waste management facilities for various waste streams.

The Kumasi Metropolitan Assembly (KMA) has made several attempts aiming at addressing the waste menace which is on the rise as a result of population hikes, growth in industrialization and consumer attitudes. The city's bye-laws and policies on waste and sanitation seek to address the waste challenge in its entirety on individual basis. The Assembly, among its efforts and strategies has contracted some waste companies to handle waste collection and disposal. It has also been implementing the polluter pays principle to get individuals to pay for the solid waste management services. Furthermore, some effort is being made to educate the public and create some level of awareness to enable members of the public to play a role in reducing waste and handling waste efficiently.

However, the level of achievement of this objective in practice and in reality leaves much to be desired as is evident on piles of wastes on the streets, city centers, homes as well as complaints from the public regarding waste and filth. This situation according to the KMA is generally attributed to inadequate finance to clear the solid waste. Thus, the assumption is that if households pay more then, the services would be improved.

The study therefore seeks to assess the determinants of households' willingness to pay for improved solid waste management services and the amount they are willing to pay. The specific objectives designed to achieve this objective include the following:

- Assess respondents' level of awareness and perception of the KMA sanitation bye-laws
- Identify methods of waste disposal used by the respondents and their perception on solid waste management within the Metropolis.
- Assess respondents' willingness to pay for improved solid waste management services and the determinants of willingness to pay more for improved services.
- Assess how much more respondents are willing to pay and determine the factors influencing amount respondents are willing to pay for improved waste management services.

It is believed that the findings of this study could assist to ascertain the feasibility and relevance of the current byelaws and principles (polluter-pays-principle) for waste management and the actual realities that are uncovered and which might need to be tackled if waste management menace is to be addressed to appreciable levels.

Descriptive survey research method was used as the research design. The contingent valuation method was used to determine willingness to pay. Semi-structured questionnaires were administered to collect primary data. Secondary data were obtained from the KMA offices in Kumasi as well as the waste collection companies and other relevant textbooks. Data were analyzed mainly by descriptive statistics and regression models. SPSS and STATA software were used. The econometric tools used include the logit and tobit regression models.

Respondents were willing to pay and even pay more for improved waste management services. The determinants of willingness to pay for improved waste management services using the logit regression model were identified. Level of education, Length of stay in the area, Housing arrangement, and Distance to solid waste dumping sites as well as Sex / Gender was noted to be significant and therefore constitute the factors that influence households' willingness to pay for improved waste management services within the Metropolis. Respondents are willing to pay GHc 5.00 more in addition to what they currently pay for improved waste management services. Again, the factors influencing the amount of money respondents are willing to pay for improved waste management services were determined using the tobit model. The significant factors include: Age, Income, Education, and Length of stay, House ownership, Bags of waste generated and Distance to dumping sites.

Most respondents' currently pay between GHc 5.00 – GHc 15.00 for waste management services. The mean or average amount in paid by respondents per month for waste management services GHc is 11.8723. The Assembly started implementing the PPP (with

subsidy) since 2009 on pilot basis and it currently covers about 95% of the entire Metropolis with the exception of some Zongo communities and newly established

residential areas where population is low.

Close to 48.5% of the respondents do not know of the existence of the sanitation byelaws of the KMA. A large number of the respondents (47.5%) seem not to have any idea as regards the comprehensiveness of the byelaws. This is particularly so because, a significant proportion of the respondents indicate that they are not aware of the byelaws and even to those who are aware they have very little knowledge regarding the content.

Methods adopted by respondents to manage solid waste include the use of secondary storage bins, refuse dumps, burning / dug holes, private collectors / house-house collection and others (where others include dumping on streets and backyards). Most of the respondents (70%) indicated not satisfied with the services provided by the waste collection companies and the Assembly.

5.2 Conclusion

- Getting households to pay more for waste management services still remains largely an untapped opportunity. This is because households are willing to pay for improved waste management services.
- Any attempt to get households to pay for waste management services could be resisted by factors like length of stay in the area, distance to dumping sites and gender

because they have a negative correlation to willingness to pay. However, when targeted at the educated and house owners there is more likelihood of success.

- Amounts paid by households for waste management services remains lower than could be paid. This is because respondents are willing to pay more (GHc 8.13) in addition to the GHc 11.00 they currently pay.
- Any attempt to increase the amounts households pay for waste management services could be resisted by factors like length of stay in the area and distance from dumping sites due to their negative correlation to willingness to pay more. It could however be successful with high income earners, the aged, the educated, house owners and more waste generators.
- The objective and rationale behind the enactment of the city's sanitation bye-laws are not fully achieved as most respondents are not aware of its existence and contents.
- Much still needs to be done to educate the residents of the city on waste and sanitation.

5.3 Recommendations

In the light of the above conclusion, the following recommendations are made:

- ✓ The assembly should make effort to provide improved waste management services and surcharge households to pay for it
- ✓ House owners and the educated should be encouraged to pay for waste management services as these variables show positive correlation to willingness to pay more for improved services.

- ✓ Households should be surcharged realistic amounts in order to raise more funds.
- ✓ Disposal bins should be brought closer to household to reduce distance from dumping sites in order to increase subscription rates as distance reduces willingness to pay more.
- ✓ Efforts should be aimed at encouraging more income earners, elderly, educated, house owners and more waste generators to pay more as these variables showed a positive correlation to willingness to pay more.
- ✓ The sanitation bye-laws of the KMA should be revised and copies of the revised bye-laws be made readily available to the public. Abridged versions could be printed and distributed to all residents of the Metropolis. It could also be published on the Assembly's website for easy access by internet users.
- ✓ The Assembly should invest in educating the public to understand the impact of waste on the socio-economic development of a nation and the roles of the individuals. They must also be made to well understand the polluter principle and why it is necessary and the contents of the bye-laws and their implications.

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Appendix 1

Household Questionnaire (Main Survey)

Section A Identification

- A1. Name of Enumerator..... Date:.....
- A2. Name of Respondent A3 Suburb:.....
- A4. Name of Head of Household: A5 Address:.....

Section B

Demographic Characteristics

- B1. Age of respondent B2. Age of Head.....
- B3. Gender of respondent B5. Gender of Head

Male = 1 Female = 2 Male = 1 Female = 2

B6

Respondent Marital status

B7. Head Marital Status

Single =1 Married =2.

Single= 1. Married= 2.

B8.

What is the total number of members of your household?

a) Adults..... b) Children below 15 years of age.....

B9 Number of years spent in schooling

a) Respondent.....

b) Head.....

B10. Household Head's Profession

a) Government sector

b) Private sector

c) Own Business

d) Small own account Worker

e) Not currently working for Money

B11.

How much do the head of the household earn from employment monthly (in Ghana Cedis).....

B12.

Other monthly income of the household from other members and other sources (in Ghana Cedis)?.....

B16. Main monthly Expenditures of the household (in Ghana Cedis)

		Ghana cedis
a	Housing (Rental charges) those renting only	
b	Food	

c	Energy Consumption (Electricity, Diesel, Charcoal, Firewood, etc	
d	Phone	
e	Education	
f	Health	
g	Other Expenses (funeral, outdooring, church harvest etc ‘.)	

B17. How long have you been staying in this house (in years)?.....

B18. Housing arrangement?

a). Privately Owned

b). Rented from your organisation

c). Rented from (SSNIT etc) other companies

d). Rented from individual

Major Concerns:

“I would like to show you a list of possible problems that might be faced by your household (or establishment):

Problem	Tick	Rank
1) Inadequate disposal of residential wastewater		

2) Inadequate disposal of human excreta		
3) Inadequate solid waste collection service		
4) Presence of litter and illegal piles of solid waste		
5) Nuisance from solid waste transfer points		
6) Nuisance from solid waste disposal sites		

1= tick if it's applicable to you.

2= rank in order of importance (1-5)

Any other concern(s).....

Section C:

Current Situation of Solid Waste Management

C1. How many "BLACK POLY BAGS" (Ghp 30 worth) of solid waste are generated in your household per week?

C2. Do you have a storage receptacle for solid waste in your house or in your compound?
 Yes =1 No =2

C3 If Yes, go to Question C5

C4 If No, go to Question C6 C5

What is it made of?

a) Plastic

b). Metal

c). Wood (Bamboo)

d). Other (specify).....

C6 What are the main problems you encounter in solid waste storage?

.....

C7. How do you dispose off your solid waste?

a). Take it to the nearby secondary storage receptacle

b). Digging a hole around the house / and bury or burn it

c). Throw it on an open space or on the street

d). Throw it in to the nearby river

e). Private collectors take it

f). Any other (specify)

C8 If the answer is "E" go to Question C9 –C11

C9. How much do you pay for this service per month?

C10 How many times they collect your waste per week?.....

C11 Are you satisfied with their service? Yes =1 No =2

C12

Is your household getting the services of solid waste collection or disposal from the assembly / or city authorities? Yes =1 No =2

C13

Are you satisfied with the existing waste collection and disposal service provided by the city government? Yes =1 No =2

C14

If no, what do you suggest to improve this condition?

.....

C15 Who do you think is responsible to properly manage solid waste (for instance financing it) in Kumasi?

a). The assembly /city authority only

b). Households only

c). Both

C16 Which of the following do you think is the best institute to handle solid waste management in KMA?

a) The assembly /city authority

b) Private companies

C17 What are your reasons for

a) Choosing the assembly / city authority

.....

b) Private companies?

.....

C18 What problems do you think, households face as a result of mishandling solid waste?

.....

C19 Can you mention some diseases related to poor solid waste management?

.....

C20 Did any of your family members suffered from (died of) any of the mentioned disease in the past one year?

Yes =1 No =2

Section D

Households' Willingness to Pay for Improved Solid Waste Management

Assume that the assembly (KMA) is planning to provide an improved solid waste management in your area. Suppose this service involves collecting your solid waste by the house twice every week, transport the waste safely to where it is going to be disposed off and the disposal involves making quality compost from decomposable solid waste and manage indecomposable wastes separately by recycling those which can be recycled and the rest will be land filled properly.

However, implementing this program is very costly. Therefore, households are required to pay for this service.

D1 Are you paying for waste management services now?

Yes =1 No =2

D2 If yes how much are you paying
now?.....

D3 If no, why?

D4 If you are currently paying for waste management services are you willing to pay
more for improved services as described above

Yes =1 No =2

D5 If you are willing to pay more how **much more** are you willing to pay?.....

D6 If you are currently paying for waste management services and not willing to pay more, why?.....

D7 If you are currently not paying for waste management services are you willing to pay for services described above?

Yes = 1 No = 2

D8 If yes, how much are you willing to pay?.....

D9 If no, why?.....

D10 At what payment point should the money be collected?

a). Water bill pay points

b). Electric bill pay points

c). KMA/Private companies should establish pay point

d). Any other (specify).....

D11 What should the frequency of payment be?

a). Daily

b). Weekly

c). Monthly

d) Quarterly

e) Yearly

e). Any Other (specify).....

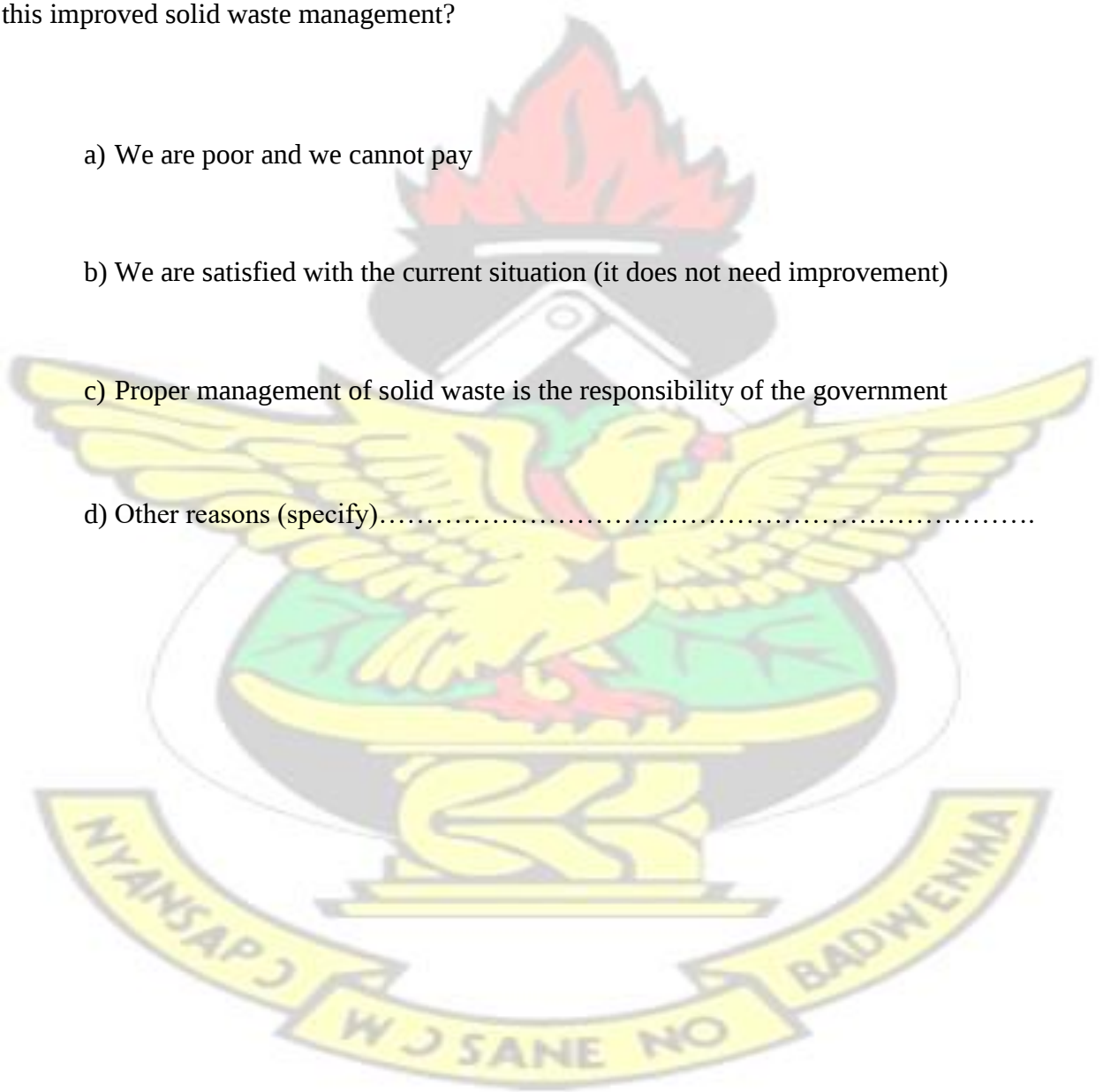
D12 Could you tell me the reason why your household does not want to pay anything for this improved solid waste management?

a) We are poor and we cannot pay

b) We are satisfied with the current situation (it does not need improvement)

c) Proper management of solid waste is the responsibility of the government

d) Other reasons (specify).....



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Laws	Aware		How did you get to know
	Yes	No	
(1) Where the KMA has set aside a place for the disposal of refuse no person shall place, cause or permit to be placed any carrion, filth, refuse or rubbish or any offensive or unwholesome matter on any street, yard, premises, enclosure or open space within the Metropolis			
(2) If any offender under sub-paragraph (1) of this paragraph has not been identified or discovered the existence of any carrion or other substance mentioned in the said section found close to any building shall be presumed to have been placed the owner or occupier thereof.			
That occupier of any premises shall clear and keep free from all dirt, underbrush, under-wood, weeds, high grass, rubbish, rugs, broken bottles and all offensive matter (filling up holes with stones, gravels or other like materials) the streets or roads at the front, back sides, thereof, with the drains, gutters and channels thereon. Provided that where two or more houses abound on the streets or roads, the occupier or each shall be responsible for keeping clean only that half of the street or road nearest to his premises.			
(1) No person shall cause a nuisance in any public or open space. (2) No occupier of any premises shall by any act, allow the existence of nuisance in his house.			
4. (1) the removal of night soil from all premises in which private bucket latrines are kept shall be the responsibility of the house owner or occupier. (2) Any occupier who fails to remove a bucket of night soil when it is full commits an offence.			
5. No food seller shall serve food in anything unless due care has been taken to make sure the food wrappers are hygienic			

6. No person shall deposit litter, refuse or other matter which may cause nuisance or block the passage provided for a gutter or drains.			
7. Any person who contravenes any of these bye-laws commits an offence and shall be liable on conviction by a court or Community tribunal to a fine not exceeding c50,000 or to a term of imprisonment not exceeding three months.			

KUMASI METROPOLITAN ASSEMBLY (SANITATION) BYE-LAWS 1999.

Source KMA, 2011

E9 If you did not know of the existence of these byelaws, why

.....

E10

Do you think the bye-laws are comprehensive enough to address the waste problem of the Metropolis? Yes No

E11 If no, why?.....

E12 Do you perceive the by-law you know as providing incentive or reward to encourage its adherence?

Yes [] No []

E13 If no, why?.....

E14 Do you think that KMA punish offenders?

Yes [] No [] Not aware of any punishment []

E15 Is the punishment prescribed for offenders of the bye-law punitive enough to serve as deterrent to others?

Yes []

No []

E16 If no, why?.....

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Appendix 2

KMA Interview Guide

Section A

Identification

A1. Name of Interviewer..... A2.
Date:.....

A3 Name of Respondent:..... A4. Position
:.....

Section B – Main Questions

1. What is the Assembly's objective in waste management for the city?
2. To what extent has this objective been achieved?
3. What are the successes and the failures?
4. What could be the possible cause(s) of the failures?
5. What measures is the Assembly putting in place to address these failures?
6. What other challenges do confront the Assembly in its bid to improve solid waste collection in the Metropolis.

7. How far is the polluter pays principle implemented by the Assembly covered?
8. What are the successes and failures of the principle?
9. What could possibly be done in the Assembly's view to improve / address the failures / challenges?
10. What educational methods / approaches do the KMA adopts to educate the public on its waste policies and programmes.
11. How effective in the view of the KMA has these approaches been and what could be done to improve upon it / them?
12. What is the extent of involvement of the public in soliciting views to address solid waste problems by the Assembly e.g. waste collection and fees charging?
13. Into what segments / zones do the KMA puts the city for the benefit of classification and management of programmes purposes?
14. What are the main solid waste collection companies in the Metropolis that the Assembly currently operates with?
15. What are the specific terms (main) for any contract between the waste companies and the Assembly?
16. How does the Assembly monitor the activities of the waste companies?
17. What are the key challenges the Assembly faces in its undertakings with the solid waste collection companies?
18. How does the Assembly intend addressing the challenges (if any)?

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Appendix 3

Interview Guide for Waste Collection Companies

Section A

Identification

A1. Name Of Interviewer..... Date:.....

A3 Name Of Respondent:..... A4. Position:.....

Section B – Main Questions

1. What is the total area covered by you to collect solid waste in the Metropolis?
2. Are you able to cover all these areas as required?
3. If not, what challenges prevents you from doing so?
4. By your terms of contract, how many times within a week are you supposed to collect solid waste from your designated / assigned areas and how often are you able to meet this demand?
5. How and where do you dispose off solid waste once you collect them?

6. What are the key challenges you face as a company in executing your mandate?
7. Specifically, what are the main terms enshrined in your contract with the KMA?
8. What do you suggest to be done to improve solid waste collection within the Metropolis?

