**UNIVERSITY OF EDUCATION, WINNEBA**

# HOUSEHOLDS' WILLINGNESS TO PAY FOR IMPROVED SOLID WASTE MANAGEMENT SERVICE: THE CASE OF KASOA, GHANA.

**MAHDI AFFUL**

**MASTER OF PHILOSOPHY**

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**A thesis in the Department of Economics Education, Faculty of Social Sciences Education, submitted to the School of Graduate Studies, in partial fulfilment**

**of the requirements for the award of the degree of Master of Philosophy (Economics) in the University of Education, Winneba**

**JULY, 2019**

# DECLARATION

**Student's Declaration**

I, Mahdi Afful, declare that this thesis, with the exception of quotations and references contained in published works which have all been identified and duly acknowledged, is entirely my own original work, and it has not been submitted, either in part or whole, for another degree elsewhere.

**Signature**: ...……....…….

**Date**: ……..……

**Supervisor's Declaration**

We declare that, the preparation and presentation of this work was supervised in accordance with the guidelines for supervision of thesis as laid down by the University of Education, Winneba.

Dr. Emmanuel Carsamer (Principal Supervisor)

**Signature**: ...……....…….

**Date**: ……..……

Dr. Anselm Komla Abotsi (Co-Supervisor)

**Signature**: ...……....…….

**Date**: ……..……

# DEDICATION

I dedicate this thesis to my late mother; Emelia Ghunney, for her sacrifices and support. Sister Esi you will forever remain in my heart.

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# ABBREVIATIONS

| | |
|---|---|
| ABM | Averting Behaviour Model |
| ARUM | Additive Random Utility Model |
| ASEMA | Awutu Senya East Municipal Assembly |
| CEM | Choice Experiment Method |
| CV | Contingent Valuation |
| CVM | Contingent Valuation Model |
| DCAM | Damage Cost Avoided Method |
| EA | Enumerated Area |
| EAB | Enumerated Area Base |
| GH¢ | Ghana Cedis |
| GHP | Ghana Pesewas |
| GIM | Ghana Innovation Market Place |
| GSS | Ghana Statistical Service |
| HPM | Hedonic Pricing Method |
| IWM | Integrated Waste Management |
| ISWM | Integrated Solid Waste Management |
| LI | Legislative Instrument |
| MLGRD | Ministry of Local Government and Rural Development |
| MMDA | Metropolitan Municipal and District Assemblies |
| MoF | Ministry of Finance |
| MSW | Municipal Solid Waste |
| NOAA | National Oceanic and Atmospheric Administrative |
| RCM | Replacement Cost Model |
| RUM | Random Utility Model |
| SCM | Substitute Cost Model |
| SPSS | Statistical Package for Social Sciences |
| SW | Solid Waste |
| SWM | Solid Waste Management |
| SDG | Sustainable Development Goal |
| TCM | Travel Cost Model |
| TEV | Total Economic Value |
| TWTP | Total Willingness to Pay |

| | |
|---|---|
| UN | United Nations |
| UNDP | United Nation Development Program |
| WB | World Bank |
| WHO | World Health Organization |
| WMDs | Waste Management Departments |
| WTA | Willingness to Accept |
| WTP | Willingness to Pay |
| MWTP | Maximum Willingness to Pay |

# ABSTRACT

Solid waste management is an integral component of sustainable development for any nation and prioritizing solid waste management is greatly supported as global initiative. This study investigated household Willingness to Pay (WTP) for improved Solid Waste Management (SWM) services in Kasoa. A cross-sectional survey design was employed for this study. Data was obtained from 276 households in six electoral areas within Kasoa. The study analysed households' Willingness to Pay and subsequently their Maximum Willingness to Pay for improved SWM service as well as the factors that influenced their Willingness to Pay. To elicit Willingness to Pay, an open-ended Contingent Valuation Model was employed for the data collection. Probit and Ordered Probit Models were used in the empirical analysis to determine the factors that influence Willingness to Pay and Maximum Willingness to Pay of households for improved SWM service respectively. The results revealed that 73.9% of respondents were willing to pay at a maximum fee of 15Ghc per month for improved SWM service. The outcome of the study shows that, age, average monthly income, collection frequency, employment status, level of education (tertiary), house ownership and service satisfaction were the factors that significantly influenced household's willingness and maximum willingness to pay for an improved SWM service. The study recommends that government and various stake holders should make efforts towards improving residents' income as willingness to pay relates positively to income. More so, a flat rate should not be charged across households since household Maximum Willingness to Pay values vary among households.

# CHAPTER ONE

# INTRODUCTION

## 1.1 Background to the Study

Solid waste management is a universal issue affecting everyone in the world. The world is on a trajectory where waste generation will drastically outpace population growth by more than double by 2050 (World Bank, 2018). Although there has been some improvem` ` ` `ents and innovations in solid waste management globally, it is a complex issue and one that needs urgent attention (World Bank, 2018). At the World Summit on Sustainable Development in 2002, which took place in Johannesburg, South Africa, governments reaffirmed the importance of solid waste management. They called for priority attention to be given to waste prevention and minimisation, reuse and recycling. They also called for the development of environmentally sound disposal facilities, including technology to convert waste into energy (WSSD, 2002).

Urbanisation and rapid population growth of cities and towns in the world have been reported as one of the reasons for the increase in solid waste (SW) generation in the world (Ali et al., 2012). Across the African continent, the rate of urbanisation is around 3.5% and the rate is expected to rise in the future (UNESCO, 2009). Farvacque-Vitkovic, Madhu, Eghoff and Boakye (2008) assert that by 2010 more than half of Ghana‘s population will be living in urban areas, with urbanization expected to reach 65 percent by 2030.

The world generates 2.01 billion tonnes of municipal solid waste annually, with at least 33 percent of that extremely and conservatively not managed in an environmentally safe manner (UNEP, 2013). Global waste generated per person per day averages 0.74 kilogram and is expected to grow to 3.40 billion tonnes by 2050

(World Bank, 2018). In Africa, it is estimated that, the rate at which solid waste is growing in urban areas is much faster than the urbanization itself (Hoornweg and Bhada-Tata, 2012). African total urban waste production was 169,119 tons per day and the estimates expect to reach an average of 441,840 tons per day by 2025 (World Bank, 2012).

In Ghana an average daily solid waste generation is 0.45kg per person and the daily aggregate production of solid waste is about 11,700 tonnes with annual generation of 3.0 tonnes Accra for example generates about 2000 tonnes of solid waste per day of which only about 55% is collected and disposed. It is therefore common to find mountains of solid wastes uncollected for months (Mensah and Larbi, 2005). The situation is not different in Kasoa where equally large quantities of solid waste is generated. According to the Ministry of Finance composite budget of the Awutu Senya East Municipal Assembly for the 2014 Fiscal Year, it is estimated that about 900 tonnes of solid waste is generated daily in the Awutu Senya East Municipal Assembly. Out of this, only 300 tonnes is hauled every day leaving a backlog of 600 tonnes uncollected (MoF, 2014).

Urban sprawls, poor financing capacity of local authorities, low technical capacity for planning and management of solid waste and weak enforcement of environmental regulations have significantly contributed to compounding the difficulties associated with waste management (Chati, 2012). Solid waste management has been a major developmental challenge facing city authorities, especially in developing countries (UNEP, 2013). Poor solid waste management, coupled with inadequate financial resources, has led to indiscriminate dumping of solid waste into open spaces and drainages, choking drains which are causing flooding, environmental pollution and

public health issues (UNEP, 2013; Perera, 2003). Insufficient and ineffective management of wastes worldwide leads to generating a lot of human and environmental problems like ozone layer depletion, acidic rains, greenhouse effects as well as land and epidemic diseases (Ali et al., 2012).

The challenge of sanitation in Ghana revealed in a report released in 2012 by the World Bank's Water and Sanitation Program (WSP) indicates that Ghana's economy loses, GH¢ 420 million, which is 1.6% of GDP each year is due to poor sanitation (World Bank, 2012). The desk study titled *Economic Impacts of Poor Sanitation in Africa - Ghana*, found that the majority (74 percent) of these costs come from the annual premature death of 19,000 Ghanaians from diarrhoea disease, including 5,100 children under the age of 5, nearly 90 percent of which is directly attributable to poor sanitation. The report also found 4.8 million Ghanaians have no latrine at all and defecate in the open (World Bank, 2012).

Solid waste management is a complex task which depends on organization and co-operation between households, communities, private enterprises and municipal authorities on the selection and application of appropriate technical solutions for waste collection, transfer, recycling and disposal (Addai and Danso-Abbeam, 2014). The priority for establishing effective SWM system should be given to the emerging cities as a crucial role of protecting the environment and public health (Hagos et al. 2012).

Based on the 2010 National Population and Housing Census, the most popular means of disposal of solid waste by households is through using the public dump; either dumping in a container, (23.8%) or dumping into open dump site, (37.7%). Further, about 9.1 % of household dump solid waste indiscriminately into the open fields,

gutters and drains while another 10.7% of households burn their solid waste. Only 14.4% households engage the services of the solid waste management companies to collect their solid waste(GSS,2012). The estimate of the proportions of solid waste not properly collected in Ghana are high; these include 61% by (GSS,2012) and 60% to 75% by (Anomanyo,2004).

In Ghana, much effort has been made on SWM especially in the big cities such as Accra, Takoradi, Kumasi, and Tamale among others. The government of Ghana started Public Private Partnership (PPP) of SWM after the implementation of the Structural Adjustment Programs (SAPs), in the mid-1990s (Baud and Post, 2002). The introduction and the use of sanitary inspectors _Tankase' in the SWM were very significant in dealing with insanitary conditions in the past. Frantic effort is being made by government to resuscitate the activities of these sanitary inspectors. The government in the attempt to deal with the solid waste menace have tried several measures and policies from the provision of free dustbins, injection of huge capital to moral suasion where last Saturday of every month is declared as sanitation day to encourage individuals to take responsibility to clean their environments. With all these interventions, its impact is yet to be felt as heap of solid wastes continue to be a common spectacle in the communities.

Solid waste management (SWM) is very crucial to households living in rural and urban areas because solid waste has been reported to be directly linked to the development of human activities in terms of technologies and social aspects (Awuyo-Vitor, Ishak, and Jasaw, 2013). The production of solid waste materials is associated with human activities, from preparations of meals to the manufacturing of goods. Since the solid waste produced cannot be put to effective use again, they need to be

disposed of effectively. The health implications of poor solid waste management can be very damaging to the people exposed to these unsanitary conditions.

There is a large number of studies conducted on SWM in municipalities globally and the willingness to pay (WTP) for an improved SWM service. It has been therefore argued that information about households WTP for improved SWM and the determinants of WTP for it is essential for policy makers to expand the improved sanitation coverage in a given population (Minh, Nguyen-Viet, Thanh and Yang, 2013, Ezebilo, 2013).

**1.2 Statement of the Problem**

Solid waste management is one of the essential utility services underpinning society in the 21st Century, particularly in urban areas (Nkhabu, 2018). Solid waste management is an essential task which has important consequences for public health and well-being, the quality and sustainability of the urban environment and the efficiency and productivity of the urban economy (Addai and Danso-Abbeam, 2014). Ensuring proper sanitation and solid waste management ranks alongside the provision of potable water, shelter, food, energy, transport and communications and are all essential to society and to the economy as a whole (Nkhabu, 2018). However, the public and political profile of solid waste management is often lower than other utility services particularly in developing countries. Unfortunately, until recently many African countries, regard the concern for effective urban solid waste management as a less important issue than achieving a faster rate of economic growth (Onukogu, MohdRusli, Abdullahi and Zainudin, 2017). This attitude stems in part from the belief that environmental degradation with urban solid waste generation is an inevitable price of development (Uwadiegwu and Chukwu, 2013). The consequences of doing

little or even nothing to address waste management can be very costly to society and to the economy overall.

In Ghana, deficiencies in solid waste management (SWM) are most visible in and around urban areas such as Accra, Tema and Kumasi among other cities where equally important competing needs and financial constraints have placed an inordinate strain on the ability of the authorities to implement proper SWM strategies in tandem with the rapid population growth (Oteng-Ababio, 2011).

Kasoa, the municipal capital of Awutu Senya East is experiencing rapid urbanisation and increasing urban population due to territorial expansion, increased rural-urban, urban- urban migration rate and the increasing commercial activities in the area. This has led to the increased production of solid waste in the area. The production has increased rapidly in terms of waste amount as well as composition, which ultimately creates a critical issue for waste management authority. As a result of the under-collection of the solid waste that is generated, there is significant littering and heaping of solid waste on the streets of Kasoa. The sight of communal containers that are overflowed with solid waste within the municipality is also a common phenomenon (Quarcoo, 2014). The menace of indiscriminate disposal of SW raises the question of the nature of the current solid waste collection system in the area.

As the urban areas grow, they exhaust the capacity of existing traditional disposal sites so that solid wastes must be transported greater distances to sites outside the city and this actually increase the cost of solid waste management (Nkahabu, 2018). Household often complain of unsatisfactory or unreliable waste management services. As a result, they often resist paying the charges levied and instead preferring to dispose by informal dumping (Nkahabu, 2018). The collection agencies have then less

funding for their services. There is thus a clear need for more appropriate methodologies or financing mechanisms for solid waste management (Anku, 2000). Development of various policies and strategies on SWM which include demand-side and supply-side is a fundamental way of achieving sustainable SWM service. However, such endeavours faced several problems including ignoring the demand side (household participation) in SWM. Household participation which is the mainstay of understanding solid waste management has been the main source of failure in SWM service (Sansa and Kaseka, 2004).

Solid waste management is the responsibility of the municipal assembly and so there is no suitable price mechanism to reveal the choice of stakeholders like households for varying levels of service provision (Quarcoo, 2014). In such a situation, information regarding households' preference for cleaner environment can be obtained if one could carefully develop the demand for improved SWM services designed in agreement with the standard of Municipal solid waste handling policy.

Establishing effective and sustainable SWM services is very important in protecting the environment to improve sanitary and public health. Exploring the demand-side policies and strategies of SWM to bring cost-sharing with households who are primary producers of solid waste is vital in providing sustainable financing mechanism for improved SWM service in Kasoa. Cost-sharing in the SWM is very crucial because budget constraints have made the municipal assemblies unable to meet the cost in managing the ever increasing volumes of solid waste (Chati, 2012). But information on the demand-side that provides a good "road-map" towards the achievement of sustainable SWM in Kasoa does not exist, leading to an information gap that has to be filled.

### 1.3 Objective of the Study

Using a contingent variation survey the study discussed households' willingness to pay for improved SWM service in Kasoa**.** The main aim of this study is thus to investigate households' willingness to pay for improved SWM service in Kasoa.

Specifically, the study aimed to:

- Analyse the existing solid waste collection systems of households in Kasoa.
- Estimate households' willingness and the amount to pay for improved SWM service.
- Evaluate the factors influencing households' willingness to pay for improved solid waste management services in Kasoa.

### 1.4 Research Questions

The following research questions are to be answered in this study:

- What is the nature of existing solid waste collection systems of households in Kasoa?
- What is households' willingness and the amount of money to pay for improved solid waste management service in Kasoa?
- What factors influence household's willingness to pay and the amount of money they are willing to pay for improved SWM services in Kasoa?

### 1.5 Significance of Study

The output of this study provides useful recommendations for future studies to other cities in the country or to other national contexts of a similar set-up to test and extend the generalisations of the findings. It will also inform the waste management companies how much the average household is willing to pay for improved SWM service. The results of the study will also be useful for policy recommendation on

waste management in the country. The study also intends to fill the knowledge gap that exists between studies conducted on WTP at different times and locations and this study which seeks to explore the WTP for improved solid waste management at Kasoa.

### 1.6 Delimitation of the Study

Creswell (2009) defines delimitation as ―how the study will be narrowed in scope". It has to do with the scope of the research. Geographically, the study was conducted in Kasoa in Awutu-Senya East Municipality in the Central Region of Ghana. This study focuses on household's willingness to pay and the factors that determine their willingness to pay for improved solid waste management in the study area.

### 1.7 Organization of the Study

This study is organized in five chapters. Chapter one gives the background to the study, discusses the statement of the research problem and the research questions that arise, the objectives of this study and the significance of the study.

Chapter two provides theoretical settings that guided the study. It reviews relevant literature on theoretical part, empirical studies that support the entire study design and methods of enquiry. Chapter three provides methodological description used in this study. It covers the study area, research design, data type and data collection methods, target population and sample selection, data analysis and reliability and validity. Chapter four presents the findings and the discussion of the study. The final chapter concludes the study and offers recommendations for policy based on the findings of this study. Limitations encountered in the course of this study as well as recommendations for further research are also presented in the concluding chapter.

# CHAPTER TWO

# LITERATURE REVIEW

This section provides theoretical and empirical framework that guided the study. Theoretical framework discusses relevant concepts, theories and assumptions of the research base. An empirical framework presents a review of relevant literature based on the contributions of previous researchers on the research topic and related concepts. Generally, the theoretical and empirical review focuses on households' willingness to pay for improved solid waste management services. Literature is sourced from a wide range of sources including local and international. These included literature from books authored by individuals and groups, journals, articles, the internet and other scholarly works to achieve the results for the present study. The review of literature covered the following strands:

## 2.1 Review of the Theoretical Literature on Willingness to Pay for Improved SWM Service

The theoretical perspective of this study is centred on the threshold decision-making theory proposed by Hill and Kau (1981), Pindyck and Rubinfeld (1981) and the Random Utility Model developed by Lancaster (1966) and McFadden (1974). The theory points out the fact that when the individual is faced with a situation to take a decision, for instance, to pay for improved SWM services or not to pay, the individual has a reaction threshold, which is dependent on a certain set of factors. As such, at a certain value of stimulus below the threshold, no reaction is observed while at the critical threshold value, a reaction is stimulated (Awunyo-Victor et al., 2013). This theory is based on the consumer choice models and random utility theory which uses proxy market values to directly elicit consumers' preferences and WTP by using none merchandised markets conditions which offer potential improvements or damages.

The neoclassical microeconomic consumer theory provides the basic approach to the mathematical theories of individual preferences (Ben-Arikiva and Lerman, 1985). The objective of the theory is to provide the means for transformations of assumptions about desires into a demand function expressing the action of the consumer under given circumstances. According to this theory, consumer demand, as measured by the quantity of the SWM service consumed, is a function of real income and a set of consumer characteristics. The consumer is faced with a budget that defines the choice set and has to choose some quantities of goods and services that give the highest satisfaction for a given limited income. These consumer characteristics are proxies for tastes and preferences. The satisfaction is the utility he/she derives from the services.

The basic problem confronted by discrete choice analysis is the modelling of choice from a set of mutually exclusive and collectively exhaustive alternatives (Ben-Arkiva and Lerman, 1985). A decision-maker is modelled as selecting the alternative with the highest utility among those available at the time choice is made. It is impossible to specify and estimate a discrete choice model that will always succeed in predicting the chosen alternatives by all households. We therefore adopt the concept of Random Utility. The true utilities of the alternatives are considered random variables, so the probability that the alternative is chosen is defined as the probability that it has the greatest utility among the available alternatives.

The Contingent Valuation Method (CVM) is employed to ask consumers about a current situation compared with an alternative one and their willingness to pay for the one they think would give them a higher net satisfaction. In the context of this study, consumers are asked their willingness or otherwise, to pay for an improved SWM service and if they are willing how much they are willing to pay in excess of what

they are paying currently. Thus, the CVM stimulates a market for non-marketed goods and obtains a value for that good, contingent on a hypothetical market described during the survey. Owusu and Anifori (2013) stressed that consumers are allowed to value the product contingent on the market in order to solicit their WTP.

Following Walker and Ben-Akiva (2002), Adjei- Mantey (2013) and Lunojo (2016), a representative individual household *i* willing to buy the improved SWM service will have a utility function given by:

$U_i = \beta X'_i + e_i$

Where, $U_i$ is the utility derived by household *i* from purchasing the improved waste collection service, $X'_i$ is the row vector of various household factors and characteristics of the alternatives that affect disposal, $e_i$ is the unobserved component, and $\beta$ is the vector of parameters of the model. Based on this utility function the Probit and Ordered Probit models will be used to analyse factors influencing household's WTP and MWTP value respectively.

### 2.1.1 Key Concepts

### 2.1.2 Household

According to Ellis (1998), Household can be defined as a social unit characterized by sharing of the dwelling house, with resources that are pulled together for common use. For this study, household is defined as a social unit which consists of one or more people living in the same house and share common budget.

### 2.1.3 Solid Waste

There are varied definitions of the term solid waste. Solid waste refers to any material with no direct value to the producer and so must be disposed of. Misra and Panday (2005) pointed that ~~"a~~ solid material becomes waste when it is discarded without expecting to be compensated for its inherent value".

According to UN-HABITAT (2010), solid waste (such as garbage, trash, waste, rubbish) is viewed as an unwanted material generated from human and animal activities that are normally solid and are considered as useless or has no consumption value to the person disposing it. Solid waste according to Zerbock (2003), comprises commercial, non-hazardous industrial, and domestic waste. Examples of these solid wastes are household organic trash, institutional garbage, construction wastes and street sweepings.

Another definition given by Ghana Innovation Market Place [GIM] (2009) posited that solid waste does not include atmospheric emissions and wastewater discharges which may arise from commercial, industrial, institutional and domestic activities. That is, any form of waste that is neither liquid nor gaseous. Solid waste is the unwanted or useless solid materials generated from combined residential, industrial and commercial activities in a given area.

From the above definitions, solid waste can operationally be defined as materials that may come from domestic, commercial, and industrial sources and they result from human actions or activities and may have no value to people who own them and therefore are thrown away as useless. It is important, however, to note that significant amount of these waste materials could be recycled into useable materials and hence not all waste materials are useless.

### 2.1.4 Solid Waste Management (SWM)

Many scholars have varied views on what the definition of solid waste management is. Kumah (2007) describes the term as ~~t~~he administration of activities that provide for the collection, source separation, storage, transportation, transfer, processing, treatment, and disposal of waste". In a more comprehensive definition, Tchobanoglous et. al. (1993), stated that "solid waste management is that discipline associated with the control of generation, storage, collection, transfer and transport, processing and disposal of solid wastes in a manner that is in accord with the best principles of public health, economics, engineering, conservation, aesthetics and other environmental considerations and that is also responsive to public attitude". In that vein, the essential aspects and relationships involved must be identified and understood clearly if solid waste management is to be accomplished in an efficient and methodical manner (Tchobanoglous et. al, 1993). On this foundation, it implies that solid waste management must incorporate the following: source, storage, collection, transportation and disposal of solid waste in an environmentally sustainable manner.

Othman (2002) also viewed solid waste management as the control of waste generation, collection, storage, transfer and transport, processing and disposal consistent with the best practices of public health, economics, financial, engineering, administrative, legal and environmental considerations. The evolution of solid waste management stem from primitive origins through the development of open dumps in ancient civilizations of the world to the sophisticated collection and disposal systems that are common in use today.

## 2.2 Sources and Types of Solid Waste

As shown in the definitions of solid waste, there are different categories of solid waste and many researchers have classified solid waste based on these categories. Solid waste may be categorized according to its origin (example domestic, industrial, commercial, construction or institutional); according to its contents (example organic material, glass, metal, plastic paper); or according to hazard potential (example toxic, non-toxin, flammable, radioactive and infectious). Tchobanoglous et. al. (1993) also identified forms of solid waste and grouped them into food waste, rubbish, ashes and residues and special waste. Each of these forms of solid waste has been explained in the ensuing paragraphs.

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

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

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

Special waste: The items included in the list of special waste are roadside litter, litter from municipal containers, catch-basin debris, street sweepings, and abandoned vehicles and dead animal (Tchobanoglous et al. 1993). In addition to the classification of solid waste by Tchobanoglous et. al. (1993, 2008), the Centre for Environment and Development [CED] (2003) has also categorized solid waste types on three main grounds. The first category is based is on the source (for example food waste, ashes and residues, rubbish, demolition and construction, agriculture waste). The second classification is based on features of the material (biodegradable and non-biodegradable) while the third classification is based on the risk potential (hazardous waste). Further, the center enumerated sources of solid waste as residential, waste from shops, commercials establishment, hotels/restaurants/eating stalls, slaughter houses and others. It is obvious that the CED classification is akin to the sources and types categorization done by Tchobanoglous et al (1993). On the grounds of types of solid waste enumerated by Tchobanoglous et al (1993) and the Centre for Environment and Development (2003), solid waste largely includes the following items: food waste, rubbish, ashes and residues, demolition and construction, and agriculture waste. The sources of solid waste also include domestic, commercial and industrial.

## 2.3 Components of Solid Waste

Tchobanoglous and Kreith (2002) indicated that an understanding of the characteristics of the waste stream is a must in any solid waste management system. According to Cheremisinh off (2003), this is helpful to municipalities in determining the best management methods for different materials, planning recycling and recovery programmes, purchasing equipment etc. Boadi and Kuitunen (2003) stated that as in most developing cities, solid waste in most cities of Ghana has a high putrescible organic content. Asomani-Boateng and Haight (1999) also stated that organic fraction composes of kitchen waste including food leftovers, rotten fruits, vegetables, leaves, crop residues, animal excreta and bones. Plastics, glass, metals, and paper account for less than 15 percent of the total waste. High organic and moisture contents coupled with prevailing high temperatures necessitate frequent removals, which place additional burden on an over strained collection system. When the waste is not collected in time it emanates a foul smell especially in low income areas where the waste is often mixed with human waste due to inadequate sanitation facilities (Boadi and Kuitunen, 2003).

Hai (2005) alludes to the fact that information about physical and chemical properties of solid waste is important in evaluating equipment needs, systems and management programs and plans, especially with respect to the implementation of disposal and resource and energy recovery options. Characterization of waste is also important to determine its possible environmental impacts. The waste components, although vary widely with the location and season of the year, include food wastes, paper, plastic, cloths, metal, glass, construction materials and others (Dhaka City Corporation, 1999). There are varied components of solid waste. These include materials that can burn and those that cannot; material that are recyclable and others that are non-

recyclable. From this background, it is obvious that a comprehensive appreciation of the content of solid waste will give direction to the methods that can be used to manage the waste. As stated earlier, solid waste is made of materials that are combustibles and non-combustible. Some of the combustible materials are yard debris, plastics, food waste, paper, disposable diapers, textiles, wood, and other organic materials. On the other hand, examples of non-combustibles are metal, glass, leather, aluminum and bones (Kreith 1994; Zerbock, 2003).

**2.4 Solid Waste Management in Ghana**

The Ministry of Local Government and Rural Development is responsible for general waste management in Ghana. The ministry supervises the decentralized Metropolitan, Municipal and District Assemblies (MMDAs). The responsibility of waste management in Ghana is placed on the (MMDAs). By the Local Government Act (1993), Act 462(10)(3)(d and e), MMDAs are mandated to initiate programmes for the development of basic infrastructure, provide municipal works and services and also be responsible for the development, improvement and management of human settlements and the environment in the district. This means waste deposited in the public domain is the property of the District Assembly.

The selection of a site for developing a dump site is therefore one of the most important decisions MMDAs make in executing their waste management responsibilities. They are further required to ensure that they make available adequate sites for the present and future storage, treatment and disposal of wastes by identifying, acquiring, demarcating and protecting suitable areas for such purpose (Environmental Sanitation Policy, 1999). The policy framework guiding the management of hazardous, solid and radioactive waste includes the Local

Government Act (1994), Act 462, the Environmental Protection Agency Act (1994), Act 490, the Pesticides Control and Management Act (1996), Act 528, the Environmental Assessment Regulations 1999, (LI 1652) the Environmental Sanitation Policy of Ghana (1999), the Guidelines for the Development and Management of Landfills in Ghana, and the Guidelines for Bio-medical Waste (2000). All these Acts and Regulations emanate from the National Environmental Action Plan (Sanitation Country Profile Ghana, 2004).

However, local government authorities find it difficult to deal with the large quantities of solid waste generated due to urbanization and increasing densities in these areas. People resort to indiscriminate dumping as the only means to managing their domestic solid waste, resulting in littering and heaping of waste. On daily basis, the amount of solid waste that piles up in public places such as markets and walkways is a sure indication that solid waste disposal in Ghana has become a major challenge for metropolitan, municipal and district assemblies Quarcoo (2014).

**2.5 Sustainable Waste Management**

Throughout the years, the major concern of waste management has been changing. Today, sustainability of solid waste management has become the major concern of waste management in addition to health and related issues (UNEP, 2002). Accordingly, sustainable waste management incorporates the three major pillars of sustainable development, which are economic, social and environmental. According to the Brundtland Report titled *Our Common Future* published in 1987, Sustainable development or sustainability is defined as "a development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED, 1987). ´´For a waste management system to be sustainable, it needs

to be environmentally effective, economically affordable and socially acceptable (Nilsson-Djerf & McDougall, 2000). This point is buttressed by Petts (2000) who stressed that the best waste management must be related to local environmental, economic and social priorities and must go further to involve the public before important waste management decisions are made. Social, environmental and economic compatibilities are therefore observed to be the dimensions of sustainable waste management models or strategies (Morrissey and Browne 2004 all cited in Anomanyo, 2004).

In general, sustainable waste management has three objectives and these are: reducing the amount of waste generated, managing sustainably (by minimizing the environmental burden, minimizing the economic cost and maximizing the social acceptability), and the last objective is considering waste as a resource (UNEP, 2002). Changing attitudes towards waste and considering it as a resource shows shifting of societies towards sustainability.

At present, a more systematic approach, sustainable and integrated solid waste management has been developed to incorporate major aspects and stakeholders in the planning of a waste management system. This approach considers major planning aspects such as environmental, legal, socio-cultural, institutional and political, and additionally considers the importance of the role of stakeholders such as the informal recycling sector and small-scale enterprises in addition to the existing stakeholders.

Other elements of the waste management system such as prevention, reuse and recycling, collection, street sweeping and disposal are also considered as the integral parts of the system. The approach strengthens the sustainability of the waste management system by providing economic service delivery and establishing cost

recovery mechanisms. The approach gives recognition to the direct linkage of willingness to pay and the quality of service delivered. The approach makes sure that the cost is recovered through direct fees, indirect general taxes and revenues from recycling and resource recovery among others. The approach is also encouraging the minimization of resource use and impact on the environment (Zhu et al. 2007 cited Gugssa, 2012). Improved Solid Waste Management for the purpose of this study shall include all activities and actions required to manage solid waste sustainably from its inception to its final disposal.

### 2.6 Integrated Waste Management

In recent years, the concept of integrated waste management (IWM) has become popular as a new approach to waste management (Baabereyir, 2009). The concept of integrated waste management developed by McDougall et al. (2001) links waste streams, waste collection, treatment and disposal methods with the life cycle analysis concepts while aiming at achieving environmental benefits, economic optimisation and social acceptability (Anomanyo, 2004). IWM has been defined by Tchobanoglous et al. (1993 cited in Chati, 2012) as the selection and application of appropriate techniques, technologies, and programs to achieve specific waste management objectives and goals.

As defined by the World Resource Foundation (WRF, cited in UK Environment Council, 2000), IWM refers to ―the use of a range of different waste management options rather than using a single option". It considers how to manage solid waste in a way that prevents harm to humans and the environment (Anomanyo, 2004). In other words, IWM is an approach, which relies not only on technical solutions to the waste problem, but on a wide range of complementary techniques in a holistic approach.

The approach involves the selection and application of appropriate technologies, techniques and management practices to design a programme that achieves the objectives of waste management (Tchobanoglous et al., 1993). The concept of IWM seems to have emerged from the realization that technical solutions alone do not adequately address the complex issue of waste management and that there is the need to employ a more holistic approach to waste management (Baabereyir, 2009).

The UNEP International Environmental Technology Centre (1996 cited in Chati, 2012) has identified the importance of integrated solid waste management. These include:

- Some problems can be solved more easily in combination with other aspects of the waste system than individually;
- Adjustments to one area of the waste system can disrupt existing practices in another area, unless the changes are made in a coordinated manner;
- Integration allows for capacity or resources to be completely used; economies of scale for equipment or management infrastructure can often only be achieved when all of the waste in a region is managed as part of a single system;
- Public, private, and informal sectors can be included in the waste management plan;
- An ISWM plan helps identify and select low cost alternatives;

Some waste activities cannot handle any charges; some will always be net expenses, while others may show a profit. Without an ISWM plan, some revenue-producing activities are ―skimmed off" and treated as profitable, while activities related to maintenance of public health and safety do not receive adequate funding and are managed insufficiently.

As argued by Rhyner et al. (1995 cited in Baabereyir, 2009), ~~a~~ single choice of methods for waste management is frequently unsatisfactory, inadequate, and not economical". Use of an integrated approach to managing solid waste has therefore evolved in response to the need for a more holistic approach to the waste problem. In this approach, all stakeholders participating in and affected by the waste management regime are brought on board to participate in waste management.

Furthermore, issues such as social, cultural, economic and environmental factors are considered in the design of an IWM project (Tchobanoglous et al., 1993; Rhyner et al., 1995; Schubeller et al., 1996 all cited in Baabereyir, 2009). IWM involves the following functional elements: waste reduction, reuse, recycling, recovery through physical, biological, or chemical processes (e.g., composting, incineration) and land filling. These elements of IWM are frequently formulated into a waste hierarchy model (Baabereyir, 2009). The hierarchy of integrated solid waste management thus involves the 3Rs (reduce, reuse and recycle), incineration and land filling (Chati, 2012).

### 2.7 Economic Valuation of Non-Market Goods

Non-market goods may refer to goods and services that are not captured in the market place or for which no or limited market exists and for which people do not pay money to receive. Usually, most environmental goods are non-market goods because they exhibit the characteristics above. Not many of such environmental goods have markets and hence prices. The prices that exist for those few indicate that minimum amount at which suppliers and consumers have agreed to enter into a market transaction. At these prices therefore, surpluses are bound to exist either on the

producer side or the consumer side. The economic value of such goods thus goes beyond the price to include all the surpluses unaccounted for in the price.

Given that most environmental goods do not have markets, and those that do have prices that do not reflect the full value of the goods, economic valuation is most important to the sustainability of non-market goods. The theory of economic valuation is based on individual preferences and choices (Perman et al. 2003). That is to say, the economic value of a good, service or a resource is based primarily on what people want. It is generally assumed in Economics that individuals are the best judges of what they want given that they are rational. Individual preferences are observed by the choices and the tradeoffs make. Economic value is measured by the maximum that someone is willing to forego in terms of other goods or services to obtain a good or service. As already discussed, this may be different from the market price since the market price may not accurately measure the economic value. In fact, from conventional demand analysis, most people are usually willing to pay more for a good especially the first units of the good than the price of the good resulting in their WTP going beyond the market price.

The economic value of a resource such as environmental good can be classified into use value and non-use value. These together, make up the total economic value (TEV) of the resource, a concept which emerged in the mid-1980s. Use value refers to the benefits that the society derive from using the resource. For example, society may use a clean river for drinking purposes, swimming, boating, among others without paying for it. This is use value. Use value is further divided into two – direct use value and indirect use value.

Direct use value of a resource is the contribution of the resource to current production or consumption or the value derived from directly consuming services provided by the resource. Logging a forest to obtain wood for fuel could be an example of direct use value. Indirect use value of a resource refers to the functional services the resource provides to support current consumption and production (Perman et al. 2003). In the case of the forest, water shed protection is an example of an indirect use value derived from the resource.

### 2.8 Methods for Non-Market Valuation

According to Mishra (2014), methods for valuing non-market resources may be generally classified into two – pecuniary and non-pecuniary methods. Pecuniary methods are those methods that use money as the numéraire. That is, the monetary value or money equivalent of the goods, services or resources being valued is obtained. Non-pecuniary methods, on the other hand, do not look to assign a money value. They are more general in nature and any value or standard may be used as the numéraire.

The pecuniary methods may be grouped into three main categories – Revealed Willingness to Pay, Imputed Willingness to Pay/Circumstantial Evidence and Expressed Willingness to Pay (Mishra, 2014).

#### 2.8.1 Willingness to Pay (WTP)

Willingness to pay (WTP) is generally used to consider the evaluation of the potential benefits of an environment. According to Omonona and Fajimi, (2011), WTP is the sum of real expenditures at market prices plus the value of consumer surplus above market prices that the household would have been willing to pay or the maximum amount consumers are prepared to pay for a good or service.

Willingness to pay for the purpose of this study as expressed in monetary terms as Maximum Willingness to Pay (MWTP) is the maximum amount which a consumer would be willing to pay in order to receive a good or service, or to prevent damage. The aim of a consumer is to maximize utility. Therefore, if the good or service has high utility to the consumer, then the consumer will be willing to pay for such good or service for his satisfaction; and if the good or service has little and does not satisfy the consumer‘s utility, then he will not be willing to pay for such good or service. The consumer‘s ability and high willingness to pay shows that the good or service has more preference, and hence it is more demanded. A high value service is the one which satisfies the consumer the most (Sansa and Kaseka, 2004).

### 2.8.2 Revealed Willingness to Pay

Revealed Willingness to pay method is based on the market price or on consumers‘ revealed willingness to pay. The main idea here is that if the good, service or resource being valued has a market, then it will have a market price and buyers will reveal their preference for that particular resource by paying for it at the market price. They reveal their willingness to pay by paying what the market price is. Thus the existence of a market price is exploited to assess the value of the resource. Based on this principle, the following valuation methods have been developed: Travel Cost Method (TCM), Averting Behaviour Method (ABM), Market Price Method (MPM), Hedonic Pricing Method (HPM), and Production Function Method (PFM).

The revealed willingness to pay only measures the use value of a resource and since use value only form a component of the total economic value of a resource, estimates obtained from valuation methods in this class fall short of what the total value of the resource may be.

### 2.8.3 The Travel Cost Method (TCM)

This method is often used to value recreational sites and parks. The basic assumption that underpins this method is that if people are willing to incur the costs of travelling to a recreational site and the price of being admitted to the site, then they must value the site that much. It can be noted from how this method works that the value of the resource is drawn from the prices people are willing to pay to access it; that is the cost of transporting oneself to the site and the cost of admission to the site. This way, it is only the use value of the resource that is observed. This is because the inherent values that the users of the site have for the resource is not measured. It is just the cost they pay to use the resource that is measured. Hence, TCM cannot measure the total economic value of a resource.

A major criticism against the TCM is that an individual's decision to visit a site does not only depend on the cost of visiting, but also to a large extent, dependent on the time available at the disposal of the individual. That is to say, sampling only visitors to a site to ask about their travel costs and use that as a measure of the value of the resource may be flawed since other people may equally have value for the resource but may have other engagements such as a tight work schedule that do not afford them the time to visit the site for recreation. The values of such individuals may not be counted and this is likely to bias the value given to the resource at the end of the valuation exercise. Furthermore, it is argued that potential visitors to a recreational site may not be fully informed about the total costs involved and the total benefits they may derive from the site before deciding to visit. Thus for such people, it is difficult to assume that they embarked on the visit because the costs involved indicates their valuation of the resource.

The issue of multipurpose visit is also essential in assessing the validity of value estimates derived from the TCM. A multipurpose trip is the situation whereby an individual embarks on a visit to a particular area for varied reasons. Perhaps work-related or family- related visits may be combined with a visit to a recreational site – a situation which adversely affects the value attributed to the resource by such a visitor based on his travel costs since he did not incur all those costs merely for the sake of the recreational site.

Since the TCM values only use values, and especially because the method has been used to value recreational sites and parks, it may not be suitable for valuing improved solid waste management service as this is the focus of this study. Typically, people do not travel to go and use improved solid waste management service and return to their homes, thus making this method less preferred for a study such as this one.

### 2.11 The Averting Behaviour Method (ABM)

The Averting Behaviour Method (ABM) values a particular resource by looking at the costs of the actions people take to avoid or, as the name goes, to avert the risks they face should that resource deteriorate in quality. ABM has been typically used to value environmental quality. The underlying assumption here is that individuals are aware of the adverse effects of deterioration in environmental quality such as air pollution, water pollution, and depletion of the ozone layer among others. Knowing the adverse effects that the deterioration brings, individuals do take certain measures that seek to avert or reduce the risks they face in such environments.

The cost of the measures they take is used as a measure of the value of the resource. For example, the willingness of people to pay for clean water from a river will be derived from the cost they incur to purify the water to avoid the risks of the polluted

water. Another example is when people purchase such goods as sun glasses to avoid the risks they face by walking under the sun due to ozone layer depletion. The costs of these actions are used as a measure of how much they value environmental quality. In the specific case of this study on WTP for improved SWM, an example could be the costs households incur in adopting measures that reduce the adverse effects of insanitary conditions such as cost of collection, purchasing of dustbins, sorting and recycling.

ABM faces a number of criticisms. A common one is that individuals may value a resource much more than it costs to avert the adverse effects. Further, people may purchase a good not because they seek to avert any risk but as fashion. If it becomes fashionable to wear sun glasses, people will make expenditures on it for the sake of fashion and not for the sake of mitigating the effects of ozone layer depletion. It is further argued that just because people do not make any expenses to avert the effects of deterioration in environmental quality does not imply they have no value for it. In the case of improved solid waste management service, the fact that people do not purchase waste bins and participate in solid waste management practices to prevent them from the adverse effects of poor solid waste management practices does not imply that they do not value improved solid waste management services. They may be constrained by other factors for which reason they are unable to enjoy those services. Thus valuing a resource based on information only from those who take certain actions is likely to bias the value given to the resource at the end of the valuation exercise.

The ABM can only be used to determine the value of resources of nature based on certain qualities. Since it does not help in giving the total value of nature because it loses out on non-use value, it is not the preferred method for this study.

### 2.12 The Market Price Method (MPM)

This method calculates the total net economic benefit or the total economic surplus of a good and uses that as a measure of value of the good. The higher the economic surplus, the greater is the value of the good or service. Total economic surplus is the sum of the consumer and producer surpluses. Consumer surplus measures the benefits a good or service gives a consumer over and above the cost of acquiring the good. Producer surplus is a measure of the benefits that accrue to a producer over and above the cost of making the good or service available to the consumer. This method is largely hinged on the market price of the commodity being valued since surpluses are calculated using the market price.

However, only a few of environmental goods have markets and hence prices. Therefore, this method cuts off quite a number of non-market goods needing valuation. For those goods that have market prices, information asymmetry and other imperfect market conditions do not yield an efficient price and thus arriving at the true economic surplus from these prices is questionable. Furthermore, in many developing economies, the government takes care of many resources while many inputs are not accounted for in the price of the final commodity probably due to inefficient systems, leading to prices that do not fully reflect the worth of the commodity. Again, prices paid by consumers are the going market prices and do not capture their intrinsic value for a resource, hence the MPM is not very appropriate for this study.

## 2.13 The Hedonic Pricing Method (HPM)

The Hedonic Pricing Method (HPM) is often used to value the properties' market and the labour market. In the properties market, it is known as Property Value Approach while in the labour market, it is known as the Wage Differential Approach. The HPM is used to measure non-market components or attributes of a marketed good.

The HPM relies on the assumption that the price of a good is dependent on the attributes of the good in question and that individuals do value the characteristics that make up a good more than the good by itself. A good may however, have as part of its attributes or characteristics an environmental component which may be difficult to value and the HPM comes in handy to value such non-market components of goods. The HPM measures the value of the separate attributes of a good by looking at how the price of the good changes when the attribute changes.

The HPM regresses the price of the good on its attributes yielding a certain function $V = f(Y_i)$. Where V is the value or price of the marketed good and $Y_i$ are the attributes of the good. From this function, one can calculate how the value of the good changes when there is a marginal change in the explanatory variables (the attributes).

HPM assumes weak complementarity and this is a weakness of this method. Weak complementarity here means that for a person who does not use the good or pay for the good, his value of its characteristics is zero which includes the environmental qualities of the good. For a property, this means that HPM will only value the environmental quality of the neighbourhood within which the property is located and not for other places.

This method also assesses use values only since it measures environmental changes' effects on price that an individual is willing to pay of the good. It does not measure non-use values and hence cannot be used in this study.

### 2.14 The Production Function Method (PFM)

The Production Function Method investigates how environmental qualities affect output levels of an economic activity. PFM relies on the fact that some natural resources and environmental quality are inputs in the production process such that changes in these resources or environmental qualities will have some impacts on production which change market prices. The method essentially measures changes in environmental qualities on production costs and output.

Critics have argued that losses arising from costs of production due to changes in environmental quality may not be very representative of society's value for that environmental quality. In other words, it is one sided because only the producer side is considered without due consideration given to consumer side issues such as consumer surpluses.

Furthermore, some producers in the course of production may resort to averting behaviour to reduce the impact of changing environmental quality on their output. This makes it difficult to accurately measure losses in production output as a result of changing environmental quality. For example, a farmer whose land suffers from soil erosion may resort to fertilizers to booster the nutritional needs of the soil in order to avert the soil's inability to sustain high crop yields.

The PFM does not capture the total economic value of nature; it captures only a part of total value and thus cannot be used in this study.

### 2.15 Imputed Willingness to Pay/Circumstantial Evidence

Here, the value of a resource is arrived at by finding out people's willingness to pay or the cost of the actions people take to avoid the losses they will incur should the services rendered by the resource cease. In this case, the losses do actually occur; the cost of people's actions to replace the losses could also be used as a measure.

In line with this principle, different valuation methods have been developed, namely Damage Cost Avoided Method (DCAM), Replacement Cost Method (RCM), and Substitute Cost Method (SCM) and Circumstantial Evidence Approach is sometimes known as Surrogate Market Valuation (Mishra, 2014). It involves measuring the value of a non-market good, service or resource by looking at the shadow price of related goods and services in the market. These related goods or surrogates may either be substitutes to the non-market good in question or complements to the good or service a resource may provide or any good from which indirect information about the non-market good's changing economic impact may be obtained.

It is argued that the surrogate market valuation technique is limited by the fact that it is potentially able to provide dependable estimates only if the value of the non-market good under consideration is revealed by the prices and behavior of consumers in related markets. Since market prices typically reflect use values of a commodity, what it implies then is that the surrogate market valuation technique is not appropriate if a resource exhibits non-use values rather than benefits from use.

### 2.16 The Substitute Cost Method (SCM)

The Substitute Cost Method (SCM) bases its estimation of the value of a natural resource on the cost of providing a substitute to the resource or the services provided by the resource. An example in Ghana is the Keta sea defense wall project. This wall

was built as a substitute to the ecosystem since the ecosystem had been destroyed and could no longer protect the people of Keta from probable flooding by the sea. The cost of the sea defense project could be used to value the ecosystem under the SCM method of valuation.

### 2.17 The Replacement Cost Method (RCM)

The Replacement Cost Method (RCM) bases its value of a resource by observing the costs incurred in replacing the resource or the services provided by the resource. Replacement cost is often in terms of the market prices of the resource used as a replacement. For example, if fertilizer is purchased to replace nutrients lost in the soil due to soil erosion, then the costs of the fertilizer in terms of its market price is used to value the soil.

### 2.18 The Damage Cost Avoided Method (DCAM)

The Damage Cost Avoided Method (DCAM) bases its value estimates of a resource on the costs of actions that society takes to avoid damages or loses that may occur should the resource cease. It is argued that the methods in this class –circumstantial evidence- are risky and inaccurate to use. This is because human beings though rational, make some replacement and damage avoidance decisions not entirely out of economic reasons. Sometimes, it is based on emotions and feelings. Due to these considerations, damage avoidance or replacement methods of valuation are most appropriate to situations where those damages have actually been made or will definitely be made (Mishra, 2014).

As stated earlier, these methods are not appropriate for valuing the improved solid waste management for this study because among their other flaws, they are unable to intrinsically measure the non-use value of nature.

## 2.19 Expressed Willingness to Pay

As has earlier been mentioned, non-market goods are not traded in the market place and some if not most of them may not have close semblance. Thus _revealing' ones' preference to pay for them is not an option. It is also not always possible to impute people's willingness to pay for a good by observing the costs of their actions taken to avert suffering or damages as a result of the loss in the resource. In such cases, people are asked to state their willingness to pay for a resource after they have been presented with a hypothetical scenario. Data generated from the surveys are used to estimate willingness to pay for the good, service or resource in question.

This category measure both use and non-use values of a resource that gives the total economic value of the good, service and resource being valued.

Botchway (2011) posited that because these methods are not tied to behaviour, they can be used to value some goods and services that the revealed preference methods are not able to value. Valuation methods in this class are the Contingent Valuation Method (CVM) and Contingent Choice Method or the Choice Experiment Method (CEM).

## 2.20 The Contingent Valuation Method (CVM)

Ciriacy-Wantrup first came out with the Contingent Valuation Method in 1947 as a means of eliciting the market value of a non-market good. However, it was first used in a study by Davis (1963). Since then it has become the most widely used technique (Hanley et al. 2002) for estimating use and non-use values of environmental commodities (Perman, McGivary and Common, 1999). The two major non-use values, _option and existence' values, recognized as important components of the total economic values in an environmental good, especially during the 1960s

(Venkatachalam, 2004). The CVM has been applied in other areas of economics such as health economics, transportation safety and cultural economics (Pearman, 2003). Some studies have taken advantage of this methodology to determine consumers' WTP for genetically modified foods (Chern et al., 2002; Onyango, 2003). Maynard and Franklin (2003) employed it in their study of the commercial potential of "cancer-fighting' dairy foods. Aguilar and Kohlmann (2006) used it to determine the willingness to produce and consume transgenic bananas in Costa Rica. It is applicable to every commodity for which these market value is not well defined.

In this study, CVM was used to investigate the WTP for improved solid waste management service. The CVM was preferred due to its advantage over other valuation techniques. It is one of the most widely used and generally acceptable techniques for estimating the total economic value both use and non-use values of many classes of public goods and services that other economic techniques cannot accommodate. It is able to measure the total economic value of a resource because respondents will consider both the use values as well as non- use values of the resource to them before arriving at the maximum amount they are willing to pay for the resource or willing to accept for deterioration in the resource. In addition, CVM results are also relatively easy to understand, interpret, and to use for policy purposes.

Despite its advantages and wide range of applicability, CVM have been criticized for many biases comprising strategic bias, design bias, hypothetical bias, and operational bias (Pearce and Turner, 1990). However, it has to be noted that the limitations are inherent in any valuation method of damages from deprivation of passive-use and not special to the CVM (Arrow, et al., 1993).

The CVM measures the value of a resource by calculating the WTP of local residents to keep the resource or the amount required to compensate for their deterioration, or a total loss of the resource. In effect, this method asks people to directly state their WTP for a particular good, or to improve a particular service or for deterioration in a service or their Willingness -to -Accept (WTA) to give up a good. Thus, CVM approach involves asking individuals directly the value they attach to a particular resource or its characteristics. In CVM technique, a hypothetical scenario which details out the attributes of a certain resource and its effects is created and respondents are asked in a survey how much they (household) will be able to pay for that resource or how much compensation they will accept should the resource deteriorate or be lost completely.

This technique got its name Contingent Valuation because people are asked to state their WTP based or contingent upon a specific hypothetical scenario and description of the service (Mitchell and Carson, 1989; Cummings et al.,1986). The total value of the service is determined by averaging respondents‘ values and extrapolating it across the population. This is an open ended contingent valuation format. It has been argued, however, that respondents often find it difficult to assign an appropriate value to the service on their own. This often leads to a wide range of responses in a survey.

In sharp contrast to the open ended format is the close ended format of contingent valuation. This is a discrete or dichotomous choice question where respondents are presented with a value and are asked to respond either _yes‘ if they would pay that amount or _no‘ if otherwise. This typically reflects the choice consumers face in an actual market for a commodity where a commodity has a price and they either buy the commodity at the going price (yes) or they don‘t (no).

### 2.21 Elicitation Techniques of CVM

The choice of an elicitation technique, however, depends on the type of resource being valued and the nature of the sample. Among the common elicitation techniques are the bidding game format, discrete choice format.

**The bidding:** The bidding game was first used by Davis in the early 1960s. This elicitation technique involves taking the respondent through a series of bids until a negative response is generated and a threshold established. There is a starting bid given by the interviewer to which the respondent either agrees to pay (or accept) or disagrees. The interviewer keeps increasing the bid till the respondent answers ‗no' to it or keeps decreasing the bid till the respondent answers ‗yes' to it. The latest bid to be accepted represents the respondent's maximum WTP (or minimum WTA). There is a starting point bias in this technique. The situation whereby the starting bid suggested by the interviewer has the potential to ultimately influence the respondent's final bid is what is termed as a starting point bias.

**The payment:** This format was developed by Carson and Mitchell (1981 and 1984) as an alternative to the bidding game. This format asks respondents to choose from a range of values which best suits their maximum WTP. This approach doesn't provide a single starting point and thus eliminates the starting point bias as found in the bidding game. However, biases may arise as a result of the ranges used on the cards.

**The discrete choice format:** The discrete or dichotomous choice format is what may be known also as the take-it-or-leave-it format or the referendum format developed by Bishop and Heberlein in 1979. This approach asks the respondent to either agree or disagree to an amount stated by the interviewer. The amounts given are varied across the sample. This is what most consumers face in actual markets and hence, are

familiar with this system. This is also called the single bounded dichotomous choice. This method makes the respondents' task easier similar to the bidding game but this excludes the iterative process component of the bidding game. As noted by Botchway (2011) and emphasized by Adjei-Mantey (2013), the disadvantage with this method is that more observations are required for the same level of statistical exactness in a sample estimate.

**The discrete choice with a follow up approach:** This approach requires respondents to answer _yes' or _no' to pay for a particular service. _yes' response draws out a follow up question with a higher amount while a _no' response attracts a follow up question with a lower amount this time round. This approach though gives the survey process significant gain in efficiency, still has the limitations observed under the discrete choice technique. After all, this is just the same as the discrete choice; only with follow up questions. Additionally, the follow up questions gives this format some semblance with the bidding game and thus suffers from the limitations of the bidding game especially the starting point bias. The approach to be employed in this study follows the discrete choice with a follow up approach.

Some of the biases that are likely to confront the use of CVM as a valuation technique are discussed below.

**Starting point bias:** The starting point bias arises when the starting bid given by the interviewer goes to ultimately influence the final response given by the respondent. This bias is best minimized by varying the starting bid among the sample. This way, the interviewer is able to investigate the influence of the starting bids on the final WTP.

**Strategic bias:** This bias arises when respondents deliberately understate their WTP or overstate their WTA. Sometimes also, WTP may be overstated especially if the respondents are aware that they will not be asked to pay for the resource but their responses are merely being used to get a value for the resource after which the government will provide the good. Respondents are likely to overstate their WTP if they want the good provided or may understate it if they do not want the resource provided. A discrete choice format where _yes' or _no' responses are required for differing amounts within the sample may minimize this bias.

**Hypothetical bias:** Hypothetical bias results from a poor understanding of the hypothetical scenario created from which WTP questions are asked. If respondents misunderstand the scenario or the scenario is misrepresented by the interviewer, it will lead to responses that do not match the hypothetical scenario hence biases. This can be minimized by well explaining the hypothetical scenario, and avoiding any ambiguity whatsoever. Hypothetical bias may also arise because people may respond differently to hypothetical decisions compared to how they make actual decisions.

**Interview and Compliance bias**: Interview bias arises from the conduct of interviewers that tend to influence the responses given by the respondents in a survey. Compliance bias arises when respondents attempt to give answers that they think may please the interviewer. These biases can be minimized by training interviewers well to adhere to the principles of conducting an effective survey.

**Non response bias:** Non response bias results from the fact that some sample members do not respond and yet they have values for the resource which may be different from those given by respondents. This has the tendency to bias the overall value placed on the resource.

**Information bias:** Information bias arises because respondents may be asked to value attributes for which they have little or no knowledge of. This means that the information that they are given to the respondents will have substantial influence on their responses. Despite the likely biases that may arise when the CVM is employed, there are effective ways by which to reduce these biases or eliminate them in some cases as have been discussed. This makes it less costly to use the CVM since the potential biases may be dealt with as opposed to the earlier valuation methods discussed whose biases may be difficult to overcome.

### 2.22 Willingness to Pay (WTP) and Willingness to Accept (WTA)

There are two Hicksian measures of utility change developed by Hicks (1941) which can be used to study the value attributed to a good or service in a contingent valuation survey namely compensating variation and equivalent variation. Compensating Variation is the change in income that would _ompensate' for a price change. It is the maximum amount that an individual would give up for a good or service to keep his utility constant. Equivalent Variation is the change in income that will be _equivalent' to a proposed price change. It is the minimum amount an individual would accept to forego a good or service or lose some part of the good. This information has been detailed in Table.

**Table 1: Hicksian Monetary Measures for the Effects of a Price Change**

| Price Change | Compensating Variation | Equivalent Variation |
|---|---|---|
| **Price fall** | willingness to pay for the change occurring. | Willingness to accept compensation for the change not occurring. |
| **Price rise** | Willingness to accept compensation for the change occurring. | Willingness to pay for the change not occurring. |

Source: Perman et al. 2003

Willingness to pay and willingness to accept may provide different values for the same commodity change. WTP for a good is usually lower than WTA compensation to forego the same good (Bishop and Heberlein, 1979) and most studies have also suggested that people tend to value losses more highly than corresponding gains. It is often difficult to measure WTA accurately in contingent valuation. Bishop and Heberlein (1979) and Bishop et al (1983) substantiate this by reporting in their studies that WTA compensation in contingent valuation surveys exceed actual WTA compensation for the same goods. Due to this, researchers have almost always focused on WTP in assessing the value of a resource.

### 2.23 The Choice Experiment Method (CEM)

Under this valuation technique, WTP is deduced from hypothetical choices or trade – offs that respondents make. Respondents are given a set of alternative representations of a good and are asked to choose their preference. This is similar to real market situations where consumers face two or more goods which possess similar characteristics but at different levels of these characteristics. The respondents are asked to choose whether to buy one of the goods or none of them. In other words, Choice Experiments are a contingent valuation method based on random utility theory and Lancaster‘s characteristic theory of value which states that, the value of a good is determined by the attributes that make up the whole (Garrod and Willis, 1999). Choice experiment therefore seeks to find the values for each of these attributes of a particular resource by presenting respondents alternative choices each made of different degrees of the various attributes. Respondents are required to either choose an option or maintain the status quo. The analysis of the trade-offs helps to arrive at the WTP for each attribute. Choice experiment provides more information about the resource being valued on the whole and the decisions here mirror the decisions faced

by consumers in real life where they have options of varying attributes from which to choose.

Considering the evaluation methods reviewed above and many others not reported here, the CVM has been shown to be very widely used in estimating the economic values people place on non market goods such as improved solid waste management service. This study will therefore use the CVM to estimate the WTP and the value households in Kasoa are willing to pay for improvement in SWM service and investigate the factors that affect their WTP with guidance from the literature as discussed above.

## 2.24 Review of Empirical Literature on Willingness to Pay for Solid Waste Management

The indiscriminate disposal of solid waste leads to serious risks to public health and the environment, each risk having its own economic cost. Solid waste management is an issue that deserves to be taken seriously by everyone. Several studies have been conducted in different part of the world on willingness to pay for improved solid waste management service. Various socioeconomic and cognitive factors have been found to influence willingness to pay for waste management.

Empirical evidence on the relationship between age and WTP are mixed. Some studies show positive association between age and WTP while others do not. Nkansah, Dafor, and Essel-Gaisey, (2015); Addai and Danso-abbeam, (2014) posited that age has a positive influence on WTP for improved SWM services. On the other hand, Afroz *et al.* (2009) in their study on the households' willingness to pay for improved SWM in Daka city, Bangladesh and the studies by Seth et al. (2014) and Niringiye and Douglason, (2010) found a negative relationship between age and the

WTP for improved SWM services. It is also revealed that older people tend to have high WTP because they have knowledge on environmental degradation and epidemic history, which help them to understand the need to protect and keep a clean environment and are more likely to pay for improved waste management service than the younger people. However, it is also revealed that older people may consider the SWM service as a government responsibility and could be less willing to pay for it while young people might be more familiar with cost sharing and their WTP is expected to be high.

Education has been reported as having a positive relationship with WTP for improved SWM services. With high educational level, people are much aware of environmental problems caused by insanitary conditions and therefore are more likely to pay additional cost to secure the environmental safety and their health. Addai and Danso-abbeam, (2014) using Logit model found a positive and significant result of education on a WTP. Other studies (Subhan et al. 2014; Banga et al. 2011; Niringiye and Douglason, 2010; Afroz, Hanaki, and Hasegawa-Kurisa, 2009) have also reported positive and significant result of education and WTP. However, Seth et al. (2014) who examined household‘s demand and WTP for SWM service and reported an insignificant result of education on a WTP.

Households with higher average monthly income are expected to be able to pay and thus will have the WTP. Various empirical findings suggest a positive relationship between household income and WTP. Hagos *et al*. (2012) used Contingent Valuation, Probit and Tobit models to identify the determinants of households‘ WTP for improved solid waste management system. Household income was found to be positive. This was corroborated by other studies (Banga et al., 2011; Assa, 2013;

Nkansah et al., 2015; Massito, 2009; Ezebilo, 2013; and Niringiye and Omortor, 2010, Adjei-Mantey, 2013, Afroz *et al.* (2009). SWM service is considered as a normal good and therefore, as income increases its demand certainly increases. The studies demonstrate that people with higher income are ready to pay for waste management services and are expected to pay more even for an improved service.

WTP for improved SWM service is also influenced by gender. Alhassan and Mohammed (2013) and Oteng-Ababio (2010b) found in their studies on WTP that women were more willing to pay for solid waste services. However, Afroz (2011) and Assa (2013) found no statistically significant relationship between willingness to pay and gender in their studies in Bangladesh and Malawi respectively.

The aim of every consumer is to maximise satisfaction (utility) from the goods or services he/she consumes. Satisfaction with the current SWM service by SWM service providers influence the WTP for improved SWM services (Assa, 2013). Household WTP for improved SWM service goes together with the satisfaction with the quality of service offered (Afroz et al., 2009 and Kassim and Ali, 2006). In other words, the quality of service offered by the solid SWM companies determines the satisfaction level of the household and their WTP. Addai and Danso-abbeam (2014) also revealed that households that are satisfied with the current waste collection services are willing to pay more than unsatisfied ones. However, Amfo-Out et al. (2012) proposed that people who are satisfied with the current SWM services are not inspired to pay for any additional improvement of waste management services in their areas.

Othman (2002) carried out a study at Kajang and Seremba municipalities in Malaysia using two stated preference methods: Contingent Valuation (CV) and Choice Experiment (CE) to elicit consumers‘ willingness to pay (WTP) for different SWM alternatives. An intention CV was to assess the aggregate value of SWM package, and that of CE was to classify the marginal values for SWM attributes.

The choice sets followed the standard LMN experimental design (where L is the number of levels, M is the number of alternatives in each choice set, and N is the number of attributes) where only the main effects were modeled. Each choice set contained three SWM options (one status quo and two improved SWM options). The service attributes that were used in the study are transportation mode, disposal methods, collection frequency, monthly charges and free provision of multiple containers for separation of waste at source. The study found that all the attributes were significant and the signs appeared as they were predicted. The two models deduced that the households supported improvement of SWM, in terms of disposal methods, collection frequency, transportation mode and separation of waste at source.

The study by Madenge (2005) in Dodoma Municipality found that 74% of the respondents could afford to pay for the waste collection fee every month from their monthly earnings; but this was not happening. The survey results showed that people did not pay not because they did not have the money but because they did not want to pay. This implies that people did not see the reason for paying waste collection fee on the one hand, and on the other hand they did not see SWM as their responsibility. Most of them said it was the responsibility of the government to make sure that the waste is collected and disposed of properly. The study findings also indicated that 15% of the respondents said that the waste was collected once per week, 50% said twice a week, 20% said three times a week, 10% said more than three times a week

and 5% said the waste was not collected at all. This shows that on average solid waste was collected twice a week, that is why they need to increase the number of days for garbage collection so as to minimize the accumulation of the waste in the streets. Although the study tried to indicate the ability of the respondents to pay for SWM, it failed to show what factors influenced the respondents into being unwilling to pay for SWM.

Solomon (2007) employed Choice Experiment (CE) to evaluate household‘s preferences for improved SWM in Yeka, Addis Ababa. The study used a sample of 242 households selected at random, and conducted a face-to-face interview. The attributes that were employed in the study are collection frequency, monetary charge and separation of waste at source. Two Multinomial Logit (MNL) models were employed for the estimation. The first model included the attributes only and the second model included the attributes jointly with socio-economic variables: age, sex, income, education level, family size and number of working household members. The findings of the basic model showed that the coefficients of all attributes were significant at 1% level. In the extended MNL model, out of the six socio-economic variables, only two of them were found significant. These are age, which was negative and significant at all levels and income, which was positive in sign and significant at 10% level. All non-monetary attributes, like in the basic model, were significant and their signs appeared as they were expected. Lastly, the results of the study revealed that the Choice Experiment method (CE) could be applied in the context of developing countries in identifying households‘ preferences that fit the requirements of the model.

## 2.25 Conclusion

From the literature review, the issue of households' willingness to pay for improved solid waste management have been extensively researched in most developing countries but the findings from these studies points to varying factors which influence the phenomenon, leading to inconclusive findings.

In line with microeconomic consumer theory and the empirical studies, some of the major factors that have been revealed to determine WTP for such goods as improved SWM services include demographic and socioeconomic characteristics such as age, gender, education, average monthly income, service satisfaction of current SWM services, house ownership and employment status among others.

# CHAPTER THREE

# METHODOLOGY

## 3.0 Introduction

This chapter detail the methodology adopted in this study. It discusses the theoretical framework underpinning the study, gives an overview of how the survey was conducted and the means by which the responses obtained were analyzed.

## 3.1 Study Area

The study was conducted in Kasoa; the Municipal capital of the Awutu Senya East Municipal Assembly (ASEMA). Kasoa, formerly known as Odupongkpehe, is a peri-urban town in the Awutu Senya East Municipal of the Central region of Ghana.

The Awutu Senya East Municipal is located in the Eastern part of the Central Region. It shares common boundaries with Ga South Municipal Assembly (in the Greater Accra Region) at the East, Awutu Senya District at the North and Gomoa East District at the West and South respectively. The Municipality covers a total land area of about 108.004 sq. km, about 1.1 percent of the total land area of the Central Region. Kasoa, the Municipal capital, is located at the South-Eastern part, about 31 km from Accra, the national capital. The major settlements of the municipal are Opeikuma, Adam Nana, Kpormertey, Ofaakor, Akweley, Walantu and Zongo.

Kasoa was carefully selected for this study because of rapid urbanization and expansion of the municipality which has led to enormous increase in solid waste generation. Heavy heaps of refuse are easily observed which affects the aesthetic nature of the study area. Also, from a socio-economic point of view; Kasoa is an important commercial city which attracts people from all walks of life. Thus, such a study towards WTP for improving the management of solid waste from households in

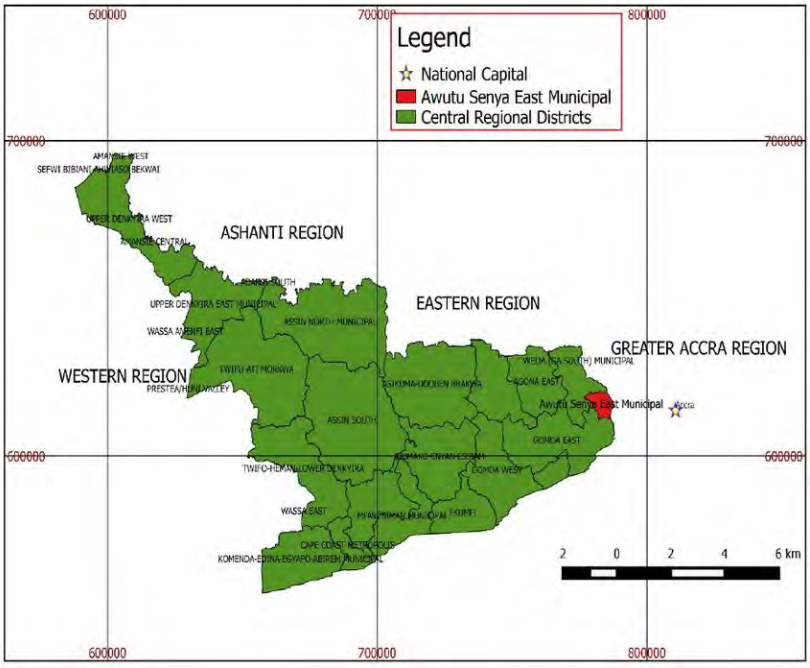
the municipality, may serve as a driver for improvement of the same in other towns in the country. This municipality is among the top rapidly growing communities in Ghana (Ministry of Finance, 2014).

According to the assembly‘s official website (www.asema.gov.gh), Awutu Senya East Municipal Assembly is one of the newly created Municipalities in the Central Region. The Municipality was carved out of the former Awutu Senya District in 2012 and established as a Municipality by Legislative Instrument (LI) 2025. The rationale was to facilitate government‘s decentralization programs and local governance system. The people of the Municipality are mainly Guans. There are other settler tribes of different ethnic backgrounds; these include the Gas, Akans, Ewes, Walas/Dagartis, Moshies, Basares and other numerous smaller tribes. The Awutu Senya East Municipal Assembly exists to facilitate the improvement in the quality of life of the people in close collaboration with the private sector and other development partners in the municipality through the mobilization and the judicious use of resources and provision of Basic Socio-Economic Development within the context of commitment to Equity, Accountability, Transparency and excellence. The population of the ASEMA is estimated at 270,000 (projected from 2010 Population and Housing Census). The average annual growth rate of the Municipal is 3.0%. The ratio of male to female 1 to 1.06 and the population is basically youthful (Ministry of Finance, 2014).

The target population for this study was all households in Kasoa, the capital of the Awutu Senya East Municipality. The gender ratio is about 1 male to 1.06 females (www.asema asemadevelopments.gov.gh, 2014). There are two main waste collection companies namely, Zoomlion Company Limited and Alliance Waste Company

Limited. Data on the number of waste companies operating within the Kasoa was not readily available.

**Figure 1: A Map of Central Region Showing the Study Area**




Google map 2019

**Figure 2: Map Showing the Study Area**


Source: Ghana Statistical Service, GIS

### 3.2 Research Design and Type of Data

This study employed a cross sectional study design, where data collection was confined to a single time period for each household head. Thus, the study made use of routine data collected at a point in time. Cross sectional research design was preferred, as it gave room to compare more than one variable at the same time with little or no additional cost, such as socio-demographic factors and WTP in relation to the study context. Also, it is capable of using data from a large number of subjects unlike other types of research designs which are geographically bound. However, the shortfall of this design is that the changes in phenomena of the study area cannot be measured as it offers a snapshot of a single moment in time (Gray, 2009). Data for this study was obtained from primary sources within the study area.

### 3.3 Population of the Study

This study targeted adults representing household head aged 18 years and above to make a meaningful contribution to improve SWM services in Kasoa, the municipal capital of Awutu Senya East in the Central Region of Ghana. Thus, the study considered all households within the selected area.

### 3.4 Sample Size

Given the population of interest (i.e households), a simplified scientific formula suggested by Yamane (1967) was used to calculate the sample size for this study. The formula is given as:

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

Where;

n = the desired sample size

N= is the population size = 25,322

e= acceptable margin of error = 0.05 with confidence level of 95%.

Substituting the values of N and $e$ into the formula for the sample size gives:

$$n = \frac{25{,}322}{1 + 25{,}322(0.05)^2} = 393.7796(4.d.p)$$

From the above sample size calculations, 394 households were to be selected as respondents however, this number is large to manage considering the availability of funds and time allocated for the study. Therefore, the sample size was reduced to 280. Further, a rule posited by Green (1991) was applied to confirm the appropriateness of the sample size chosen with respect to the number of variables included in the hypothesized model for multiple regression analysis. According to Green (1991), the sample size, $n$ must be greater than 50+8p where p is the number of independent variables. In this study eight (8) independent variables were used in the empirical model and according to the equation, the sample size of the study should be greater than 50 +8(8), giving the result as 114, the sample size of 280 respondents is greater than 114 that is $n$ = 280 >114. It can therefore be concluded that, the sample size in this study adequately satisfies the aforementioned requirement and thus, satisfactory for multiple regression analysis.

### 3.5 Sampling Technique

A multistage sampling technique was employed to select the respondents for the study. The study area is zoned into six electoral areas which were Zongo electoral area, Beakoye (CP) electoral area, Opeikuma Zonal Council, Otamins Zonal Council, Down Town electoral area and Walantu Zonal Council. Simple random sampling technique specifically lottery method was used to select four (4) electoral areas for the study. From each selected electoral area, a systematic sampling technique was used to select houses in each area. From the houses selected, the simple random sampling

technique was employed to select the household heads in houses where the households were more than one to participate in the study.

### 3.6 Research Instrument

Following the recommendations of the National Oceanic and Atmospheric Administration (NOAA) (Arrow et al. 1993) and Mitchell and Carson (1989), the Contingent Valuation questionnaire was structured to focus on precision and clarity of the hypothetical scenario. The report of the NOAA also recommended that WTP should be about a future event and not one that had already occurred. Additionally, the interview should be conducted in person (face-to-face). The questionnaire was therefore designed to meet these standards. The questionnaire was specifically about the benefits of the proposed improvement in SWM service for which respondents were being asked their WTP.

The questionnaire included questions about households' solid waste collection systems, household's willingness to pay, factors that determine their WTP and the socioeconomic characteristics of the respondent. A well-structured questionnaire was self-administered via face-to-face with the respondent.

### 3.7 Pilot-Testing

Like most surveys, inaccurate responses are likely to be given by respondents and this study is no exception. To increase the accuracy and validity of the responses given in this survey, a pilot study was conducted prior to the main survey at Gomoa Budumburam. The researcher visited Gomoa Budumburam to meet with some residents in the area. The interactions with the residents gave the researcher an understanding of the current solid waste management conditions. A mock questionnaire was designed and the respondents were asked to respond to the

questions to the best of their knowledge. Feedback from the pilot survey was used to review and redesign the questionnaire for the actual survey.

### 3.8 Theoretical Model

This study adopts the framework of threshold decision-making theory proposed by Hill and Kau, (1981), Pindyck and Rubinfeld, 1981) and the Random Utility Model developed by Lancaster (1966) and McFadden (1974). As employed by Walker and Ben-Akiva (2002), Adjei-Mantey (2013) and Lunojo (2016), this study assumes a utility function based on Random Utility Model (RUM) in which utility provided to individual *i* by good *j* ($U_{ij}$) is a function of observed characteristics of the individual and of the good being consumed as well as a function of an unobserved stochastic error term $e_{ij}$. The indirect utility function associated with this kind of utility function may be written as;

$U_{ij} = U_i (Y_j, X_j, e_{ij})$ …… (3.1)

Where $Y_j$ is disposable income for household j, $X_j$ is the vector of observed characteristics of the household and of the given choice of the household, and $e_{ij}$ is the unobserved error term of the indirect utility function.

A payment bid Yi* is introduced which changes the characteristics of the (environmental) good in a Contingent Valuation survey such as the quality of the good. The consumer will agree to the payment proposed if and only if the utility derived from the improved state is greater than the utility derived from the status quo. Symbolically, If.

$U_{ij} (Y_j - Y_i^*, X_j, e_{ij}) > U_{ij} (Y_j, X_j, e_{ij})$ …… (3.2)

Where $Yi$ * is the amount the respondent is willing to pay for the proposed improvement in the service. The probability that a respondent will answer ‗yes' to a proposed bid, is an indication that he prefers the proposed improvement. Thus for the $j$th respondent, the probability that he/she answers ‗yes' is given by

$$\Pr(\text{yes}) = U_{1j}(Y_j - Y_i^*, X_j, e_{ij}) > U_{0j}(Y_j, X_j, e_{ij}) \quad \ldots\ldots\ldots \quad (3.3)$$

According to Cameron and Trivedi (2005), a common formulation of the Random Utility Model (RUM) is the Additive Random Utility Model (ARUM). The ARUM assumes that the utility function is additively separable into deterministic and stochastic preferences. Thus equation (3.1) may be rewritten as

$$U_{ij} = U_i(Y_j, X_j) + e_{ij} \quad \ldots\ldots\ldots\ldots\ldots \quad (3.4)$$

The probability statement that a respondent answer ‗yes' to a proposed bid therefore becomes

$$\Pr(\text{yes}) = U_{1j}(Y_j - Y_i^*, X_j) + e_{1j} > U_{0j}(Y_j, X_j) + e_{0j} \ldots\ldots\ldots\ldots\ldots \quad (3.5)$$

$$U_i = WTP_i$$

Now let $WTP_i$ be the maximum amount a household is willing to pay for improved SWM service. $WTP_i$ is hypothesized to be a function of the household's socioeconomic attributes and the characteristics of the SWM service provided (Greene, 2008). Furthermore, since utility in the RUM depends on deterministic and random components, the change in utility associated with an improvement in SWM service will equal the change in the deterministic and random components. Thus, WTP can be written without loss of generality as:

$$WTP_i = \beta_i X'_i + e_i \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (3.6)$$

Where, βi is the vector of estimated parameters, $X_i$ is a vector of the household's socioeconomic attributes and the characteristics of SWM service and $\varepsilon_i$ the error term which captures all other factors that affect households' WTP which have not been

included in the model. The error term is assumed to follow a standard normal distribution with a mean of zero and variance of one.

### 3.9 Empirical Model

On the basis of this framework, this study estimates the following equations for Probit and Ordered Probit regressions:

$$Y_1 = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \varepsilon_i \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (3.7)$$

$$Y_2 = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \varepsilon_i \quad \ldots\ldots\ldots (3.8)$$

Where:
$Y_1$ = Willingness to Pay

$Y_2$ =Maximum Willingness to Pay

$X_1$ = Age of Respondent

$X_2$= Gender

$X_3$= Average Monthly Income

$X_4$ = Collection Frequency

$X_5$= Educational level

$X_6$ = Employment status

$X_7$= House ownership

$X_8$ = Satisfaction with existing SWM service

$\varepsilon_i$= Error term

### 3.10 Variables Description

**Dependent Variables**

#### 3.10.1 Willingness to Pay (WTP)

Willingness to pay is a dummy variable which measures the desire of household to pay a fee for improvement in solid waste management or otherwise. WTP takes the

form ‗yes' or ‗no', where ―yes" is represented by 1, which means the household is willing to pay for the proposed improvement in SWM service and ―no" represented by 0, which is an indication that the household is not willing to pay for the proposed improved improvement.

### 3.10.2 Maximum Willingness to Pay (MWTP)

Maximum willingness to pay measures the amount (value) of money (Ghana cedis) households are ready to pay to be provided with improved SWM services. Households are asked to state in monetary terms, the maximum amount they are willing to pay in order to enjoy the proposed improvement in the solid waste management service. It is a continuous variable.

**Independent Variables**

### 3.10.3 Age

This refers to the age of the respondent and it is expected to affect the willingness and maximum willingness to pay negatively. This is because old people may consider waste collection as the government responsibility and could be less willing to pay for it, while the younger generation might be more familiar with cost sharing and hence may be willing to pay more for improved SWM service. This is in line with findings of Aggrey and Douglason (2010).

### 3.10.4 Gender

Sex of the respondent is used as proxy to measure the relationship between gender and WTP. Gender is a dummy variable with 1 representing male and 0 representing female. Although typically, males are usually the controllers of households' finances and are in the position to determine how much they can pay for improved services. However, Musa (2015) pointed out that women are more involved in SWM in the

house than men. Therefore, expected sign is uncertain. Some WTP studies such as Mensah (2011), Botchway (2011), Aguilar and Sterner (1995) have revealed same.

### 3.10.5 Average Monthly Income

This variable refers to the monthly money income of the head of household in terms of Ghana Cedis. Household income is a continuous variable and is a sum of the monthly incomes of all earnings by the head of household. Positive relationship is expected between WTP and household income. This is because holding all other variables constant wealthier people are willing to pay more than lower income people. (Tamura (2005), Afroz *et al.* (2009) also emphasized this point since a higher level of income could be related to a greater ability to pay. Additionally, earlier empirical studies (Kateregga, 2009; Abdallah and Mariel, 2010; Mensah, 2011) have revealed a positive relationship between income and WTP.

### 3.10.6 Collection Frequency

This variable measures the number of times in a month household's solid waste is collected by the SWM companies. Collection frequency is expected to have positive and significant effect on WTP. Thus, an increase (improved) collection frequency promotes sanitary and quality of environment and generally increase the respondents' utility hence their willingness to pay. This is supported by Addai and Danso-abbeam, (2014) and Musa (2015).

### 3.10.7 Educational Level

This variable captures the number of years the head of household had spent in formal school system. Education is expected to have positive and significant effect on SWM Thus, the longer the period the individual spent in formal school system, the more likely that he/she would be willing to pay more for improved SWM service. The

higher the level of education the more people would appreciate the consequences of mishandling of solid waste and the more value the individual would give in order to avoid the risk of being a victim of unclean environment. Addai and Danso-abbeam, (2014) and other studies by (Subhan et al. 2014; Banga et al. 2011; Niringiye and Douglason, 2010; Afroz, Hanaki, & Hasegawa-Kurisa, 2009) have reported similar findings.

Education is dummied into basic education, secondary education and tertiary education with no formal education as the reference point against which the impact of other levels of education will be studied.

### 3.10.8 Employment Status

This variable measures how active or inactive the head of household is in the labour market. Employment is a dummy variable with employed being 1, and unemployed being 0. Employment status will influence the income level of the head of the household and subsequently the WTP for improved SWM service. This follows the work of Addai and Danso-abbeam (2014). Positive relationship is expected.

### 3.10.9 House Ownership

This variable measures the house ownership of the head of household. Household heads that live in their own house or by the virtue of the accommodation arrangement do not pay rent were considered as ownership while those who pay rent or do not live in their own house were classified as tenants. House ownership is a dummy variable with 1 representing house owners and 0 representing tenants. Those living in their own houses are expected to be more willing to pay for the proposed improvement in SWM service as compared to their tenants. This is because the house belongs to the

owners and if the place is clean they may have a higher value for their properties. This is supported by Banga et al. (2011) and Musa (2015). The expected sign is positive.

### 3.10.10 SWM Service Satisfaction

Satisfaction with SWM services measures whether households are satisfied with the present SWM service or otherwise. Satisfaction is captured as dummy variable with satisfied represented by 1, otherwise 0. An ambiguous relationship is expected between this variable and WTP because on one hand, households who perceive the current SWM service to be unsatisfactory will be willing to pay more to improve it, as opposed to households who deem the current service satisfactory. On the other hand, households who are satisfied with the current SWM service will be willing to pay more to maintain the service (Afroz *et al*., 2009, Kassim and Ali, 2006 and Lunojo, 2016).

The description, measurement and priori expectation of the explanatory variables used in the Probit and Ordered Probit regression model is shown in the Table 2 below.

**Table 2: Classification of Explanatory Variables and their Expected Signs**

| Variable (X) | Description | Classification | Expected Sign |
|---|---|---|---|
| Age | Actual number of years of respondent's age | Continuous | +/- |
| **Gender (Ref. Female)** | | | |
| Male | Sex of the head of the household | Dummy | +/- |
| Average monthly Income | The average monthly income earned by the household head | Continuous | + |
| Collection Frequency | Number of times in a month solid waste is collected by SWM companies | Continuous | + |
| **Education (Ref: None)** | | | |
| Level of Education | Number of years a respondent spent in formal school system | Dummy | + |
| **Service Satisfaction (Ref. Dissatisfied)** | | | |
| Satisfied | A dummy that tells whether respondents are satisfied with the present SWM service | Dummy | +/- |
| **House Ownership (Ref. Tenant)** | | | |
| House Ownership | Housing arrangement of head of household | Dummy | + |
| **Employment status Ref: (unemployed)** | | | |
| Employed | Activeness of household head in the labour market | Dummy | + |

Source: Author's Survey, 2019

### 3.11 Data Analysis and Estimation Techniques

The estimation technique was Probit and Ordered Probit. The Probit model was used because the dependent variable is based on decision of _yes' or _no'. The Probit model was more suitable because of its normality assumption. Probit model gives a statistical fit to data that is equal or superior to that of the Logit model. Thus, the error

term is symmetrically distributed about the zero mean (Wooldridge, 2009). The Orderd Probit was used to estimate the factors influencing the WTP values. The Ordered Probit was employed because the amount to be paid varies among households. The dependent variable is categorized and the ordering of the categories matters (Greene, 2002). Both qualitative and quantitative methods were used to analyze the data. For more precise analysis, computer based statistical software such as _Statistical Package for the Social Sciences‘ version sixteen and Stata version fourteen were used for the data analysis. Descriptive statistics and tables were used to present the results. Data entry was done with _Statistical Package for the Social Sciences‘ version sixteen whiles Stata version fourteen was used to run the Probit and Ordered Probit Regression Model to determine factors influencing households‘ WTP.

### 3.11.1 The Probit Model

To analyse the WTP for improved SWM services, consideration was given to the conventional practice of using a discrete and limited dependent variable model.This is because, the random preferences are unknown and we can only predict the probability statements about the binary responses on _yes‘ and _no‘, Therefore a Probit model was employed to estimate the WTP. The Probit model was used because of its normality assumption. Probit model gives a statistical fit to data that is equal or superior to that of the Logit model. Thus, the error term is symmetrically distributed about the zero mean (Wooldridge, 2009). The drawback of Probit model is that the response probability will not have the Probit form, if the error term does not have a standard normal distribution. Also, the model lacks flexibility as it does not easily incorporate more than one prediction variable. Nevertheless, the model was useful in this study as it has power over the logit.

The Probit model is therefore modeled based on the utility function presented in equation (3.6). Thus, we assume an individual household i has a WTP (price for the improved waste collection service) represented by:

$WTP_i = \beta_i X'_i + e_i$ ..... (3.8)

Where $WTP_i$ is households' willingness to pay, $X'_i$ represents the vector of explanatory factors and $e_i$ signifies the systematic random error term with zero mean and unit variance that arises from the unobserved factors about *i*'s WTP.

$WTP_i$ is a decision and households may or may not be willing to pay for the service. In such cases, the dependent variable assumes a latent (unobserved) status as represented by the following equation

$Y_i^* = BX_i + e_i$ ..... (3.9)

Where $Y_i^*$ is the unobserved dependent variable.

$\beta$ is a parameter of the model (the intercept and coefficients),

*Xi* is an exogenous set of explanatory variables and

$e_i$ is the error term, where the error term is assumed to follow a standard normal distribution with a mean of zero and variance of one.

If an individual household *i* is willing to pay, $y_i = 1$ and otherwise $y_i = 0$ (zero).

Mathematically, this is given by

$$y_i = \begin{cases} 1 \text{ if } y_i^* = 1 \text{ (household willingness to pay)} \\ 0 \text{ otherwise} \end{cases}$$

When $y_i^* = 1$ then $y_i = 1$ implying the specific household is willing to pay a positive amount (price) for the service. This observed model can be specified as:

$\text{Prob}(y_i = 1/X) = (2\pi)^{-1/2} \exp(-(\beta X_i)^2/2)$ ..... (3.10)

Where; $y_i$ is the dependent variable taking a value of 0 or 1;

*Xi* is the vector of explanatory variables of age, gender, household average monthly income, level of education, house ownership, service satisfaction, and employment Status; and β is the coefficient vector.

### 3.12 The Ordered Probit Model

The Ordered Probit Model was employed to estimate the factors influencing the Maximum Willingness to Pay (MWTP) amount. The Ordered Probit was preferred in this study because, although households may give an amount as their WTP, it may not be their maximum WTP. This implies that although the outcome of the event is discrete, the Multinomial Logit or Probit model would fail to account for the ordinal nature of the response variable. The Ordered Probit model has merits over the Unordered Multinomial conditional or Nested Logit or Probit model in that while accounting for the nature of the dependent variable, the Unordered Multinomial Probit and Logit models fail to account for the ordinal attribute of the dependent variable (Botchway, 2011). Linear regression model is also not an appropriate procedure for dealing with such an ordinal dependent variable because the assumptions regarding the specification of the error term in the linear model will be violated (Maddala, 1983). The Ordered Probit is also preferred to linear regression model because it accounts for unequal differences between the ordinal categories in the dependent variable (Greene, 2008). The Ordered Probit model is specified as follows:

$$MWTP_i = \beta_i X'_i + e_i \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (3.11)$$

$MWTP_i$ is unobserved; however, we would know the ranges within which $MWTP_i$ falls from the responses. Let $R_1$, $R_2$, ……., $R_J$ be the j prices which divide the range of WTP space into J+1 categories and $MWTP_i$ be a categorical variable such that:

$$MWTP_i = \begin{cases} 1 & \text{if} \quad MWTP_i^* \le R_1 \\ 2 & \text{if } R_1 < MWTP_i^* \le R_2 \\ 3 & \text{if } R_2 < MWTP_i^* \le R_3 \\ . & \\ . & \\ J+1 & \text{if} \quad R_1 < MWTP_i^* \end{cases} \quad \ldots\ldots\ldots\ldots (3.12)$$

If j=1, 2, J+1, then the $MWTP_i^* = j$ if

$$\begin{aligned} R_{j-1} < MWTP_i^* \le R_j \\ Or\ R_{j-1} < \alpha + X_i^{\,1}\beta + \varepsilon_i \le R_j \\ Or\ R_{j-1} < \alpha + X_i^{\,1}\beta + \varepsilon_i \le R_j - \alpha \quad \ldots\ldots\ldots\ldots\ldots (3.13) \\ Or\ R_{j-1} - \alpha - X_i^{\,1}\beta + \varepsilon_i \le R_j - \alpha\, X_i^{\,1}\beta \end{aligned}$$

The maximum WTP (MWTP) valued obtained from the survey would be used as the dependent variable in the Ordered Probit regression. This is because, although $MWTP_i^*$ is unobserved, we can determine the exact category of MWTP household _A' belong to since they would indicate the amount they would be willing to pay for improved solid management service. From the above discussions, the probability that household i will choose category j is given by:

$$\begin{aligned} \Pr[MWTP = j] &= \Pr[\, R_{j-1} < MWTP_j \le R_j \,] \\ &= \Pr[\, R_{j-1} < \alpha + X_i'\beta + \varepsilon_i \le R_j \,] \\ &= \Pr[\, R_{j-1} - \alpha - X_i\beta < \varepsilon_i \le R_j - \alpha - X_i'\beta] \ldots\ldots (3.14) \\ &= \Pr[u_{j-1} - X_i'\beta < \varepsilon_i \le u_j\, X_i'\beta] \\ &= \Phi[u_j - X_i'\beta] - \Phi[u_{j-1} - X_i'\beta] \end{aligned}$$

Where uj = Rj - α

Given J+1 MWTP categories, the probability of a household i choosing a category j (Where j=1, 2, 3,……, J+1) is given by:

$Pi\ (1) = Pr\ (MWTP_i = 1) = Pr\ (MWTP_i^* \leq R_1) = Pr\ (X_i'\ \beta + e_i \leq u_1) = Pr\ (e_i \leq u_i - X_i'\ \beta)$

$= \Phi$

$(u_1 - Xi'\ \beta)$

$Pi\ (2) = Pr\ (MWTP_i = 2) = Pr\ (R_1 < MWTP_i^* \leq R_2) = Pr\ (e_i \leq u_2 - X_i'\ \beta) - Pr\ (e_i \leq u_1 - X_i'\ \beta)$

$= \Phi\ (u_2 - Xi'\ \beta) - \Phi\ (u_1 - X_1'\ \beta)$

:

:

$Pi\ (J) = Pr\ (MWTP_i = J) = Pr\ (R_{J-1} < MWTP_i^* \leq R_J) = \Phi\ (u_J - X_i'\ \beta) - \Phi\ (u_{J-1} - X_i'\ \beta)$

$Pi\ (J+1) = Pr\ (MWTP_i = J+1) = Pr\ (MWTP_i^* > R_J) = 1 - \Phi\ (u_j - X_i'\ \beta)$

Where $u_j$'s are the threshold parameters which will be estimated as well as the coefficient vector $\beta$ (Woodridge, 2010). The cumulative standard normal distribution is given by $\Phi$ [.] Greene, (2008).

The threshold parameters are the cut off points where a respondent's MWTP moves from one category to the next. The $\beta$s and the threshold parameters may be obtained by maximizing the log likelihood function:

$lnL = 1[MWTPi = 1]\ ln\ [\Phi\ (u_1 - X_1'\ \beta)] + 1[MWTP_i = 2]\ ln\ [\Phi\ (u_2 - X_1'\ \beta) - \Phi\ (u_1 - X_1'\ \beta)]$

$+\ldots\ldots + 1[MWTPi = j]\ ln\ [\Phi\ (uj - X_1'\ \beta) - \Phi\ (uj\text{-}1 - Xi'\ \beta)] + \ldots + 1[MWTP_i = J+1]\ ln\ [1 - \Phi\ (u_j - X_i'\ \beta)]$

When the above equation is simplified, it yields

$Ln\ L = \sum \sum MWTP_{ij}\ ln\ [\Phi\ (uj - X_i'\ \beta) - \Phi\ (u_{j-1} - X_i'\ \beta)$ ……. …… (3.15)

In using models such as the Ordered Probit, interpreting the parameters from the regression is of little importance. According to Woodridge (2010), the response probability does not matter much because MWTP is unobserved. Meaningful conclusions can be made if the marginal effects are estimated. The marginal effects

show how the probability of each outcome change as a result of changes in the repressors. The marginal effects for the categories are given by:

$\partial Pr(MWTP_i = 1| X) / \partial Xi = -\phi (u_1 - Xi'\beta) \beta$

$\partial Pr(MWTP_i = 2| X) / \partial Xi = [\phi (u_1 - Xi' \beta) - \phi (u_2 - Xi' \beta)] \beta$

:

:

$\partial Pr(MWTP_i = J| X) / \partial Xi = [\phi (u_{J-1} - Xi' \beta) - \phi (uJ - Xi' \beta)] \beta$

$\partial Pr(MWTP_i = J+1| X) / \partial Xi = \phi (u_J - Xi' \beta)] \beta$

Where $\phi$ (.) is the derivative of $\Phi$[.]

In the Ordered Probit model, the signs of the _internal' marginal effects are unknown and cannot be determined by the signs of the estimated coefficients (βs) in the regression. Only the signs of the marginal effects of the lowest and highest categories may be known by observing the signs of their coefficients in the Ordered Probit regression. Thus only the marginal effects of Pr (MWTPi=1 |X) and that of Pr (MWTPi=J+1|X) may be known readily. The signs of the marginal effects of the other categories may differ from the signs of the βs.

### 3.13 Validity of the Research Instrument

According to Patton (2005), validity of a research instrument is how well it measures what it is intended to measure. Bell (2004) also argued that, validity of any instrument is important because it determines whether an item measures or describes what is intended to measure or describe. To Orodho (2004) validity would be concerned with establishing whether the right questionnaire content is measuring what they were intended to measure. For face validity the research instrument was given to colleagues to check for wrong spellings, omissions and grammatical errors. For content validity the research instrument was given to the supervisor and other lecturers who are

experts in the field of environmental economics. This helped to ensure that data collected represented the content area under study.

### 3.14 Reliability of the Research Instrument

Joppe (2000) defined reliability as the extent to which results are consistent over time and depict a precise representation of the total population under the study phenomenon. It implies that, if the results of a study can be reproduced under a similar methodology, then the research instrument can be considered as being reliable. Reliability concerns the degree to which an experiment, test or any measuring procedure yields the same results on repeated trials (Patton, 2007). Therefore, in order to ensure that the quality of data is maintained, the following measures were taken into account. First, the questionnaires for data collection were structured in such a way that some questions were designed to elicit same information in different ways to ensure internal consistency.

Second, the questionnaires were also administered in a language convenient to the respondent (Fante, Ga, English etc). The introduction to every questionnaire was very clear and all respondents were equally treated with no bias. To maintain consistency of responses from respondents, questionnaires were coded in excel on daily bases before going to the field the next day.

### 3.15 Ethical Consideration

Ethical consideration is part of the research work, and cannot be avoided (Bryman, 2004). Informants were ensured their protection from harm, exposure and anonymity. Ethical guidelines and legal rules should be considered by the researcher (Holloway, 1997).

The researcher ensured that ethical requirements were met by making sure that all participants of the study were informed of the purpose of the study. Their freedom to choose whether to participate or withdraw from the study was assured. The identity of all participants in the study was also protected to ensure anonymity. Confidentiality of all participants was equally guaranteed.

Furthermore, all sources of information that was used in the study was as much as possible acknowledged to avoid plagiarism.

# CHAPTER FOUR

# PRESENTATION AND DISCUSSION OF THE FINDINGS

## 4.0 Introduction

The chapter presents the findings on households willingness to pay (WTP) for improved SWM services in Kasoa. Both qualitative and quantitative findings are presented. Descriptive statistics presents the demographic data and econometric results present quantitative findings.

## 4.1 Distribution of Households Characteristics

Households demographic characteristics is shown in Table 3 below.

**Table 3: Distribution of Households' Demographic Characteristics**

| Demographic Characteristics | Criteria | Number of Respondents | Percentage (%) |
|---|---|---|---|
| **Gender** | Male | **168** | **60.9** |
| | Female | 108 | 39.1 |
| | **Total** | **276** | **100** |
| **Education Level** | No formal education | 7 | 2.5 |
| | Primary education | 5 | 1.8 |
| | JHS/middle school | 113 | 41.0 |
| | SHS/Technical/Vocational | 58 | 21.0 |
| | Tertiary education | 93 | 33.7 |
| | **Total** | **276** | **100** |
| **Employment Status** | Employed | 255 | 96.01 |
| | Unemployed | 11 | 3.99 |
| | **Total** | **276** | **100** |
| **House Ownership** | Ownership | 88 | 31.9 |
| | Rent | 188 | 68.1 |
| | **Total** | **276** | **100** |

Field survey 2019

As illustrated in Table 3, males constitute 168 of the total respondents representing 60.9% whiles female were 108 representing 39.1%. In terms of educational level, out of 276 respondents, 7 representing 2.6% had no formal education, 5 representing 1.8% had attained primary education, 113 representing 41.0% had attained

JHS/middle school education, 58 heads of households representing 21.0% of the heads of households had attained secondary/technical/vocational education, whiles the remaining 93 heads of households representing 34.0% had attained tertiary education. This shows JHS/middle school education is the average education level and indicates the compulsory level of education according to the Ghana's constitution.

With regard to the employment status of respondents, the findings showed that out of the 276 respondents, 255 respondents representing 96.01% were employed and whiles 11 respondents representing 3.99 % were unemployed and for that matter were not likely to be willing to pay for improved SWM service, because employed people are economically sound.

It was clear from the Table. 3 that, out of 276 respondents, 188 participants representing 68.1% rents the house whiles 88 respondents representing 31.9% owns the house. People living in their own houses are expected to be more willing to pay for improved SWM because they are not paying rents and are supposed to care of their home than non-owners.

**Table 4: Descriptive Statistics for Continuous Variable**

| Variables | Observations | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| **Age** | 276 | 40.33696 | 9.811248 | 22 | 71 |
| **Average monthly income** | 276 | 1499.058 | 1018.118 | 250 | 7000 |
| **Collection Frequency** | 140 | 1.554348 | 1.712186 | 1 | 4 |

Field survey 2019

Table 4 shows that the minimum and maximum age of the respondents was 22 and 71 years respectively with an average mean age of 40 years. This is an indication that most of the respondents are in their active years. Probably due to their ages, they will

make more mature decisions relating to health and environmental issues, therefore they are likely to pay for improved SWM service.

The results further revealed that there was a big difference in the household monthly average income. A minimum of GH¢250 per month to the maximum of GH¢7000 per month. The mean households' income was GH¢1,499 which seems to be high which means that household should be able to pay for improved SWM service.

With respect to the collection frequency of the existing solid waste collection service, the minimum and maximum number of times of collection was 1 and 4 respectively with an average mean collection times of 1.5. The regularity of collection is an important component of SWM. Factors such as availability and capacity of dust bins and containers need to be considered in determining how regular the waste is collected.

### 4.2 Types of Solid Waste Generated by Households

**Table 5: Distribution of the most Household Solid Waste Generated**

| Type of Solid Waste Generated | Frequency | Percentage |
|---|---|---|
| **Food waste** | 119 | 43.12 |
| **Papers** | 8 | 2.90 |
| **Plastics** | 145 | 52.54 |
| **Others** | 4 | 1.45 |
| **Total** | **276** | **100** |

Field survey 2019

The results as indicated in the Table 5 shows that, out of the 276 respondents, 145 constituting 52.54%, generate plastics waste. This was followed by food waste with 119 respondents representing 43.12%. 8 respondents representing 2.90% indicated papers as the type of domestic waste generated whiles the remaining 4 respondents

representing 1.45% stated other types of solid waste. It is obvious from the Table 4.3 that plastic and food wastes dominate waste generated by households. This can be attributed to the predominant use of plastic products in day to day activities of households and cosmopolitan nature of the study area.

The results support the findings of Oteng-Ababio (2010) and Eshun (2013) who concluded that, food waste was most prevalent waste generated within the localities of Accra and Tema as it constituted about 67% of the total waste generated within the area. Plastic material (such as plastic bottles and sachet bags) accounted for about 20%. Significantly, comparing the waste composition of Tema and Accra between 1989 and 1999 to 2000-2009, there was a fall in the food waste content from 73% to 60% whilst plastic waste content surged from 3% to 8% within the same period (ibid). Perhaps this sharp paradox can be attributed to the population increase of the area combined with the excessive use of plastics with little or no governance system put in place to check the usage, collection and disposal of waste in the municipality. Surveying Kasoa municipality, one would see skips and other open spaces, especially the market area full of heaps of solid waste mostly food and plastics. It is confirmation that plastics bags are the most common product used in the packaging items including groceries, food toiletries within the municipality.

### 4.3 Distribution of Solid Waste Collection System

One important aspect of solid waste management is the methods of disposal of the solid waste generated by household. Positive externalities exist in proper solid waste disposal, since the whole community receives health and safety benefits from the proper disposal by others Quarcoo, (2014). Knowledge of where and how the

households dispose of their solid waste provides a clear indication of the kind of solid waste management system that is in place in Kasoa.

**Table 6: Distribution of Waste Management Practices by Households**

| Solid Waste Management Practice | Frequency | Percentage |
|---|---|---|
| **Communal container** | 25 | 9.1 |
| **Dumping at backyard** | 3 | 1.1 |
| **Burning** | 96 | 34.8 |
| **Dump site** | 12 | 4.3 |
| **Waste management companies** | 140 | 51.7 |
| **Total** | **276** | **100** |

Field survey 2019

The findings in Table 6 have confirmed that, a significant percentage (51%) of the respondents rely on the services of SWM companies (house- to –house collection) as a means of disposing their solid waste because of the convenience associated with this method of waste disposal. The house-to-house collection also include the activities of what is referred to in the local parlance as –Kaya Boola". These people move from house to house in some localities to collect solid waste. They are sometimes employed by these established SWM service providers like Zoomlion, Alliiace Ghana among others due to inaccessibility to some homes. They collect the waste using either mechanized tricycles or hand drawn trolleys and charge the households or individuals some fee. Usually they charge the fee based on the volume of the waste to be lifted at a particular time. It is important to note that, these individual mobile waste collectors end up dumping the waste at the communal containers. Some residents also observed that some of the _kaya boola' also end up illegally disposing of the waste they collect from the various homes into open spaces and gutters. Notwithstanding, house-to house collection by SWM service providers is the most patronized method of waste

disposal and is consistent with the findings of Monney et al., (2013), that house-to-house waste collection method is the most patronized waste collection method by the residents of WA Municipality. This finding is similar to that of Alhassan and Mohammed (2013), who found that respondents who spend much time in walking to dump their waste are willing to pay more for the improvement than those who spend less time walking to dump their waste. The findings further revealed that, significant number (34.8%) of households in Kasoa, especially new site areas such as Lamptey Mills, Tipper Junction, Okulu Nkwanta among others engage in burning as a means of managing their solid waste, mainly as a results of absence of SWM service providers. The findings also revealed that, small proportions of the respondents,12 representing 4.3% uses dump site and the 25 respondents constituting 9.1% uses the communal container. The remaining 3 respondents constituting 1.1% uses their backyard in disposing-off their waste.

It is clear from Table 6 that; majority of the households use services of SWM companies as a means of disposing their solid waste generated. It can therefore be concluded that, SWM services are being appreciated by the households within Kasoa.

### 4.4 Frequency of Collection by SWM Companies

With respect to the use of SWM service providers in disposing of solid waste of households, regularity of collection per month is an important component of ensuring efficient and sustainable solid waste management in Kasoa.

In evaluating the frequency of solid waste collection by the SWM service providers per month, the findings of the 140 households who use the services of SWM companies are presented in the Table 7 below.

**Table 7: Distribution of the Frequency of the Solid Waste Collection**

| Number of Times of Collection per Month | Frequency | Percentage |
|---|---|---|
| **Inconsistent** | 54 | 38.57 |
| **Once a month** | 6 | 4.28 |
| **Twice a month** | 55 | 39.29 |
| **Three times a month** | 23 | 16.43 |
| **Four times a month** | 2 | 1.43 |
| **Total** | **140** | **100** |

Field survey 2019

From the Table 7, out of 140 households, 54 of the household heads representing 38.57% indicated inconsistency in the collection, 6 heads of household representing 4.28% had their solid waste collected once a month, 55 and 25 heads of household representing 39.29% and 17.86% had their solid waste collected twice and three times in a month respectively. Small proportion of the respondents, 2 representing 1.43%. have their solid waste collected four times in a month. The higher percentage of collection frequency being inconsistent among the households may be attributed to the low amount paid to the waste management companies which seems inadequate to run and maintain efficient service hence the need for additional charge to ensure improvement in the service.

### 4.5 Collection Failure

Collection failure refers to the frequency at which the waste collector fails to pick the waste in terms of time and days stipulated for picking. Collection failure results in piles of waste leading to unpleasant conditions such as aesthetic disturbance, nuisance from flies and unpleasant odours. Households who engage the services of the SWM companies were asked of the collection failure of the existing solid waste collection system.

**Table 8: Distribution of Collection Failure SWM Service Providers**

| Responses | Frequency | Percentage |
|---|---|---|
| **Very often** | 14 | 10.00 |
| **Sometimes** | 112 | 80.00 |
| **Rarely** | 12 | 8.57 |
| **Never** | 2 | 1.42 |
| **Total** | **140** | **100** |

Field survey 2019

From Table 8, Out of the 140 households,12 heads of households representing 10.0% indicated SWM service providers fail to collect their solid waste very often, 112 respondents representing 80.0% said sometimes. Whiles 12 and 2 household heads representing 8.6% and 1.4% said rarely and never respectively. This implies that, frequency of service provision is poor; the interval between collections is too long with high collection failure rate leading to uncontrolled dumping occurring around unauthorised solid waste disposal areas such as open space, drains, streets etc. Only few households have their bins emptied on regular basis. This pattern of solid waste collection creates inconvenience for the residents and even discourages many residents not to subscribe for the bins for their households. The practice of leaving solid waste in the households for long periods is unhygienic and poses very high health risks to the residents. This is consistent with the findings of Addai and Danso-Abbeam (2014). Irregularities in the collection process might be disastrous as the households will begin to find their own way to deal with the waste. This will have influence on WTP for waste management services (Onibokun and Kumuyi, 2004).

### 4.6 Time Spent to Communal Container

The amount of time spent to dispose-off refuse is also likely to have significant influence on the behaviour of people. For instance, if the locations of communal containers are further away from houses, it creates a lot of inconvenience. People are therefore likely to dump at places they find convenient to them. The responses of the 25 respondents with respect to how long it takes to dispose-off refuse in the communal containers available is shown in the Table 9.

**Table 9: Distribution of Time Spent to Communal Container**

| Time in minutes | Frequency | Percentage |
|---|---|---|
| **5 – 10 minutes** | 7 | 28.00 |
| **11 – 15 minutes** | 18 | 72.00 |
| **Total** | **25** | **100** |

Field survey 2019

From Table 9 ,72% of households who dump their waste in the communal container spend between 11 to 15 minutes while 28% spend up to about 10 minutes to get to the containers. This clearly shows that most of the communal containers are not within acceptable walking distance from them. This is likely to create inconvenience for the residents and hence the likely to resort to indiscriminate dumping of solid waste.

### 4.7 Satisfaction with SWM Service Providers

With reference to the 140 households who have their SW collected by SWM companies, were asked to state their satisfaction with the current SWM service providers. The result is shown in the Table 10.

**Table 10: Satisfaction with Current SWM Service**

| Responses | Frequency | Percentage (%) |
|---|---|---|
| **Satisfied** | 58 | 41.43 |
| **Not Satisfied** | 82 | 58.57 |
| **Total** | **140** | **100** |

Field survey 2019

From the Table 10, 82 households representing 58.57% agreed that they are not satisfied with the current situation with solid waste service providers whiles 58 respondents representing 41.43% were satisfied. Majority of the households are not satisfied with the SWM service provided by the SWM companies due to high inconsistent collection frequency, collection failure rate, long distance to communal container site. This is supported by the findings of Afroz et al. (2009).

### 4.8 WTP for Improved SWM Service

In examining households' WTP for improved SWM services on monthly basis, respondents were asked whether or not they are prepared to pay for the proposed improvement in the SWM service. The finding is presented in Table 11.

**Table 11: Distribution of WTP by Households**

| Variable | Criteria | Frequency | Percentage |
|---|---|---|---|
| WTP for improved service | Yes | 204 | 73.9 |
| | No | 72 | 26.1 |
| | **Total** | **276** | **100** |
| Reasons for not willing to pay | Satisfied with the existing service | 40 | 55.6 |
| | Do not trust the new system | 6 | 8.3 |
| | Cannot afford the cost of service | 24 | 33.3 |
| | General taxes should cover the cost | 2 | 2.8 |
| | **Total** | **72** | **100** |

Field survey 2019

From the Table 11, out of 276 respondents interviewed, 204 household heads representing 73.9% indicated ―Yes" meaning that, they are willing to pay for improved SWM service. While 72 of them representing 26.1% indicated ―No" meaning that, they are unwilling to pay for improved SWM services. The major reasons for respondent's unwillingness to pay for the improved SWM service were that, 40 households, representing 55.6% were satisfied with the existing SWM practice or the use of burning, backyard and dump site as methods of solid waste disposal. While 6 households, representing 8.3% do not believe in the new system being proposed and therefore were not willing to pay. Whiles 24 households, representing 33.3% said they cannot afford the cost of the new service as a result of low income. However, the remaining 2 households, representing 2.8% believed that, their general tax should cover the cost of SWM services and hence were not willing to pay. As noted by Buenrostro and Bocco (2003), budget and infrastructure constraints make it difficult for the municipal and district assemblies alone to manage large amounts of solid waste generated. This makes the work of private companies in the business of waste management important. Therefore, the municipal assembly should arrange to have contractual agreement with serious companies to provide the service to ensure proper SWM in order to reduce its health related problems. Its seems new adjustment in SWM service price is possible, therefore, Municipal Assembly, service providers and opinion leaders should meet regularly to discuss and fix new price for improve SWM service with private companies.

### 4.9 The MWTP Amounts

This section estimates the maximum amount in Ghana cedis households are willing to pay per month for improved SWM service.

**Table 12: Maximum Willingness to Pay and Frequency Distribution**

| Mean | Mode | Std. Deviation | Minimum | Maximum |
|---|---|---|---|---|
| **GH¢ 16.13768** | GH¢ 10.00 | GH¢12.32865 | GH¢5.00 | GH¢ 60.00 |

Author's Field survey 2019

Table 12 indicates the amount households are willing to pay per month for the proposed improved SWM service by SWM companies. It was revealed that, the mean WTP is GH¢ 16.14. This means that on average, every household in Kasoa is prepared to pay GH¢ 16.14 per month for SWM if and only if the service is improved to yield the desired satisfaction. The mean WTP is 62% higher than the current average fee of GH¢ 9.94 paid by households for SWM service. The lowest WTP by household is GH¢5.00 and the highest is GH¢60.00. The amount with highest frequency is GH¢ 10.00.

### 4.10 Categorisation of Maximum WTP Amount (MWTP)

The maximum amounts that respondents were willing to pay were grouped into three categories as Low WTP (GH¢15 and below) representing outcome 1; Medium WTP (greater than GH¢15 and less than GH¢30) representing outcome 2 and High WTP (GH¢30 and above) representing outcome 3. The grouping is necessary because the Ordered Probit model used require the ordering of the dependent variable into categories (Greene, 2002). The categories indicate the threshold parameters of outcomes 1, 2 and 3. These thresholds provide help in calibrating the differences and preferences in the individuals' willingness to pay for improved solid waste management services. The distribution of the categorization is shown on Table 12.

**Table 13: Distribution of Categorisation of MWTP**

| MWTP amount | Frequency | Percentage |
|---|---|---|
| **GH¢15 and below (outcome 1)** | 121 | 53.07 |
| **Greater GH¢15and less than GH¢30 (outcome 2)** | 73 | 32.02 |
| **GH¢ 30 and above (outcome 3)** | 34 | 14.91 |
| **Total** | **228** | **100** |

Field survey 2019

The descriptive statistics in Table 13 shows that the most preferred outcome is (outcome 1). Out of the 228 respondents who expressed WTP, 121 respondents representing 53.07% are prepared to pay GH¢15 and below (low MWTP) for improved SWM service. This means that most households in Kasoa, prefer to pay GH¢15 and below for improved SWM service. The next preferred outcome is (outcome 2) and the least preferred is (outcome 3) paying an amount greater GH¢15 but less than GH¢30 (medium MWTP) and GH¢ 30 and above (high MWTP) respectively. This confirms the basic law of demand that, all things being equal, the lower the price of a commodity, the higher the quantity demanded of that commodity and higher the price of the commodity, the lower the quantity demanded of that commodity. Therefore, the most preferred MWTP of households in Kasoa, is GH¢15 and below.

### 4.11 Determinants of WTP for Improved SWM Service

To begin with, a test was run to determine whether or not multicollinearity exists in the model. Multicollinearity exists in a model when two or more of the explanatory variables are highly correlated. To test for multicollinearity, a correlation matrix was employed. Gujarati (2006) perceives multicollinearity to be a problem in a model when the pair-wise correlation coefficient is greater or equal to 0.8 The table

presented in Appendix A shows that there is no multicollinearity problem. All the correlation values were within the acceptable range.

The Probit estimation result in Table 13 below showed that the likelihood ratio chi-square of 133.26 with a p-value of 0.0000 meaning that the joint significance test of all.

Variables in the model is significant at one percent level, implying that the variables correctly predict the model. The Probit regression gave a Pseudo R-squared of about 0.4206, suggesting that approximately 42% of the variation in WTP is explained by the explanatory variables. This is an indication that the estimated Probit Model has integrity; it is appropriate and is generally good. The validity of the Probit Model in estimating households' WTP is in line with related studies (Hagos et al., (2012), Seth et al., (2014), Alhassan and Mohammed, (2013) and Sun et al., (2016)).

**Table 14**: Results of Probit Regression: Dependent variable: WTP

| **Independent Variable (X)** | **Coefficient** | **Std. Err.** | **P>\|z\|** | **Marginal effects** |
|---|---|---|---|---|
| Age | 0.0226391 * | .0133799 | 0.091 | 0.0029673 |
| **Gender (Ref. Female)** | | | | |
| Male | 0.0527435 | 0.2198073 | 0.810 | 0.0069733 |
| Average Monthly Income | 0.0007721 *** | 0.0002934 | 0.009 | 0.0001012 |
| Collection Frequency | -0.1654534* | 0.0842864 | 0.050 | -0.0216859 |
| **Education (Ref: None)** | | | | |
| Education (Basic) | -0.5505719 | 0.5935879 | 0.354 | -0.1036467 |
| Education (Secondary) | -0.0180784 | 0.2741796 | 0.947 | -0.0023881 |
| Education (Tertiary) | 0.095795 | 0.3654616 | 0.793 | 0.012271 |
| **Employment status Ref: (unemployed)** | | | | |
| Employed | 0.7482777 ** | 0.3281098 | 0.023 | 0.1459316 |
| **House Ownership (Ref. Tenant)** | | | | |
| House Ownership | -0.2187023 | 0.3229449 | 0.498 | -0.0304889 |
| **Service Satisfaction (Ref. Dissatisfied)** | | | | |
| Satisfied | 2.225379 *** | 0.4556372 | 0.000 | 0.3304372 |
| Constant | -2.024858 *** | 0.5817606 | 0.001 | |
| Number of observations | 276 | | | |
| Log likelihood | -91.782363 | | | |
| LR $chi^2$ (10) | 133.26 | | | |
| Prob > $chi^2$ | 0.0000 | | | |
| Pseudo $R^2$ | 0.4206 | | | |
| * Significant at 10% | **Significant at 5% | | ** *Significant at 1%, | |

Authors Estimation, (2019)

From the Table 14, the findings confirmed that age, average monthly income, collection frequency, employment status and service satisfaction are the influencing factors on WTP for improved SWM. The age of respondent has a statistically

significant and positive effect on the WTP. The positive sign of the age coefficient implies that holding all other variables constant, elderly is more willing to pay than younger people. This suggests that elderly make more mature decisions related to evaluating health and environmental issues, possibly due to their age. The marginal effect revealed that as the age of household respondent‘s increases by one year, the willingness of an individual to pay would increase by 0.30%. This result is consistent with the findings of Addai and Danso-Abbeam (2014), Mary and Adelayo (2014), Afroz et al. (2009) but contradicts the findings of Seth et al. (2014), Awunyo-victor et al. (2013) and Niringiye and Douglason (2010).

Considering the rate of urbanization and the high percentage of young people from rural to urban areas, there is therefore the need to develop and create special SWM programs and awareness that motivates youths to make rational decisions associated SWM and to value health and environmental matters thereby achieving improved sanitary services in urban areas.

The average monthly income has the expected positive sign on WTP and is statistically significant. This indicates that the WTP of a household to pay for the proposed improved SWM service increases with household income. The reported marginal effect implies that a unit increase in household average monthly income is likely to increase the willingness to pay of an individual for improved SWM by 0.01%. This result is in accordance with the findings of Sun et al. (2016), Mary and Adelayo (2014), Awunyo-victor et al. (2013) and Banga et al. (2011). The result is also consistent with the environmental economics literature having positive relationship between income and the demand for improved environmental value (Alhasan and Mohammed, 2013).

Collection frequency is statistically significant but has unexpected negative sign on WTP. This means that an increase in the respondent‘s collection frequency index of one, decreases the respondents WTP for the improved solid waste management by 2.17%. The inconsistency result might be partly attributed to the fact that an increase in the collection frequency comes with an additional charge by the service providers hence the decline in their WTP. This result is consistent with findings of Musa (2014) however the study recorded positive significance with WTP.

Employed compared to those unemployed as a base category of employment status dummy is significant and has a positive effect on households‘ WTP for improved SWM service. This means that respondents who are employed are more likely to pay for improved service than respondent who are unemployed. This is because employed respondents earn income and as a results are in better economic position to pay for improved service. The employment status marginal effects coefficient in Table 4.12 means that a unit change in the respondent‘s employment status, is likely to increase the respondents WTP by 4.59%. This is in line with the work of Rahji and Oloruntoba, (2009).

Service satisfaction is positive and significant implying that WTP goes together with the household‘s satisfaction with the current SWM services provided. This conforms to a prior expectation which can be explained by the fact that satisfied respondents with the current SWM service will be more likely to believe the proposed improvement in SWM service. Studies on service satisfaction such as Vinagre and Neves (2008) revealed that satisfied customers serve as an important source of free advertisement through referrals and recommendations, whereas dissatisfied customers are more likely to defect and to convey the negative experiences to other potential

subscribers. Improvement in the service delivery is very important as satisfaction level of the households determines the WTP for the service. This is in line with the argument by Afroz et al. (2009) that households were motivated to pay their fees effectively, if they were satisfied with the service being provided. This result could be in line with the utility maximisation theory that indicates satisfaction as a primary driver of demand for the WTP for improved SWM.

The marginal effect of respondents' satisfaction showed that a unit's increase in satisfaction with the current SWM services will increase WTP by 33.04%. This finding confirms the works of Lunojo (2016), Assa, (2013), Afroz et al., (2009) and Addai and Danso-Abbeam (2014).

The results further showed that gender (male) and tertiary education dummy have positive impact on households' WTP but statistically insignificant. Basic and secondary education dummy and house ownership have negative effect and statistically insignificant on households WTP.

**4.12 Determinants of Maximum WTP (MWTP)**

To determine the factors that influence maximum WTP, respondents were asked to give the maximum amount of money they were willing to pay for improved SWM service. The same variables as were used in the Probit formulation were used in the Ordered Probit regression model. The study estimated and presented both the coefficients of the variables and the marginal effects of the estimated variables.

From the Table 15 below, the model likelihood ratio chi-square is 231.43 and it is highly significant (Prob > $\chi 2$ = 0.0000). The significance of the LR Chi-squared value shows that all the variables jointly determined the dependent variable. The sign of the

coefficients shows whether the latent variable y∗ increases with the regressor ($X_i$). The positive coefficient means that the likelihood of increasing the WTP for improved SWM service and the negative coefficient implies decreasing the likelihood of the WTP for improved SWM service. The Pseudo R squared value of 0.5154, shows that the explanatory variables could explain about 52% of the variations in the dependent variable. The cut-points indicate where the latent variable is cut to make the three groups that is observed in the data.

**Table 15: Results of Ordered Probit Regression: Dependent variable: MWTP**

| **Independent Variable (X)** | **Coefficient** | **Std. Err.** | **P>\|z\|** |
|---|---|---|---|
| Age | 0.0277232 * | 0.0142231 | 0.051 |
| **Gender (Ref. Female)** | | | |
| Male | 0.0972182 | 0.2272643 | 0.669 |
| Average Monthly Income | 0.0005453 *** | 0.0001297 | 0.000 |
| Collection Frequency | 0.5363516 *** | 0.0698867 | 0.000 |
| **Education (Ref: None)** | | | |
| Education (Basic) | 0.6875476 | 0.8647068 | 0.427 |
| Education (Secondary) | 0.1237257 | 0.3087092 | 0.689 |
| Education (Tertiary) | 0.7221836*** | 0.2651114 | 0.006 |
| **Employment status Ref: (unemployed)** | | | |
| Employed | 0.6746929 | 0.4958472 | 0.174 |
| **House Ownership (Ref. Tenant)** | | | |
| Ownership | 1.098747 *** | 0.2513235 | 0.000 |
| **Service Satisfaction (Ref. Dissatisfied)** | | | |
| Satisfied | 0.5760439 ** | 0.2362472 | 0.015 |
| Constant cut1 | 4.945136 | | |
| Constant cut2 | 7.13271 | | |
| Number of Observations | 228 | | |
| Log likelihood | -108.78373 | | |
| LR chi2 (10) | 231.43 | | |
| Prob > chi2 | 0.0000 | | |
| Pseudo R2 | 0.5154 | | |

*Significant at 10% * * Significant at 5%, *** significant at 1%

Authors Estimation, (2019)

From the Table 15, the findings confirmed that age, average monthly income, collection frequency, tertiary education dummy, house ownership and service satisfaction are the influencing factors on how much household are prepared to pay per month to enjoy the proposed improved SWM services.

Age of respondents has a positive and significant impact on MWTP value for improved SWM services. The positive coefficient for age indicates that holding all other variables constant, older people are willing to pay higher values for improved SWM service than younger people. This suggests that older respondents make more mature decisions related to evaluating health and environmental issues. This result is consistent with findings of Afroz *et al*., (2009).

Average monthly income is highly significant at one percent and it carried the expected sign, positive. An increase in household income will thus lead to increased values for households' MWTP for improved SWM service. This implies that households who earn more income would be ready to pay more than households with less income. The results comply with economic theory which indicates that income is positively related to the theory of demand, and the environmental demand. This is in conformity with the work of Nkansah et al. (2015), Padi et al. (2015), Awunyo-victor et al. (2013), and Hagos et al. (2012). Mohammed, 2013).

Furthermore, the findings showed that the coefficient of collection frequency from Table 4.13 is statistically significant and has positive impact as expected on MWTP value. The positive sign suggests that as collection frequency index increases, respondents are more likely to increase their MWTP value. Thus, as number of times of collection increases, the likelihood of paying higher MWTP value also increases. This result is consistent with findings of Musa (2014).

The level of education of respondents has the expected sign, positive. Basic and secondary education levels are not significant but tertiary education dummy is significant at one percent significance level with the MWTP value for improved SWM service. This means that as one attains tertiary level of education, the higher the probability of the respondent‘s MWTP for improved SWM services. This could be attributed to the fact that as individuals receive higher education, the more likely to access information about the environment and health more easily, hence, they understand the necessary requirements for proper waste management to protect their health. Educated people are more likely to read newspapers and magazines and, therefore, have a higher awareness of risks caused by poor waste management and the advantages of appropriate waste disposal. This result confirms the findings of Nkansah et al. (2015) and Hagos et al. (2012).

House ownership has significant impact and positively related to the MWTP value. This means that households who live in their own house will be willing to pay higher amount for improved SWM system than those living in rented houses. This could be explained from the fact that people living in a rented house considers their residential area as temporary or may be due to the current condition in the municipal that only house owners pay for sanitation. This is in conformity with the work of Padi et al. (2015).

Service satisfaction with SWM is statistically significant and positively related to the MWTP amount for improved SWM service. This means that, households who are satisfied with the service are likely to pay higher amount for improved SWM services than households who are dissatisfied with the service. Households‘ MWTP would depend on the quality of services currently provided by the SWM service providers.

The result supports the findings of Cheng and Urpelainen (2015), Assa (2013) and Afroz (2009).

### 4.14 Marginal Effects of MWTP Values (GH₵15 and below (outcome 1)

The marginal effects indicate the predictive power of the independent variables on the dependent variables. The results of the Ordered Probit regression of (outcome 1) is shown on Table 16 below.

**Table 16: Marginal Effects of the Ordered Probit Regression (Outcome 1)**

| Independent Variable (X) | dy/dx | Std. Err. | P>\|z\| |
|---|---|---|---|
| Age | -0.0109614 * | 0.00561 | 0.051 |
| **Gender (Ref. Female)** | | | |
| Male | -0.0383384 | 0.08931 | 0.668 |
| Average Monthly Income | -0.0002156 *** | 0.00005 | 0.000 |
| Collection Frequency | -0.2120673 *** | 0.02744 | 0.000 |
| **Education (Ref: None)** | | | |
| Education (Basic) | -0.263966 | 0.29869 | 0.377 |
| Education (Secondary) | -0.0490921 | 0.12274 | 0.689 |
| Education (Tertiary) | -0.2815193 *** | 0.09914 | 0.005 |
| Employment status (Employed) | -0.2422706 | 0.15085 | 0.108 |
| **House Ownership (Ref. Tenant)** | | | |
| House Ownership | -0.417172 *** | 0.08594 | 0.000 |
| **Service Satisfaction (Ref. Dissatisfied)** | | | |
| Service Satisfaction | -0.2232532 ** | 0.0881 | 0.011 |
| Y = Pr(MWTP==1) (predict, outcome 1) | = .55320984 | | |

*Significant at 10% * * Significant at 5%, *** significant at 1%

Authors Estimation, (2019)

The Table 16, shows that, age, average monthly income, collection frequency, tertiary education dummy, employment status (employed dummy), house ownership and service satisfaction were significant for low MWTP values (outcome1). The negative estimated magnitude of - 0.0109614 of the age variable implies that young respondent had a 0.01 higher probability of not paying for solid waste management than the old. Thus an increase in the age of individuals by one year decreases the probability of willingness to pay an amount of GH¢15 and below for improved solid waste management by 0.01. With respect to the average monthly income variable, the negative estimated magnitude of –0.0002156 implies that the poor had a 0.0002 higher probability of not paying for the improved SWM service than the rich. Thus, one percent increase in the monthly income of individuals decreases the probability of willingness to pay an amount of GH¢15 and below for improved SWM service by about 0.0002.

Similarly, the negative estimated magnitude of -0.2120673 of collection frequency means that relatively less number of times of collection had a 0.21 higher probability of not paying for improved SWM service than those with relatively high number of times of collection. Thus, an increase in the collection frequency decreases the probability of willingness to pay an amount of GH¢15 and below for improved SWM service with probability difference of about 0.21.

Furthermore, the negative marginal effects of -0.2815193 of tertiary education dummy variable implies that, respondents with no tertiary education had a 0.28 higher probability of not paying for improved solid waste management services than their counterparts who had tertiary education. Thus, a year increase in the tertiary education

of the respondents decreases the probability of willingness to pay an amount of GH¢15 and below for improved SWM service by about 0.28.

With respect to house ownership, the negative estimated magnitude of -0.417172 means that, respondent who rent house had a 0.42 higher probability of not paying for improved SWM service than respondent who live in their own house. This implies that, a change in the house ownership status of the respondents' decreases the probability of willingness to pay an amount of GH¢15 and below for improved SWM service by about 0.42.

Lastly, the negative estimated magnitude of -0.2232532 of service satisfaction variable indicate that, unsatisfied respondent had a 0.22 higher probability of not paying than satisfied respondent. This means that, an increase in the service satisfaction index of the respondent decreases the probability of willingness to pay an amount of GH¢15 and below for improved SWM service by about 0.22.

**4.15. Marginal** Effects of MWTP Values GH¢15 **and less than GH¢**30 **(Outcome 2)**

The results of the Ordered Probit regression of (outcome 2) is shown on Table 17.

**Table 17: Marginal Effects of the Ordered Probit Regression (Outcome 2)**

| Independent Variable (X) | dy/dx | Std. Err. | P>\|z\| |
|---|---|---|---|
| Age | 0.0102139* | 0.0053 | 0.054 |
| **Gender (Ref. Female)** | | | |
| Gender (Male) | 0.0358072 | 0.08361 | 0.668 |
| Average Monthly Income | 0.0002009 *** | 0.00005 | 0.000 |
| Collection Frequency | 0.1976053 *** | 0.02996 | 0.000 |
| **Education (Ref: None)** | | | |
| Education (Basic) | 0.2238834 | 0.21255 | 0.292 |
| Education (Secondary) | 0.0454594 | 0.11298 | 0.687 |
| Education (Tertiary) | 0.2563276 *** | 0.08982 | 0.004 |
| **Employment status Ref: (unemployed)** | | | |
| Employed | 0.2323833 | 0.14817 | 0.117 |
| **House Ownership (Ref. Tenant)** | | | |
| House Ownership | 0.3676142 *** | 0.07602 | 0.000 |
| **Service Satisfaction (Ref. Dissatisfied)** | | | |
| Service Satisfaction | 0.2083161** | 0.08357 | 0.013 |
| Y = Pr(MWTP==2) (predict, outcome 2) = .43665617 | | | |

*Significant at 10% * * Significant at 5%, *** significant at 1%

Authors Estimation, (2019)

The Table 17 show that, the positive estimated magnitude of 0.0102139 of the age variable implies that, the relatively old respondents had a 0.01 higher probability of paying for the improved SWM services than the young. This means that, an increase in the age of individuals by one year increases the probability of willingness to pay an amount greater than GH¢15 and less than GH¢ 30 for improved solid waste management by 0.01.

Furthermore, the positive marginal effect of average monthly income variable of 0.0002009, implies that richer respondents had a 0.0002 higher probability of paying for the improved SWM service than their poor counterparts. This means that, one percent increase in the monthly income of individuals increases the probability of willingness to pay an amount greater than GH¢15 and less than GH¢ 30 for improved SWM service by about 0.0002 which is small and negligible though.

On collection frequency, the marginal effect of 0.1976053 implies that, the relatively high frequency of collection had a 0.20 higher probability of paying for improved SWM service than those with relatively low collection frequency. Thus, an increase in the collection frequency increases the probability of willingness to pay an amount greater than GH¢15 and less than GH¢ 30 for improved SWM service by about 0.20.
The marginal effects of tertiary education dummy variable of 0.2563276 implies that, respondent with tertiary education had a 0.26 higher probability of paying for the improved SWM service than their counterpart without tertiary education. This means that, a year increase in the tertiary education of the respondents increases the probability of willingness to pay an amount greater than GH¢15 and less than GH¢ 30 for improved SWM service by about 0.26.

With respect to house ownership, the estimated magnitude of 0.3676142 means that, respondent who live in their own house had a 0.37 higher probability of paying to for the improved SWM service than respondent who live in a rented house. This means that, a change in the house ownership status of the respondents‘ increases the probability of willingness to pay an amount greater than GH¢15 and less than GH¢ 30 for improved SWM service by about 0.37.

Lastly, the estimated magnitude of 0.2083161 of service satisfaction variable indicate that, respondent who are satisfied with the current SWM service had a 0.21 higher probability of paying for the improved service than dissatisfied respondents. Thus, an increase in the service satisfaction index of the respondent increases the probability of willingness to pay an amount greater than GH¢15 and less than GH¢ 30 for improved SWM service by about 0.21.

### 4.16 Marginal Effects of MWTP Values GH¢30 and above (outcome 3)

The results of the Ordered Probit regression of (outcome 3) is shown on Table 18.

**Table 18: Marginal Effects of the Ordered Probit Regression (Outcome 3)**

| **Independent Variable (X)** | **dy/dx** | **Std. Err.** | **P>\|z\|** |
|---|---|---|---|
| Age | 0.0007475 | 0.00049 | 0.125 |
| **Gender (Ref. Female)** | | | |
| Male | 0.0025312 | 0.00585 | 0.665 |
| Average Monthly Income | 0.0000147 ** | 0.00001 | 0.045 |
| Collection Frequency | 0.0144619 ** | 0.00634 | 0.022 |
| **Education (Ref: None)** | | | |
| Education (Basic) | 0.0400826 | 0.0884 | 0.650 |
| Education (Secondary) | 0.0036327 | 0.00993 | 0.715 |
| Education (Tertiary) | 0.0251917 * | 0.01514 | 0.096 |
| **Employment status Ref: (unemployed)** | | | |
| Employment status (Employed) | 0.0098873* | 0.00593 | 0.095 |
| **House Ownership (Ref. Tenant)** | | | |
| House Ownership | 0.0495578 ** | 0.02377 | 0.037 |
| **Service Satisfaction (Ref. Dissatisfied)** | | | |
| Service Satisfaction | 0.0149371* | 0.00864 | 0.084 |
| Y = Pr(MWTP==3) (predict, outcome 3) | = .01013399 | | |

*Significant at 10% * * Significant at 5%

Authors Estimation, (2019)

As shown in Table 18, the positive marginal effect of average monthly income variable implies that richer respondents had a 0.0000147 higher probability of paying for the improved SWM service than their poor counterparts for high MWTP values.

On collection frequency, the marginal effect of 0.0144619 implies that, the relatively high frequency of collection had a 0.0145 higher probability of paying for improved SWM service than those with relatively low collection frequency for high MWTP values of GH¢30 and above.

The marginal effects of tertiary education dummy variable of 0.0251917 implies that, respondent with tertiary education had a 0.0252 higher probability of paying for the improved SWM service than their counterpart without tertiary education for high MWTP values of GH¢30 and above.

Furthermore, the marginal effects of employment status variable of 0.0098873 implies that, respondent who are employed had a 0.0099 higher probability of paying for the improved SWM service than their unemployed counterpart for MWTP values of GH¢30 and above.

With respect to house ownership, the positive estimated magnitude of 0.0495578 means that, respondent who live in their own house had a 0.0496 higher probability of paying for the improved SWM service than respondent who live in a rented house for high MWTP values of GH¢30 and above.

Lastly, the estimated magnitude of 0.0149371of service satisfaction variable implies that, respondent who are satisfied with the current SWM service had a 0.0129 higher probability of paying for the improved service than dissatisfied respondents for MWTP values of GH¢30 and above.

# CHAPTER FIVE

# SUMMARY, CONCLUSION AND POLICY RECOMMENDATIONS

## 5.0 Introduction

This chapter concludes the study by providing a summary of the entire study. The findings and conclusions as well as recommendations are provided in this chapter.

## 5.1 Summary

Assessing WTP for environmental goods and services is of substantial importance because funding agencies and policy makers can use this information for improving the provision of such services as SWM. This study analysed household's WTP and MWTP for improved SWM service. The study also explore the existing solid waste collection system and determine the factors influencing households' WTP and MWTP for improved SWM services. The study used cross-sectional design with 276 households and self-administered structured questionnaire. The dichotomous continuous CVM was used to elicit the WTP value for improved SWM services, where a hypothetical case of an improved SWM was given to households who were then asked their MWTP on monthly basis to receive SWM service with those improved features. The study employed the theoretical framework employed by Adjei- Mantey (2013) to come out with a model. Factors that dominated the literature also informed the formulation of the model. The Probit and Ordered Probit Models were used to estimate the significant factors that affect WTP and MWTP amount respectively.

## 5.2 Findings

The findings revealed that, out of 276 respondents interviewed, 204 household heads representing 73.9% indicated ―Yes" meaning that, they are willing to pay for improved SWM service. While 72 of them representing 26.1% indicated ―No" meaning that, they are unwilling to pay for improved SWM services. This is an indication that majority of households in Kasoa are willing to pay for improved SWM service.

The findings further revealed that respondents were eager to pay on average additional amount of GH¢ 6.2 for improved SWM service. This implies that households were willing to pay so much for a reason among others as individuals being responsible for the solid waste they generate. The estimated mean monthly MWTP amount in Kasoa was found to be GH¢ 16.14, an amount which is 62% higher than current average fee of GH¢ 9.94 paid by households for SWM service. However, the preferred MWTP amount category was outcome1, that is GH¢15 and below (low MWTP).

The findings further revealed that, SW collection by the SWM companies was the popular and most used system of SW disposal in the study area. Indeed, as many as 51.0% uses the services of SWM companies as a means of disposing their solid waste generated in the household. About 42.0% of the respondents also resort to indiscriminate ways of disposing off their waste like burning, dumping at backyard, open spaces among others. This can be highly attributed to inadequate public containers in addition to the cost involved in collecting the waste generated by these waste management companies within the municipality.

It was discovered that, majority (58.57%) of the respondents were not satisfied with the current SWM services by the service providers and called for improvement. This is attributed to the inconsistency with collection frequency and collection failure rate. The study further revealed that, plastic waste is the dominant SW generated in the study area. As many as 52.54% of the respondents indicated plastic waste as the most dominant type of waste generated while about 43.12% indicated food waste to be the solid waste generated most within their households.

The Probit model showed that age, average monthly income, collection frequency employment status (employed), and level of satisfaction (satisfied) were found to be significant while the Ordered Probit model revealed that MWTP amount was influenced by age, average monthly income, collection frequency, level of education (tertiary), house ownership and service satisfaction.

Other variables included in the empirical estimation were found to be insignificant in determining households' WTP and the MWTP amount for improved SWM service.

### 5.3 Conclusion

In conclusion, it is evident from the empirical work done in this study that households in Kasoa, are not satisfied with the current solid waste management service and its attending effects. To improve on SWM services, they are prepared to pay on average an amount of GH¢ 16.14 on monthly basis, which is nearly double the current fee they pay. However, their most preferred MWTP amount category is GH¢ 15 and below (low MWTP). Households are prepared to pay this amount if and only if SWM service is improved and made more reliable.

Factors that influence the households' WTP include age, employment status (employed), average monthly income, collection frequency and level of satisfaction (satisfied). The maximum amount households are willing to pay is influenced by average monthly income, level of education (tertiary), level of satisfaction, collection frequency and house ownership.

### 5.4 Policy Recommendations

On the basis of the findings, the following recommendations are made for policy consideration.

The ever increasing population growth in the study area means that the volume of waste generation is likely to increase. Therefore, Government and SWM companies should invest heavily in infrastructure and other relevant logistics in the SWM sector. This will improve service delivery as households maximise their utility from improved services and as such are prepared to pay nearly double of what they are currently paying. However, it is recommended that, while charging for the service, it is not mandatory to charge as per calculated household MWTP mean amount of GH¢ 16.14 as most preferred MWTP ranges from GH¢ 15 and below. For this, a socially acceptable fee may be based on median income. Thus, a flat rate cannot be charged across households since MWTP value vary among households. The reported mean WTP value may be a guide to Municipal authorities and SWM companies in setting an appropriate solid waste collection fee.

Household income has a strong positive relationship with WTP. As such to increase households' preparedness to pay for improved SWM, government should take measures to increase the incomes of the households. Such measures may include increasing the national daily minimum wage so that incomes will go up significantly.

Measures should also be undertaken by the government to provide jobs for the unemployed through agriculture, industrialization and other sustainable employment modules. This way, the incomes of previously unemployed persons who now have jobs will add to their households‘ incomes to enhance their households‘ willingness to pay.

The study further showed that people with tertiary education influence MWTP amount. It is therefore recommended that measures be put in place by the Ministry of Education to ensure mass tertiary education. Additionally, there should be massive investment in the tertiary level of education by the government to make it, if possible free, as it is enshrined in the 1992 constitution of the Republic. This will further increase the percentage of the population who attain tertiary education hence increase their WTP and MWTP amount.

In the course of undertaking the field survey, some observations were made by the researcher from which the following recommendations have been proposed.

It was observed that quite a number of households especially in the congested suburbs of the Municipal capital like the Zongos do not have proper access route. The SWM companies are not able to serve them directly. This was one of the major reasons why chunk of household SW is fund on the street and other unapproved areas. It is therefore strongly recommended that the Municipal Assembly should endeavour to embark on decongestion exercises in such areas to create access route as it will go a long way to improve SWM in Kasoa.

It was also observed that quite a number of the areas visited like the Tipper Junction and Lamptey Mills localities did not have any of the SWM companies operating in the

area even though they have high WTP. It is recommended that SWM companies extend their services to such areas including most of the new settlement areas.

### 5.5 Limitations of the Study

This study was carried out from a sample of households represented randomly from six electoral areas in Kasoa, and the findings are thus area-specific. Future studies could use samples of households from other towns, municipals and regions in the country or from other national contexts of a similar set-up to test and extend the generalisations of the findings.

This study did not take into account the costs involved in providing the improved SWM service with all the benefits described in the hypothetical scenario since that was not the focus of this study. Further technical analyses need to be done to know the total costs of providing such reliable SWM service to households.

Financial as well as time constraints partly limited the scope of the study. But for time and funding, many more households would have been interviewed to widen the scope of this study to better represent the views of households in Kasoa.

The CVM technique employed for this study, however, suffers from one major drawback despite its ability to measure total economic values. The hypothetical nature of the questions used in CVM surveys may pose problems since respondents may have little incentive to provide information on their true WTP. Despite this limitation which is well acknowledged in this dissertation, CVM was used because of its ease of data collection and requirement compared to other valuation methods.

The study also suffers from the weakness associated with survey interviews when data accuracy depended heavily on the respondent‘s ability to recall information and to answer survey questions accurately.

### 5.6 Recommendations for Future Studies

Having established the fact that households are willing to pay significantly to utiliise improved SWM service, it is recommended that future studies should concentrate on researching into what the total costs of providing such an improved SWM service would be. Knowledge of the total costs will guide the service providers to know which fee level will yield optimum profits or commensurate the improved service.

This survey was conducted in Kasoa, the municipal capital of Awutu Senya East and might not be a representative of the whole country. Therefore, for future studies, it is recommended for extension to other parts of the country.

Furthermore, the study provides important insight to households SWM in Kasoa. Nevertheless, further studies of similar nature is needed with a significantly higher number of responders extending to all key actor groups (households, hotels, restaurants, markets, hospitals, schools and other institutions). Data from such studies would give more in-depth knowledge of SWM services in Kasoa and would provide valuable and helpful details needed for sustainable development and implementation of improved SWM programmes and policies that are most appropriate for the area.

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# APPENDICES

## APPENDIX A:

Test for Multicollinearity: Pairwise Correlation Matrix

```
. corr Age average_monthly_income collection_frequency gender_male house_ownership satisfactory secondary_edu tertiary_edu Basic_edu emplo
> yed
(obs=276)
```

| | Age | averag~e | collec~y | ge~_male | house_~p | satisf~y | second~u | tertia~u | Basic_~u | employed |
|---|---|---|---|---|---|---|---|---|---|---|
| Age | 1.0000 | | | | | | | | | |
| average_mo~e | 0.3577 | 1.0000 | | | | | | | | |
| collection~y | 0.1146 | 0.4167 | 1.0000 | | | | | | | |
| gender_male | 0.2216 | 0.2560 | 0.0863 | 1.0000 | | | | | | |
| house_owne~p | 0.5643 | 0.4752 | 0.2134 | 0.2084 | 1.0000 | | | | | |
| satisfactory | 0.2640 | 0.5458 | 0.3260 | 0.2178 | 0.2871 | 1.0000 | | | | |
| secondary_~u | -0.1603 | -0.0555 | -0.0008 | 0.0127 | -0.0820 | -0.0666 | 1.0000 | | | |
| tertiary_edu | 0.0905 | 0.5019 | 0.3249 | 0.0690 | 0.1763 | 0.3763 | -0.3677 | 1.0000 | | |
| Basic_edu | 0.1521 | -0.1019 | -0.1063 | -0.0123 | 0.0394 | -0.0622 | -0.0832 | -0.0662 | 1.0000 | |
| employed | 0.0321 | 0.2062 | 0.1042 | 0.1038 | 0.0021 | 0.1655 | 0.0201 | 0.0187 | 0.0584 | 1.0000 |

# APPENDIX B

## CONTINGENT VALUATION SURVEY QUESTIONNAIRE
## (INTERVIEW GUIDE)

Code | | Enumeration Area | |

Interviewer……..

Place of Interview……

Date of Interview……

## Introduction

Hello, I am Mahdi Afful, Master of Philosophy in Economics Student from the Department of Economics Education in the University of Education, Winneba. I am interviewing a sample of households in Kasoa, with the aim of estimating the households Willingness to Pay (WTP) for improved solid waste management service. Please be assured that information provided would not in any way be linked to you and would be treated with utmost confidentiality. This interview is completely confidential and strictly for academic purposes and therefore honest discussion is the best way ahead.

**SECTION A: SOCIO ECONOMIC CHARACTERISTICS.**

Q1. How old is the head of household? .....

Q2. Gender of head of household: 1= Male 2 = Female

Q3. What is the highest level of education of head of household?

1=No formal education 2= Primary

3= JHS/Middle school 4=SHS/Technical/Vocational

5= Tertiary 6=Other (specify)……

Q4. What is the current marital status of head of household?

1=Married 2= Single

Q5. Employment Status of head of household 1= Full Time Employed

2= Part Time Employed 3= Unemployed

Q6. If employed, what is your main occupation? ……

Q7. Do you have other jobs you do besides your main occupation? If yes, what are they? ……

Q8. On the average, how much do you earn in a month from your main occupation? GH¢.....

Q9. How much do you earn from other income sources? GH¢ …….....…….

Q10.How much does the head of household spend averagely in a day? GH¢……..

Q11. How many people are in the household? .....……

Q12. What is the accommodation arrangement of the head of household?

1 = Ownership 2 = Rented

**SECTION (B) METHODS OF SOLID WASTE DISPOSAL BY HOUSEHOLDS IN THE STUDY AREA**

Q13. Which of the following types of solid waste do you often generate in your home?

1= Food wastes 2 =papers 3= plastics 4= Others, specify: ……

Q14. How much (quantity) of solid waste do you generate in your house per week? (*Units of measurement is shopping plastic (polythene) bag (50 Ghana pesewas worth*)

1=1 bag 2= 2 bags 3= 3 bags

4 = 4 bags 5=Other specify……

Q15. Where do you dispose-off your waste?

1 = Roadside 2 = Nearby gutter 3 = Communal container

4. = Backyard 5 = Open spaces 6 = Burn it

7 = Dump sites 8 = Collected by waste company or –Kaya Boola”

9 = Others, specify: .....

Q16. Which waste management institution collects waste in your area for disposal?

1= Municipal Assembly 2 = Zoomlion

3 = Alliance Ghana 4 = –Kaya Boola”

5 = Others, specify: ……

Q17. How often do they collect?

1= Inconsistently 2= Once a month 3= Twice a month

4= Three times a month 5= Others, specify……

Q18. How often do they fail to collect?

1=Very often 2=Sometimes 3= Rarely

4= Never 5= Not aware

Q19.If waste is dumped in communal container, approximately, how many minutes does it take you to get to the site?

1. = 5-10mins 2. =11-15mins 3. = 16-20mins

4. = 21-25 mins 5. =more than 25mins.

Please state your opinion regarding each statement below based on the ratings.

| | **Strongly Agree** | **Agree** | **Neutral** | **Disagree** | **Strongly Disagree** |
|---|---|---|---|---|---|
| Q20. Present collection of waste frequency is satisfying | 1 | 2 | 3 | 4 | 5 |
| Q21. Present collection method is satisfying | 1 | 2 | 3 | 4 | 5 |
| Q22. Present container location/size is satisfactory | 1 | 2 | 3 | 4 | 5 |

Q23. Does your household currently pay any fee for solid waste management service?

1. = Yes (Go to Q19) 2. =No (Go to Q20)

Q24. Why do you pay for solid waste disposal?

1= To avoid Fine (Penalty) by local authorities 2= Environmental awareness

3= Peer pressure 4= Others, pplease specify……

Q25. If No, what is/are your reason(s) for not paying for solid waste management service?

1=Not satisfied with the current services 2= Cannot afford to pay for the full cost

3= Don't consider the service as important 4= Service not available

5= General taxes should cover the cost of this service

6= Others, please specify……

Q26. How much does your household pay per month as fee for solid waste management service? GH¢……

Q27. Are you satisfied with the quality of service by the solid waste management company?

1= Satisfied 2= unsatisfactory

**SECTION C**

**(A) CONTINGENT VALUATION SCENARIO OF WILLINGNESS TO PAY FOR IMPROVED SOLID WASTE MANAGEMENT SERVICE. (NOT CURRENTLY PAYING)**

Suppose a solid waste managing company decides to offer solid waste collection service to households, will you subscribe to? The service will be such that the firm will provide subscribers with free litter bins and a cart driven person will pick up the solid waste from your house. The waste from all households subscribing to the service will be disposed off properly by the company. This will assuage the difficulty of households in managing their solid waste. By so doing, garbage will not be left around in the Neighbourhood to create insanitary problems for the inhabitants. This kind of service can only be offered if you agree to pay a monthly charge on regular basis.

Q27. Will your household be willing to pay more on regular basis for an improved solid waste management service? 1=Yes GO TO 28 2= No GO TO 29

Q28. What factor(s) may contribute to your willingness to pay for improved solid waste management services?

1=Quality of service 2=Cost of service

3=Instant Fine by authorities 4= Quantity of waste generated

5=Others (please specify) ……

29. Could you tell me the main reason why you do not want to pay extra for an improved waste collection service?

1= Satisfied with existing system 2= Don‘t trust the new system

3= Government‘s responsibility to provide waste collection for free

4= I cannot afford 5=Others (please specify) ……

Q30. If there were to be a penalty/fine for not properly disposing off your solid waste, will that compel you to pay more for improved solid waste management service?

1= Yes 2= No

NB: Bid values distributed uniformly among GH¢25.0 GH¢22.5, GH¢20.0, GH¢17.5, GH¢15.0, GH¢12.5 and GH¢10.0. The double dichotomous format is used.

Q31. Will your household be willing to pay Gh¢…… per month for this service?

1= Yes GO TO Q32. 2=No GO TO Q34

If Yes, Increase Bid by Gh¢2.5 If No, Reduce Bid by Gh¢2.5

Q32. If the service provider decides that the household pays Gh¢…… per month, will your household be willing to pay for the service?

1= Yes GO TO Q34 2= No GO TO Q36

Q33. If the service provider decides that the household pays Gh¢…… per month, will your household be willing to pay for the service?

1= Yes GO TO Q36 2= No GO TO Q35

Q34. Will your household be willing to pay Gh¢……? for this service?

1= Yes GO TO Q36 2= No GO TO Q36

Q35. Will your household be willing to pay Gh¢……for this service?

1= Yes GO TO Q36 2= No GO TO Q36

Q36. Think carefully for a moment. What is the maximum amount your household will be willing to pay to use this improved service? Gh¢……

**(B). CONTINGENT VALUATION SCENARIO OF WILLINGNESS TO PAY FOR IMPROVED SOLID WASTE MANAGEMENT SERVICE. (ALREADY PAYING)**

Currently, people receiving the house to house service have the 240 litre size bin and have their solid waste picked for disposal two times a week in a month.

However, the growing household size and the rise in the standard of living of some individuals have rapidly increase the quantity of solid waste generated by households already paying for the service. This development requires that the number of times the waste is picked for disposal must be increased from the current twice to five a week in a month. The company will also provide additional waste bin for sorting and recycling. Let us assume that your household is offered such an uninterrupted and improved solid waste management service and you will be charged a monthly user fee on regular basis based on the quantity of solid waste your household generate in a month, will you be willing to pay more than you are currently paying?

Q37. Will your household be willing to pay more on regular basis for an improved solid waste management service? 1=Yes GO TO 35 2= No GO TO 36

Q38. What factor(s) may contribute to your willingness to pay for improved solid waste management services?

1=Quality of service 2=Cost of service

3=Instant Fine by authorities 4= Quantity of waste generated

5=Others (please specify) ……

Q39. Could you tell me the main reason why you do not want to pay extra for an improved waste collection service?

1= Satisfied with existing system 2= Don‘t trust the new system

3= Government‘s responsibility to provide waste collection for free

4= I cannot afford 5=Others (please specify) ……

Q40. If there were to be a penalty/fine for not properly disposing off your solid waste, will that compel you to pay more for improved solid waste management service?

1= Yes 2= No

NB: Bid values distributed uniformly among GH¢25.0 GH¢22.5, GH¢20.0, GH¢17.5, GH¢15.0, GH¢12.5 and GH¢10.0. The double dichotomous format is used.

Q41. Will your household be willing to pay Gh¢……per month for this service?

1= Yes GO TO Q42. 2=No GO TO Q43

If yes, Increase Bid by Gh¢2.5….. If no, Reduce Bid by Gh¢……

Q42. If the service provider decides that the household pays Gh¢……per month, will your household be willing to pay for the service?

1= Yes GO TO Q44 2= No GO TO Q46

Q43. If the service provider decides that the household pays Gh¢……per month, will your household be willing to pay for the service?

1= Yes GO TO Q46 2= No GO TO Q45

Q44. Will your household be willing to pay Gh¢…… for this service?

1= Yes GO TO Q46 2= No GO TO Q46

Q45. Will your household be willing to pay Gh¢…… for this service?

1= Yes GO TO Q46 2= No GO TO Q46

Q46. Think carefully for a moment. What is the maximum amount your household will be willing to pay to use this improved service? Gh¢……

**Thank You.**

# APPENDIX C

## ECONOMETRIC ESTIMATION RESULTS

Probit regression — Number of obs = 276

LR chi2(10) = 133.26

Prob > chi2 = 0.0000

Log likelihood = -91.782363 — Pseudo R2 = 0.4206

| WTPREAL | Coef. | Std. Err. | z | P>\|z\| | [95% Conf. | Interval] |
|---|---|---|---|---|---|---|
| Age | .0226391 | .0133799 | 1.69 | 0.091 | -.003585 | .0488631 |
| average_monthly_income | .0007721 | .0002934 | 2.63 | 0.009 | .000197 | .0013472 |
| collection_frequency | -.1654534 | .0842864 | -1.96 | 0.050 | -.3306517 | -.0002551 |
| gender_male | .0527435 | .2198073 | 0.24 | 0.810 | -.378071 | .4835579 |
| house_ownership | -.2187023 | .3229449 | -0.68 | 0.498 | -.8516627 | .4142581 |
| satisfactory | 2.225379 | .4556372 | 4.88 | 0.000 | 1.332346 | 3.118411 |
| Basic_edu | -.5505719 | .5935879 | -0.93 | 0.354 | -1.713983 | .6128389 |
| secondary_edu | -.0180784 | .2741796 | -0.07 | 0.947 | -.5554605 | .5193037 |
| tertiary_edu | .095795 | .3654616 | 0.26 | 0.793 | -.6204967 | .8120866 |
| employed | .7482777 | .3281098 | 2.28 | 0.023 | .1051943 | 1.391361 |
| _cons | -2.024858 | .5817606 | -3.48 | 0.001 | -3.165088 | -.884628 |

Marginal effects after probit

y = Pr(WTPREAL) (predict)

= .93215551

| variable | dy/dx | Std. Err. | z | P>\|z\| | [ 95% C.I. ] | | X |
|---|---|---|---|---|---|---|---|
| Age | .0029673 | .002 | 1.49 | 0.137 | -.000945 | .006879 | 40.337 |
| averag~e | .0001012 | .00004 | 2.46 | 0.014 | .000021 | .000182 | 1499.06 |
| collec~y | -.0216859 | .0119 | -1.82 | 0.068 | -.045004 | .001632 | 1.55435 |
| ge~_male* | .0069733 | .02929 | 0.24 | 0.812 | -.050441 | .064388 | .608696 |
| house_~p* | -.0304889 | .04801 | -0.64 | 0.525 | -.124588 | .06361 | .315217 |
| satisf~y* | .3304372 | .05635 | 5.86 | 0.000 | .219999 | .440875 | .478261 |
| Basic_~u* | -.1036467 | .15076 | -0.69 | 0.492 | -.399138 | .191844 | .025362 |
| second~u* | -.0023881 | .03651 | -0.07 | 0.948 | -.07394 | .069164 | .210145 |
| tertia~u* | .012271 | .04618 | 0.27 | 0.790 | -.078245 | .102787 | .336957 |
| employed* | .1459316 | .09523 | 1.53 | 0.125 | -.040713 | .332576 | .884058 |

(*) dy/dx is for discrete change of dummy variable from 0 to 1

Ordered probit regression — Number of obs = 228

LR chi2(10) = 231.43

Prob > chi2 = 0.0000

Log likelihood = -108.78373 — Pseudo R2 = 0.5154

| REALMWTP | Coef. | Std. Err. | z | P>\|z\| | [95% Conf. | Interval] |
|---|---|---|---|---|---|---|
| Age | .0277232 | .0142231 | 1.95 | 0.051 | -.0001536 | .0556 |
| average_monthly_income | .0005453 | .0001297 | 4.20 | 0.000 | .0002911 | .0007996 |
| collection_frequency | .5363516 | .0698867 | 7.67 | 0.000 | .3993762 | .6733271 |
| gender_male | .0972182 | .2272643 | 0.43 | 0.669 | -.3482117 | .5426482 |
| house_ownership | 1.098747 | .2513235 | 4.37 | 0.000 | .6061616 | 1.591332 |
| satisfactory | .5760439 | .2362472 | 2.44 | 0.015 | .1130079 | 1.03908 |
| Basic_edu | .6875476 | .8647068 | 0.80 | 0.427 | -1.007247 | 2.382342 |
| secondary_edu | .1237257 | .3087092 | 0.40 | 0.689 | -.4813332 | .7287846 |
| tertiary_edu | .7221836 | .2651114 | 2.72 | 0.006 | .2025747 | 1.241792 |
| employed | .6746929 | .4958472 | 1.36 | 0.174 | -.2971497 | 1.646535 |
| /cut1 | 4.945136 | .9162037 | | | 3.149409 | 6.740862 |
| /cut2 | 7.13271 | .9932103 | | | 5.186054 | 9.079366 |

```
. mfx,predict(outcome(2))

Marginal effects after oprobit
      y  = Pr(REALMWTP==2) (predict, outcome(2))
         =  .43665617
```

| variable | dy/dx | Std. Err. | z | P>\|z\| | [ 95% C.I. ] | | X |
|---|---|---|---|---|---|---|---|
| Age | .0102139 | .0053 | 1.93 | 0.054 | -.000171 | .020598 | 41.2632 |
| averag~e | .0002009 | .00005 | 4.00 | 0.000 | .000102 | .000299 | 1686.14 |
| collec~y | .1976053 | .02996 | 6.59 | 0.000 | .138879 | .256332 | 1.87719 |
| ge~_male* | .0358072 | .08361 | 0.43 | 0.668 | -.128062 | .199676 | .662281 |
| house_~p* | .3676142 | .07602 | 4.84 | 0.000 | .218621 | .516607 | .359649 |
| satisf~y* | .2083161 | .08357 | 2.49 | 0.013 | .044529 | .372104 | .574561 |
| Basic_~u* | .2238834 | .21255 | 1.05 | 0.292 | -.192707 | .640474 | .017544 |
| second~u* | .0454594 | .11298 | 0.40 | 0.687 | -.175976 | .266894 | .210526 |
| tertia~u* | .2563276 | .08982 | 2.85 | 0.004 | .080293 | .432362 | .394737 |
| employed* | .2323833 | .14817 | 1.57 | 0.117 | -.058017 | .522784 | .929825 |

(*) dy/dx is for discrete change of dummy variable from 0 to 1

```
. mfx,predict(outcome(3))

Marginal effects after oprobit
      y  = Pr(REALMWTP==3) (predict, outcome(3))
         =  .01013399
```

| variable | dy/dx | Std. Err. | z | P>\|z\| | [ 95% C.I. ] | | X |
|---|---|---|---|---|---|---|---|
| Age | .0007475 | .00049 | 1.53 | 0.125 | -.000208 | .001703 | 41.2632 |
| averag~e | .0000147 | .00001 | 2.00 | 0.045 | 3.3e-07 | .000029 | 1686.14 |
| collec~y | .0144619 | .00634 | 2.28 | 0.022 | .002043 | .026881 | 1.87719 |
| ge~_male* | .0025312 | .00585 | 0.43 | 0.665 | -.008937 | .013999 | .662281 |
| house_~p* | .0495578 | .02377 | 2.08 | 0.037 | .002971 | .096144 | .359649 |
| satisf~y* | .0149371 | .00864 | 1.73 | 0.084 | -.001987 | .031862 | .574561 |
| Basic_~u* | .0400826 | .0884 | 0.45 | 0.650 | -.133169 | .213334 | .017544 |
| second~u* | .0036327 | .00993 | 0.37 | 0.715 | -.015837 | .023103 | .210526 |
| tertia~u* | .0251917 | .01514 | 1.66 | 0.096 | -.00448 | .054863 | .394737 |
| employed* | .0098873 | .00593 | 1.67 | 0.095 | -.001728 | .021503 | .929825 |

(*) dy/dx is for discrete change of dummy variable from 0 to 1