UNIVERSITY OF CAPE COAST

WILLINGNESS TO PAY FOR IMPROVED SOLID WASTE MANAGEMENT IN DUNKWA-ON-OFFIN

BY

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DECLARATION

Candidate's Declaration

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

Candidate's Signature…… Date……..

Name: Kwabena Nyarko Addai

Supervisor's Declaration

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

Supervisor's Signature…… Date……

Name: Prof. S.B. Kendie

ABSTRACT

This study sought to examine willingness to pay for improved solid waste management in Dunkwa-on-Offin. A multi-stage sampling technique was used to select 100 households enjoying the communal container and house-to-house systems of solid waste collection. The selected households were drawn from residential areas which were divided into high, middle and low socio-economic strata. A double-bound choice contingent valuation was used to elicit households' willingness to pay (WTP) for improved solid waste management. The study also examined the existing solid waste collection systems in operation and household's level of satisfaction with them. Assessment was also done on household's perception and attitudes towards the solid waste problem.

The results showed that households perceived the current solid waste collection services to have some level of inconsistencies. On the current solid waste problem, 88 percent of the respondents rated it as not serious. The majority (94%) of the respondents were satisfied with the current solid waste collection services. The results of the study also revealed that willingness to pay for improved solid waste management is significantly related to level of education, gender, household size and age of the household head. It is recommended that the current collection operator should maintain service charges with the WTP levels while striving to improve services to maintain and attract new clients.

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DEDICATION

Dedicated to my mother, Lofty Akosua Yalley

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LIST OF ACRONYMS

CCC	Central Communal Container
CPCB	Central Pollution Control Board
CV	Contingent Valuation
CVM	Contingent Valuation Method
EMS	Environmental Management Systems
GM	Genetically Modified
GNP	Gross National Product
HHC	House-to-House Collection
LCA	Life Cycle Analysis
MDGs	Millennium Development Goals
MMDAs	Metropolitan Municipal and District Assemblies
MSWM	Municipal Solid Waste Management
SAP	Structural Adjustment Programme
SWC	Solid Waste Collection
SWM	Solid Waste Management

UN	United Nations
UNDP	United Nations Development Programme
UNDESA	United Nations Department of Economic and Social Affairs
UNEP	United Nations Environment Programme
UNCHS	United Nations Centre for Human Settlement
WHO	World Health Organization
WMD	Waste Management Department
WTA	Willingness to Accept
WTP	Willingness to Pay

CHAPTER ONE

INTRODUCTION

Background to the Study

Increasing levels of generation of municipal solid waste have long posed serious threats to local environmental quality and human health (CPCB, 2000; UN, 2000). Especially during the last decade the volume and complexity of solid waste generated particularly in large cities, have been increasing at an unprecedented rate. This increase has been attributed to two main drivers: intensification of urbanization and rising living standards (Rathi, 2007). The solid waste management (SWM) system comprises four activities: waste generation, collection, transportation and disposal (Sharholy, Ahmad, Mahmood and Trevedi 2007). SWM therefore requires adequate infrastructure provision and maintenance for all four activities. When not managed adequately, solid waste generates several public health and environmental hazards. These include environmental pollution (air quality, water quality, land use, noise), communicable diseases (diarrhoea, gastro-intestinal diseases, respiratory, skin diseases), non-communicable diseases (poisoning, hearing defects/loss, dust), injury (occupational injury by sharp needles, glasses, metals, wood) and aesthetics (odour, visibility, dust).

The increasing volume and complexity of solid waste pose the greatest challenges to large cities in developing countries, where organization and planning of solid waste collection and disposal services tend to be rudimentary. Due to budget and infrastructure constraints, public authorities in these cities are often unable to manage large amounts of solid waste generated. This fact is reflected in the unknown volume and types of solid wastes collected; amount recovered and recycled; the inadequacy of disposal sites, as well as efficient reutilization and recycling programmes (Buenrostro and Bocco, 2003). Developing countries have similar patterns of SWM services which are characterized by lack of planning, poor or no segregation of waste at source and unscientific and informal disposal systems. Lack of sufficient public and private funds and corrupt public sector are considered among the bottlenecks to the improvement of the SWM services (Buenrostro and Bocco, 2001). Further the negative externalities generated by increasing levels of unmanaged solid waste are exacerbated by the inadequate provision of other basic infrastructure and services as water supply, sanitation facilities and transportation (UNCHS Habitat, 2001).

Most municipalities in developing countries spend a large proportion of their budgets on the collection, transport, and disposal of solid wastes. According to Cointreau (1984), in most cities in developing countries, municipal SWM costs consume 20-50% of municipal revenues yet collection service levels remain low with only 50-70% of residents receiving service and most disposals being unsafe. This deplorable situation is not different in the urban areas of Ghana such as Accra Tema, Cape Coast, Kumasi, Tamale and Sekondi-Takoradi. Based on an

estimated population of 18 million and an average daily waste generation per capita of 0.45kg, Ghana generates annually about 3.0 million tonnes of solid waste. Accra, the capital, and Kumasi, the second largest city combined, with a population of about 4 million and a floating population of about 2.5 million generates over 3,000 tonnes of solid waste daily. It is however, estimated that throughout the country only about 10 percent of solid wastes generated is properly disposed of (Mensah and Larbi, 2005). In Accra, for example, only 11 percent of the 1.4 million residents benefits from home collection (Songsore, 1992), while the remaining 89 percent dispose of their waste at community dumps, in open spaces, in water bodies, and in storm draining channels (Asomani-Boateng and Height, 2004). This situation is quite different in small town such as Dunkwa-on Offin which don't generate large quantities as that of the big cities.

In Ghana, after the implementation of the structural adjustment programs (SAPs), the government started privatizing Solid Waste Collection (SWC) in mid-1990s (Baud and Post, 2002). Even though the government has privatized SWC, the public sector still collects half of the waste in cities. SWC systems differ depending on the income status of households. Low-income groups cannot afford to pay for proper waste disposal and they tend to dump domestic waste near their houses, in rivers, into sewages, drains and at other illegal sites. Before 1995, a greater percentage of waste was collected by Waste Management Departments (WMD) (Boadi and Kuitunen, 2002). After the government started privatization of SWC in 1995, the ratio of waste collection by public and private sectors increased by 1999 (Post, Broekema and Obirih-Opareh, 2002).

In high-income areas, the public and the private sectors collect waste at each house (House-to-House collection service). The poor, on the other hand, have to bring their waste to a public container where it is collected by WMD- that is the Central Communal Container (CCC) system (Post *et al.*, 2002). Low-income groups cannot afford House-to-House collection (HHC). They criticize the CCC system because of the irregularity of SWC (Post and Obirih-Opareh, 2002). The collection points usually are not close to the areas where low-income citizens live. The residents do not take their waste to SWC centres because it is far from their home and also because of irregularity of collection (Baud and Post, 2002). Furthermore, there are many problems associated with SWC. These include lack of financial support, lack of service consistency (especially the CCC for low-income areas), inadequate service facilities and the difference of collection services between high-income and low-income areas.

Problem Statement

Municipal solid waste management (MSWM) is a major responsibility of local governments, typically consuming between 20% and 50% of municipal budgets in developing countries (Cointreau, 1994). It is a complex task which depends as much upon organization and cooperation between households, communities, private enterprises and municipal authorities as it does upon the selection and application of appropriate technical solutions for waste collection, transfer, recycling and disposal. Furthermore, 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. In most cities of developing countries, waste management is inadequate: a significant portion of the population does not have access to a waste collection service and only a fraction of the generated waste is actually collected. Systems for transfer, recycling and/or disposal of solid waste are unsatisfactory from the environmental, economic and financial points of view.

There are, however, diverse schools of thought on what actually has contributed to this deplorable waste management problem in most cities in Sub-Saharan Africa. On one hand, urban environmental problems in Africa of which disposal is part have been justified on the grounds that most of the countries in Sub-Saharan Africa lack adequate funding and suffer from rapid population growth (Onibokun and Kumuyi, 1999:2). On the other hand, other researchers have taken a more pessimistic path of the population and environment relationship (Kendie, 1998; UNEP, 2005). Kendie (1998) argues that population pressure and lack of funding are nothing but convenient excuses to justify low investment in the provision of waste disposal facilities. He stresses that the upsurge in waste disposal problems stems from the fact that "attitudes and perceptions towards wastes and the rating of waste disposal issues in peoples' minds and in the scheme of official development plans have not been adequately considered".

Most attempts to improve solid waste management in cities in developing countries have focused on the technical aspects of different means of collection and disposal (Flintoff, 1984). More attention has been paid to improving institutional arrangement for service delivery (Bartone, Leite, Triche and

Schertenlieb, 1991), with special emphasis on privatization options (Cointreau, 1994). By comparison, much less effort has been directed at investigating the demand-side aspects related to solid waste management. Although the SWM process may seem to be straightforward, managing solid waste has become a major global problem for many governments, due to unstructured management plans and higher awareness of public health, and better education. Ghanaians pay a fee for the collection and disposal services but the exact value is unknown to the households.

Budget constraints have made Metropolitan, Municipal and District Assemblies (MMDA's) unable to meet the cost in managing the ever increasing volumes of waste. Improvement in solid waste management is required; however, to obtain such improvements, a higher payment is also anticipated. In line with this, it is very important to explore the possibility of cost sharing by households and for this we need to explore the demand of these households for SWM services.

Objectives

The main objective of this study is to examine willingness to pay for improved solid waste management in Dunkwa-on-Offin.

Specific Objectives

The specific objectives are to;

- Examine the existing solid waste collection systems

- Investigate household level of satisfaction with the current solid waste management system
- Assess household perceptions towards the current solid waste problem.
- Analyze household willingness to pay for improved solid waste management.
- Suggest policy measures to enhance effective solid waste management

Research Questions

These research questions are to be answered in this study;

- How are the existing solid waste collection systems?
- Are households satisfied with the current solid waste management system?
- What is the perception of household's towards the current solid waste problem?
- Are households willing to pay for improved solid waste management?

Scope of the Study

The scope of this study is limited to households in Dunkwa-on-Offin that enjoy the house- to- house collection (HHC) and central communal container (CCC) solid waste collection. Dunkwa-on-Offin is a rapidly growing town, the Municipal capital of Upper Denkyira East which is one of the thirteen Administrative Districts of the Central Region.

The population of Dunkwa-on-Offin increased from 15,437 in 1970 to 16,905 in 1984 and to 26,215 in 2000. An environmental problem associated with the built environment is poor sanitary conditions within settlements. Unorganized

open dumping is the commonest form of solid waste disposal in Dunkwa-on-Offin.

Significance of Study

Solid waste management is an important facet of sustainable development for any nation and prioritizing solid waste management is greatly supported by global initiatives. Agenda 21, the Rio Declaration on Environment and Development, explicitly affirmed that environmentally sound management of wastes was among the environmental issues of major concern in maintaining the quality of Earth's environment and especially in achieving environmentally sound and sustainable development in all countries (UNDESA, 2005). Sustainable solid waste management was again affirmed by the United Nations Millennium Development Goals (MDGs), adopted by 189 countries and signed by 147 heads of state and governments during the UN Millennium Summit in September 2000 (UNDP, 2007).

A number of studies depict that the practice of household solid waste management and environmental attitudes and behaviours are associated with both intrinsic and extrinsic household variables. Thus, it pays to study household demand for improved solid waste collection and disposal services in the bid to improve the practice of solid waste management in Dunkwa-on-Offin. As such, this work will try to use the environmental attitudes and behaviours of households, attitudes to waste and waste facilities by households, and practices in waste management in the bid to analyze the willingness to pay by households to get services of improved solid waste collection and disposal.

This study provides important demand-side information for policy makers to make decisions based on the defined attributes levels and additional monthly SWM charge which the public is willing to pay for those improved service quality. The willingness to pay for waste management services or facilities is very important to the success of the private participation in SWM programme. The willingness to or not pay could have direct impact (positive or negative) on the reliability and success of any solid waste management strategy (Rahman, Salequzzama, Uddin, Islam, and alHrun, 2005). The question therefore has to do with the economics of household waste management especially in a developing economy like Ghana.

Organization of Study

The study is organised into five chapters. Chapter one provides the background, problem statement, objectives and justification of the study.

Chapter two gives an overview of literature relevant to the study. Chapter three outlines the methodology employed to achieve the objectives of the study.

In Chapter four, the results and discussion are provided and the summary of findings, conclusions and recommendations from the study are distilled in Chapter five.

CHAPTER TWO

LITERATURE REVIEW

Introduction

This chapter provides an extensive literature review of the study. It starts with the increasing environmental concerns and SWM in Ghana and the concept of solid waste and its classification is also discussed. Overview of SWM in developing countries and issues on the environmental and health problems associated with poor solid waste management are also treated. The theoretical framework, the concept of contingent valuation procedure and willingness to pay are also critically reviewed. Finally, attitudes, perception and waste management and existing studies on willingness to pay are discussed.

Increasing Environmental Concerns

Global concern over environmental impacts knows no boundaries. Complexity of waste management covers not only effects of the management approach itself, but also the components within the system, such as those effects derived from transportation activities to final disposal sites from households or transfer stations (Jamaluddin, 2001). Other components of the system include: public behaviour (Clark, 1994), perceptions of consumers (Clark, 1994; Davio,

2001; Park, 1998), as well as perceptions of government officials on certain approaches (Churtoff and Buxbaum, 1986).

There is definitely a need for an improved planning and management approach particularly among developing nations. Latest trends in an attempt to emphasize the environment have been shown by the development of standards at the international level such as the International Standards, ISO 14000, the Irish Standards, ISO 310, and the Canadian Standards Association Standard CSA Z750. It is one of the aims of the standardization of products and services to meet customer satisfaction. Thus, it requires some sort of consumer-based information in the management system. Therefore, it is clear that supporters of Life Cycle Analysis (LCA), a part of the 21 environmental management systems (EMS), view the importance of the understanding of consumer behaviours in the design of plans for future improvements. Thus, the level of understanding of the public concerning their rights to form a complaint of such acts should be studied in order to make the monitoring of industrial activities more effective.

The fact that there is an “insufficient public appreciation of the need to find a waste disposal alternative that permitted relatively few people to redirect public policy (other than concentrating on only landfill sites)” (Chertoff and Buxbaum, 1986) makes it crucial to explore the levels of understanding of current public and its involvement in political behaviour. The action will help future plans to change the public views. While some researchers argue that the issue of environmental degradation is brought about by misapplied or faulty technology, others believe that it is a direct result of population growth and per capita

consumption. On the other hand, other non-scientists believe in the importance of public involvement and the strength of public opinion in affecting any governments' actions. Policies are the main keys to the problem and are able to minimize negative environmental impacts, particularly those arising from the generation of solid wastes (Anderson, 1999).

The Concept of Solid Waste

The concept of waste is often that of an otherwise "useless or discarded material". But the idea of what constitute a waste is often notional rather a concrete term because waste is more easily recognized than defined. The concept of solid waste is therefore very tricky to define (Furedy and Lardinios, 2000). In that light, it becomes clear perception of what contributes a waste are likely to differ widely and that the divide between a waste and resource may be indistinguishable (Collin, 1995). A waste is therefore what the person responsible for discarding the material regards as a waste. Generally, materials discarded for disposal are deemed to be wastes (Furedy and Lardinios, 2000). Based on this controversy, a material is only defined as waste if it is useless; as soon as it is usable it becomes a resource (Fobil *et al*, 2007).

However, different authors have defined waste differently. Solid waste can be defined as any substance or article which requires to be disposed off as broken, worn out, contaminated or otherwise spoiled. Again it can also be defined as any material which constitutes a scrap material or other unwanted surplus substances arising from the application of any process. An option to improve the current waste situation could consist in enhancing resource recovery. Recycling of

inorganic materials such as paper and other scrap materials from municipal solid waste is often effectively carried out by the informal sector. However, reuse of organic waste materials which often amounts to more than 50% of the total waste is still limited despite its great recovery potential.

Solid waste is differentiated by their origin, physical form, detailed composition and risk potential. The quantity and the composition of some types of solid wastes, such as municipal waste, vary from day to day, season to season and from locality to locality.

Classification of Solid Waste

Solid Waste is classified based on their origin, treatability and risk potential.

Classification based on origin

Food waste: Food wastes are the animal, fruit and vegetable residues resulting from the handling, preparation and eating of foods. They are putrescible and decompose rapidly causing malodour.

Rubbish: This comprises combustible and non-combustible solid wastes of households, institutions of commercial activities etc excluding putrescible materials. The combustible rubbish consists of materials such as paper, cardboard, furniture parts, textiles, rubber, leather, wood and garden trimmings. Non-combustible rubbish consists of items such as glass, broken crockery, plastic, discarded tins, aluminium cans and materials made of ferrous and non-ferrous metals.

Ashes and residues: Materials remaining from the burning of wood, coal, coke and other combustible wastes in homes, stores, institutions, industrial and municipal facilities for the purpose of heating and cooking and above all the remains of combustible wastes are categorised as ashes and residues. Ashes and residues are normally composed of fine powdery materials, cinders, clinkers and small amounts of burned and partially burned materials.

Demolition and construction wastes: Waste from demolished buildings and other structures are classified as demolition wastes. Wastes from the construction, remodelling and repairing of individual residences, housing complexes, multi-storied flats, commercial buildings etc are classified as construction wastes. The constituents of this waste are stones, concrete, bricks, plaster and plumbing.

Municipal wastes: Wastes such as street sweepings, roadside litter, litter from municipal dustbins, dead animals and abandoned vehicles. Municipal waste includes rubbish, trash and almost all types of waste.

Industrial process wastes: Industrial process waste includes the solid and semi-solid wastes from industrial plants. The specific characteristics of these materials vary depending on the nature of the manufacturing process.

Agricultural wastes: Agricultural wastes are residues resulting from cultivation of plants and raising of livestock such as crop residues from fields and waste from feedlots.

Classification based on characteristics

Based on characteristics, solid wastes can be classified as biodegradable and non-biodegradable. This classification is based on the quality of solid waste

generated from different sources. The biodegradable waste consists of all carbonaceous wastes that can be biodegraded into useful or less polluting products by the action of microorganisms and such animals like Annelids and Insects. Non-bio degradable wastes include inorganic wastes, and non-degradable polymeric organics like certain type of plastics.

Classification based on risk potential

Wastes that pose a substantial danger immediately or over a period of time to human, plant or animal life are classified as hazardous wastes. A hazardous waste exhibits the characteristics like ignitibility, corrosivity, reactivity or toxicity. They are classified into following categories as radioactive substances, chemicals, and biological wastes containing radioactive materials, flammable wastes and explosives. The chemical category includes wastes that are corrosive, reactive or tonic. The biological waste category is represented by dangerous wastes emanating from hospitals and biological research facilities.

Sources of Solid Waste

The source classification of waste is based on the fact that waste emanates from different sectors of society such as residential, commercial and industrial sources.

Waste from residential areas

The wastes generated from residential areas are generally classified as domestic waste. Waste generated from residential areas varies a lot based on the socio-economic and cultural situations. In high-income residential areas where gas or electricity is used for cooking, the waste generated will be less compared to

the houses using wood and charcoal as fuel. Paper, cardboard, tin and bottles are found to be more in prosperous settlements and in commercial areas.

Waste from shops/commercial establishments/vegetable/ fruit markets

The wastes generated from shops and commercial establishments are mainly recyclable in nature. The vegetable shops/markets generate large quantities of degradable waste including dried plantain leaves used for wrapping agricultural goods.

Waste from hotels/restaurants/eating stalls

Hotels and restaurants generate both degradable and non-degradable waste. The domestic type waste generated will be large in quantity and hence to be removed daily. They can be provided with separate bins for waste collection.

Waste from slaughter houses/fish markets

Slaughterhouses and fish markets generate highly putrescible matter. They decay very fast and are the main reason for the malodour near these premises. No proper collection or removal is practiced and hence the waste rots in the premises itself.

Waste generated by street hawkers

Street food vendors and hawkers generate large quantities of waste particularly food waste and plastic paper plates.

Characteristics of Solid Waste

The material composition or state of the waste stream is also used to classify solid wastes based on the physical and chemical characteristics.

Physical characteristics

The physical characteristics of solid wastes vary widely based on socio-economic, cultural and climatic conditions. The physical qualities of solid waste like bulk density, its moisture content etc. are very important and to be considered for the selection of disposal, recycling and other processing methods.

Chemical characteristics

Information on the chemical composition of solid wastes is important in evaluating processing and recovery options. In addition, the analysis helps in adopting and utilizing proper equipment and techniques for collection and transportation. The chemical characteristics like pH, chemical constituents like carbon content, N, P, K micronutrients etc are to be analyzed for the selection of proper waste management technology. But this cannot be readily and accurately measured nor can they be standardized due to its wide range in composition. Each and every category of waste varies with locations and local conditions. However the percentage of Carbon, Hydrogen, Nitrogen and non-combustibles are determined. Higher organic content of Carbon in refuse activates the process of putrefaction. Thus both physical and chemical characteristics of the solid waste determine the selection of the final method of waste disposal.

Overview of Solid Waste Management in Developing Countries

Solid waste management is becoming a major public health and environmental concern in urban areas of many developing countries. The situation in Africa, particularly in the capital cities is severe. The public sector in many countries is unable to deliver services effectively, regulation of the private sector

is limited and illegal dumping of domestic and industrial waste is a common practice. In general, solid waste management is given a very low priority in these countries. As a result, very limited funds are provided to the solid waste management sector by the governments, and the levels of services required for protection of public health and the environment are not attained. The problem is acute at the local government level where the local taxation system is inadequately developed and, therefore, the financial basis for public services, including solid waste management, is weak.

Improper solid waste management leads to substantial negative environmental impacts (for example, pollution of air, soil and water, and generation of greenhouse gases from landfills), and health and safety problems (such as diseases spread by insects and rodents attracted by garbage heaps, and diseases associated with different forms of pollution). Municipal (or local) authorities charged with responsibility of providing municipal solid waste management services (together with other municipal services) have found it increasingly difficult to play this role. The difficulty has been aggravated by lack of effective legislation, inadequate funds and services, and inability of municipal authorities to provide the services cost-efficiently. Changing lifestyles such as use of canned soft drinks, mobile phones, and disposable diapers (movement towards a “consumer society” in general), moreover, will pose special waste management challenges, as waste management systems in developing countries are incapable of frequent adjustment to match these lifestyle changes.

Cities in both developed and developing countries generally do not spend more than 0.5 per cent of their per capita gross national product (GNP) on urban waste services, which covers only about one-third of overall cost (World Bank, 1999). The responsibility over solid waste collection and disposal is thus well beyond the capacity of municipal governments. More than 80 per cent of the total waste management costs in low-income countries are collection costs (World Bank, 1999). In Latin America the cost of waste collection is about 46 per cent of the total municipal solid waste management cost. Cost recovery in SWM service is difficult because, even though there is some willingness to pay for waste collection service, there is little such willingness for waste disposal. Traditionally, therefore, municipal authorities have financed the services through general revenues or attempted to charge for the service through inefficient property tax. Owing to the existence of willingness to pay, however, private provision of waste collection has potential. In addition, limited economies of scale and ease of entry and exit in waste collection imply that competition can keep the price of the private service competitive.

The upshot is that an increasing proportion of urban dwellers in developing countries, particularly the urban poor, will lack access to municipal solid waste management services and, consequently, suffer from pollution-related environmental and health problems.

Solid Waste Management in Ghana

In Ghana, after the implementation of the structural adjustment programme (SAP) in the mid-1990s by the World Bank, the government started

privatizing solid waste collection (Baud and Post, 2002). Even though the government has privatized Solid Waste Collection (SWC), half of the waste collection activities are still done by the public sector. Also in Ghana, the collection systems differ among high-income and low-income residences. The low-income groups tend to dump garbage near their houses, rivers, sewage and open sites. On the other hand, the high-income groups tend not to dump near their houses since they can afford to pay the collection fee. Both the public and private sectors have financial problems and tend to lure workers to work long hours at low wages (Post *et al*, 2002).

Challenges of Solid Waste Management

A number of interventions that will eventually promote sustainable settlement have been initiated or implemented to manage solid waste in Ghana. However, these efforts are bedeviled with obstacles and challenges which make the management of solid waste difficult. These challenges include;

- Inadequate waste collection vehicles
- Revenue generated is not sufficient to meet waste collection
- Inadequate government financial support on sanitation. The shift of attention has gone to curative instead of the preventive aspect of sanitation
- Lack of public awareness on the need to pay for sanitation services
- Indifference of the public towards good sanitary practices
- Lack of intense and sustained public education on sanitation

- Problem of land acquisition for public waste disposal
- Not in my backyard syndrome (Nimby syndrome)
- Inadequacy of law enforcement
- Need to put in place recycling plants e.g. plastic waste;
- Inter institutional cooperation and collaboration

Environmental and Health Problems Associated with Poor Solid Waste Management

A variety of environmental hazards are associated with the mishandling or mismanagement of refuse. The solid waste which is not properly stored, collected, transported and disposed off will lead to short-term as well as long term health risks. In the long term, there may be dangers arising from waste dumps particularly from it to the pollution of our drinking water sources. Fly breeding will be encouraged by uncovered piles of rotting refuse and the flies may play a role in the mechanical transmission of faecal-oral diseases. Piles of refuse will also contain mosquito-breeding sites where pools of rain water form in discarded cans, tyres etc. The mosquito Aedes aegypti will survive in these conditions and may transmit dengue, yellow fever, and other arboviral infections. Rats will also based and live in and around refuse. The main source of food for rats and other small rodents is refuse, and in dump yards they quickly proliferate and spread to neighbouring houses. They may promote and transmit a variety of diseases, including plague, leptospirosis, rat bite fever etc. Piles of refuse present a fire risk.

Flammable waste materials when dumped together at dump yards are a great danger at source. Hot ashes added to the dumped wastes are also a reason for the fire at dump yards. Usually the fire starts with the practice of open burning of refuse. Sometimes this becomes uncontrollable. When the open dumps are fired, toxic gases will be released to the atmosphere.

The dump yards may contain rubber tires, PVC, plastic materials etc and while they burn toxic gases like dioxin, furan etc., are released into the atmosphere, which are deadly poisonous. An additional danger that occurs due to fire at dump yards is that large quantities of water will be used for stopping the fire which may result in leaching of toxic materials to ground water.

Badly managed refuse can promote water pollution by rain washing debris out of piles of refuse and into surface water. Ground water pollution may also occur. Piles of refuse rot and smell, which is a nuisance and is aesthetically unpleasing in the urban environment. Where refuse disposal services are lacking much refuse is deposited in open street drains and urban waterways. This causes them to block and can cause flooding. That is, uncollected refuse obstructs streets and drainage channels. It also creates ideal breeding grounds for mosquitoes.

Apart from diseases for which insects and rats are carriers, the handling of refuse can cause illness to workers who work in collection and transportation process. Infection of roundworm and whipworm are common among people who work with solid waste disposal activities without proper protective measures.

It is therefore evident that technologies of waste management, which are simple, practical and economical for use, should be developed and they should be both safeguard public health and reduce environmental pollution.

Theoretical Framework

Two related concepts, individual preferences explained mathematically by the microeconomic consumer theory and the random utility theory will be employed in this study.

Economic consumer theory

The basic approach to the mathematical theories of individual preferences is that of microeconomic consumer theory (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 environmental quality consumed is a function of the prices faced, real income and a set of consumer characteristics. These consumer characteristics are proxies for his tastes and preferences.

The consumer is faced with a budget that defines the consumption possibilities, or the choice set. He therefore has to choose among alternatives the specific goods and services that best satisfies him and that he can afford to buy given his limited income. The satisfaction is the utility he derives from the services. The consumer's goal is there to maximize utility given his budget constraint. For a fixed income, Y , and vector of prices and $p_{2.}$

$\sum P_i(X,\Omega) = Y$ i=1,2.....

Where X is environmental quality, Ω is other goods and services, P_i is vector of prices ($P = P_1, P_2$), P_1 is price of waste collection, P_2 is price of other goods and

Y is income of the household.

It is assumed that the household has the ability to compare all possible alternatives.

Thus there exists an ordinal utility function.

$U = U(X,\Omega)$ .....

This is the household's preference expressed mathematically. The household's selection of the most preferred bundle that satisfies the budget constraint.

Mathematically, utility of a household is maximized subject to the budget constraint.

Maximize $U = U(X,\Omega)$

Subject to

$$\sum P_i(X,\Omega) = Y$$
$$P, Y > 0;$$

Random utility theory

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. Though the individual is assumed to select the alternative with the highest utility, the analyst of random variables does not know the utilities. From this perspective, the choice probability of alternative k *is* equal to the probability that the utility of alternative k, U_{kn} is greater than all other alternatives in the choice set.

$$P(k/C_n) = P(U_{in} > U_{jn}) \text{ for all } j \,\&\, C_n$$

The contingent valuation method

The Contingent Valuation Method (CVM) has widely been used in estimating use and non-use values of environmental commodities (Pearman, McGivary and Common, 1999) ever since the two major non-use values—option and existence values—were recognized as important components of the total economic values in environmental economics literature, especially during the 1960s (Venkatachalam, 2004). CVM has been applied in other areas in economics such as health economics, transportation safety and cultural economics (Pearman, *Ibid*). Besides, since the first approval for the commercialization of Genetically Modified (GM) foods in 1996, uncertainties concerning consumer acceptance have increased. As a result, some researchers have taken advantage of this methodology to determine

consumers' Willingness to Pay for genetically modified foods (see Chern *et al.*, 2002; Onyango, 2003). Maynard and Franklin (2003) employed its use in their study of the commercial potential of 'cancer-fighting' dairy foods. Hence, its use is not limited to finding the Willingness to Pay (WTP) of environmental goods only. It is applicable to every commodity for which market value is not well defined. Aguilar and Kohlmann (2006) used it to determine the willingness to produce and consume transgenic bananas in Costa Rica.

The essence of CVM is to obtain from a hypothetical market, a valuation or bid that would be as close as possible to what would have existed in the real market. This is done by asking respondents to participate in a hypothetical market and directly measure their compensating and equivalent variation for quantity changes of the good in question, such as an improvement in environmental quality. Respondents then state what they will be willing to pay (WTP) for improved environmental quality or the minimum compensation they would be willing to accept (WTA) for a loss in environmental quality (Arima, 1996). Compensating variation is the appropriate measure when the person must purchase the good, such as an improvement in environmental quality. However, equivalent variation is appropriate if the person faces a potential loss of the good, as he would if a proposed policy results in the deterioration of environmental quality (Alberini and Cooper, 2000).

The CVM has number of shortcomings. Problems of questionnaire design and biases in responses to WTP question may make results difficult to apply if adequate controls are not built into the data collection process. A number of

potential biases have been identified in CVM literature, and survey design is seen as an exercise in eliminating and reducing bias as much as possible. Two class of problem are subsumed by the term 'bias'. The first concerns getting respondents to answer the question that would, if they answer honestly, elicit respondents true WTP in regard to a policy issue that the exercise is intended to inform. The second concerns getting respondents to answer honestly. An example of 'bias' of the first class is where the environmental 'commodity' perceived as being of concern by the respondents differs from that intended by the CVM analyst. This is known as amenity misspecification bias. Dealing with this class of biases is mainly a matter of the design of the scenario presented, especially in terms of the background information to be given to respondents. An example of 'bias' of the second class is where the respondents perceive what the analyst intends, but provide response which is not his or her true WTP but is intended to influence the provision of environmental 'commodity' and/ or his or her level of payment for it. This is called strategic bias. The use of dichotomous choice model is less subject to strategic bias than the use of open-ended bid elicitation as was fairly common in early CVM applications is way of dealing with strategic bias. Many CVM practitioners argue that with good survey instrument design strategic bias is not a major problem nowadays. Other biases include;

Hypothetical Bias: This arises due to the hypothetical nature of the market in CVM surveys which can render respondents' answers meaningless if their declared intentions cannot be taken as accurate guides of their actual behaviour.

Experimental trials suggest that this problem is less when one uses WTP format instead of WTA format.

Information Bias: The quality of information given in a hypothetical market scenario almost certainly affects the responses in a CVM Survey. Inadequate or improper presentation of information on the good or service to be valued can bias the quality of the CVM study.

Starting Point Bias: The suggestion of an initial starting point in a bidding game can significantly influence the final bid. For example choosing a low (high) starting point leads to a low (high) mean WTP.

Interviewer and Respondent Bias: The interviewer's conduct and interviews can influence responses. Though this kind of bias can be minimised by using mail or telephone surveys, this will result in less information forthcoming and also give rise to hypothetical bias. Respondents may not give correct answers or give the questions proper consideration. Therefore to minimise this problem professional interviewers should be used or well trained interviewers to reduce this type of bias.

Willingness to pay

A rational consumer will, due to the constrained maximization facing him, gives preference to alternatives that give him higher utility. A good or service associated with highest WTP would be the one that yields highest utility to the consumer and vice versa. Subsequently, a high willingness and ability to pay indicates high utility derived from the commodity and hence such a good would be given preference, implying its high demand. Logically, a service that satisfies

one most is also highly valued. The value of a service would be expressed through WTP for the service.

Generally there are two approaches for assessing demand or WTP. The first is the demand curve approach, which entails making observations on prices and quantities in a market. A demand curve is estimated and WTP can be inferred. The other is the survey-based approach. This survey-based method uses responses to some questions posed to the consumer to their preferences and WTP for a hypothetical product or service. This is the method in this study since environmental quality is not available in the market. According to theory, if demand for this service exists, then this must be reflected by WTP. A high WTP is logically a proxy for its demand. Thus the value placed by a consumer on a service can be expressed as WTP to obtain it.

An appropriate approach is to directly ask households or individuals to state their willingness to pay for improved solid waste management using the survey techniques. Despite the arguments that strategic bias will invalidate survey results, the survey technique is most relevant to this study because with good survey instrument design strategic bias can be eliminated. Also results of using the survey approach for estimating the value of public goods or services are internally consistent, replicable and consistent with demand theory.

Methods of eliciting WTP responses

Eliciting WTP responses have been achieved using four major techniques: the bidding game, the payment card, the open-ended approach and dichotomous

choice approach. The latter is of two formats: the single-bound dichotomous choice and the double-bound dichotomous choice. Each of these approaches has its own advantages and disadvantages and the choice of an approach depends on the nature of the statistical technique used, the nature of the respondents targeted, the cost of the survey and the nature of the good investigated (Venkatachalam, 2004).

In the open-ended approach, respondents are asked to declare the maximum amount they would be willing to pay, or close-ended, asking the respondents if they would be willing to pay a specific amount or not (dichotomous choice). The open-ended format can be problematic since the respondent might not have sufficient information and stimuli to thoroughly consider the values they would attach to such good/service if a market were to exist, and might not return realistic estimates (Arrow *et al*., 1993).

Close-ended questions, on the other hand, are easier for the respondent and are more realistic since they correspond more to a real market situation, where the consumer is presented with a price for a product, and faces a yes/no decision. In the single-bounded method, the individual only responds to one bid. This approach is incentive-compatible in that it is in the respondent's strategic interest to say yes if his/her WTP is greater or equal to the price asked and no otherwise (Mitchell and Carson, 1989). Utility maximization implies that a person will then only answer yes to the offered bid if his/her maximum WTP is greater than the bid. However, the single bound method requires a large sample size and is statistically not very efficient (Hanemann *et al*., 1991). Efficiency can be

improved by offering the respondent a second bid, higher or lower depending on the first response, in an approach generally known as the double-bounded CVM. This method incorporates more information about an individual's WTP and therefore provides more efficient estimates and tighter confidence intervals (*ibid*).

Different people have different WTP for a particular good, and it is the distribution of this WTP among the target population that offers interesting market information. In the dichotomous choice approach, WTP is not directly observed, but assumptions about its distribution can be made, allowing for the estimation of the parameters of this distribution. Thus, the mean WTP of a population, in monetary terms, can be derived from the survey (Lusk and Hudson, 2004).

Empirical Studies on Willingness to Pay

Various socioeconomic and cognitive factors have been found to influence willingness to pay for waste management. These factors include gender, age, education, household size, marital status, quantity of waste generated, income, satisfaction on current waste collection services, tenure status of house, preparedness to separate waste and concern about waste management (Afroz, Hanaki and Hasegawa-kurisu, 2009; Aggrey and Douglason, 2010; Altaf and Deshazo, 1996; Chuen-Khee and Othman, 2002; Kassim and Ali, 2006; and Tamura, 2005). Afroz *et al*.,(2009) pointed out that age, household size, education, income, concern about waste management, satisfaction with waste collection services females influence WTP positively, whiles males and bid (WTP values) tend to negatively affect WTP. Aggrey and Douglason (2010) further

reemphasized that variables such as household expenditure, quantity of waste generated, education, marital status, gender, household size and age also affect WTP.

Some empirical studies have shown a positive relationship between education and WTP for waste management. This captures the level of understanding of people about the desirability of proper management of solid waste. According to Aggrey and Douglason (2010), it is hypothesized that 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. Afroz *et al*., (2009) also reiterated the fact that education relates to a better understanding of the problem of solid waste and hence WTP for waste management.

Age also influences WTP for waste management. Empirical results on age on WTP are mixed. Afroz *et al*., (2009) pointed out that holding all other factors constant, older people are willing to pay more than younger people. This suggest that older citizens make more mature decisions related to evaluating health and environmental issues, possibly due to their age , leading them to express a high WTP value. However, according to Aggrey and Douglason (2010) age affect WTP waste management negatively. Old people may consider waste collection as government's responsibility and could be less willing to pay for it. Whiles the younger generation might be more familiar with cost sharing and could be willing to pay.

Household size is another factor that influences WTP for waste management. Chuen-Knee and Othman (2002) pointed out that the more the number of people in the household, the more willing the household will appreciate a clean environment.

Another factor that influences WTP for waste management is marital status. According to Aggrey and Douglason (2010) married people are likely to be more responsible to keep the environment clean than single ones because married people are likely to have larger family size and hence face higher risks of hygiene associated diseases that those married.

In addition, income also influences WTP for waste management. This is so because holding all other variables constant wealthier people are willing to pay more than lower income people. Tamura (2005) in analysing the individual attributes of the demand for solid waste collection in Accra, Ghana found that the more income people have, the more willing they are to pay for solid waste collection. Afroz *et al.*, (2009) also emphasized this point since a higher level of income could be related to a greater ability to pay.

The quantity of waste generated by a household also influences WTP for waste management. Aggrey and Douglason (2010) pointed out that, the higher the generation of waste, the more the household faces the challenges of waste disposal and the greater the willingness to pay.

Satisfaction on waste collection services also influences WTP for improved waste management. People who are more satisfied with waste

collection services are willing to pay more than dissatisfied people (Afroz *et al*., 2009 and Kassim and Ali, 2006)

Attitudes, perceptions and waste management

Attitude is an enduring predisposition towards a particular aspect of one's environment (McDougal and Munro, 1987). Attitude consists of three basic components: perception (emotional impression), cognition (thought) and behavioural tendency to act (Warner, n.d). Warner further explains that perception is an emotional response(s) and is/are not logic and/or rational whereas cognition is rational thought but behavioural tendency is a tendency to behave in a specific manner (depending also on culture). Warner points out that there is no right or wrong behaviour or attitude, except within a given cultural context. But even within the same culture, our behaviour can be influenced by a number of factors- and these develop over time. Therefore, WHO (2006) argues that since cultural beliefs and perceptions (with regards to waste collection and disposal) vary so widely in different parts of the world. It is not possible to assume that any of the practices that have evolved in relation to waste management can be readily transferred elsewhere.

Perceptions, like attitude are influenced by our knowledge, resources, beliefs, values, and norms but can be created without experience and knowledge of the object/person. People's attitudes influence the effective demand for waste collection services. Attitudes may be positively influenced through awareness building campaigns and education about the negative aspects of inadequate waste

collection with regards to public health and environmental conditions, and the value of effective disposal. Such campaigns also should inform people of their responsibility as waste generators and of their rights as citizens to adequate solid waste management services (Bernstein, 2004).

Thus, the design and implementation of MSWM systems require an adequate analysis of existing behaviour of key stakeholders (including their attitudes, perceptions and values). The underlying attitudes of the urban population are themselves influenced by the social and cultural context. Programmes to disseminate knowledge and skills to improve behaviour patterns and attitudes regarding waste management must be based on sound understanding of the social and cultural characteristics. Fast growing low-income residential communities may comprise considerably diverse social and ethnic groups, and this social diversity strongly influences the capacity of communities to organize local waste management (Bernstein, 2004). Being cultural derivatives and therefore learned response sets, belief, attitudes and perceptions can be changed or modified through education (Agbola, 1993 citied in Kendie, 1998).

CHAPTER THREE

METHODOLOGY

Introduction

This chapter describes the study area, the research design and the factors that influence households willingness to pay (WTP) for improved solid waste management. The empirical model, population and sampling procedure and sample size are also discussed in this chapter. The chapter concludes with the instrument of data collection and an overview of the analysis of the data.

Study Area

Dunkwa-on-Offin is a rapidly growing town, the municipal capital of Upper Denkyira East which is one of the thirteen Administrative Districts of the Central Region. The population of Dunkwa-on-Offin increased from 15,437 in 1970 to 16,905 in 1984 and to 26,215 in 2000. A map of the study area is shown in figure 1.

Females represent the dominant sex in the town, constituting 50.4 percent of the population whilst males make up 49.6 percent. This gives a sex ratio of 98.3 males to 100 females. The age distribution of the town is considerably youthful, with a medium age of 19.1 years, which above the national average of

19.4. More than half of the population (59%) is below 20 years of age while children below 15 years constitute as much as 28.9%. those aged below 15-64 years, who form the potential labour force, constitute about 52% giving an age dependency ration of 1:9. Water services in Dunkwa-on-Offin are managed by Ghana Water Company limited. Water consumption level for the town is 13637m^2 hr^{-1}, which is supplied by 5 boreholes in pipelines to customers. About 70 percent of the township has access to potable water except those newly developed areas such as Burger's and Newman's Estate etc. Other households also have individual hand dug wells.

The predominant type of housing in the town is the compound house type. However, there are a few self-contained houses mostly in the new settlement areas built mostly by citizens living abroad. Physical planning in its technical sense is mostly non-existent as houses are built haphazardly without any recourse to lay-down physical planning requirements and principles. Most settlements in the Dunkwa-on-Offin have no layout to guide the management of land in the built environment.

Another environmental problem associated with the built environment is poor sanitary conditions within settlements. There are only few collection sites. While these are inadequate and not strategically distributed in the town, there are numerous uncontrolled and indiscriminate disposal of solid waste. The town lacks well constructed drainage system. Most of the drains are silted. Periodically, parts of Dunkwa-on-Offin become flooded and sometimes rivers overflow their banks, rendering some suburbs, which are low lying in accessible. Drainage channelling

domestic effluent is inadequate in most suburbs. Stagnant and pools of dirty water around dwelling units are common scenes in the town.

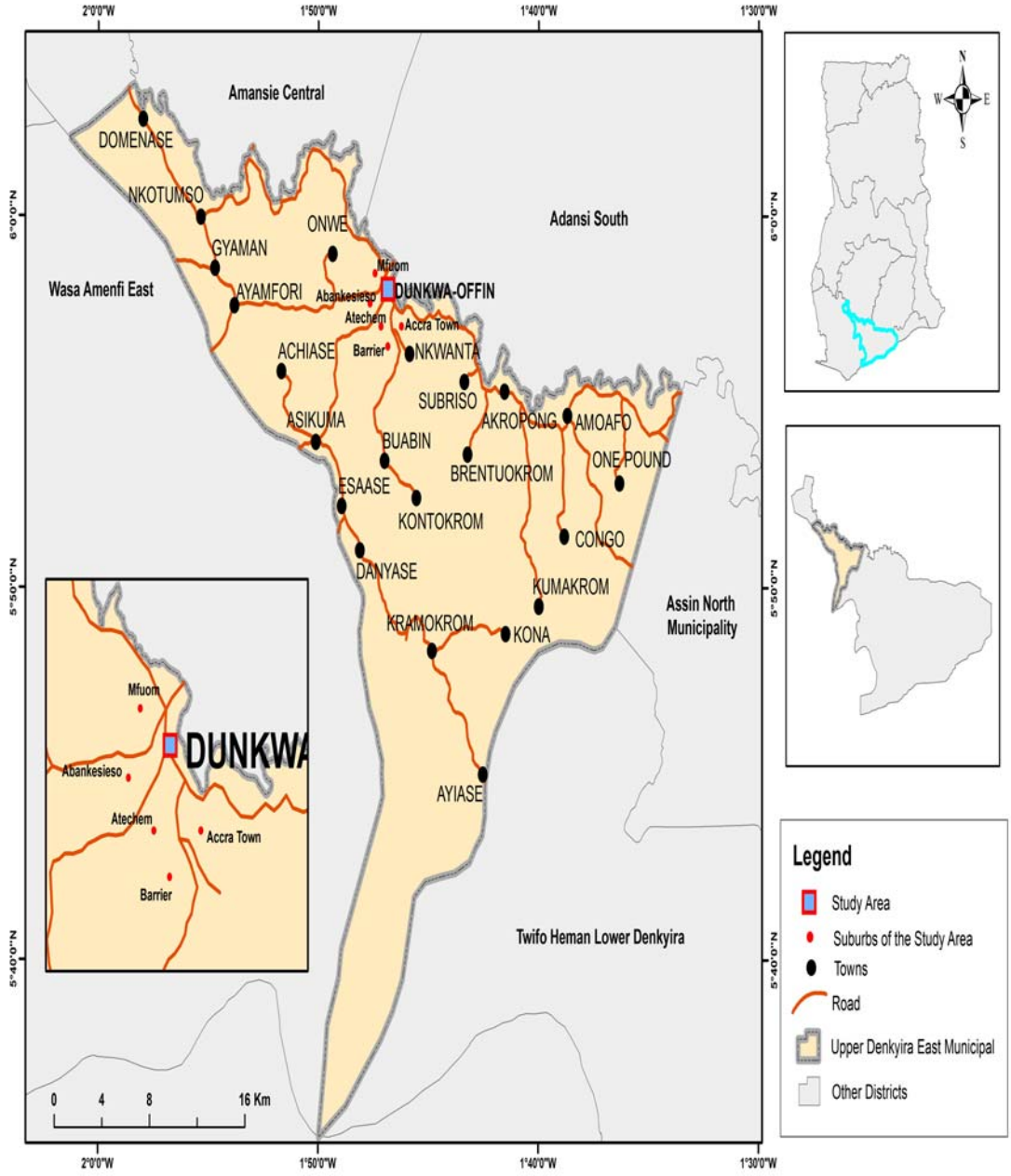

Figure 1: The Study Area

Source: GIS/Remote Sensing Unit, Department of Geography & Regional Planning, UCC, 2011

Two main types of waste collection services are provided in the Municipality; the communal and house-to-house collection methods. The solid waste collection is a public-private managed system. It is the assembly which contracts the private company for solid waste collection. The only private waste collection company in the Municipality is Zoomlion Ghana limited. Health delivery system in the town is made up of the orthodox and traditional system. The latter is underdeveloped and is made up of herbalists, fetish priests and spiritualist. Under the orthodox system in the town exists up to Level C under the countries primary health care system. The town can boost of one public and one private hospital. Economic activities within the town includes trading, small scale mining, agriculture and artisans.

Research Design

Despite a variety of validity and measurement issues (Carson and Hanemann, 2006), application of contingent valuation (CV) surveys are argued to be a viable method of collecting information on preferences for providing public goods and services in developing countries (Whittington, 1998). For instance Aggrey and Douglason (2010) in Kampala, Chuen-Khee and Othman (2002) in Malaysia and Afroz *et al* (2009) in Dhaka provide examples of recent CV studies in developing country contexts. Many of these studies provide evidence that households are willing to pay a significant amount for the provision of improved waste management. Eliciting a respondent's preferences through the CV method requires careful survey design, choice of survey mode, and selection of random sample (Whittington, 2002).

Following the work of Kimenju and De Groote (2008), the WTP of a group of consumers for a particular product at a price (or bid) B can be assumed to have a certain probability distribution function. This distribution function can be seen as a function of price, with a higher price having lesser probability of being accepted. In applied research, the logistic distribution is commonly used, and the effect of price is entered indirectly in an argument called the index function, denoted as v. The most common index function is linear in the price or bid, B:

$$v = \alpha - \rho B, \tag{3.1}$$

and the probability distribution of the WTP is then presented by

$$P(WTP = B) = \exp(v)/(1+\exp(v))^2. \tag{3.2}$$

The logistic function has the advantage of a closed-form cumulative distribution function $G(.)$, which then represents the proportion of the population whose WTP lies below a certain value B:

$$G(B) = P(WTP < B) = \exp(v)/(1+\exp(v)). \tag{3.3}$$

People who will accept an offer of value B are those whose WTP is equal to, or higher than, B (Hanemann and Kanninen, 1998; Hanemann, Loomis and Kanninen, 1991).

In the double-bounded dichotomous choice model, the consumer is presented with two consecutive bids, and the second bid depends on the response

to the first. If the consumer answers "yes" to the first bid (B_i), the second bid (B_i^u) is set higher, but if the individual responds "no" to the first bid, the second bid (B_i^d) is set lower. There are four possible outcomes: "yes" to the first bid followed by a "yes" to the second bid (with probability denoted by π^{yy}); "yes" followed by "no" (π^{yn}); "no" followed by "yes" (π^{ny}); and two consecutive "no" answers (π^{nn}). To receive information on a wider range of values, different amounts for the bids are assigned randomly between respondents i. The probability of receiving a "yes" answer to both questions equals to the probability that the respondent's WTP is higher than the highest bid offered:

$$\pi^{yy}(B_i, B_i^u) = \Pr(B_i^u < WTP_i) = 1 - G(B_i^u). \tag{3.4}$$

Similarly, the probability of receiving a "yes" followed by a "no" equals the probability that the WTP of respondent i lies between the initial bid and the second, higher bid offered:

$$\begin{aligned} \pi^{yn}(B_i, B_i^u) &= \Pr(B_i^u < WTP_i < B_i^u) \\ &= G(B_i^u) - G(B_i). \end{aligned} \tag{3.5}$$

The probability of receiving a "no" followed by a "yes" is again the probability that WTP_i lies between the initial and second bid, now lower, bid offered:

$$\begin{aligned} \pi^{ny}(B_i, B_i^d) &= \Pr(B_i^d < WTP_i < B_i) \\ &= G(B_i) - G(B_i^d). \end{aligned} \tag{3.6}$$

Finally, the probability of receiving two "no" answers are equal to the probability that WTP_i lies below the second, lowest bid offered:

$$\pi^{nn}(B_i, B_i^d) = \Pr(B_i^d < WTP)_i = G(B_i^d). \quad (3.7)$$

Combining the probabilities of four outcomes, the log-likelihood function for a sample of N consumers takes the form

$$\ln L^D(\theta) = \sum_{i=1}^{N} \left\{ d_i^{yy} \ln \pi^{yy}(B_i, B_i^u) + d_i^{nn} \ln \pi^{nn}(B_i, B_i^d) + d_i^{yn} \ln \pi^{yn}(B_{i,} B_i^u) + d_i^{ny} \ln \pi^{ny}(B_i, B_i^d) \right\},$$

(3.8)

Where d_i^{yy}, d_i^{nn}, d_i^{yn}, and d_i^{ny} are binary variables with 1 denoting the occurrence of that particular outcome, and 0 otherwise.

Factors Influencing WTP for Improved Solid Waste Management

Market analysis traditionally deals with the demand for homogeneous goods, determined by a set of relevant prices or incentives and demographic variables. Demand for quality traits, however, need not be determined by the same set of variables. Research needs to give more attention to the demand for differentiated, frequently branded products, to the disaggregation of the population, and to the recognition that traditional demographic factors may have limited explanatory power (Senauer, 2001). Even if there is an objective measure of a particular quality, it does not follow that all individuals perceive quality in the same way. It is not unusual to find that an individual's utility increases with a

particular quality, whereas another individual's utility decreases. In such cases, demand for quality depends on an individual's knowledge and perception of that quality, as well as trust in the authorities guarding this quality. The effect of these factors on households' willingness to pay for improved solid waste management has already been demonstrated in several studies in developed countries and Asia (Aggrey and Douglason, 2010; Chuen-Khee and Othman , 2002), but such studies have been very limited in Africa.

Given the general nature of consumer theory, we explore whether the same cognitive variables influence WTP in Dunkwa-on-Offin, in addition to the price incentive and socioeconomic factors. The probability of an individual participating in new/improved service of solid waste collection and disposal, when offered at a certain price B_i can be hypothesized to be a function of a vector of cognitive and socioeconomic factors z_i

$$\pi^y(B_i, z_i) = \pi^y(v_i), \tag{3.9}$$

Where v_i, as defined earlier, is the index function with the predetermined relationship between B_i and z_i, assumed to be linear:

$$v_i = \alpha - \rho B_i + \lambda' z_i + \varepsilon_i, \tag{3.10}$$

and ε_i is the random term capturing unobserved effects. As explained in the basic model, the probability of a bid being accepted (either the first or the second bid in

the double-bounded method), taking into account other consumer characteristics, becomes:

$$\begin{aligned}\pi^{y}(v_i) &= 1-G(v_i) \text{ or } \pi^{y}(B_i, z_i) \\ &= 1-1/(1+\exp(\alpha-\rho B_i+\lambda^{'} z_i)\end{aligned} \tag{3.11}$$

The required log-likelihood function for the double-bound method can then be constructed in analogy to Equation (3.8). Based on the results from existing studies on household willingness to pay for improved solid waste management , the cognitive factor that can be included is the satisfaction on the existing solid waste management (binary variable) (Afroz *et al*., 2009). Furthermore, socioeconomic variables such as age, gender, education, household size, income and marital status could be considered. It is therefore hypothesized that the factors that influence household willingness to pay for improved solid waste management are concern about solid waste management and the satisfaction with the existing solid waste management and socioeconomic characteristics of households.

Empirical Model Specification

Willingness to pay of a household for improved solid waste management can be specified as:

$$WTP = \alpha + \rho b + \beta z + \varepsilon \tag{3.12}$$

Where b represents the last bid level which the respondent was offered, z socio economic factors and ε is the random variable accounting for unobserved factors.

α , ρ and β are parameters to be estimated.

The empirical formulation of equation (3.12) is finally formulated as:

$$WTP = \alpha + \rho b + \beta_1 AGE + \beta_2 GEND + \beta_3 EDU + \beta_4 INC + \beta_5 MSTA + \beta_6 COSAT + \beta_7 HHS + \varepsilon$$

(3.13)

Where AGE is the age of the respondent, $GEND$ is the gender of the respondent, EDU is the number of years of schooling of the respondent, INC is the average monthly income of the respondent, $MSTA$ is the marital status of the respondent, $COSAT$ is satisfaction with already existing waste collection service and HHS is the household size of the respondent.

Population

The primary data employed in this study was obtained through a household survey conducted in Dunkwa-on-Offin in April, 2011. The target population for the study was household heads in Dunkwa-on-Offin that use the central communal container (CCC) and house-to-house (HHC) solid waste collection services. A household in this study is defined as a group of individuals who live under the same roof and share common resources (http//www.canterburg.gov.uk).

Sampling Procedure and Sample Size

The total number of houses in Dunkwa-on-Offin according to the 2000 population and housing census is 2486 with 6166 households. A multistage

sampling technique was employed for this study. The first stage involved a stratification of households into three socio-economic strata: High, Middle and Low-income groups based on the Municipality's socio-economic status index. The advantage of employing the stratified sampling is to ensure that all income groups of the target population are represented in the sample. At the second stage, households receiving the central communal container (CCC) and house to house collection (HHC) method of solid waste collection services were targeted. These two groups were targeted because they constitute the most organized from of solid waste collection in Dunkwa-on-Offin. Finally, a simple random sampling was used to select the required sample size from each stratum based on the development plan percentages for each income group.

The number of households selected in the various residential areas is indicated in Table 1. In all a total of 100 respondents were selected for the study. Relevant sampling frame was developed based on the number of households using the central communal container and house to house collection method of solid waste in the various income areas in Dunkwa-on-Offin which were obtained from Upper Denkyira East District Assembly. The development plan revealed that out of the 26,215 population size of the town, 15 percent falls into high income group, 35 percent falls into middle income group and 50 percent falls into the low income group. The variations in the number of the households of the various income groups indicate that sample size was disproportionate to the units of the target populations from each stratum. From each household, the head who is 18 or above was then selected for the study.

Table 1: Residential Areas Household Selection

Classification	Selected Households	Areas
High income areas	15	Mfuom estate, Bungalow
Middle income areas	35	Abankesieso, Dunkwa soro, Atechem Police Station
Low income areas	50	Barrier, Atechem, Mfuom
Total	100	

Source: Author's construct

Instrument of Data Collection

A structured questionnaire (appendix A) was used to solicit information from the household heads in the sampled locations. The questionnaire had three sections. The first section included questions on the respondents' socio-economic characteristics. The second section collected information relating to the perception, attitudes and awareness of the respondents towards the environment and towards solid waste management in general. The third part included a description of the current situation regarding waste collection and disposal, existing problems and stakes of the current waste management program, the contingent choices/market about an improved/new hypothetical solid waste management program and the payment methods.

The WTP questions were design with double-bounded, dichotomous choice contingent valuation format. The double-bound questionnaire approach was used to estimate the mean household WTP for improved solid waste management. With this approach, a second bid which was higher or lower was offered, depending on the first response. This method gave more information about a household's WTP and provided more efficient estimates and tighter confidence interval (Hanemann *et al*., 1991).

The structured questionnaire consisted of both open-ended and closed-ended questions. The open-ended questions gave the respondents the chance to express their views about organic products. The closed-ended questions on the other hand gave the respondents pre-coded responses in which the respondents selected the option they agreed most. The attitudes of the households were measured using perception indices. Respondents were asked to rate some statements on the solid waste problem. The responses were coded into classes and then averaged to form an index called the perception index.

Pre-test

To ascertain the reliability and validity of the instrument, a pilot test was conducted using the instrument in Ayanfuri. During the pre-test of instrument, it was noted that the options provided for some questions were not enough. All the necessary corrections were made before embarking on the actual field work.

Data Analysis

Descriptive analysis such as frequencies, means and standard deviations were first used to describe the data. The descriptive analysis is important as it gives the general behaviour of the data collected. The association of household's willingness to pay with socio-economic and the cognitive factors were analyzed using logistic regression analysis. The analysis was done with SPSS and STATA econometric software.

CHAPTER FOUR

RESULTS AND DISCUSSION

Introduction

This chapter presents the results and discussions in relation to the specific objectives. First, the socio-economic characteristics of the respondents are discussed. This is followed by an examination of the existing solid waste collection system and respondent's level of satisfaction with the existing solid waste collection system is also discussed. It concludes with a discussion of the willingness of respondents to pay for improve solid waste collection and an analysis of factors influencing household's willingness to pay for improved solid waste management.

Socio-economic Characteristics of the Respondents

The socio-economic characteristics of the respondents in this study are presented in this section. Table 2 depicts the gender distribution of the respondents. Most of the respondents were females (90%). Even though the proportion of the female to male respondents is 90 percent to 10 percent, one does not expect this disparity to greatly influence respondent's attitude and perception on household waste management. Recent findings however suggest that gender difference could affect people's perception on solid waste management

(Ehrampoush and Maghadam, 2005). In most Ghanaian households, women, rather than men, have the responsibility of disposing solid waste. Therefore, most men declined to participate in the survey since, they were of the view that solid waste management at the household level is the responsibility of women.

Table 2: Gender of Respondents

	Type of Residential Areas							
Responses	High Income		Middle Income		Low Income		Total	
	Freq.	Percent	Freq.	Percent	Freq.	Percent	Freq.	Percent
Male	2	13.3	6	17.1	2	4	10	10
Female	13	86.7	29	82.9	48	96	90	90
Total	15	100	35	100	50	100	100	100

Source: Field survey, 2011

Age of respondents

Table 3 reveals that most of the respondents are between the ages of 25-45 years. This is an indication that most (66%) of the respondents are in their active years. Probably due to their ages, they will make more mature decisions related to evaluating health and environmental issues leading them to express a higher WTP value. Again, the younger generation might be more familiar with the concept of cost sharing in waste management than older people. This is because older people may consider waste collection as government responsibility and could be less willing to pay for it.

Table 3: Age of Respondents

Responses	Type of Residential Areas							
	High Income		Middle Income		Low Income		Total	
	Freq.	Percent	Freq.	Percent	Freq.	Percent	Freq.	Percent
25-35	5	33.3	11	31.4	17	34	33	33
36-45	5	33.3	12	34.3	16	32	33	33
46-55	2	13.3	5	14.3	12	24	19	19
56-65	3	20	6	17.1	4	8	13	13
66-75	0	0	1	2.9	1	2	2	2
Total	15	100	35	100	50	100	100	100

Source: Field survey, 2011

Marital status of respondents

Table 4 shows that the majority (88%) of the respondents are married with 12 percent being singles. A high percentage of married recorded in all the residential areas will influence their family size and hence their waste generation levels. Respondent's marital status will influence their WTP for waste management. This is due to the fact married people are likely to be more responsible to keep the environment clean than single ones because married respondents are likely to have large family size and hence face higher risks of hygiene associated diseases.

Table 4: Marital Status of Respondents

Responses	Type of Residential Areas							
	High Income		Middle Income		Low Income		Total	
	Freq.	Percent	Freq.	Percent	Freq.	Percent	Freq.	Percent
Married	12	80	32	91.4	44	88	88	88
Single	3	20	3	8.6	6	12	12	12
Total	15	100	35	100	50	100	100	100

Source: Field survey, 2011

Educational level of respondents

As indicated in Table 5, out of the total of 100 who responded to the questionnaire, 4 percent had no formal education, 22 percent junior high school education, 48 percent senior high school education and 26 percent tertiary level education. Eight percent of respondents recorded as having no formal education in the low income residential area will affect WTP for improved solid waste management. This because people with low level of education are quite difficult to convince to pay for waste management. On the contrary, enlightened people think about environment issues such as solid waste. It is hypothesized that the higher the level of education the more the respondent would appreciate the consequence of mishandling solid waste and the more value the individual would give to avoid the risk of being a victim of unclean environment (Afroz *et al*., 2009). Twenty six percent of respondents' in the low income areas have had

tertiary education. This can be explained by the fact of residential mixing which is evident in Ghanaian cities and towns.

Table 5: Educational Level of Respondents

	Type of Residential Areas							
Responses	High Income		Middle Income		Low Income		Total	
	Freq.	Percent	Freq.	Percent	Freq.	Percent	Freq.	Percent
None	0	0	0	0	4	8	4	4
JHS/Middle	2	13.3	7	20	13	26	22	22
SHS/Tech	8	53.3	20	57.1	20	40	48	48
Tertiary	5	33.3	8	22.9	13	26	26	26
Total	15	100	35	100	50	100	100	100

Source: Field survey, 2011

Employment status of respondents

Table 6 presents responses of the employment status of respondents. Thirty one percent of the respondents are government employees, 13 percent private employees, 8 percent unemployed, 45 percent self employed, 1 percent retired and 2 percent as others. The respondent's employment status will influence their income levels and subsequently their willingness to pay for improved solid waste management.

In the low income residential areas, 60 percent of the respondents are self employed and this may be due to the relatively low level of education in the areas.

A higher percentage of unemployed respondents in the high income areas may be attributed to the higher percentage of females in the sample.

Table 6: Employment Status of Respondents

	Type of Residential Areas							
Responses	High Income		Middle Income		Low Income		Total	
	Freq.	Percent	Freq.	Percent	Freq.	Percent	Freq.	Percent
Govt employee	4	26.7	12	34.3	15	30	31	31
Private employee	4	26.7	6	17.1	3	6	13	13
Unemployed	7	46.7	0	0	1	2	8	8
Self employed	0	0	15	42.9	30	60	45	45
Retired	0	0	1	2.9	0	0	1	1
Others	0	0	1	2.9	1	2	2	2
Total	15	100	35	100	50	100	100	100

Source: Field survey, 2011

Income level of respondents

Table 7 reveals that 5 percent of respondents have income below GH¢50, 46 percent between GH¢51 to GH¢150, 38 percent between GH¢151 to GH¢300 and 11 percent between GH¢301 to GH¢600. The low income level of respondents is considered a very important variable that could influence negatively people's WTP for improvement in solid waste management. The low income levels can be attributed to the higher percentage of female respondents.

Most females until recently, were mostly housewives and were not into major or full time employment.

Table 7: Income Level of Respondents per Month

Responses	Type of Residential Areas							
	High income		Middle Income		Low Income		Total	
	Freq.	Percent	Freq.	Percent	Freq.	Percent	Freq.	Percent
<GH¢50	0	0	2	5.7	3	3	5	5
GH¢51-150	4	26.7	16	45.7	26	52	46	46
GH¢151-300	9	60	12	34.3	17	34	38	38
GH¢301-600	2	13.3	5	14.3	4	8	11	11
Total	15	100	35	100	50	100	100	100

Source: Field survey, 2011

Tenure status of respondents

From Table 8, the majority of the respondents (50%) are renting the houses in which they say, whereas those who are house owners are 45 percent and the remaining 3 percent are engaged in other forms of house tenancy.

Table 8: Tenure Status of Respondents

Responses	Residential Areas							
	High income		Middle income		Low income		Total	
	Freq	Percent	Freq	Percent	Freq	Percent	Freq	Percent
Owned	10	66.7	17	48.6	20	40	45	45
Rented	5	33.3	18	51.4	27	54	50	50
Others	0	0	0	0	3	6	3	3
Total	15	100	35	100	50	100	100	100

Source: Field survey, 2011

Household size of respondents

The size of the household ranges between 1 and 14 persons. The majority of the households have five to nine persons (67%) whereas 29 percent have a size of 1-4 people in the household. The remaining (4%) represents large families where the household size is from 10-15. Low income residential areas have a large household size and this could be attributed to the low level of education in such areas; large household sizes are also associated with low income households. Low income households tend to have a lot of children because they believe that those children will help to create income. However, large household sizes also tend to generate more waste.

Table 9: Household Size of Respondents

Responses	Residential Areas							
	High income		Middle income		Low income		Total	
	Freq	Percent	Freq	Percent	Freq	Percent	Freq	Percent
1-4	7	46.67	7	20	15	30	29	29
5-9	8	53.3	27	77.14	32	64	67	67
10-15	0	0	1	2.86	3	6	4	4
Total	15	100	35	100	50	100	100	100

Source: Field survey, 2011

Existing Solid Waste Collection System

The condition of the existing solid waste management systems in operation is an incentive to determine whether households will be willing to pay more for improvement in the services being rendered. This is important as respondents will rationally not pay for poor services.

Frequency of collection

With respect to the collection frequency of the existing solid waste collection system as indicated in Table 8, 70 percent of the respondents indicated inconsistency in the collection, 4 percent once a week, 2 percent twice a week and 24 percent three times a week. The higher percentage of collection frequency being inconsistent in the low income residential areas may be attributed to the low priority given to people in low income areas when it comes to issues that concern

their welfare. The high and regular collection frequency in the high income residential areas may be due to the high premium paid by households relative to the other residential areas.

Table 10: Frequency of Collection

	Type of Residential Areas							
Responses	High Income		Middle Income		Low Income		Total	
	Freq.	Percent	Freq.	Percent	Freq.	Percent	Freq.	Percent
Inconsistent	1	6.7	22	62.9	38	76	61	61
Once a week	1	6.7	3	8.6	1	2	5	5
Twice a week	8	53.3	2	5.7	0	0	10	10
Three times a week	5	33.3	8	22.9	11	22	24	24
Total	15	100	35	100	50	100	100	100

Source: Field survey, 2011

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. As shown in Table 11, respondents were asked of the collection failure of the existing solid waste collection system. Eight percent of the respondents indicated very often, 48 percent sometimes, 40 percent rare and 4 percent of the respondents said never.

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).

Table 11: Collection Failure

Responses	Type of Residential Areas							
	High Income		Middle Income		Low Income		Total	
	Freq.	Percent	Freq.	Percent	Freq.	Percent	Freq.	Percent
Very often	0	0	6	17.1	2	4	8	8
Sometimes	4	26.7	18	51.4	26	52	48	48
Rare	8	53.3	10	28.6	22	44	40	40
Never	3	20	1	2.9	0	0	4	4
Total	15	100	35	100	50	100	100	100

Source: Field survey, 2011

Level of Satisfaction with the Current Solid Waste Collection Services

The perception of households towards the present collection system was also investigated. Overall, 54 percent of the respondents agree that they find the size of the container provided for the solid waste as satisfactory, 40 percent the respondents were however indifferent about the size of the collection container whereas 6 percent believed that the size of the containers were not big enough. Eight percent of the respondents in the low income residential areas disagree to the assertion that the container sizes are satisfactory. These responses may be

influenced by the number of households sharing a container and their waste generation levels.

Table 12: Satisfaction with Container Size

Responses	Type of Residential Areas							
	High Income		Middle Income		Low Income		Total	
	Freq.	Percent	Freq.	Percent	Freq.	Percent	Freq.	Percent
Agree	10	66.7	18	51.4	26	52	54	54
Neutral	5	33.7	15	42.9	20	40	40	40
Disagree	0	0	2	5.7	4	8	6	6
Total	15	100	35	100	50	100	100	100

Source: Field survey, 2011

As indicated in Table 13, the majority of the respondents (94%) were satisfied with the solid waste collection services in Dunkwa-on-offin. The higher percentage of respondents recorded as satisfied could be mostly those receiving the CCC system of solid waste collection. This is the case as people who do not pay anything for a service being rendered naturally do not complain much. A hundred percent satisfaction recorded in the high income residential areas may be due to the high rates they pay, hence they are normally provided with quality services.

Table13: Satisfaction with Current Collection Services

Responses	Type of Residential Areas							
	High Income		Middle Income		Low Income		Total	
	Freq.	Percent	Freq.	Percent	Freq.	Percent	Freq.	Percent
Yes	15	100	30	85.7	49	98	94	94
No	0	0	5	14.3	1	2	6	6
Total	15	100	35	100	50	100	100	100

Source: Field survey, 2011

Respondents Perception on the Current Solid Waste Problem

The perceptions of respondents on the current solid waste problem are presented in Table 14. Two percent said it is very serious, 10 percent serious rated it as serious and 88 percent considered it not serious. The percentage of residents in the middle and low income residential areas' rating the waste problem to be serious may be due to the low priority given to them in terms of waste management. Generally the high percentage of respondents seeing the current solid waste problem as not serious is not surprising as Dunkwa-on-Offin is a developing town and is yet to experience fully this negative aspect of development. However, being aware of the seriousness of a problem is an important step towards finding solutions (Kerlinger, 1986 cited in Kendie, 1998).

Table 14: Respondents' Perception on the Current Solid Waste Problem

Responses	Type of Residential Areas							
	High Income		Middle Income		Low Income		Total	
	Freq.	Percent	Freq.	Percent	Freq.	Percent	Freq.	Percent
Very serious	0	0	0	0	2	4	2	2
Serious	0	0	4	11.4	6	12	10	10
Not serious	15	100	31	88.6	42	84	88	88
Total	15	100	35	100	50	100	100	100

Source: Field survey, 2011

Willingness to Pay for Improved Solid Waste Collection

When assessing the potential for collecting money for formerly free public services like solid waste it is important to understand the contextual differences involved. Waste is both a public good and a private bad. The issue here is not the generation of waste but waste collection and handling that have public good characteristic - one cannot be excluded from the benefits of waste collection. However in conducting WTP surveys, it should be noted that there are several methodological difficulties so such results should be interpreted with caution (Munsasinghe, 1992 cited in Kendie, 1998). However, with appropriate controls to reduce 'strategic bias' it should be possible to obtain fairly accurate results (Kendie, 1998).

Table 15: Willingness to Pay more for Improved Solid Waste Management

Responses	Type of Residential Areas							
	High Income		Middle Income		Low Income		Total	
	Freq.	Percent	Freq.	Percent	Freq.	Percent	Freq.	Percent
Willing	4	26.7	8	22.9	4	8	16	16
Not willing	11	73.3	27	77.1	46	92	84	84
Total	15	100	35	100	50	100	100	100

Source: Field survey, 2011

As revealed in Table 15, most (84%) of the respondents were not willing to pay for the improved solid waste management with only 16 percent out of the total of 100 respondents willing to pay. It is not surprising to note that low income residential areas recorded the highest level of unwillingness to pay. This finding is in conformity with the literature that low income groups always have lower willingness to pay for waste management services since they have other pressing needs to worry about (Afroz *et al*., 2009). Secondly, low income groups have generally low level of education hence it is very difficult to convince them to pay for waste management.

Generally, the WTP for the improved solid waste management will be influenced by a set of socio-economic and cognitive factors. Hence the effects of variables such as gender, marital status, age, income level, household size and educational level on willingness to pay were also investigated. A chi-square (χ^2) test was employed with the significance level of 0.10. It is noted that a significant

difference exists in household's willingness to pay with respect to educational level (χ^2=19.348; ρ=0.001), gender (χ^2=0.586; ρ=0.071), household size (χ^2=15.911; ρ=0.069), and age (χ^2=19.348; ρ=0.001). There is a positive linear relationship between household's willingness to pay for improved waste management and the level of education This confirms Bernstein (2004) argument that it is only when people are more enlightened that they think about environmental issues such as solid waste. Thus people are more willing to pay for cleaner environment (waste management) services after achieving higher educational levels.

On the contrary, no significant differences were detected with respect to marital status (χ^2=0.059; ρ=0.668), income level (χ^2=18.089; ρ=0.440) and level of satisfaction with current services (χ^2=0.016; ρ=0.899). Thus willingness to pay is the same irrespective of households head marital status, income level and satisfaction level. The generalisation for gender with regards to willingness to pay should be done with caution since the study did not achieve equal representation of males and females.

The reasons given for the unwillingness to pay include the following: 'it is government responsibility to provide waste collection for free'; 'I cannot afford'; the current rate is enough'; 'I want to see improvement'; 'satisfied with existing system' and 'don't trust the new system'

Determinants of WTP for Improved Solid Waste Management

For the double dichotomous choice question, double bounded logit analysis model was used in this study. The independent variables used in the double bounded logit analysis and their basic statistics are given in Table 16. To analyze the influence of different factors on households' WTP for improved solid waste management, the parameters of the model were estimated and the marginal effects also calculated in Table 17. The probability of a households' WTP was modelled as a function of socio-economic and cognitive factors. The pseudo R-squared explains the proportion of variation in the observed values of the response variable explained by the regression. It summarizes the proportion of variance in the dependent variable associated with the independent variables, with larger pseudo R-squared values indicating that more of the variation is explained by the model.

A pseudo R-squared of 0.5014 was obtained suggesting that the degree of correlation between the dependent variable and the independent variable is 50.14%. The log-likelihood ratio statistics also computes the difference between the log-likelihood function of the full model and restricted model. The value of the log-likelihood function is -59.817 for the WTP of households.

Table 16: Descriptive Statistics of the Variables used in the Logistic Regression

Variables	Definition	Type of Residential Areas					
		High Income		Middle Income		Low Income	
		Mean	S.d.	Mean	S.d.	Mean	S.d.
Dependent							
Willingness to Pay	1 if willing to pay; 0 otherwise	0.27	0.46	0.23	0.43	0.08	0.27
Independent							
Bid	Increase in waste collection service charge (GH¢ per month)	11.17	3.99	7.71	5.5	4.55	4.48
Gender	1 if male; 0 otherwise	0.13	0.35	0.17	0.38	0.04	0.2
Age	In years	40.13	11.05	41.66	11.55	41.38	10.6
Education	Years of Schooling	12.93	2.46	12.31	2.35	11.3	4.23
Marital Status	1 if married; 0 otherwise	0.8	0.41	0.9	0.28	0.88	0.32
Household size	Number	5.07	1.71	5.66	1.66	5.56	1.88
Income	GH¢ per month	222.03	108.26	190.24	124.05	167.7	104.7
Collection Satisfaction	1 if satisfied with current collection ; 0 otherwise	1	0	0.86	0.36	0.98	0.14

Source: Field survey, 2011

Gender had a negative coefficient and is significant (ρ <0.10) on willingness to pay. This indicates that female respondents are more willing to pay for improved solid waste management than males, since traditionally it is the role of women to clean the house and dispose of the waste. This result leads credence to findings of Afroz *et al*., (2009) and Aggrey and Douglason (2010),

The positive coefficient for age (ρ <0.10) indicates that holding all other variables constant, older people are willing to pay more than younger people. This suggests that older citizens make more mature decisions related to evaluating health and environmental issues, possibly due to their age. This result is consistent with findings of Afroz *et al*., (2009). However, this result contradicts the findings of Aggrey and Douglason (2010). They are of the view that old people may consider waste collection, as government responsibility and could be less willing to pay for it.

Education had positive significant effect on willingness to pay at 1% level of significance. Holding all other variables constant, educated people are willing to pay for improved waste solid management than less educated people. This result seems straightforward and reasonable since level of education could be related to a better understanding of the problem of solid waste. This result is consistent with the findings of Afroz *et al*., (2009), Aggrey and Douglason (2010) who conducted similar studies in Bangladesh and Uganda respectively.

The negative coefficient for household size (ρ <0.10) indicates that holding all other variables constant, the number of persons in the household even

though significant did not have the expected sign on WTP. This result is consistent to the findings of Afroz *et al*., (2009) and Aggrey and Douglason (2010) but contrast the work of Altaf and Deshazo (1996). Household size is expected to have a positive coefficient due to the fact that the more the number of people in the household, the more willing the household will appreciate a clean environment. The negative relationship between household size and WTP could be due to their income level, as low income household generate low volumes of waste. It is also due to more waste generated by larger households and the fact that they cannot pay for all the waste they generate. Large household sizes are also associated with low income households.

The size of the effects can be gauged by analyzing the marginal effects, which are indicators of percentage change in people's willingness to pay, when all other factors are kept at their average value. An increase in the respondents collection satisfaction index of 1, for example decreases the respondents willingness to pay for the improved solid waste management by 2.5 percent.

Table 17: Estimates of Household WTP with Respondents Characteristics

Variables	Coefficient	Standard Error	Z-value	Marginal Effect
Constant	-1.035	2.347	-0.44	
Bid	-0.247	0.310	-0.80	-0.0600
Gender	-0.882*	0.544	-1.89	-0.2162
Age	0.045*	0.025	1.82	0.0110
Education	0.211***	0.081	2.61	0.0511
Marital status	0.379	0.485	0.78	0.0924
Household size	-0.313*	0.146	-2.15	-0.0758
Income	0.001	0.002	0.33	0.0002
Collection satisfaction	-0.102	0.485	-0.21	-0.0246
Log likelihood	-59.817			
Pseudo R^2	0.5014			
Observation	100			

***, ** and * indicates 1%, 5% and 10% level of significance

Source: Field survey, 2011

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Introduction

This chapter presents a summary of the main findings, conclusions drawn and recommendations emanating from the study. The limitations of the study are discussed and finally suggestions are made for future research.

Summary

This study sought to examine willingness to pay for improved solid waste management in Dunkwa-on-Offin. A multi stage sampling technique was used to select 100 households enjoying the communal system and house-to-house system of solid waste collection. A double-bound choice contingent valuation was used to elicit households' willingness to pay for improved solid waste management. The study also examined the existing solid waste collection systems in operation and also investigated households' level of satisfaction with the current systems. Assessment was also done on household's perception and attitudes towards the solid waste problem.

The results reveal that on the current solid waste problem 88 percent of the respondents rated it as not serious, 2 percent as very serious and 10 percent serious. Collection failure with the existing waste collection system had 8 percent

of respondents saying it was very often, 48 percent sometimes, 40 percent rare and 4 saying never.

The number of times collection is done with the existing solid waste collection system had 70 percent of the respondents saying it was inconsistent, 4 percent once a week, 2 percent twice a week and 24 percent being three times a week. The majority (94%) of the respondents were satisfied with the current solid waste collection services. Years of schooling (education) and age were the factors that had a positive and significant effect on household WTP for improved solid waste management. Whiles gender and household size negatively and significantly influence WTP.

Conclusions

The results of the study show that willingness to pay for improved solid waste management in Dunkwa-on-offin is only significantly related to level of education, household size, gender and age of the household head. The current solid waste collection service has its weakness but nonetheless, the majority of households in Dunkwa-on-Offin are satisfied with the current solid waste management in District.

Recommendations

Based on the findings of the study, the following interventions could be pursued to improve solid waste collection in Dunkwa-on-Offin;

1) A key policy recommendation of this study is that policy makers can choose from a set of scenarios, which includes different levels of attributes and WTP estimates for each attribute, in designing an improved solid waste management project for Dunkwa-on-Offin.

2) Households should be educated on effective solid waste disposal through regular sensitization programmes by a collaborative effort of key stakeholders in the solid waste management such as local government, the private sector, NGOs and residents as there was statistically significant effect of education on willingness to pay for solid waste collection.

3) Private companies into waste management should improve their services to maintain and attract new clients.

4) The ever increasing population growth means that the volume of waste generation is likely to increase. Hence strengthening or increasing the capacities of relevant stakeholders involved in the provision of solid waste collection services would provide satisfactory service delivery as households maximise their utility from improved services.

5) The municipal assembly and the service operator should concentrate on awareness campaigns about the consequences of waste mishandling and benefits of payment for improved waste management.

Limitations of the Study

1) This study 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.

2) Segregation of the study area into income levels could not be done well as most respondents who were taught to belong to a particular group declined to give accurate levels of their income.

3) This study also suffers from the weakness of the contingent valuation method.

Suggestions for Future Research

1) Future research should include firms as this study involved only households.

2) The study included households receiving the house-to-house and central communal container only. Further research should include collection modes such as pay as you dump.

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APPENDIX

APPENDIX A: QUESTIONNAIRE

WILLINGNESS TO PAY FOR IMPROVED SOLID WASTE MANAGEMENT IN DUNKWA-ON-OFFIN

Respondent ID #.....

Questionnaire for Household Heads

Location/Suburb……..

SECTION A: SOCIO-ECONOMIC CHARACTERISTICS

1. Gender

1=male [ ]

0=female [ ]

2. Age……..years

3. Educational level

1= No formal education [ ]

2= Primary [ ]

3=JHS/ Middle School [ ]

4= SHS/ Technical [ ]

5= Tertiary [ ]

6=Others (specify)……

4. Marital status

1= Married [ ]

0= Single [ ]

5. Religion

1=None [ ]

2=Christian [ ]

3=Muslim [ ]

4=Traditionalist [ ]

5=Others (specify)……

6. Ethnicity

1=Denkyira [ ]

2=Ashanti [ ]

3= Fante [ ]

4=Nzema [ ]

5=Northerner [ ]

6=Ewe [ ]

7= Others (specify)……

7. Average income per month

1. Less than GH¢50 [ ]

2. GH¢ 51- GH¢150 [ ]

3. GH¢151- GH¢300 [ ]

4. GH¢301- GH¢600 [ ]

5. GH¢601- GH¢1000 [ ]

6. Greater than GH¢1000 [ ]

8. Occupation

1=Government employee [ ]

2=Private employee [ ]

3=Unemployed [ ]

4=Self-employed [ ]

5=Retired [ ]

6=Others (specify)…….

9. Tenure status of the house

1=Owned [ ]

2=Rented [ ]

3= Others (specify)…….

10. /i/ Household size……

/ii/ Number of children under 15 years of age……..

SECTION B

a. **Perception on the most important environmental problems**

Please state your opinion regarding the problems below based on the ratings.

Environmental problems	Very serious	Serious	Not serious	Don't know
1. Insufficient water supply	1	2	3	4
2. Inadequate waste collection	1	2	3	4
3. Noise	1	2	3	4
4. Air pollution	1	2	3	4
5. Unsafe drinking water	1	2	3	4
6. Unsafe waste disposal	1	2	3	4
7. Presence of litter and illegal piles of solid	1	2	3	4

waste				

b. **Perception on the current solid waste problem**.

Please state your opinion regarding this statement below based on the ratings

	Very serious	Serious	Not serious	Don't know
1. How do you see the current solid waste problem?	1	2	3	4

c**. Perception on existing solid waste collection system.**

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

	Agree	Neutral	Disagree
1. Present collection frequency is satisfying	1	2	3
2. Present collection method is satisfying	1	2	3
3. Present container location/size is satisfactory	1	2	3

4. How often do they collect?

    a. Inconsistent [ ]

    b. Once a week [ ]

    c. Twice a week [ ]

    d. Three times a week [ ]

5. How often do the fail to collect?

    a. Very often [ ]

    b. Sometimes [ ]

    c. Rare [ ]

    d. Never [ ]

    e. Not aware [ ]

6. Are you satisfied with the current collection services?

    1. Yes [ ]

    0. No [ ]

7. Are you concern about solid waste management?

    1. Yes [ ]

    0. No [ ]

8. Which type of waste disposal do you utilize?

1. House-to-House [ ] (Go to Section C (B))

2. Communal Container [ ] (Go to Section C (A))

SECTION C

(A).CONTINGENT VALUATION SCENARIO OF IMPROVED SOLID WASTE SERVICE

Suppose that it is decided to offer an improved solid waste collection service to households in this neighborhood. A cart driven person will pick up your solid waste from your house. The waste from all households subscribing to the service will be disposed of properly and will be provided with free litter bins. This will save the family of the pain of walking a distance to throw their solid waste into a central communal container. In so doing your waste will not be left around the neighbourhood to create any sanitary problem.

This kind of service can only be offered if you agree to pay a monthly charge on a regular basis.

1. Are you willing to pay GH¢……. per month for the solid waste to be collected three times per week per month?

1. Yes [ ]

0. No [ ]

NB: Bid values distributed uniformly among GH¢ 5, GH¢7.5 and GH¢10.0. The double dichotomous format is used.

Enumerator: Is the respondent's maximum bid greater than zero?

Yes – Greater than zero-stop

No- Bid is zero - continue

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

a) Satisfied with existing system

b) Don't trust the new system

c) I cannot afford

d) Government's responsibility to provide waste collection for free

e) Other (specify)…….

(B).CONTINGENT VALUATION SCENARIO OF IMPROVED SOLID WASTE SERVICE

Currently, people receiving the house to house have the 240 litre size bin and have their solid waste picked for disposal three times a week in a month. However, the growing household size and the increase in per capita income of some houses have resulted in a lot of waste being generated. This development requires that the number of times the waste is picked for disposal be increased. This kind of improvement in service can only be offered if you agree to pay a new monthly charge on a regular basis.

1. Are you willing to pay GH¢……. per month for the solid waste to be collected five times per week per month?

1. Yes [ ]

0. No [ ]

NB: Bid values distributed uniformly among GH¢12.5, GH¢15 and GH¢17.5. The double dichotomous format is used.

Enumerator: Is the respondent's maximum bid greater than zero?

Yes – Greater than zero-stop

No- Bid is zero - continue

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

a) I cannot afford

b) I want to see improvement

c) The current rate is enough

d) Other (specify)…….