

UNIVERSITY OF GHANA

COLLEGE OF HUMANITIES

**HOUSEHOLDS' WILLINGNESS-TO-PAY AND PARTICIPATE IN SOURCE
SEPARATION OF SOLID WASTE IN THE ACCRA AND TAMALE
METROPOLISES, GHANA.**

BY

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**THIS THESIS IS SUBMITTED TO THE UNIVERSITY OF GHANA,
LEGON IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR
THE AWARD OF PHD DEVELOPMENT STUDIES DEGREE**

JULY, 2017

DECLARATION

I, Hamdiah Alhassan, hereby declare that this thesis is as a result of my own research under supervision, except for reference to other people's work which has been duly acknowledged. This thesis has neither in whole nor in part been presented for the award of another degree elsewhere.

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DEDICATION

To my lovely husband Joseph, and our children Anulana, Awetoga and Wemenga.



ACKNOWLEDGEMENT

I am most grateful to the Almighty God for His protection, wisdom, strength and guidance which saw me through this study successfully. Special thanks go to my supervisors Professor Felix Ankomah Asante, Professor Martin Oteng-Ababio and Dr Simon Bawakyillenuo for their encouragement, support, guidance and constructive criticism which made it possible for this thesis to be successful. To my supervisors, I am most grateful.

I am highly indebted to ISSER-University of Ghana, Centre for Development Studies (ZEF)-University of Bonn, the German Academic Exchange Programme (DAAD) and the Association of African Universities (AAU), which provided the academic environment and financial support for this PhD research. I am also grateful to all the researchers at ISSER, especially Dr Nana Akua Anyidoho, Dr Charles Ackah and Professor Kwabena Anaman for their encouragement and support during the study.

Many thanks also go to Mr. Hamidu Kanton of WMD/TaMA and Mr. Victor Quartey of WMD/AMA, for their support during the study. Prof. Samuel Donkoh, of the University for Development Studies, you have been a part of this journey and thanks for your concern and fatherly advise. Special thanks go to Dr Paul Adjei Kwakwa of the Presbyterian University College, Ghana for proof-reading my work and the research thoughts we have shared over the years. To my colleague PhD students at ISSER, the time and thoughts we shared were motivating enough. More importantly, I am extremely grateful to my lovely husband Joseph, and our cherished children Anulana, Awetoga and Wemenga for their support, patience and love shown during the study. God bless you all.

TO GOD BE THE GLORY

LIST OF ABBREVIATIONS/ACRONYMS

ACARP	Accra Composting and Recycling Plant
ACC	Accra City Council
AMA	Accra Metropolitan Assembly
CCC	Central Communal Container
CCWL	City and Country Waste Limited
CE	Choice Experiment
CG	Central Government
CM	Choice Modeling
CVM	Contingent Valuation Method
DACF	District Assembly Common Fund
EA	Enumeration Area
ENSO	El Niño-Southern Oscillation
EPA	Environmental Protection Agency
ESPA	Environmental Sanitation Provider Association
FAO	Food and Agriculture Organization
FGD	Focus Group Discussion
FPB	Fee-Performance Based
GAMA	Greater Accra Metropolitan Area
GSDA	Ghana Shared Growth and Development Agenda
GSS	Ghana Statistical Service
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit
HDIS	High Density Indigenous Sectors
HDLCS	High Density Low Cost Sectors
HtH	House-to-House
HPM	Hedonic Pricing Method
ILO	International Labour Organization
ISWM	Integrated and Sustainable (Solid) Waste Management
ITCZ	Inter Tropical Convergence Zone
KMO	Kaiser-Mayer-Olkin

LG	Local Government
LI	Legislative Instrument
MCIS	Medium Class Indigenous Sector
MDMCS	Medium Density Middle-Class Sector
MESTI	Ministry of Environment, Science, Technology and Innovation
MLGRD	Ministry of Local Government and Rural Development
MMDA	Metropolitan, Municipal and District Assembly
MSW	Municipal Solid Waste
MTDPF	Medium Term National Development Policy Framework
NEPAD	New Partnership for African Development
NESP	National Environmental Sanitation Policy
NESSAP	National Environmental Sanitation Strategy and Action Plan
NIMBY	Not-In-My-Backyard
NSD	National Sanitation Day
OLS	Ordinary Least Square
PAYD	Pay-As-You-Dump
PCA	Principal Component Analysis
PPP	Public-Private Partnership
PPS	Probability Proportional to Size
PSU	Primary Sampling Unit
PWD	Public Works Department
SWC	Solid Waste Collection
SWM	Solid Waste Management
SSNIT	Social Security and National Insurance Trust
SSU	Secondary Sampling Unit
TaMA	Tamale Metropolitan Assembly
TCM	Travel Cost Method
TPB	Theory of Planned Behaviour
UESP	Urban Environmental Sanitation Project
UNEP	United Nations Environmental Programme

UN	United Nations
UNDP	United Nation Development Programme
US.EPA	United States Environmental Protection Agency
USAID	United States Agency for International Development
WHO	World Health Organization
WMD	Waste Management Department
WRI	Water Research Institute
WSSDP	Water Sector Strategic Development Plan
WTP	Willingness-To-Pay



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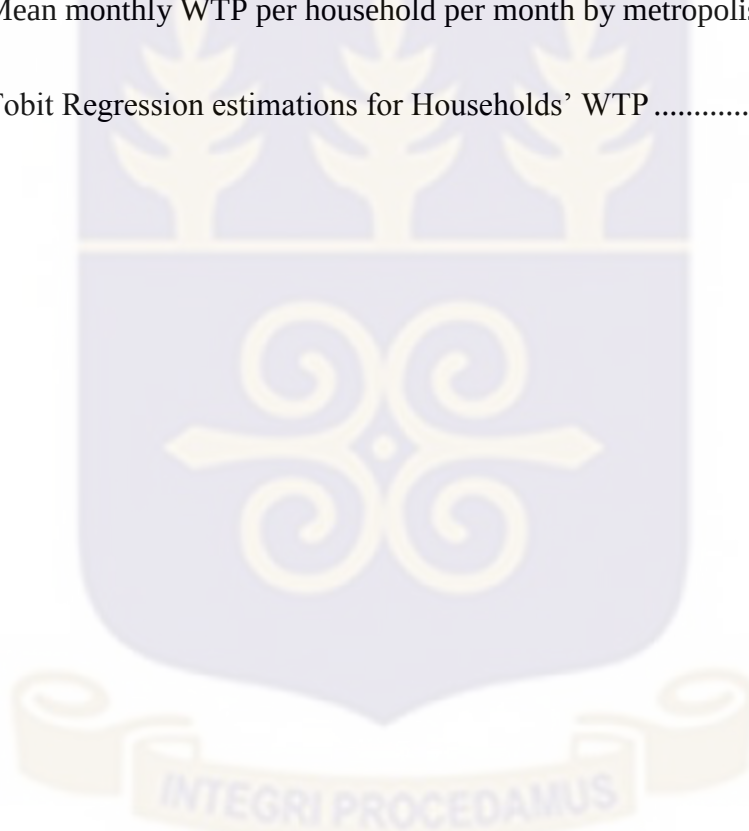
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ABSTRACT

Solid Waste Management (SWM) has become a major problem in most cities of the world. However, many developed countries have managed to overcome this challenge by instituting the Integrated and Sustainable (Solid) Waste Management (ISWM) system. This practice reduces the cost of SWM, environmental pollution and increase lifespan of landfill. On the other hand, in most developing countries including Ghana where solid waste management financing remains an unsettling problem, most tenets of ISWM has received little attention both in terms of policy and practice. On this premise, the study examine the factors that influence households' willingness-to-pay (WTP) and participation in source separation of solid waste in Accra and Tamale Metropolises in Ghana. The study employed the mixed methods in its data collection and analysis process and applied ordered probit and tobit regression models to estimate the determinants of households' source separation behaviour and WTP for improved SWM services respectively. The results reveal that the current SWM practices in the study locations stand in sharp contrast to the tenets of ISWM. The findings further reveal that policy and practice focus mainly on solid waste collection and disposal at the expense of minimizing activities that are critical to sustainable management outcomes. On the factors influencing households' WTP for improved services, as well as their participation in future source separation, socio-economic, socio-psychological and situational factors were identified as being most prominent. The study recommends the adoption and implementation of the tenets of the ISWM system that place equal importance on all the segments of the management cycle. It further calls for efficient governance structure involving all stakeholders in the SWM processes. Acknowledging the fact that the success of any SWM policy is dependent on making economic sense to service providers and beneficiaries, the study cautions against adopting one-size fit all policies.

CHAPTER ONE

INTRODUCTION

1.1 Background

Solid waste is a product of human development agenda. Globally, solid waste generation continues to increase in tandem with rapid urbanization, population growth and increasing economic growth (Wilson, *et al*, 2012; UNEP, 2015). A report by the Food and Agriculture Organization (FAO) in 2013 revealed that, the world population grew from 3.1 billion in 1960 to almost 7 billion in 2010 and is projected to reach 9 billion in 2025 from its 2015 population figure of 7.3 billion (UNEP, 2015). In the same way the world urban population also increased from its 1960 figure of 1 billion to 3.5 billion in 2010 (FAO, 2013) and estimated to reach 7.2 billion by 2025 (UNEP, 2015). According to the UNEP (2015) report about 3 billion of the projected 7.2 billion world urban population is expected to be in the middle-class with enough disposal income.

These significant increase in the world population coupled with rapid urbanization, had resulted in enormous solid waste generation which is said to have increased tenfold between 1900 (110 million tonnes) and 2008 (1.1 billion tonnes) (Hoornweg *et al.*, 2013). Currently, the global municipal solid waste (MSW) generation is estimated at about 2 billion tonnes per year and projected to reach 2.2 billion by 2025 (World Bank, 2012; UNEP, 2015). It is also reported that, almost 2 billion people in the world still lack access to solid waste collection (SWC) (UNEP, 2015). Such a situation is worrying, because there is a tendency for the projected future increase in solid waste generation to overburden the existing management system and impact on the environment negatively (Wilson, *et al*, 2012; UNEP, 2015).

Typically, cities in many developed countries have succeeded in addressing this Solid Waste Management (SWM) crisis by adopting the Integrated and Sustainable (Solid)

Waste Management (ISWM) approach, where solid waste is segregated at its source to prevent contamination and to preserve its value for recycling and recovery (Oteng-Ababio, 2014a; UNEP, 2015). This practice reduces the cost of SWM, improves cost recovery, reduces environmental pollution, conserves natural resources and improves public participation (Scheinberg *et al.*, 2010; UNEP, 2015).

Despite the benefits of source separation, most developing countries have not formally adopted the practice. They are still grappling with the “major challenges in ensuring universal access to solid waste collection services and eliminating uncontrolled disposal and burning” (UNEP, 2015:7). Cities in most developing countries are characterized with poor sanitary conditions because of lack of access to SWM services which has resulted in indiscriminate dumping of solid waste into open spaces, roadsides and beaches (Oteng-Ababio, 2011b; UNEP, 2015). While several factors have been identified for the solid waste crisis in these cities, central to these is the poor SWM practices and inadequate financial resources (Oteng-Ababio, 2010a; Ezeah and Roberts, 2012; Guerrero *et al.*, 2013). Urban solid waste collection is the most expensive cost component to SWM (UN-HABITAT, 2010). About 80-90% of the SWM budget is used to collect only 40-70% of urban solid waste, most of which are disposed in open dumps (Achankeng, 2003; UN-HABITAT, 2010; World Bank, 2012; UNEP, 2013).

Like other developing countries, Africa is experiencing rapid urbanization and population growth. A report by the United Nations (UN), (2015) stated that, the population of Africa grew from 294 million in 1960 to 1.2 billion in 2015 and projected to reach 1.7 billion by 2030. Similarly, urban population in Africa also grew from 56 million in 1960 to 409 million in 2010 and is projected to increase to 1.4 billion in 2050 (FAO, 2013). This future projected increase in urban population is expected to lead to an

increase in the quantity of solid waste generation which will further aggravate the current capacity constraints in SWM (Scheinberg *et al*, 2010; Wilson, *et al*, 2012; UNEP, 2015).

Ghana, like any other sub-Sahara Africa country, is also experiencing increasing solid waste generation with population growth, rapid urbanization, changing life style and increase economic growth (Songsore, 2003; World Bank, 2014; Owusu and Oteng-Ababio, 2015). According to the Ghana Statistical Service (2013), the total population of Ghana in 2010 was 24,658,823 (GSS, 2013), and it is projected to reach 28,511,828 in 2020. Similarly, the quantity of solid waste generated in Ghana had increased rapidly over the years due to factors such as population growth, rapid urbanization and changing lifestyles (Songsore, 2003; Owusu and Oteng-Ababio, 2015; Oteng-Ababio, 2011b; World Bank, 2014). For instance, the amount of solid waste generated daily in Accra in 1994 was 750-800 tonnes (Asomani-Boateng, 2007), it increased to 2,200 tons per day in 2010 and projected to reach 4,419 tonnes by 2030 (Oteng-Ababio, 2010a). Given the anticipated and projected population and the daily solid waste generation increase in the near future, the problems facing municipal SWM in the city is expected to exacerbate.

The existing SWM system in Ghana where solid waste is collected and disposed of without any incentive to recycle (i.e. “end-of-pipe approach”) is unsustainable. This has led to unsightly accumulation of waste, indiscriminate dumping, increase in the management cost and reduction in life-span of existing dump site or landfill (Oteng-Ababio, 2010a, 2014; Owusu *et al*, 2012). In Accra for instance, 2,200 tonnes of solid waste was produced daily in 2010 out of which about 70% -80% were collected (Oteng-Ababio, 2010a; Huober, 2010). The remaining 20-30 percent were either burned or buried or dumped on the side of roads or into drainage channels or open spaces (Ministry of Local Government and Rural Development (MLGRD), 2010b), contributing to public health problems, perennial flooding events, methane generation and leachate formation

which are sources of environmental pollutants (Oteng-Ababio, 2010a; Othman *et al.* 2013).

Proper and efficient SWM is essential to public health and environmental protection. In Ghana, 70-85 percent of out-patient cases such as malaria, diarrhea and typhoid fever reported at health facilities are related to poor environmental sanitation (MLGRD, 2010a). It has further been reported that between June 2014 and April 2015, about 28,975 cases of cholera with 243 deaths were recorded in Ghana (World Health Organization, 2015). Improper SWM has also resulted in frequent flooding in Ghana (Oteng-Ababio, 2013b). The latest devastating flooding in Accra occurred on 3rd June 2015, which claimed over 160 lives and destroyed properties worth millions of Ghanaian Cedis (The Ghanaian Times, June 10, 2015:4). Apart from public health issues and the perennial flooding associated with poor SWM, solid waste when improperly managed emits methane and other greenhouse gases that pollute the environment (UNEP, 2015). Finally, poor SWM negatively affect the “overall livability of urban dwellers, cities economic competitiveness and the resilience of urban areas” (World Bank, 2014:23). The unsightliness of solid waste reduces the attractive environment for investment and tourism which affect job creation and reduce new business opportunities for local entrepreneurs (ibid).

In an attempt to resolve the solid waste crisis, a privatization policy was initiated in early 1990s (Obirih-Opareh and Post, 2002; Oteng-Ababio, 2010a). Before the policy, local government authorities were solely responsible for municipal SWM (Post, 1999; Awortwi, 2004; Oteng-Ababio, 2010a), but due to financial and technical problems they failed to provide adequate and efficient SWM services (Obirih-Opareh and Post, 2002). This policy on Public-Private Partnership (PPP) was primarily expected to solve the SWM problems by improving service delivery and coverage, increasing cost recovery

and enhancing sustainability (Post, 1999; Post *et al.*, 2003). Unfortunately, the involvement of the private sector in the provision of solid waste services has not seen any significant improvement in environmental conditions and the quality of solid waste services provided, especially in low-income areas, even though coverage has increased by 25% (Oteng-Ababio, 2010a).

Scholars like Obiri-Opareh, (2003), Awortwi, (2003), Oteng-Ababio, (2010a), and Oduro-Kwarteng, (2011) have partly attributed the failure of the PPP policy on low cost recovery and inadequate funds. According to Oteng-Ababio, (2010a), the tardy payments and high level of indebtedness to private contractors by local government has created a vicious cycle in the SWM system. For example, as at 2014 the Accra Metropolitan Assembly (AMA) was in arrears of not less than 15 months of payment to private contractors (EPSA, 2014). Consequently, private contractors are unable to provide quality and reliable solid waste collection services to beneficiaries. Service beneficiaries on the other hand are unwilling to pay for poor SWM services. This unfortunate development led to the heap of uncollected refuse and indiscriminate dumping into drains, open spaces and forests, which resulted into serious public health and environmental hazards. By implication, it stands to reason that financing SWM has been one of the major banes of most assemblies.

Typically, SWM in Ghana has been financed through government subsidies, direct user charges and cross-subsidization. The direct user charge is based on the concept of pay-as-you-Dump (PAYD). Under this policy solid waste generators are expected to pay a fee based on the quantity (volume or weight) of solid waste discarded (Skumatz and freeman, 2006). The cross-subsidization approach on the other hand, charges residents of high-income areas more to subsidize for the poor. Under this system, users are billed monthly for SWM services regardless of the quantity of solid waste generated and are

practiced predominantly in most high and middle-income areas (Oteng-Ababio, 2010a; Oduro-Kwarteng, *et al.* 2011).

Another SWM financing mechanism which has received little attention in Ghana is formal source separation. Source separation enables city authorities to divert the high organic content of solid waste (about 67%) generated (Oteng-Ababio, 2011b) from landfill. The fact is, diverting organic and other recyclable materials from the landfill would extend its lifespan, reduce the cost of management and mitigate water pollution by reducing leachate (Oteng-Ababio, 2014a). This also has a positive impact on climate change mitigation by reducing the amount of methane, a potent greenhouse gas (Bennagen *et al.*, 2002; Oteng-Ababio, 2014a). Experiences in the country, point to the fact that, there is an urgent need to move away from the conventional practice of collection-transportation-disposal to a more sustainable system of SWM that integrates source separation, reuse, recycling and recovery. Such a system is more sustainable, economically prudent and environmentally acceptable (UNEP, 2015) for a developing country like Ghana, where sanitary landfill sites are scarce and final solid waste disposal poses a daunting challenge (Owusu *et al.*, 2012).

1.2 Problem Statement

SWM has become one of the major developmental challenges facing countries all over the world today. Generally, cities in many developed countries to a large extent have succeeded in solving this crisis by adopting an ISWM. This is a system where generated wastes undergo source separation and thus facilitating a reduction of SWM cost and environmental pollution thereby increasing the lifespan of landfill and improving public health (Oteng-Ababio, 2014a; UNEP, 2015).

However, developing countries like Ghana have to a large extent failed in providing adequate SWC and disposal services, a situation that has been attributed to a number of factors such as low cost recovery, weak enforcement of by-laws and weak human and physical capacity of the public and private sector organization (Post, 1999; Obirih-Opareh, 2003; Awortwi, 2003; Oteng-Ababio, 2007; Oduro-Kwarteng, 2011). Faced with these challenges, most city authorities are constraint to provide the needed infrastructure and resources required to keep pace with the ever-increasing amount of solid waste and the changing solid waste type (Oteng-Ababio, 2012).

This disturbing situation has prompted the government to adopt several policies and programme. In an attempt to achieve cost efficiency and better service provision the Public-Private Partnership (PPP) policy was instituted in early 1990s. Traditionally, the Waste Management Department (WMD) of district assemblies are mandated by the Local Government act (Act 462), to provide SWM services (MLGRD, 1999), but due to inadequate SWC and low cost recovery, the PPP concept was conceived (Oduro-Kwarteng, 2011). It was envisaged that the adoption of the PPP would improve revenue mobilization, quality of service and also extend the coverage of SWM services (Post, 1999; Oteng-Ababio, 2010a; Oduro-Kwarteng, 2011).

In Accra (the national capital and most urbanized city in Ghana) for instance, PPP started in 1995 on a pilot programme with five companies rendering franchise service mostly to middle to high-income area, while the assembly continues to provide services to other areas. The concept has evolved through lots of stages and transformed from the creation of a “virtual monopoly for City and Country Waste Limited (CCWL) between 1999 to 2000” (Oteng-Ababio, 2012: 44) to the current state, where collection of solid waste is fully privatized with nine contractors operating in the city. Tamale’s (medium-sized and fastest growing city in Ghana) experience with PPP dates back to 2002 when the city

awarded a franchise contract with declining subsidy to Sava Company and five other companies in 2005 (Oduro-Kwarteng, 2011). Like Accra, the PPP has gone through various stages and currently six private companies are providing waste collection services for a fee in mostly middle to high-income areas, while the assembly continues to provide fee-free collection services in low to middle-income area through the Communal Container Collection (CCC) system (Oduro-Kwarteng, 2011).

The implementation of PPP concept saw an increase in SWC coverage, but failed to improve environmental quality, especially in low-income areas because of the high indebtedness of the assembly to these private contractors (Oteng-Ababio, 2010a). As at 2008, the Accra metropolitan assembly indebtedness to private contractors was 75 billion Ghana Cedis (Oteng-Ababio, 2013a). With such huge unpaid debt, the contractor cannot provide reliable and quality service. Beneficiaries on the other hand, are unwilling-to-pay for poor services, hence the poor environmental conditions experienced in the cities.

Apart from the PPP policy, city authorities have engaged in a number of projects and programme to divert solid waste from landfill for recycling, recovery and composting. This practice, if executed well through source separation of solid waste, is envisaged to improve solid waste financing (by reducing the amount paid as tipping fees) and keep the environment clean (Oteng-Ababio, 2014a). One such attempt was the Teshie-Nungua Compost plant and the Accra Composting and Recycling Plant (ACARP) established in 1974 and 2010 respectively. Another such intervention is the National Source Waste Segregation Programme which was launched in November 2013, by the Ministry of Environment, Science, Technology and Innovation (MESTI), in collaboration with Environmental Protection Agency, Zoomlion and Jekora Ventures, (Ghana News Agency, November, 22, 2013), but was not successful because of low participation (EPA/BED, 2015). In November 2014 the National Sanitation Day (NSD) was

established and observed every first Saturday of the month to sensitize the general public in keeping their environment clean.

In addition to practical interventions, a number of policies, legislations and guidelines have been developed by regulatory Ministries, Departments and Agencies to guide the management of environmental sanitation in Ghana. The revised Environmental Sanitation Policy, 2010 was developed to provide direction for sustainable management of environmental sanitation. The Local Government Act, 1990 (Act 462), the National Environmental Policy, 1991, the Environmental Protection Agency Act 1994 (Act 490), the Landfill Guidelines and the Water Resources Commission Act, 1999 (Act 522) among others were developed to assist in managing environmental sanitation. National development policy frameworks including the Water Sector Strategic Development Plan (WSSDP) 2012–2025, the Ghana Shared Growth and Development Agenda (GSGDA I) 2010–2013, Ghana Shared Growth and Development Agenda (GSGDA II) 2014–2017, and the Medium Term National Development Policy Framework (MTDPF, 2014–2017), have all recognized the importance of environmental sanitation to poverty reduction.

In spite of these efforts and experiences, efficient SWM continues to be a major challenge in major cities in the country, and Accra and Tamale Metropolises are not exceptions. Accra, Ghana's national capital is the largest city and also serves as the administrative, political and economic hub of the country. It is wholly urbanized and highly populated with a population of 1.9 million in 2010 (GSS, 2014a). As in tandem with the growing urban population the generation of solid waste continues to increase and this has serious implications for SWM. The increasing volume and content of solid waste generation has increased the cost of SWM, which has made it difficult for

collection to keep pace with generation, thus posing serious public health and environmental hazards (Oteng-Ababio, 2010a).

Tamale, on the other hand is a medium-sized city and the Northern regional capital. It is the largest urban center in Northern Ghana, and has over the years been experiencing very rapid population increases as well as spatial expansion and economic prosperity (Fuseini, and Kemp, 2016). From a population of about 18,000 inhabitants in 1948, Tamale's population increased to 135,952 in 1984 and more than doubling to 371,351 in 2010 (GSS, 2014b). This rapid growth has brought about an unprecedented increase in solid waste generation, which has outstripped the capacity of the assembly to manage the solid waste sustainably (Kranjac-Berisavljevic and Gandaa, 2013). This has serious implications for public health and environmental protection.

In spite of the various efforts by government and its development partners in arresting the environmental sanitation problem, the country is still ranked among the dirtiest place in Africa (Blacksmith Institute, 2013). Also, government expenditure on SWM is rising but environmental sanitation has taken a nose dive (Oteng-Ababio, 2012), creating a conundrum. Most of the open spaces and roadsides are littered with refuse; gutters and drains are choked with solid waste and the beaches in Accra are littered with plastic waste. This study therefore addresses this challenge by focusing on SWM financing and its implication for sustainable SWM in Accra and Tamale Metropolises. Its argument is guided by the following key question: To what extent can households' Willingness-To-Pay (WTP) and participation in source separation of solid waste help mitigate the challenges of solid waste financing in Accra and Tamale Metropolises, Ghana?

Specifically the study asks:

- i. What are the institutional arrangements for SWM in Accra and Tamale Metropolises?
- ii. How can households' be encouraged to participate in source separation of solid waste?
- iii. Which factors will encourage households' WTP for improved solid waste services?

1.3 Research Objectives

The study examines the factors that will motivate solid waste generators to contribute to its management through participating in source separation and their WTP for efficient services. Specifically, the study seeks to:

- i. Examine the institutional arrangements for solid waste management in Accra and Tamale Metropolises.
- ii. Analyse the factors that will motivate households' participation in formal source separation of solid waste.
- iii. Examine the factors influencing households' WTP for improved solid waste services.

1.4 The Relevance of the study

Solid waste management is one of the most discussed environmental issues, especially in urban centres due to the continuous insanitary and health threatening conditions, in spite of the numerous public interventions, thus creating a 'vicious cycle' in the sector. Generally, the cost of solid waste collection and disposal in most low-income areas are

paid by the government. The low-income areas make up 70-80% of the urban population and generate over 60% of urban total solid waste (Oteng-Ababio, 2007). This places a huge financial burden on local authorities such that they are unable to provide adequate sanitary facilities to meet the ever-increasing quantities of solid waste generated as a result of increasing population. The huge financial burden on the authorities also made it almost impossible to pay private contractors on time. The tardy payment and huge indebtedness to private contractors by the assembly, affect the quality of service provided by the latter (Oteng-Ababio, 2010a). The beneficiaries on the other hand, are unwilling-to-pay for poor services. This situation has led to heaps of uncollected refuse, overflowing containers, indiscriminate dumping of solid waste into drains, open spaces and waterbodies, which has implication for public health and environmental hazard. Furthermore, the system of household SWC in Ghana does not encourage source separation of solid waste. In view of the increasing cost of SWM and the scarcity of disposal or landfill sites, there is a need to divert solid waste from landfills. This will reduce the cost and environmental impacts of SWM. For source separation to be successful it requires the active participation of householders who generate most of the solid waste in the country. Previous studies have shown that about 55-80% of municipal solid waste from developing countries is generated from households, followed by commercial or markets which generate 10-30% of municipal solid waste (Nagabooshnam, 2011, Okot-Okumu, 2012). Thus a study to examine the factors that influence households' WTP and participation in formal source separation in Accra and Tamale Metropolises in Ghana cannot be overemphasized.

The expectation is that the study will contribute to efforts geared towards improving solid waste financing in Accra and Tamale Metropolises. This is because when households' pay for SWM services and adopt source separation it will help minimize the

amount of solid wastes to disposal sites and maximize the economic benefits. Consequently, SWM financing which has been one of the major banes of city authorities would be improved substantially.

The study provides two important insights for service providers and local authorities: First, the incorporation of the service users' perspectives or preferences into the design of Municipal SWM services and fee schedules, and second, factors which will encourage households' participation in source separation of solid waste. Identifying service user's preferences, fee-schedules and factors influencing their WTP would help service providers design SWM system that meets the needs of the service beneficiaries. This will help minimize the problem of mismatch in terms of services that can be provided by service providers and what the service beneficiaries want and are willing-to-pay for. Similarly, determining the factors that encourage households' source separation behaviour would enable local authorities design source separation schemes that are convenient and meets the local conditions as well as educational campaigns that would change households' attitude towards source separation.

This study is novel in the Ghanaian context because there exist limited research if none on source separation intention in Ghana using the TPB framework. Second, empirically, socio-psychological variables are rarely used in WTP for improved SWM studies and this study fill the knowledge gap by using socio-psychological, socio-economic and situational factors in understanding households' WTP for improved SWM services.

Identification of the determinants of households' WTP and source separation behaviour is necessary to help formulate and direct policy guidelines for a country where formal source separation is virtually non-existent, and scarcity of landfill and limited funding

coupled with increasing solid waste generation have made sustainable SWM almost impossible. Ultimately, the study will contribute to achieving the sustainable development goal (SDG6) on universal access to safe water and adequate sanitation (which include efficient SWM) and support the implementation of Ghana's Water Sector Strategic Development Plan (WSSDP) 2012–2025 and other policies and plans designed to improve environmental sanitation and urban poverty.

1.5 Organization of the Study

The study has eight (8) chapters. Chapter one gives the background of the study. The study problem, research questions, objectives and relevance of the study are also described in this chapter. Chapter two reviews the existing solid waste management system in Ghana. This helps provide the contextual issues on SWM for the study. Chapter three explores the concept of waste and Integrated and Sustainable (Solid) Waste Management (ISWM). The importance of such review is to situate the study within the conceptual boundaries of ISWM. Theoretical and empirical literature on households' WTP and source separation behaviour are reviewed to identify gaps in the literature as well as the theories and methodological approach that can be adopted for the study. This chapter concludes with the conceptual framework that guides the study. The study area and methodology is laid out in chapter four. In chapter five, the institutional arrangements for SWM in Accra and Tamale Metropolises is presented while chapter six focuses on the determinants of households' source separation behaviour in the Accra and Tamale Metropolises. Chapter seven is a discussion on the determinants of households' WTP for improved SWM services. Chapter eight concludes the study; it sets out the findings of the study, recommendation for policy interventions, as well as possible areas of further research.

CHAPTER TWO

SOLID WASTE MANAGEMENT IN GHANA

2.1 Introduction

The previous chapter presents the background of the study. It also laid out the research problem, research questions and objectives. This chapter reviews the existing solid waste management (SWM) system in Ghana. Attempts are made to describe the actors within the SWM system and the existing SWM practices in Ghana to understand the nuances in the system. It further discussed the institutional and regulatory context within which the SWM system operate as well as the historical development of SWM and financing in Ghana. The chapter examined the SWM in Ghana to identify some opportunities for sustainable solution and also provides the context for exploring the institutional arrangements for SWM in the study areas.

2.2 Actors within the Solid Waste Management Service Chain

Solid waste management activities can be grouped into five functional elements: (1) solid waste generation and composition, (2) primary storage (3) collection and transportation, (4) source separation, reuse, recycle and recovery and (5) final disposal (Tchobanoglous, *et al.* 1993; Oduro-Kwarteng, 2011). At each stage different actors play different roles in order for the system to be efficient and effective. Oteng-Ababio, (2007), identified three actors within the SWM chain in Ghana and this include the consumers (i.e. households), service provider and local authorities consisting of politicians, assembly members, administrators and officials who prepare and implement policies. Households' generate solid waste, store it temporary, present it for collection and sometimes pay user fees to the service provider. Whiles the service provider is responsible for the collection and transportation of solid waste. The service provider may

be formal or informal private contractor or public organization. Solid waste generators, itinerants' buyers and recycle companies are actors involved in source separation, reuse, recycle and recovery. The private or public organizations are responsible for the final disposal of solid waste on sanitary landfill or control dump sites (Oduro-Kwarteng, 2011). The next section explores the existing SWM practices in Ghana under the functional elements.

2.3 Solid Waste Management Practices in Ghana

2.3.1 Solid Waste Generation and Composition

Solid waste generation rate and composition are dependent on population growth, level of economic development, consumption patterns and the solid waste policy kept in place to encourage solid waste prevention and minimization (Hoornweg and Bhoda-Tata 2012). According to UN-HABITAT, (2010), having accurate and consistent data on solid waste generation per capita and composition is a strong indication of proactive SWM. Apparently, that is not the case for Ghana. In Ghana since 1993, there has not been any comprehensive solid waste audit to determine the correct solid waste generation rate and composition (Oteng-Ababio, 2011b). Consequently, various sources give conflicting figures. In Accra for instance, official sources put solid waste generation rate at 0.51 kg per person, (MLGRD 1999), the World Resource Institute's (WRI) estimate is 0.41 kg/day (WRI, 2007 in Oteng-Ababio, 2013a) and the CHF International's estimate is 0.81kg/day (CHF International, 2010 in Oteng-Ababio, 2013a). Such discrepancies in figures serve as potential impediment to proper planning and are a strong indication of lack of proactive management and priority to solid waste (UN-HABITAT, 2010). In Tamale, the solid waste generation rate was estimated at 0.45kg daily per capita (Puopiel, 2010).

With regard to solid waste composition, Miezah *et al.*, (2015) observed that the solid waste stream in Ghana is dominated by organics (61%), 14% plastics, 6% inert, 5% miscellaneous, 5% paper, 3% metals, 3% glass, 1% leather and rubber, and 1% textiles. As in most developing cities, solid waste in Accra has a high putrescible organic content (65%), but also includes substantial proportions of inert materials (17%), paper and cardboard (6%), and plastic (4%). Other components are glass, metal, and textile wastes (Oteng-Ababio, 2013a). Just like Accra, the most common type of solid waste generated in Tamale and Kumasi is organic waste (Miezah *et al.* 2015).

A waste audit by Oteng-Ababio, (2011b) revealed that, there had been a gradual reduction in the proportion of organic waste from 72.6% in 1993 to 65% in 2010 and 67% in 2011. But a corresponding increase in plastics, increasing from 1.3% in 1993 to 3.5% in 2010 and 20% in 2011. The reduction in the organic component over time is attributed to the increasing use of plastics in recent times among the populace (Oteng-Ababio, 2011b). The proliferation of plastic packaging and high consumption of “pure water” packaged in plastic bags all over the country had led to this observed phenomenon. The continuous increase in plastic waste is seen as presenting another problem to SWM in the country.

2.3.2 Solid Waste Collection and Transportation

The institutional arrangement for SWC in a particular area depends on factors such as income, physical characteristics and the level of service required (Oduro-Kwarteng, 2011; Oteng-Ababio, 2010a). Principally, there are two modes of solid waste collection systems that operate in Ghana: the central communal container (CCC) and the house-to-house (HtH) system. The HtH operates predominantly in low density, middle and high-

income areas with easy access, identifiable houses and appreciable disposable income. Under this system, beneficiaries pay a monthly fee directly to the private waste contractor who picks up waste from private homes with compactor trucks for dumping (Oteng-Ababio, 2010a). The CCC system is rendered in high density, low and middle-income area with difficult access to individual homes. With this system, householders carry their solid waste free of charge to a communal container at sanitary sites where collection vehicles pick up the containers when full of solid waste. Under this system the skip containers of different sizes (7, 12, 15, or 23 cubic meters) are lifted mostly with roll-on-roll-off and multi-lift skip loading refuse collection trucks (Oteng-Ababio, 2007). Table 2.1 presents the institutional arrangement for solid waste collection.

Table 2.1: Characteristics of the Institutional Arrangement for SWC

Variables	House-to-House Collection	Communal Container Collection
Standard collection frequency	At least once a week	Daily
Dominant waste storage container	Standard plastic bins with lid	Old buckets, polythene bags
Mode of Transportation	Multi-lift trucks , open truck, three-wheeled tractor, etc	Skip loader
Mode of lifting waste	Multi-lift trucks	Skip loader
Areas of operation	High and middle-income areas	Low-income and slum
Area infrastructure characteristics	Good road network, excellent accessibility houses	Poor road network and poor accessibility
User fee	Yes	No
Type of service provider	Private sector	Public/Private sectors
Beneficiary satisfaction/appreciation	Very satisfied/clean neighbourhood	Unsatisfied/ dirty neighbourhood
Percentage of population	Between 20-30 percent	Between 70-80 percent

Source: Oteng-Ababio, (2007)

According to Oteng-Ababio, (2010a), beneficiaries of HtH system in high-income areas appear highly satisfied with the solid waste collection services than those in low and middle-income areas using the CCC system. This is because in most instances, the container provided are inadequate and emptied irregular causing it to overflow, posing public health and environmental issue.

The choice of vehicle or transportation used to collect and transport solid waste is contingent of the type of service which is also influenced by the rate of solid waste generation, density, composition, transport distance and road conditions, quality of service and residents' willingness to pay for solid waste collection services. According to Oteng-Ababio, (2011b), the most common means of transporting solid waste in Ghana are by handcarts, pushcarts and wheelbarrows used to carry solid waste over short distance. Whiles carts drawn by bullocks, horses or donkeys are used to pull larger loads. However, the high technology vehicle like skip-loaders and compaction trucks operate in more accessible area and that of the low technology ones (donkey, pushcarts etc.) operate in densely populated and inaccessible areas.

2.3.3 Solid Waste Final Disposal

Solid waste disposal infrastructure is currently underdeveloped in Ghana and the poor disposals of refuse remain a challenge for most assemblies (Oteng-Ababio, 2007). The Environmental Sanitation Policy (2010) recommends sanitary landfills for Metropolitan and Municipal Assemblies as one of the most cost-effective methods of solid waste disposal. However, AMA has no disposal site within its boundaries. This is as a result of rapid urbanization, the Not-In-My-Backyard (NIMBY) attitude of the public and scarcity of land for disposal site (Oteng-Ababio, 2014b). The current disposal sites are ordinary

waste dumps characterized by opening burning (Owusu, *et al.* 2012). Kumasi and Tamale have engineered landfill site both built with external donor support (MLGRD, 2010a).

2.3.4 Resource Recovery

Recycling of solid waste in Ghana is hindered by lack of policy drive even though it has been demonstrated that over 50% of the inorganic waste generated could be recycled. The revised Environmental Sanitation policy, (2010) prioritizes SWC and disposal at the expense of solid waste prevention, reuse, recycle and recovery. There are no concrete targets on resource recovery. In addition, there is no waste minimization Act in Ghana (Oteng-Ababio, 2011c). Consequently the system of household solid waste collection does not motivate householders' to source separate. Mixed solid wastes are usually collected for disposal (Oteng-Ababio, 2010b).

Solid waste sorting and recycling is largely in the domain of the informal sector (Oteng-Ababio, 2011c). At the household level in low-income areas, materials recovery includes the reuse of plastic bags, bottles, paper, cardboard, and cans for domestic purposes (Oteng-Ababio, 2010b). In high-income areas, recovery is carried out by domestic servants and/or wardens. Rather than reusing the materials directly, they sell them to intermediaries or commercial centres that pay for these materials. At waste dumps, scavengers are constantly searching through freshly tipped waste for items of economic value. Items recovered from waste include plastic bags, bottles, paper, cardboard and cans.

2.3.4.1. Compositing

Owing to the large organic fraction of solid waste stream in Ghana, composting has been promoted as an appropriate method for transforming this organic solid waste into a important product (Mbuligwe *et al.*, 2002). In an attempt to divert solid waste from landfill and sustainably manage the growing solid waste crisis, a compost plant was set up at Teshie-Nungua in 1979 to process part of the large volume of organic waste into manure. However, available information revealed that the compost plant is non-functional and has become a disposal site (Oteng-Ababio, 2007). The failure of this project is as a result of the high cost of managing the plant in terms of labour, maintenance and contamination of solid waste as the solid waste is not source separated before collection (Oteng-Ababio, 2011b).

2.3.4.2 Incineration

Incineration also referred to as waste-to-energy involves the conversion of waste by-products into reusable steam which is used to produce electricity through combustion, or produce reusable products such as methane, methanol, ethanol or synthetic fuels (Peavy *et al.*, 1985). In Ghana, incineration was introduced in 1929 and used until 1970 when the last one collapsed at Abofu near Achimota due to increased solid waste generation (Oteng-Ababio, 2007). Currently some health facilities and rural communities use incineration in its “crude” form.

2.4 History of SWM System and Financing in Ghana

The historical developments of SWM and its financing from colonial period to date are discussed in this section. SWM and financing has evolved over the years from sole management and financing by the central government to local governments (LGs) and

currently the involvement of private sector. SWM and its financing in the colonial and post-colonial periods was done by the central government (Oduro-Kwarteng, 2011). The Accra City Council (ACC) was established in 1898 and charged with the responsibility of providing sanitation services to residents. Systematic solid waste collection and disposal services commenced during the period and by 1925, public dustbins, emptied by two pushcarts and later, replaced with large carts drawn by mules, were introduced. Incinerators were also introduced in 1929 with the increase in population and improvement in technology (Oteng-Ababio, 2011c). After independence in 1957, the Public Works Department (PWD) was instituted to provide solid waste management services in urban and rural areas. Central government invests public funds to build and operate final disposal sites. This system was financed by the city's general budget.

In the early 1970s, the ACC introduced two systems of solid waste collection: the house-to-house (HtH) collection system which operates in the high-income areas and beneficiaries pay user fees; whilst residents in the low-income areas use the central communal container (CCC) system where they dump solid waste at no cost. The cost of SWM for residents using the CCC was paid by the assembly. By late 1970s, SWM service provision worsened in most urban centres (Awortwi, 2003). This is because the unprecedented increase in solid waste generation outpaces the capacity of the central government (CG) to manage it sustainably. The increasing solid waste generation led to the breakdown of the incinerators by 1970, leading to crude dumping into quarry pits at Aborfu, Achimota and Abeka.

The problem of poor SWM aggravated when the country experience worsened economic conditions in the early 1980s. This negatively affected the financial resources available for managing solid waste efficiently and effectively, resulting in the provision of poor SWM services (Oduro-Kwarteng, 2011). The condition attained “a crisis level in 1985”

(Benneh *et al.*, 1993:38; AMA/Colan Consult, 1995). Consequently, access to SWC service was inadequate and most people dumped their solid waste indiscriminately into drains, open spaces and water bodies.

As a result of this crisis, a waste management department (WMD) was instituted in most of the urban cities in Ghana, which include Accra, Kumasi, Tema, Takoradi, and Tamale. The WMD was resourced by the German Agency for Technical Co-operation (Deutsche Gesellschaft für Technische Zusammenarbeit GmbH-GTZ) (Oduro-Kwarteng, 2011). Consequently the provision of SWM service was improved because the WMDs were resourced to manage waste effectively. However, the service beneficiaries did not pay service charges to WMDs, and this placed huge financial burden on local governments. Overtime, the WMDs were not able to sustain and maintain the equipment and resources required for effective SWM after the end of the GTZ project. In “Accra for instance, the collection of service charges from few wealthy and medium-income neighbourhoods did not cover even half of the operational costs”(AMA/ Colan Consult, 1995:35). The high service coverage of 80%, which was as a result of the GTZ assistance fell to 45% in early 1990, because of inadequate financial resources. (AMA/Colan Consult, 1995). SWM problems became major challenge for local authorities, and the residents perceived the WMDs as not efficient and effective (Agbemabiawo, 1996; Karikari, 1999). In 1988, SWM was decentralized to local governments (Adarkwa, 2005). After which LGs established service units to provide SWC services virtually free of charge, as it was done in the past by the CG (Oduro-Kwarteng, 2011). However, the LG was not able to deliver quality solid waste services because of the rapidly increasing volume of solid waste generation due to high growth rates of urban population and changing patterns of consumption (Awortwi, 2003).

Inspired by the Public-Private Partnership (PPP) approach in the developed countries and the structural adjustment programme in the 1980s in Ghana, critics questioned the service delivery role of LGs (Oduro-Kwarteng, 2011). Based on PPP concept, in 1990 Accra and Tema started giving out franchise contracts to private waste contractors. Under the privatization model, the private sector was to invest its own money in purchasing equipment and building facilities for collecting, transporting, treating, recycling, and final disposal of wastes.

The Urban Environmental Sanitation Project (UESP) funded by World Bank and implemented in Tema, Takoradi, Kumasi, and Tamale from 1995, had at its core the involvement of the private sector in urban SWM. The project proposed that LGs provide about 60% of SWM services, while the private sector provides the remaining 40%. In addition, the LGs were expected to set realistic and economically viable tariffs to sustain recurrent cost recovery and depreciation of capital investments and to build private sector capacity through access to adequate financial resource (Oduro-Kwarteng, 2011). The change in policy from sole provision of services by LGs to franchise contract to private waste contractors requires that the LGs had to completely re-organize, reorient their management and regulatory activities and strengthen their human capabilities (Awortwi, 2003), in order to facilitate, regulate, and monitor the private sector provision of SWM services.

2.5 Legislative, Regulatory and Policy Framework for SWM

According to Oduro-Kwarteng, (2011), the local context of legal, regulatory and policy frameworks are critical for sustainable SWM in developing countries including Ghana. This section reviews the situation in Ghana to provide the context for exploring the

institutional arrangements for SWM in the study areas, which is one of the objectives of this study.

2.5.1. Institutional roles and the Legal and Regulatory Frameworks

Under the local government law 1993 (Act 462), the Central Government (CG) controls the activities of the Metropolitan, Municipal, and District Assemblies (MMDAs). The appointment of the Chief Executives to run the MMDAs is done by the CG, and the Minister for Local Government approves the Assemblies by-laws, budgets, and proposals for revenue generation or to increase existing taxes. The CG also occasionally issues directives affecting the assemblies. More importantly is the fact that the assemblies depend on the CG for funds needed for its operations. However, the MMDAs have been given the full mandate to manage solid waste in their jurisdictions. The relationship between the CG and LG has implications for SWM governance.

The LG Act 462 gives the Ministry of Local Government (MLGRD) certain mandates which include policy formulation and planning, legislation, monitoring and enforcement of SWM activities. The LG is responsible for the implementation of the policy, monitoring and enforcement of SWM activities in their jurisdiction. The LG is mandated by the LG Act 1993 (Act 462) to promulgate by- laws to oversee and regulate SWM, sanitation, cleansing and abatement of nuisance in the city (Oduro-Kwarteng, 2011). The WMD is responsible for waste collection and transportation, management of final disposal sites, repair and maintenance of waste vehicles and equipment.

In 1994, the Environmental Protection Agency (EPA) was instituted as a regulatory authority under the auspices of Ministry of Environment and Science. The EPA is responsible for setting standards and guidelines on wastes discharge, control of toxic substances and monitoring of activities of the WMDs to ensure that waste disposal meet

the minimum public and environmental safety standards (Oduro-Kwarteng, 2011). In 2002, the EPA came out with relevant documents such as the Ghana Landfill Guidelines, Guidelines for the management of Healthcare and Veterinary Waste in Ghana and the Best Practice Environmental Guidelines Series No. 3-Manual for the Preparation of District, Waste Management Plans in Ghana among others.

The “Criminal Code of Ghana, 1960 (Act 29) provides that “whoever places or permits to be placed, any refuse, or rubbish, or any offensive or otherwise unwholesome matter, on any street, yard, enclosure, or open space, except at such places as may be set apart by the local authority or health officer for that purpose commits a punishable offence” (Oduro-Kwarteng, 2011:63). This law is instituted to encourage waste generators to take responsibility for the cleaning of the streets in front of them and their premises. The laws in Ghana make it mandatory that the owner of the waste generated in the city is the Assembly, and therefore has the responsibility to collect, recycles and disposes of the solid waste. Apart from the regulatory and legislative instruments for SWM, the assemblies have model by-laws to regulate the activities of waste generators in their jurisdiction.

The National Building Regulations, 1996 (LI 1630) stipulates that a building for residential, commercial, industrial, civic or cultural use shall have a facility for refuse disposal. It further state that each household unit shall have a standardized dustbin or other receptacle approved by the Assembly for temporarily storage of refuse generated. It provides for transfer stations to be located within reach and protected from rain and the prevention of spreading, pest infestation, and scavenging activities (Oduro-Kwarteng, 2011).

The other significant legal provisions for the Assemblies to function include: Procurement Act and Assembly Tender Board regulation, By-law of the Assemblies, Environmental Protection Agency Act, 1994 (Act 490); Environmental Assessment Regulations, 1999 (LI 1652); National Building Regulations, 1996 (LI 1630); Town and Country Planning Ordinances, 1944 (Cap 84); Vaccination Ordinance Cap 76; Food and Drugs Law 305b (1992); and Mortuaries and Funeral Facilities Act, 1998 (Act 563). All these legal frameworks have provisions for sanitation and SWM and therefore require the effort of the public sector institutions to implement and enforce the laws for effective SWM. Despite all these laws in place to direct affairs in the SWM process, they seem not deterrent enough in ensuring clean, safe and healthy environment possibly due to lack of general enforcement and follow-ups. The solid waste problems come about as a result of poor implementation of polices and legal provisions.

2.5.2 The National Environmental Sanitation Policy (NESP)

According to the UN-HABITAT, (2010: 185), “a clear and transparent policy framework is key for sustainable SWM and guides the city authorities in the processes related to planning and implementation”. In Ghana, the NESP, (2010) is the current policy that guides SWM in the country. The NESP was first published in 1999 and revised in 2010 to update its contents to meet current development objectives and address aspirations of sector actors after ten years of slow implementation with very little impact (MLGRD, 2010c). The policy reflects the changing context of national and international development priorities (i.e .Ghana Poverty Reduction Strategy, Millennium Development Goals, and New Partnership for African Development-NEPAD). The overall objective of the revised policy is “to provide adequate and efficient waste management services with an effective utilization of national resources for clean and

healthy environment in Ghana. In general, the policy has proposed strategic elements under seven policy focus areas which are capacity building, information, communication and education, legislation and regulation, levels of service, sustainable financing and cost recovery, research and development, monitoring and evaluation” (MLGRD, 2010c: 12-18). The policy outlines four distinct functions to be carried out by the Assemblies with regard to SWM. These functions are the provision of SWM services, public health management services, environmental monitoring services as well as planning, monitoring and public relations. It also proposes strengthening the private sector partnership (AMA 2010c).

In an attempt to translate the measures of the objectives of the revised NESP into actionable targets and implementation packages to guide all sector actors to achieve incremental improvements over the long-term planning horizon (2008-2025), the National Environmental Sanitation Strategic Action Plan (NESSAP), Materials in Transition (MINT) was developed. On sustainable financing and cost recovery strategies it was argued that in the short term the private sector should be motivated to inject capital to improve services by providing appropriate incentives that promote investor-confidence. It also proposed the use of “polluter-pays-principle” in determining levies, fees and fines for environmental sanitation services. The policy proposes a direct cost recovery from all users and argued that in applying this concept consideration should be given to affordability, differential tariffs and cross subsidization. In a situation where full cost recovery is not possible the LG should provide subsidies. The policy indicated that user fee tariffs should be set with the full participation of the service providers and users; separate accounts should be created for environmental sanitation at the LGs and government should progressively increase budget allocations to environmental

sanitation. In addition, the policy proposes that the LGs should identify additional sources of revenues such as fees, rates, water-surtax among others.

Apart from the used of the “polluter-pays-principle” other financing strategy such as MINTing was also identified as another means of ensuring sustainable financing and cost recovery. The philosophy underlying the concept of MINTing is, “waste is a resource which is not to be discarded but value added on at various stages while in transition within the production and consumption cycles” (MLGRD, 2010a: viii). MINTing aim at changing the perception and the behaviour of the public from viewing waste as a useless material to a valuable resource that can be reuse, recycle and recovered. Even though the strategic action document NESSAP acknowledged that waste is a material in transition; unfortunately source separation is minimally practice in the country as an alternative option for financing SWM. Prioritizing source separation would reduce the amount of solid waste disposal, a situation that would put less financial constraints on LGs and service provider (Oteng-Ababio, 2014a).

Even though the seven focus areas of the revised NESP (2010) and the NESSAP which include capacity building, information, communication and education, legislation and regulation, levels of service, sustainable financing and cost recovery, research and development, monitoring and evaluation embrace every sector of the SWM chain. The weak point of revised NESP (2010) and the NESSAP is its failure to build the seven focus areas around the principles of the four Rs (i.e. reduce, reuse, recycle, recovery). This has created a situation where solid waste collection and disposal are given paramount interest at the neglect of the four Rs. This means government, local authority and donor funds will mainly go into activities such as solid waste collection and disposal as opposed to solid waste reduction, reuse, recycling, and recovery.

In addition, these documents fail to set concrete targets on various aspects of SWM, a situation that makes it difficult to evaluate the policy with regards to the policy actions and measures outlined. Furthermore, detailed plan on how to implement the MINTing concept and the lack of waste minimization Act makes it not-mandatory for solid waste generator to source separate. Hence the current practice where service providers collect mixed solid waste from their clients.

2.6 Challenges of Solid Waste Management in Ghana

Many researchers including Oteng-Ababio,(2007), Fobil *et al.*,(2008), Baabereyir, (2009) and Oduro-Kwarteng, (2011), and have elaborated on factors that militate against SWM in Ghana and classify them into rapid urbanization and high population growth, resource constraint, weak enforcement of by-laws and poor SWM governance.

2.6.1 Rapid urbanization and high population growth

Rapid urbanization which is currently happening in most urban area in Ghana has several positive impacts including economic growth but is also associated with problem of worsening solid waste situation which has implication for public health and environmental protection (Baabereyir, 2009). The growing and changing pattern of consumption among the rapidly growing urban populations has led to unprecedented solid waste generation well above the abilities of local authorities responsible for SWM (Fobil *et al.* 2008; Baabereyir, 2009). The extensive used of polythene bags and other plastic packaging have change the solid waste type and this have implication for SWM (Oteng-Ababio, 2007).

2.6.2. Resource constraints (i.e. Financial, human and equipment)

Low cost recovery and inadequate funds have led to financial constraint for local authorities and the private contractor (Oduro-Kwarteng, 2011; Obirih-Opareh and Post, 2002). Local authorities have difficulties in providing the needed solid waste infrastructure and the also meeting the continuous increase demand for SWM services because of financial constraints (Oduro-Kwarteng, 2011).

The low cost recovery is also attributed to the fact that the CCC system which accounts for 70% of total solid waste collection is virtually free of charge (Oteng-Ababio, 2007). This place huge financial burden on the authorities such that there are not able to honour their financial obligations to private contractor on time. The tardy payment by local authorities to private contractor influences their capacity to provide quality service to beneficiaries. Scholars such as Baabereyir,(2009) and Oduro-Kwarteng, (2011) have indicated that inadequate human resource and equipment for SWC are some of the challenges encountered in the SWM sector.

2.6.3 Weak enforcement of by-laws

The weak enforcement of by-laws according to Oduro-Kwarteng , (2011) encourages solid waste generators to adopt negative solid waste practices such as indiscriminate disposal of solid waste at illegal places, solid waste littering and non-payment of user fees because they have the perception that they would not be punish if they carry out such bad practices (Oteng-Ababio, 2007; Oduro-Kwarteng, 2011). Such practices worsen the solid waste disposal situation and increase the workload of SWC, transportation and disposal for the resource-constrained local authorities. Thus, weak enforcement of by-laws greatly constrains efforts to overcome the problem of SWM that currently confront the cities.

2.6.4 Poor SWM governance

The poor SWM situation in the country has also been blamed on poor SWM governance. Due to poor governance, residents, especially the poor, are usually not involved on issues that affect their solid waste practices (Baabereyir, 2009; Oteng-Ababio, 2011b). Second, the informal waste collectors are not recognized, protected and regulated in the current institutional arrangements despite their involvement in solid waste collection and resource recovery (Oteng-Ababio, 2007). According to the UN-HABITAT, (2010), service users and providers inclusivity in SWM is key for instituting strong safeguard policies and no government can achieve sustainable SWM without the active participation of the service users and providers.

2.7 Conclusion

This chapter presented a review of SWM in Ghana which looks into the actors, existing SWM practices and the institutional and regulatory context within which the SWM system functions in Ghana. The LG have the mandate and legality for sustainable SWM, which includes the implementation of policies, solid waste service provision, and they are also mandated to regulate, monitor and enforce by-laws and SWM rules. The MLGRD oversees the implementation activities of the LGs.

The review also shows that there are policy and legislative instruments for SWM including private sector participation in SWM. The revised NESP (2010) has its strength and weak points. The seven focus areas of the policy which include capacity building, information, communication and education, legislation and regulation, levels of service, sustainable financing and cost recovery, research and development, monitoring and evaluation embrace every sector of the SWM chain. It adequately creates an enabling environment that encourages access to and use of sustainable solid waste services and

this facilitates the tasks of those concerned with service provision. The weak point of the policy is its failure to build the seven focus areas around the principles of the four Rs (i.e. reduce, reuse, recycle, recovery). This has created a situation where solid waste collection and disposal are given paramount interest at the neglect of the four Rs. This means government, local authority and donor funds will mainly go into activities such as solid waste collection and disposal as opposed to solid waste reduction, reuse, recycling, and recovery.



CHAPTER THREE

LITERATURE REVIEW

3.1 Introduction

The previous chapter discussed the existing SWM in Ghana. The review shows there are institutional and regulatory arrangements for SWM in Ghana. Unfortunately the existing institutional arrangements for SWM do not encourage source separation of solid waste. In addition, there is no waste minimization Act in Ghana. The lack of policy on source separation serves as a barrier to exploring the potential of converting household solid waste into a resource. In order to overcome this barrier, actors within the SWM system should rethink of solid waste as a resource rather than a useless material to be discarded. Following from this principle, this chapter attempts to conceptualize waste as a resource as well as discuss the Integrated Sustainable (Solid) Waste Management (ISWM). The importance of such a review is to situate the study within the conceptual boundaries of ISWM system which integrates source separation, reuse, recycling and recovery. It further highlights the theoretical and empirical literature on the determinants of households' willingness to pay and source separation and recycling behaviour to identify gaps in the literature as well as methodological approaches that can be adopted for the study. Finally, the conceptual framework that guides the study is presented.

3.2 Conceptualizing Waste

McDougall *et al.*, (2008:1) argued that “waste is the by-products of human activity and contains the same material as found in the useful products but only differs from the useful products by its lack of value”. ILO, (2007:1) in Gugssa, (2012) describe wastes as “something which the original owner or user no longer values, and has been discarded or discharged by the original owner or user. According to Anschutz (1996:12) waste is any

discarded materials that do not have value any more in the eyes of the first generator or user”. According to these definitions materials turn into waste when they do not have value for the owner and no more provide the service they were intended or designed to do. Furthermore, these definitions of waste acknowledge the fact that one individual’s waste may be someone else’s potential raw material or resource. For example, an empty plastic bottle was once filled with soft-drink which was first consumed by the owner. When the plastic bottle is no longer useful to its owner, it may be given to the woman who sells local drinks or palm oil in the community. The woman may reuse it to store local drinks and the local market in used plastic bottle takes advantage of this reuse value.

Consequently, Gutberlet, (2008:6) argues that the way waste is understood and defined may influence efficient and sustainable waste management. Thus if a community see waste as a resource that could be reuse, recycle and recover then they will be willing to source separate and take advantage of the intrinsic value of that waste. Source separation when well organized and structured minimizes the amount of waste to disposal sites, maximize the economic benefits and conserve natural resources (UNEP, 2015). Hence, following Botkin and Keller, (2011), this study conceptualizes waste as a material discarded, if it has no consumer value to the owner but becomes a resource when another person picks it up and put it to use.

3.3 Classification of waste

A number of criteria are usually used to classify wastes into types. According to McDougall *et al.* (2008), waste can be classified into different attributes using its sources, physical state, material composition and the level of risk associated with waste substances (as shown in Table 3.1).

Table 3.1: Classification of waste

Criteria for waste classification	Examples of waste types
Sources or premises of generation	Residential, commercial, industrial, municipal services, building and construction, agricultural
Physical state of waste materials	Liquid, solid, gaseous, radioactive
Material composition of waste	Organic food waste, paper and card, plastic, inert, metal, glass, textile
Level of risk	Hazardous, non-hazardous

Source: Tchobanoglous, *et al.* (1993)

The source classification of waste is based on the different sectors of society that waste emanates from and these are: residential/household, commercial, industrial, municipal services, construction and demolition, processing and agricultural sources (see Table 3.2).

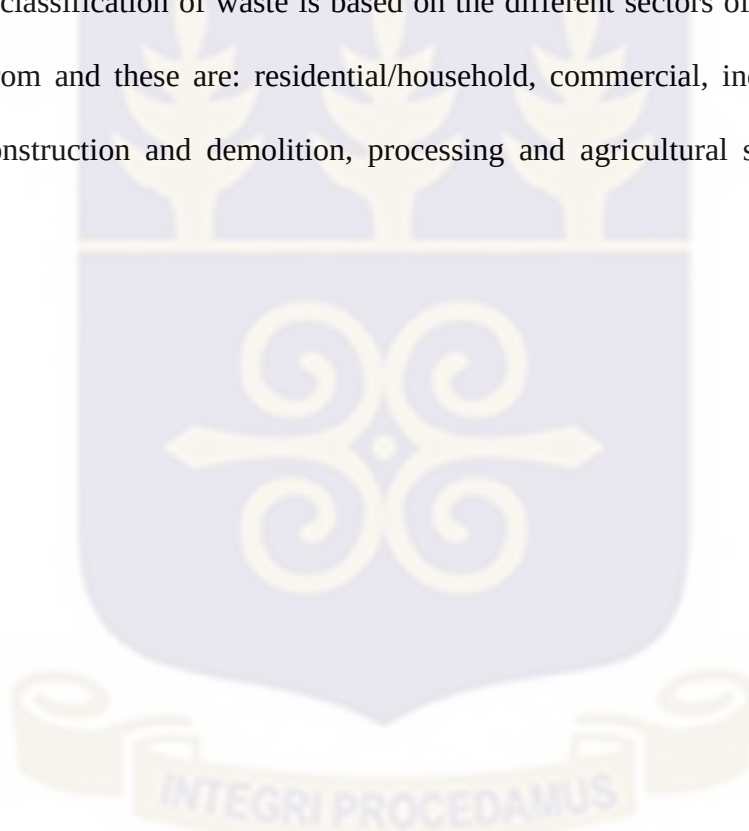


Table 3.2: Sources and Types of Municipal Solid Waste

Sources	Typical waste generators	Types of solid waste
Residential	Single and Multi family dwellings	Food wastes, paper, cardboard, plastics, textiles, glass, metals, ashes, special wastes (bulky items, consumer electronics, batteries, oil, tires) and household hazardous wastes
Commercial	Stores, hotels, restaurants, markets, office buildings	Paper, cardboard, plastics, wood, food wastes, glass, metals, special wastes, hazardous wastes
Institutional	Schools, government center, hospitals, prisons	Paper, cardboard, plastics, wood, food wastes, glass, metals, special wastes, hazardous wastes
Municipal services	Street cleaning, landscaping, parks, beaches, recreational areas	Street sweepings, landscape and tree trimmings, general wastes from parks, beaches, and other recreational areas
Construction and demolition	New construction sites, road repairs, renovation sites, demolition of buildings	Wood, steel, concrete, dirt
Process (manufacturing, etc.)	Heavy and light manufacturing, refineries, chemical plants, power plants, mineral extraction and processing	Industrial process wastes, scrap materials, off-specification products, slay, tailings
Agriculture	Crops, orchards, vineyards, dairies, feedlots, farms	Spoilt food wastes, agricultural wastes, hazardous wastes (e.g. pesticides).

Source: Tchobanoglous, *et al.* (1993)

Waste generated from residential areas are classified as residential/domestic/households waste while agricultural wastes are residues resulting from cultivation of plants and the raising of livestock. Similarly, the material composition of the waste stream is used to categorized wastes into types such as organic waste, paper and cardboard, plastic, glass, ceramics, textiles, metal and inert waste (see Table 3.3).

Table 3.3: Material classification of waste

Waste type	Examples
Paper	Newspapers, cardboards, office waste paper, magazine/glossy
Plastics	Bottles, expanded polystyrene, film plastic, other rigid plastics
Glass	Clear glass, green glass, amber glass, non-recyclable glass
Metals	Steel cans, aluminum cans, other ferrous, other aluminum
Organics	Yard waste-grass, yard waste-other, wood, textiles, diapers, fines, other organics
Inorganics	Electronics, carpets, drywall, other construction and demolition, other inorganic

Source: Tchobanoglous, *et al.* (1993)

Based on the physical state of waste substances, materials in the waste stream can also be categorized into liquid, solid, gaseous and radioactive wastes (see Table 3.4). Solid waste is described as non-liquid waste material arising from different sources (e.g. domestic, commercial, agricultural, industrial etc.).

Table 3.4: Physical State Classification of Waste

Waste type	Examples
Solid waste	Food waste, paper, plastic, metal, debris
Liquid waste	Sewage sludge, waste water from bath house and kitchens
Gaseous waste	Factory smoke, vehicle exhaust smoke, fumes from burning waste dumps
Radioactive waste	Radiation, uranium, plutonium, excess energy

Source: Tchobanoglous, *et al.* (1993)

Waste is also classified into hazardous or non-hazardous wastes depending on the potential health or pollution risk of waste materials. Hazardous wastes are those that possess properties that make them potentially harmful to human health or the environment (Tchobanoglous, *et al.* 1993). The categories of hazardous wastes include ignitable waste, corrosive waste, toxic waste and hard clinical waste (US.EPA, 2008). Non-hazardous wastes on the other hand, refer to waste that can be dealt with easily because it does not pose danger, examples include inert materials such as uncontaminated earth and excavated waste such as bricks, sand, gravel and concrete slates (Tchobanoglous, *et al.* 1993).

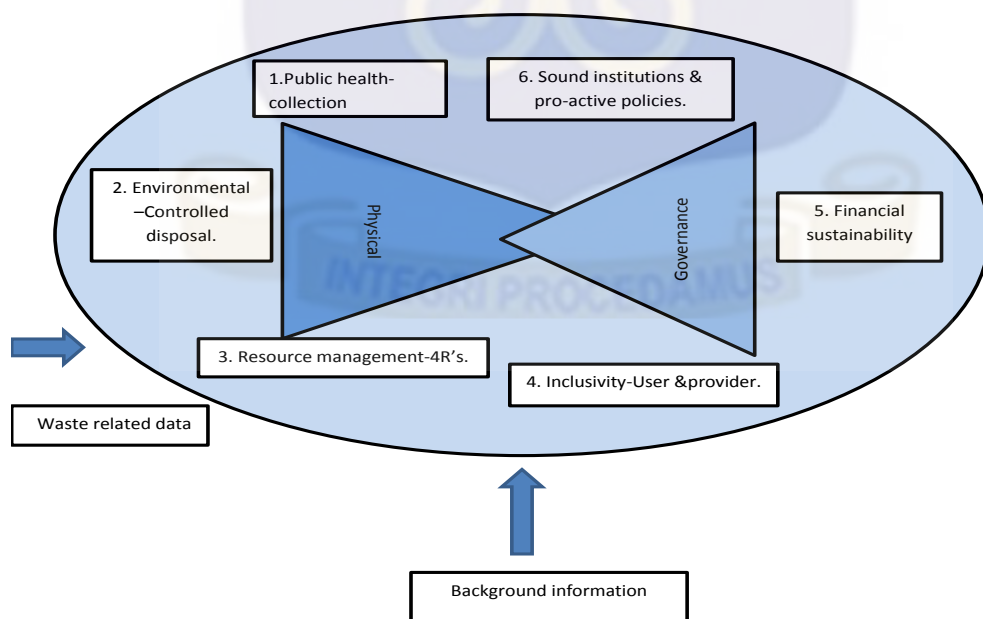
Waste materials can also be classified into biodegradable and non-biodegradable waste. Biodegradable waste is those that is generally generated from plants and animals sources and can easily be broken down by living organisms. This type of waste is commonly found in municipal solid waste (as food waste, yard waste and paper), human excreta, animal droppings and slaughterhouse waste. In contrast to biodegradable waste materials, non-biodegradable waste cannot be broken down by natural processes or living organisms, examples of which include plastics, metals and ceramics (Tchobanoglous, *et al.* 1993).

The classification of waste into types, as discussed above, is very important for waste management planning. Among other things, it provides useful information that enables waste managers/regulators and waste service provider to organize waste management operations including the frequency and means of collection, and appropriate disposal methods. For instance in developing country where a higher proportion of the waste is biodegradable it would be necessary for service providers to collect the waste frequently. This is because biodegradable waste decomposes easily and produce odour.

3.4 Integrated and Sustainable (Solid) Waste Management (ISWM)

The ISWM model is used to analyze complex and multi-dimensional systems in an integral way. Figure 3.1 below shows the simplified version of the ISWM developed by UN-HABITAT, (2010). The ISWM system is divided into two triangles, the physical elements and the governance aspects (Scheinberg, *et al.*, 2010).

Figure 3.1: The Simplified Version of the ISWM



Source: UN-HABITAT, (2010)

3.4.1 Physical aspects of ISWM

The physical element is related to the three primary drivers of SWM. Solid waste collection is driven by the commitment of local authorities to protect and improve public health and reduce sanitation related deaths and illnesses. Poor SWM has direct impact on human health and the urban environment. Inadequate solid waste collection and indiscriminate disposal of solid waste into drains, open space and water bodies causes flooding and subsequent spread of water-borne diseases. Uncollected waste clog drains and provide breeding place for mosquitoes and flies which cause malaria and diarrhoea (UN-HABITAT, 2010).

Solid waste disposal is motivated by the need to protect the environment from adverse effect of SWM. Uncontrolled dumping and burning of solid waste pollute the environment, contaminate soils and pose health threat to people who live close to the uncontrolled dump site (UNEP, 2015). In addition, poor management of landfill sites poses a serious environmental threat. For instance if methane gas and the toxic liquid produce from the decomposition of organic waste is not managed safely it can pollute water bodies, contaminate the soil and contribute to climate change (UN-HABITAT, 2010).

Lastly, solid waste prevention, reuse, recycling and recovery is driven by the resource value of solid waste and sustainable resource management. The elements of ISWM are formulated into a waste hierarchy model that places the various strategies for SWM in order of environmental friendliness, from best to worst (Tchobanoglous *et al*, 2002). Figure 3.2 shows the waste management hierarchy.

Figure 3.2: Waste Management Hierarchy.

Source: <http://morevaluelesstrash.com/wastehierarchy/>

As shown in the model (Figure. 3.2), the priority options include from top to bottom (most to least preferred respectively), waste prevention which emphasizes strict avoidance of waste, reduction/minimization, re-use of materials and products, recycling of materials, composting to produce manures, treatment (incineration with energy recovery and incineration without energy recovery), disposal in landfills (Tchobanoglous *et al*, 2002).

As a hierarchy, it suggests that the first option from environmental point of view is to prevent or minimize waste and under circumstances where further reduction is not practicable, products and materials can be reused either for the same or different purposes. It further recommends that value should be recovered from waste through recycling or composting, or through energy recovery provided the ideals of waste minimization and reuse cannot be fulfilled. Finally, only if none of these offers no appropriate solution should waste be incinerated without energy recovery, or disposed to landfill (UNEP, 2015).

The priorities of good resource management is represented by the 4Rs – reduce, reuse, recycle and recovery. The application of the 4R concept in the waste management minimizes the amount of waste that goes in to landfills. Waste reduction seeks to reduce the quantity of waste generated. Quantity reduction entails the use of smaller amounts of resources to produce the same products as a way of saving natural resources (UN-HABITAT, 2010). Reuse means using a product more than once in its original form than throwing it away. Possible reduction at the consumption level includes reuse of containers and cutting down the use of disposable products and packaging. Recycling is the process of transforming or reprocessing materials that served the original function into new products otherwise is considered as waste. Materials commonly recycled are glass, plastic, metals and electronic waste (van de Klundert and Anschutz, 1999). Composting is the biological decomposition of organic waste into compost under aerobic condition (Gugssa, 2012). The concept promotes the collaboration between waste generators, collectors, processors and manufacturers, and reduces the amount of waste that is disposed. As a result, the amount of environmental deterioration is reduced, emissions from landfills are minimized and natural resources and energy is saved (UNEP, 2015).

The concept of 4R's could be adopted successfully when waste is separated into different fraction. The extent of source separation is an important aspect that determines the level of resource recovery activities (UNEP, 2015). According to the UNEP, (2005) source separation of solid waste is defined as the setting aside of compostable and recyclable material from the waste stream before they are collected with other solid waste, to facilitate reuse, recycling, and composting.

3.4.2 Governance aspects

The second triangle focuses on the ‘softer’ aspects of ISWM. This consists of governance strategies employed to deliver a well-functioning system. Three interrelated factors under the framework of good waste governance are discussed under this component. These are:

- i. Inclusivity, providing transparent spaces for stakeholders to contribute as users, providers and enablers;
- ii. Financial sustainability: requiring the system to be cost effective, affordable and well financed and
- iii. Sound institutions and proactive policies, including both the national policy framework and local institutions.

3.4.2.1 Inclusivity

Studies have revealed that for a SWM system to be sustainable all the stakeholders including national governments, local governments, waste generators/service users and service providers (whether public or private sector, formal or informal) should be recognized and included in the SWM system (UN-HABITAT, 2010; UNEP, 2015). User inclusivity’ refers to the active involvement of householders, waste generators and other system users in SWM system. It also includes equity in service provision and proposes that all solid waste generators either poor or rich need to have their solid waste collected regularly and reliably and disposed of safely. Scholars including Oteng-Ababio, (2007) and Oduro-kwarteng, (2011) have indicated that for service provisions to have higher chance of success the service user should be consulted and involved in decision-making, planning and implementation. For instance in determining service user fees and siting of sanitary sites the service user must be involved, in order for it to be sustainable.

Provider inclusivity on the other hand, refers to the degree to which service providers (including public or private, formal or informal) are included in the planning and implementation of solid waste activities (UNEP, 2015). For a good SWM governance system all service providers must be recognized and given equal economic opportunities. Oteng-Ababio, (2011a) argued that in Ghana the informal waste collector collect and recover a significant proportion of the solid waste generated in the country but there are not recognized or protected or supervised by the city authorities. This he argued is a sign of weak SWM governance.

3.4.2.2 Financial Sustainability

Financial sustainability of SWM is one of the major banes of most local authorities in developing countries. A report by the World Bank and USAID indicated that, local authorities in developing countries spend 20–50% of their municipal budget on SWM, but serve less than 50% of the population (Henry *et al.*, 2006; Memon, 2010).

To achieve financial sustainability it is critical that financial monitoring and continuous analyses of financial data are conducted to understand the financial flows and to react timely when financial sustainability is threatened (Lohri *et al.*, 2014; UNEP, 2015). Unfortunately these activities are rarely practiced and local authorities scarcely know the actual cost of SWM in most developing countries (Bartone *et al.*, 1990; Wilson *et al.*, 2012). According to Zurbrugg *et al.*, (2007), this bad practice serves as a barrier for sustaining any envisaged improvement of the SWM system.

Many scholars including Memon, (2010), Wilson *et al.*, (2012) and Lohri *et al.*, (2014) have argued that the cost of SWM had increased continuously while revenue streams are not able to match the gap, because the financing of SWM is mostly financed through public funds and direct user fees paid by service beneficiaries. Depending on user

charges to cover full service costs may in many contexts result in user charges that are not affordable for the majority of the population (Lohri *et al.*, 2014). Therefore, different strategies that can be used to improve cost recovery in the SWM should be considered, including “cross-subsidization”, “polluter-pay-principle” and revenue from sale of recyclable materials (Wilson *et al.*, 2012; Lohri *et al.*, 2014; UNEP, 2015). In the case of cross-subsidization, some of the cost is covered by affluent waste generators and other directly by the local authorities, (obtained through property and income taxes) rather than through fixed tariffs. This option, ensure that certain urban poor who cannot afford the user fee, are serviced by solid waste collection and thus reflects a social equity in service delivery (Lohri *et al.*, 2014). For the polluter-pay-principle, those who generate more solid waste pay more, but Lohri *et al.*, (2014) propose that the tariff should be integrated with utility bill rather than directly measuring solid waste generation. Finally, solid waste can be source separated to minimize solid waste disposal and maximize economic benefits through reduction in SWM cost and generation of revenue from the sale of recyclable materials. However, the implementation of these financial mechanisms is highly political and thus need strong political will (UNEP, 2015). Lohri *et al.*, (2014), argued that a SWM system where diversified financial mechanisms are adopted can help to ensure financial sustainability.

3.4.2.3 Sound institutions and proactive policies

Political commitment and ownership of the problem of SWM by local authorities is of paramount importance for sustainable SWM (UN-HABITAT, 2010). For instance, gathering accurate information on SWM system is a sign of commitment. However, if the existing data is outdated or inconsistent it indicates a lack of proactive management and priority to solid waste.

An efficient SWM system requires that there is sound institutional coherence where a single organization is responsible and accountable for the performance of SWM system as a whole (UNEP, 2015). When one organization is responsible for SWM, there is more coherence than when functions are fragmented across different organizations so that no one is held accountable (UN-HABITAT, 2010).

Issues on proactive policy examine the existence of clear policy frameworks related to sustainable SWM. Having policies that concentrate on solid waste collection and disposal, at the expense of source separation does not augur well for sustainable SWM (UNEP, 2015). This is because, policy on waste minimization encourage source separation which helps to minimize solid waste disposal and maximize economic benefits, and makes the SWM system sustainable (Oteng-Ababio, 2007).

The concept of 'Integrated' refers to a system that uses a range of inter-related collection and treatment options at different habitat scales (households, neighbourhood, city) and involves all stakeholders and takes into account interactions between the waste and other urban management systems (UNEP, 2015). Integrating waste management with other urban systems such as drainage and agriculture is vital because compost made from organic waste can be applied in agriculture and proper waste collection system can prevent the dumping of waste into drainage thereby improving the drainage system in the city.

Similarly the 'sustainable' concept describe a system that is appropriate to the local conditions in which it operates from technical, social, economic, financial, institutional and environmental perspective and is capable of maintaining itself over a long time without reducing the resources it needs (UN-HABITAT, 2010). In general sustainable waste management has three objectives and these are: reducing the amount of waste

generated, managing waste sustainably (by minimizing the environmental burden, minimizing the economic cost and maximizing the social acceptability), and the last objective is considering waste as a resource (UNEP, 2015). Sustainable SWM can be regarded as an approach to SWM that, in addition to protecting human health and the environment, ensures that the limited resources are conserved for both present and future generation of humanity (Girling, 2005).

3.5 Environmental Valuation Methods

Solid waste is an “impure public good” that is “neither a private good (resource) nor a public ‘bad’ (a burden) and has elements of both” (UNEP, 2015:217). The “impure public good” nature of solid waste makes it difficult to control access and if resident fail to manage their solid waste responsibly, they may escape some costs but will cause harm to their neighbours and to society as a whole (UNEP, 2015). For instance a householder who dump solid waste indiscriminately into open space or burn his/her solid waste, may avoid paying for the solid waste service, but the public health and environmental impacts affect everyone in the area and the whole society. Thus solid waste does not have market values like other private service like electricity where people have separate meters and can be disconnected if users do not pay without impacting on others.

For such a situation environmental economists have identified various methods to estimate the non-market values of the environment and this can be categorized as revealed and stated preference methods depending on whether they are based on existing markets or constructed hypothetical markets (Kolstad, 2000; Alpízar *et al.*, 2001).

Valuations based on revealed preferences are derived from prices paid for goods or services (i.e. real monetary exchanges in a market place that reveal the preferences of buyers); hence, they only measure use values (Boyle 2003). For instance the price of a

house in a clean environment may be higher than the price of the same house in a dirty environment, thus the difference in price may be function of the clean environment. Under revealed preference methods there are many techniques use, which include Travel Cost Methods (TCM), Hedonic Pricing Method (HPM), Defensive or Averting Behavior, Cost of Illness and among others.

The hedonic pricing method is used to estimate economic values for environmental services that directly affect market prices. It is most often applied to variations in housing prices that reflect the value of local environmental attributes (Kolstad, 2000). The basis of the hedonic pricing method is that the price of a marketed good is a function of its characteristics.

The travel cost method is used to estimate the value of recreational benefits derived from ecosystems (Kolstad, 2000). It assumes the value of the site, or its recreational services, is a function of peoples' WTP to get to the site. It uses actual behaviour (revealed choices) to infer values. The basis of the travel cost method is that time and travel expenses incurred by visitors is the "price" of accessing the site. Their willingness to pay to visit the site can be estimated using the number of trips made at different travel costs (analogous to estimating their WTP for marketed goods based on the quantity demanded at different prices).

Stated preference techniques are characterized by the use of surveys which estimate individual preferences, by directly asking individuals about their preferences (Carson and Hanemann, 2005). This technique asks people to directly state their values rather than inferring values from actual choices. The stated preference method includes contingent valuation method (CVM) and choice modeling (Adamowicz, *et al.* 1994).

CVM is the most popular method in a family of alternative stated-preference techniques, known as “Choice Modeling” or “Conjoint Analysis”. One of the reasons for CVM’s rise in popularity is its capacity to measure both passive use and existence values of environmental goods (Carson and Hanemann, 2005). These values are not as easily captured using other prominent environmental goods/service valuation methods.

CVM is a direct survey method use to estimate consumer preferences. Using an appropriately designed questionnaire, a hypothetical market is described where a good or service in question can be traded. This hypothetical market defines the good itself, the institutional context in which it would be provided, and the way it would be financed. Respondents are then asked to express their maximum willingness to pay (WTP) or minimum willingness to accept for a hypothetical change in the level of provision of the good (Carson and Hanemann, 2005).

Several elicitation formats are used to perform contingent valuation method and these includes: open-ended method, payment card method, iterative bidding games, closed ended referendum and dichotomous choice method. The open-ended format ask respondents to state their maximum WTP while with the payment card method, respondents are presented a range of values on a card and are required to select one . For the iterative bidding games approach the respondents are given a starting bid then progressively higher bids until the mutually agreed final bid (Whittington, *et al.*, 1990). The referendum type format, the respondents are provided a single amount and asked to accept or reject the offer (Carson and Hanemann, 2005). Dichotomous choice method could either be single or double-bounded. Single-bounded dichotomous choice is an elicitation format that asks an individual if he/she will be willing-to-accept a certain specific amount for a good or service. On the other hand, double-bounded dichotomous choice format asks the same question as the preceding format, but is combined with the

bidding game format. It elicits an additional question that would bid a higher or lower amount for a good or service depending on the first answer (Pearce *et al.*, 2006).

The dichotomous choice approach mimics behaviour in regular markets especially in Western countries, where people usually purchase or decline to purchase a good at the posted price (Hoehn and Randall, 1987; Carson and Hanemann, 2005). In developing countries like Ghana even regular markets are characterized by strong bargaining processes by both sellers and consumers to get an appropriate price of a good. The dichotomous choice approach therefore, may not give a true WTP value in this case, unless a discrete choice format with a lot of follow-ups which can mimic the bargaining process is used.

The major biases of CVM are hypothetical bias, embedding effect bias, strategic bias, bid vehicle bias, information bias, starting point bias and compliance bias (Carson and Hanemann, 2005). Hypothetical bias may arise because the valuation situation is hypothetical. Strategic bias is also called the free rider effect and this occurs when respondents over or under state their WTP to influence survey results in their favour. In information bias, the type of information given to respondents and the emphasis and the sequence of the information given may influence the answers they give (Carson and Hanemann, 2005). The initial bid value in a bidding game may influence the respondents' valuation in the case of starting point bias. The valuation would be biased downwards if the starting point is low, and upwards if high. Vehicle bias arises if respondents are sensitive to the vehicle of payment such as taxes and fees. Blumenschein *et al.*, (2008) demonstrated an embedding effect bias in which the WTP for goods varies depending on whether it is on its own or as part of a more inclusive category.

Despite these biases that are associated with the stated preference methods, there is substantial evidence that answers to carefully designed surveys contain at least some reliable information (Carson and Hanemann, 2005). When the hypothetical and actual WTP measures are compared, the relationship has generally been close (Bateman et al., 2002). It has been found that the accepted possible bias can be avoided mostly by using appropriate survey method design. Bateman et al., (2002) specifies a series of guidelines that should be used to produce reliable estimates. It is argued that the issues of embedding and strategic biases which are problems in CVM are eliminated by choice modeling method.

The Choice modeling like any other stated preference techniques is used to estimate use and non-use economic values for non-market environmental goods and services (Holmes and Adamowicz, 2003). It has its origin in conjoint analysis. Choice modeling (CM) is a group of survey-based methodologies use for modeling preferences for environmental goods and services. In this method, the goods are described in terms of their attributes and the levels that they take. Respondents are presented with various alternative descriptions of a good, differentiated by their attributes and levels, and are asked to rank the various alternatives, to rate them or to choose their most preferred. By including price/cost as one of the attributes of the good, the WTP is indirectly determined from people's ranking, ratings and choices. These different ways of measuring preferences correspond to the different variants of the CM approach.

The four main variants are: choice experiments (CE), contingent ranking, contingent rating and paired comparisons. In a choice experiment respondents are asked to choose their most preferred while's contingent ranking, respondents are required to rank a set of alternative options. On the other hand, contingent rating method asked respondents to rate the various alternatives presented to them on a semantic or numeric scale. The paired

comparison method asked respondents to choose their preferred alternative out of a set of two choices and to indicate the strength of their preference in a numeric or semantic scale.

Choice modeling approaches possess some advantages relative to the contingent valuation technique. The CM techniques have the unique flexibility to evaluate both alternative management options and the marginal values of nonmarket attributes that may be difficult to identify using a typical CVM study because of lack of variation. With CE, it is possible to estimate the value of the individual attributes that make up the environmental goods, such as increased solid waste collection frequency and solid waste separation at source. The CE is also able to derive estimates of the value of changes in the aggregate level of non-market goods quality. It also provides a richer description of the attribute trade-offs that individuals are willing to pay, it avoids compliance bias or “yeah saying” problem of dichotomous choice surveys, and helps avoid the potential “embedding problem” present in CVM (Loomis *et al.*, 2000).

Experience with choice modelling in environmental contexts, particularly in solid waste management studies is limited, despite its extensive usage in the fields of transport and marketing. The CM approach has with it several problems. As reported by Loomis *et al.*, (2000) the main weakness of CM relative to CVM is with the cognitive difficulty associated with multiple complex choices or rankings between bundles with many attributes and levels. This can lead to increased random errors, irrational choices, inconsistent responses and statistical problems. Secondly the severe cognitive burden placed upon respondents induces satisficing rather than maximizing behavioural pattern.

In summary the revealed preference techniques can estimate only use values and that of the stated preference approach can estimate both use and non-use value. Since the study

aims at examining households' WTP for improved waste services the stated preference approach would be appropriate. The study employed the CVM method because it the most used stated preference method and unlike the CM does not place huge cognitive burden on the respondents.

3.6 Theoretical and Empirical Literature

3.6.1 Determinants of WTP for Improved SWM Services.

Studies on households' willingness to pay (WTP) for improved SWM services have been mainly investigated using the neoclassical consumer theory which is a microeconomic perspective of the rational choice theory (Turaga, *et al.*, 2010). The basic assumptions of the rational choice theory is that individual decision-makers are rational, selfish and isolated utility maximizing agent who make decisions based on information available to them (Ben-Akiva and Lerman 1991). Under such assumptions, economic agents make decisions by considering all relevant information and by calculating the cost and benefits and choose the option that gives the highest expected net benefit. In addition, the assumptions underlying the theory also implied that no consideration is given to the consequences of decisions on other people's welfare (Turaga, *et al.*, 2010). However, actual individual behaviour deviates from these assumptions. Indeed, economic agents are limited in their capacity of elaborating information; they are systematically biased in their behaviour and tend to misrepresent risks and opportunities (Loewenstein, 2000).

Like any rational choice theory, the neoclassical consumer theory assumes that individual make rational decisions based on perfect information (Ben-Akiva and Lerman 1991). However in economic terms, it is assumed that economic agents are autonomous; and are economically separate because of their personal property; and makes decisions based on their budget constraints (i.e. disposable income and price of goods and services)

(Ben-Akiva and Lerman 1991). The implication of this assumption is that households' demand for improved SWM services are affected by their socio-economic characteristics such as income, education, age, occupation among others (Anaman and Jair, 2001).

Previous studies have shown that household socio-economic factors such as income, education, age, gender, household size, occupation type, tenancy status among others influenced their WTP for improved SWM services. Gender was found to be a significant determinant of households' WTP by Oteng-Ababio, (2010b) and Alhassan and Mohammed, (2013) in Ghana; Hagos *et al.*, (2012) in Ethiopia and Ojok *et al.*, (2012) in Uganda. They argued that females were willing to pay more than males because traditional women are responsible for domestic waste management and thus keener towards the payment of SWM bill. However, other studies by Banga *et al.*, (2011), and Sumukwo *et al.*, (2012) argued that there is no relation between WTP and gender. Age is another variable reported to influence households' WTP by Rahji and Oloruntoba, (2009), Afroz and Masud, (2011) and Amfo-Otu *et al.*, (2012). Amfo-Otu *et al.*, (2012) indicated that older people in Ghana are not willing-to-pay more for improved SWM than younger people because they are accustomed to free solid waste collection services and may consider solid waste collection as government responsibility. In contrast, Hagos *et al.*, (2012) found no relation between WTP and age.

The relationship between income and education and WTP is consistent. Congruent to general expectation studies in developing countries found income to have statistically significant relation with WTP by Oteng-Ababio, (2010b), Afroz and Masud, (2011), Ojok *et al.*, (2012) and Alhassan and Mohammed, (2013). Afroz and Masud, (2011) argued that the educated are willing to pay more for improved SWM because education accord them the opportunity to acquire adequate information on the economic, social and environmental benefits of SWM. Alhassan and Mohammed, (2013), also observed that

the highly educated households' are willingly to pay more for improved SWM because they have easy access to modern form of accessing information on proper SWM. Income of household was also observed to have statistically significant correlation with households' WTP in studies by Oteng-Ababio, (2010b), Afroz and Masud, (2011), Ojok *et al.*, (2012) and Alhassan and Mohammed, (2013). Ojok *et al.*, (2012), argued that the affluent are willing to pay more for improved SWM services than the poor because they have greater ability to pay, while Afroz and Masud, (2011), argued that the rich consume more goods and thus generate more solid waste. This increases their demand for improved SWM. Alhassan and Mohammed, (2013), also argued that the affluence is more likely to have busy schedules and thus attach a high opportunity cost to time spent managing solid waste. Thus they will be willing-to-pay more to receive improved SWM services. The variable household size was found to have positive relationship with WTP by Ojok *et al.*, (2012), who argued that larger households are more likely to generate larger volume of solid waste than smaller households, hence the higher demand for improved SWM service. In contrast Alhassan and Mohammed, (2013) found an inverse relation with household size and WTP. Oteng-Ababio, (2010b), Banga *et al.*, (2011) and Hagos *et al.*, (2012) reported no statistically significant relationship between household size and WTP. Ojok *et al.*, (2012) found a positive relationship between WTP and marital status, and argued that married people are more likely to pay more because they are likely to have larger family size and thus face higher risks than those not married. Midaba, (2009) observed no link between marital status and WTP.

The relation between tenancy status and occupation type was also found to have a positive relationship with households' WTP by Rahji and Oloruntoba, (2009), Oteng-Ababio, (2010b) and Banga *et al.*, (2011). Oteng-Ababio, (2010b) reported that those in formal employment are more likely to pay for improved waste service than those in the

informal sector because the former earned monthly income which coincide with the current monthly billing system. Oteng-Ababio, (2010b) argued that households who live in their own house favour improvements in SWM services than those who live in rented houses because in Ghana landlords are held responsible for unclean house not tenants.

Other situational factors such as type of service provider, frequency of collection, walking time to public dump site and level of satisfaction of current solid waste disposal services had been observed to influence households' WTP for improved solid waste collection service. Alhassan and Mohammed, (2013) reported that respondents who spend much time walking to dump their wastes are more willing to pay for improved waste collection services. Oteng-Ababio, (2010b) found that resident serviced by private service operators was more WTP for SWM than their counterparts serviced by the public sector because public operators are perceived to be inefficient. In contrast, Midaba, (2009) found no relationship between WTP and type of service provider.

The neoclassical consumer model has been an important model for explaining households' WTP for improved SWM, but it has certain weaknesses. For instance it does not take into consideration the socio-psychological factors underlying an individual's preferences and demands (Hyytiä and Kola, 2006). However, these factors actually change the preference stability assumption and challenge at its core the neoclassical assumption that people are basically choosing the bundle that best suits their need given the budget constraint. Indeed, the economic act of choosing one bundles over another may not be motivated only by the budget constraint, but also by individual attitude to the behaviour and social norms to which they adapt their behaviour (Hyytiä and Kola, 2006). Accordingly, the theoretical base for this study was reinforced with Ajzen's (1991) Theory of Planned Behaviour (TPB). This theory help explain how attitudes, subjective

norm and perceived behavioural control predict households' WTP for improved SWM services.

The TPB, (Ajzen, 1991) is a social psychological variant of the general rational choice approach (Bamberg, 2012). It is one of the most well established psychological models of individual decision making. Proponents of the TPB hypothesized that an individual behaviour is directly influenced by his/her intention. Generally, a stronger intention to perform behaviour is associated with a higher chance of its performance and vice versa. Intention in turn, is influenced by individual attitude towards the behaviour, subjective norm, and perceived behaviour control. Attitude refers to an individual's evaluation that performing certain behaviour would yield positive or negative outcomes. Subjective norm reflects how social pressure influence individuals' to perform an action or otherwise. Usually the perception that influential people, opinion leaders and other important people may approve or disapprove an action determines the final decision of individuals. Perceived behaviour control reflects the individual's perception of the ease or difficulty with which the individual can perform behaviour. Empirically, these variables (attitude and subjective norms) are rarely used in WTP for improved SWM studies. Afroz and Masud, (2011) argued that concern about waste management among Malaysian influence the amount households' are WTP for improved waste service.

From the above literature review, most of the studies focused on households' socio-economic characteristics with just a few using internal variables such as attitude. It thus appears to be overconcentration of attention on external variables such as education, income among others, rather than internal variables like personal attitudes and beliefs, as emphasized in social psychology. So far the effect of internal factors on WTP is weakly understood and has not received enough attention in the literature. This study intends to

fill this research gap by adopting the neoclassical consumer theory and TPB (Ajzen, 1991) to examine the factors that influence households' WTP for improved solid waste services.

Second, these theories are developed and apply in developed countries which exhibit individualist culture, therefore it provides an interesting comparison against a typically collectivist culture encountered when investigating a developing country such as Ghana.

3.6.2 Determinants of Households' Source separation/recycling behaviour

The determinants of households' recycling and source separation behaviour have been extensively studied. Recent studies by Barr *et al.*, (2005), Knussen *et al.* (2004), Kollmuss and Agyeman, (2002), Karim Ghani *et al.*, (2013), Davies *et al.*, (2006), Tonglet *et al.*, (2004) and Echegaray and Hansstein, (2016) employed the Theory of Planned Behaviour (TPB) developed by Ajzen, (1991) to examine the factors that affect households' source separation and recycling behaviour. As described previously, the TPB hypothesized that an individual behaviour is directly influenced by his/her intention. Intention in turn, is influenced by individual attitude towards the behaviour, subjective norm, and perceived behaviour control.

On the effect of attitude on source separation and recycling behaviour, Kollmuss and Agyeman, (2002) and Barr *et al.*, (2003) found a positive relationship between attitude and recycling behaviour. Barr *et al.*, (2003), argued that residents in UK with stronger attitude towards recycling are likely to undertake recycling activities because they are more likely to be informed on the importance of recycling. Nigbur *et al.* (2010) in a study of curbside recycling in the UK, found that attitude predicted the intention to recycle, which, in turn, predicted recycling behavior. Tonglet *et al.*, (2004) studied the

determinants of participation in a kerbside recycling scheme in UK and found that attitude led to recycling behaviour but conditioned by having the appropriate opportunities, facilities and knowledge. On the other hand, Davies *et al.*, (2006) studied recycling behaviour in West Oxfordshire, and contrary to the theoretical expectation they found attitude to be insignificant.

Past empirical studies have reported mixed findings about the role of subjective norms on individual's recycling behaviour. Barr *et al.*, (2001) and Knussen and Yule, (2008) indicated that subjective norm has effect on households' recycling behaviour but in contrast other scholars including Knussen *et al.* (2004), Tonglet *et al.* (2004) and Hage *et al.* (2009) do not found social influence to be significant in explaining recycling behaviour. Perceived behaviour control has been reported to influence recycling and source separation behaviour. Mahmud and Osman (2010) found perceived behavioural control to be the strongest predictor of intentional behaviour. Similarly, Bortoleto *et al.* (2012) concluded that perceived behavioural control is the main predictors of household waste prevention behaviour.

Despite the extensive use of the TPB in analyzing recycling and source separation behaviour, several studies have recommended the addition of more variables to improve the predictive validity of the TPB (Boldero, 1995; Davies, *et.al.*, 2002; Tonglet, *et.al.*, 2004). Based on this argument several factors have been used to examine households' source separation behaviour and can be classified into the socio-economic characteristics (education, income, age, sex, family size,) and situational factors such as information and the inconvenience of source separation in terms of time and space. The role of information in source separation and recycling behaviour has been acknowledged by Vining and Ebreo (1992), Gamba and Oskamp, (1994) and Hornik *et al.*, (1995) among

others. Hornik *et al.*, (1995) reported that information on source separation issues increase households' awareness which motivate them to adopt source separation.

On gender, Vicente and Reis (2007) argued that women in Portugal bore a greater burden of recycling tasks than men in a household, while Ekere *et al.*, (2009) reported that women in Uganda are usually associated with recycling tasks because they traditionally played a greater role in domestic tasks. Saphores *et al.* (2006) also found women to be more willing to recycle electronic waste at drop-off centers in the state of California. However, other studies by do Valle *et al.*, (2004), Hage *et al.*, (2009) and Knussen and Yule, (2008) found no link between gender and recycling. Scholars including Barr *et al.*, (2003), Saphores *et al.* (2006) and Hage and Soderholm, (2008) observed statistically significant relationship between waste recycling behaviour and educational attainment. They argued that well-educated people are more aware of recycling and source separation issues because they are more exposed. Saphores *et al.* (2006) revealed that higher education increases the willingness to recycle in California, but Meneses and Palacio, (2005) reported that education has no significant effect on recycling. Other studies found age to be a significant factor influencing recycling involvement. Martin *et al.*, (2005), Barr and Gilg, (2005) and Saphores *et al.*, (2006) indicated that older people are more willing to recycle because they have time.

The effect of income on source separation and recycling behaviour has been extensively studied. Williams and Kelly, (2003), Berglund, (2006) and Martin *et al.*, (2005) observed that the rich are more likely to source separate compared to the poor. This is because they are more likely to be educated and thus tends to appreciate the social, economic and environmental benefits of recycling. In contrast, a study of income elasticity by Hage and Soderholm, (2008), revealed a negative relationship between income level and recycling

behaviour. They reported that the rich are less likely to recycle because of their busy schedules.

Dwelling, household size and population density have been identified to influence source separation and recycling behaviour. Barr *et al.*, (2001), Hage *et al.*, (2009) and Hage and Soderholm, (2008) found householders living in private housing (single-family dwelling) to recycle more than those who live in multiple-family apartment dwellings due to space availability. Household size has been found to affect waste separation and recycling behaviour positively by Ojeda- Benítez *et al.*, (2008). They argued that larger households with higher number of family member tend to have higher recycling rates.

Previous studies have reported a statistically significant relationship between waste separation and recycling behaviour of householders and convenience of waste separation/recycling scheme. Domina and Koch (2002) in their study of textile recycling behaviour reported that convenience is an important driver of recycling behaviour. Saphores *et al.* (2006) study households' willingness to recycle electronic waste at drop-off centers and observed that convenience factors such as proximity to the drop-off center increased recycling because residents do not need to travel through a longer distance to use the facility. Gonzalez-Torre *et.al.*(2003) examined selective waste collection systems that are frequently used in Europe and America and conclude that a system that requires less time and effort to dispose and separate waste result in a higher recycling rate. Karim Ghani *et al.* (2013) concluded that situational factors such as easy access to facilities and the opportunity to source separate significantly influenced waste separation intentions. A study by Ekere *et al.* (2009) revealed that urban respondents in Uganda are less likely to sort compared with their peri-urban counterparts because of lack of space to store separated waste and inadequate time to engage in such activities. Hage *et al.* (2009) found that as population density increases recycling decreases,

resulting in low collection rates in major cities. This is because a high population density cities are highly congested and thus lack space to keep extra bin for storing separated waste.

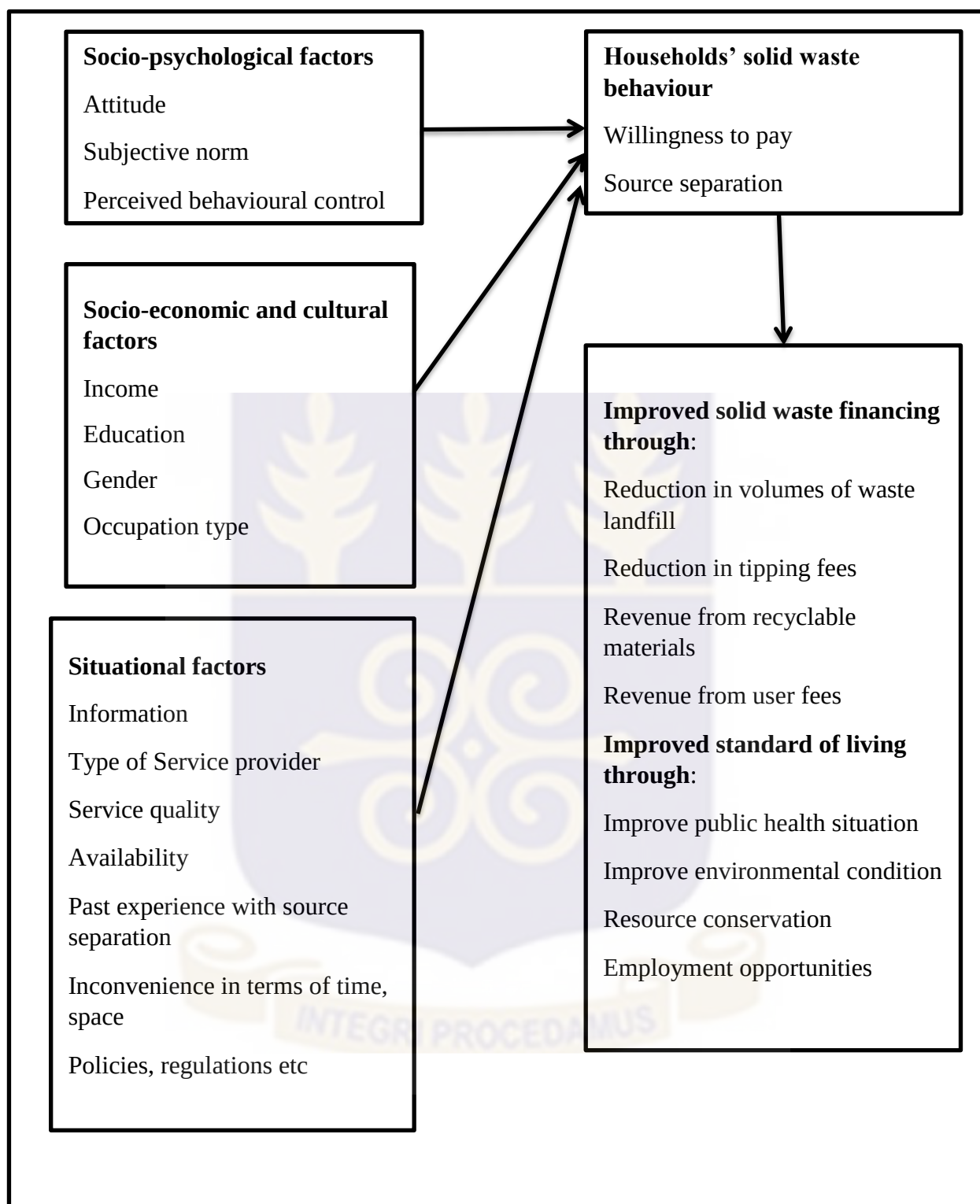
Finally, some researchers have studied the influence of households' past behaviour on source separation behaviour. Barr *et al.* (2003) found past behaviour to be very important toward current intentions, while according to Tonglet *et al.* (2004) previous experience lowers the perception of effort. In a study by Knussen *et al.* (2004) in Glasgow, past behaviour was a significant predictor of both intention to recycle and actual behaviour.

Although there exists plethora of empirical studies on determinant of household source separation and recycling behaviour for developed countries, limited research was found in the context of Africa in which Ghana is no exception. Recent studies on source separation behaviour in Ghana have focused on the technical aspects (see Asase, 2011; Adjei, 2013), the degree and category of source separation (Oduro-Appiah and Aggrey, 2013) and households' willingness-to-accept economic incentives to participate in source separation (Owusu *et.al*, 2013). In short, one can argue that though a number of studies have been done on solid waste separation in Ghana, there is hardly any detailed research using theory of planned behaviour (TPB) to examine households' source separation behaviour in Ghana. This study aims to bridge the knowledge gap by combining the TPB variables, socio-economic factors and situational factors to explain and predict households' source separation behaviours. Understanding the determinants of households' source separation behaviour is crucial to getting people to move off from zero participation to full participation.

3.7 Conceptual framework

Figure 3.3 presents the conceptual framework of the study. Based on the theory of planned behaviour, neoclassical consumer theory and empirical literature review, households' solid waste behaviour such as source separation and willingness-to-pay for improved SWM services is influenced by socio-psychological factors, socio-economic and cultural factors and situational factors (as shown in Figure 3.3). The socio-psychological factors includes households' attitude towards source separation, subjective norm and perceived behavioural control. Generally, if households' have strong attitude towards solid waste, then it is more likely that they are much informed on source separation issues and would be willing to source separate and pay more to see their environment clean. Subjective norm is expected to influence households' solid waste behaviour if individuals take into consideration how others perceive the action they are engaging in. Usually the perception that close ties, opinion leaders and other important people may approve or disapprove an action determines the final decision of the individual. This is generally dependent on the degree of social cohesion and bonding that exist in the community. In the case of perceived behavioural control if individuals perceived an activity to be difficult because of lack of skills, opportunities and facilities then that individual would not undertake that behaviour.

Figure 3.3: Conceptual framework of the study



Source: Author's own construct, 2017.

As presented in figure 3.3, in this framework households' socio-economic characteristics is also expected to influence their solid waste behaviour. For example, the literature have shown that the rich , highly educated and those working in the formal sector are willing-to-pay more because of their ability to pay and busy schedules that makes them attach a high opportunity cost to time spent managing solid waste. The situational factors in this context refers to the general characteristics of the service which includes availability, accessibility, quality, type of service provider, regulations, inconvenience in terms of time and space and information. For instance, householders' would be willing-to-pay and source separate if the facilities are available, accessible and convenient to use. Second, having much information on the economic, social and environmental benefits of improved SWM would motivate households' to source separate and pay more for improved SWM services.

It is believed that if households' source separate it will improved SWM financing. First, source separation reduce the amount of solid waste collected, transported and dispose on landfill sites. This will reduce the transportation cost since fewer solid wastes are transported and dump on landfill site; reduce the amount paid as tipping fees and revenue can be generated from the sale of recyclable materials. Second, source separation increase the lifespan of landfill site since most of the solid waste is diverted for recycling and recovery. In the case of AMA, this is important because of the difficulty in getting land to construct landfill site due to the rapid urbanization and increased population growth couple with the NIMBY attitude of the public. In the case of households' WTP, it is believed that if households' pay for SWM services then the financial burden on local authorities would be reduced and private contractors would have enough funds to provide quality services.

As shown in Fig 3.3, if households' pay for improved SWM service and source separate their standard of living would improve. First, paying for SWM services will increase the financial resource base of the service providers. This is important in SWM because the more resourced a service provider is, the more likely he/her can provide quality service, which may lead to improve public health and environmental protection. Source separation can be a source of employment since the separated solid waste can be sold to earn extra income. In addition, source separation provides quality material for recycling and recovery thereby conserving natural resources.

3.8 Conclusion

This chapter reviews literature on waste, ISWM and theoretical and empirical literature on determinants of households' WTP and source separation behaviour. It concludes by developing the conceptual framework of the study. Based on the literature review waste is conceptualized to be a resource that can be reuse, recycle and recovered, rather than a useless material to be discarded. The ISWM propose that for the SWM system to be sustainable both the physical and governance aspects of SWM should be considered. Adequate solid waste collection is critical for improved public health and environment protection. The disposal of solid waste should follow the minimum environmental safety to ensure environmental protection and the resource value of waste must be tapped to ensure sustainable resource management. For good SWM governance, the system should involve all stakeholders, be financially sustainable and have proactive policies on SWM. The theoretical and empirical literature review on determinants of households' WTP and source separation behaviour had been analysed using the neoclassical consumer theory and TPB. Empirically the factors that affect households' source separation behaviour and

WTP are broadly classified into three groups: socio-psychological, socio-economic and cultural and situational factors.



CHAPTER FOUR

STUDY AREA AND METHODOLOGY

4.1 Introduction

The previous chapter review literature on waste and the concept of ISWM. It also discussed the theoretical and empirical literature on households' WTP and source separation behaviour. This Chapter examines the study areas and presents a profile of the selected research areas. It also discusses the study research design, data collection methods and the analytical techniques used in this study.

4.2 Study Areas

The study was conducted in Accra and Tamale Metropolises in Ghana. The selection of the two urban areas of different sizes was based on Ghana's urban hierarchy, population size, geographical location and the resource base of these urban centers. The selection of two different urban centers located in different ecological zones with different socio-cultural characteristics would offer a basis of comparison of SWM practices within the geographical setting in the country.

Accra, Ghana's national capital is the largest city size and also serves as the administrative, political and a major economic hub of the country. Accra is located in the Greater Accra region. It is the most urbanized, populated and most cosmopolitan city in Ghana and lies in the coastal savannah zone with annual rainfall averaging 810mm. The city has grown significantly over time, from about 20,000 in 1891, to 135,800 by 1948, reaching 1.6 million in 2000 (Konadu-Agyemang, 2001) and almost 1.9 million in 2010 (GSS, 2014a). Accra Metropolitan Assembly (AMA) has gone through a "number of changes in terms of size and number of Sub-metros. AMA as it exists now was established in 2012 with L.I. 2034 following the creation of the La Dadekotopon

Municipal Area” (<http://www.statsghana.gov.gh/>). Consequently AMA as captured in the previous population census is quite different from that of the 2010. The significant growth in population has resulted in “increased waste generation that far outstrips the city’s capacity for containment and processing” (Oteng-Ababio, 2013a:205).

Accra hosts a number of industries, oil companies as well as institutions such as banks, telecommunication, schools, universities, hotels, hospitals and other important institutions, which provide employment opportunities to residents of the City. Majority of residents in the city are engaged basically in the primary, secondary and tertiary sectors of the economy (GSS, 2014a). In 2010, about 38.5% of the population was engaged in service delivery, making it one of the most common works. The most common industry is wholesale and retail with 35.2% of the population engaged in repair of motor vehicles and motorcycles. Self-employed without employee(s) is the main employment constituting 48% of the population. The private informal sector is the main avenue for employment (74.0%) in the Metropolis followed by the private formal sector (16.9%), indicating that the private informal and formal sectors (90.9%) were the major employers in the Metropolis (GSS, 2014a). The indigenous people who are Gas, until recently were mostly engaged in fishing and farming. As low as 3.2 percent of households in the Metropolis are engaged in agriculture. Majority of these farmers (77.7%) are involved in crop farming followed by livestock rearing (23.5%) (ibid).

Tamale, a medium-sized city, is the Northern regional capital and largest urban center in the three northern regions in Ghana. The Tamale Metropolitan Assembly (TaMA) lies within the Guinea-savannah belt of Ghana with an average annual rainfall of about 1033mm. Located in one of the least developed and poorest regions in Ghana, Tamale over the years has experienced very rapid increases in population, spatial expansion and economic activity. “Tamale is among the fastest-growing cities in Ghana with an annual

growth rate of 3.3%” (Gyasi, *et al.*, 2014:13). From a population of about 18,000 inhabitants in 1948, the population increased to 83,657 in 1970, 135,952 in 1984 and more than doubling to 371,351 in 2010 (GSS, 2014b). This rapid growth has brought about an unprecedented increase in waste generation, which, in turn, has “overburden city authorities’ that much of it remained uncollected” (Kranjac-Berisavljevic and Gandaa, 2013:47).

The economy of Tamale was predominately agrarian (70%) at independence in 1957 but has gradually evolved into a service base economy (Fuseini and Kemp, 2016). According to the GSS, (2014b), over 60% of the economically active population of TaMA was engaged in the service delivery sector which was dominated by informal economic activities. As many as 20% of the economically active population of the Metropolis was employed in agriculture, while 13.2% was employed in manufacturing and mining-related activities in 2010. Concerning the employees of the service sector, 81% of people in the Metropolis was employed in the private informal activities compared to 13% and 5% in public formal sector and private formal activities, respectively (GSS,2014b). The evolving local economic activities in Tamale have implications for sustainable SWM.

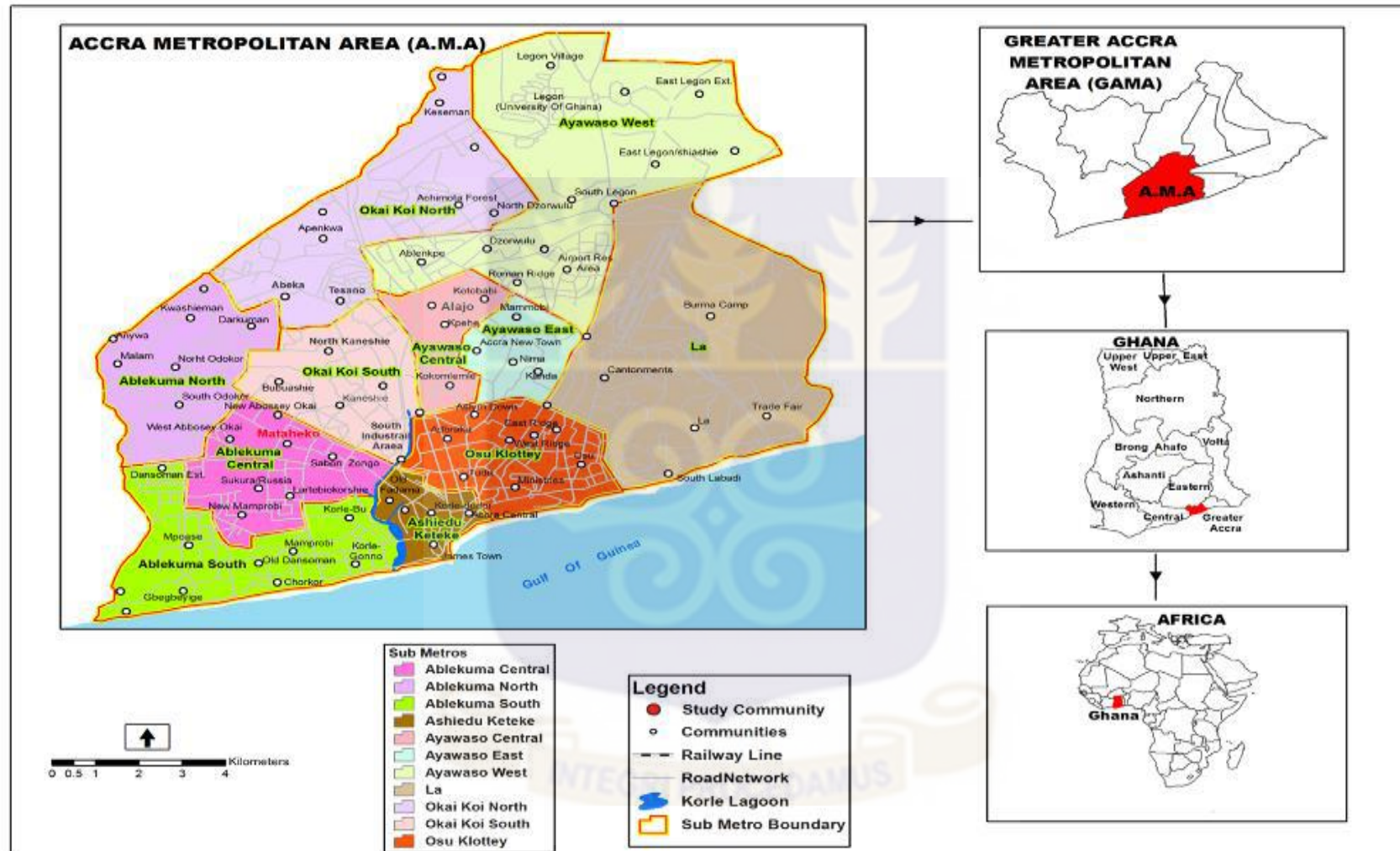
4.3 Profile of Accra Metropolitan Area

The Accra Metropolitan Area is located between longitude 0⁰.03' and 0⁰.15' west and latitude 5⁰.30' and 5⁰.53' North. Administratively, the city covers an area of 229 square kilometres (Abraham *et al.* 2006). The metropolis shares a common boundary with three municipalities in the north namely Ga East Municipality, Ga West Municipal Area and the newly created Ga Central Municipality. La Dadekotopon Municipal Area lies to the east whereas the Ga South Municipality is to the west of the Accra Metropolitan Area. In the south lies the Gulf of Guinea. The Accra Metropolitan Area and its neighbouring

municipalities together with the Tema Metropolitan Area, Ashiaman and La Kwatanang municipal areas define a functional city region, the Greater Accra Metropolitan Area (GAMA). Figure 4.1 represents the Accra Metropolitan Area in the national and regional context.



Figure 4.1: Accra Metropolitan Area in the Regional Context.



Source: Abeka, (2014).

4.3.1 Population of Accra

The population of AMA grew rapidly from 42,000 in 1921; 136,000 in 1948 (Odame-Larbi 1996); to 969,195 in 1984 and then to 1,658,937 in 2000 (Ghana Statistical Service, 2002). Ghana Statistical Service (2014a) puts the population of the Accra Metropolitan Area at 1,848,614 in 2010 of which 887,673 (48.02%) are males and the remaining 960,941 (51.02%) are females. The current population of the Accra metropolis accounts for 46.1% of the total population of the Greater Accra Region. The Accra Metropolitan Area experienced a bursting population growth of 7.5% per annum between 1970 and 1984 but this slowed down to 3.4% per annum between 1984 and 2000. Between 2000 and 2010, Accra grew slowly at a rate of 1.1% per annum (www.ama.ghanadistrict.gov.gh).

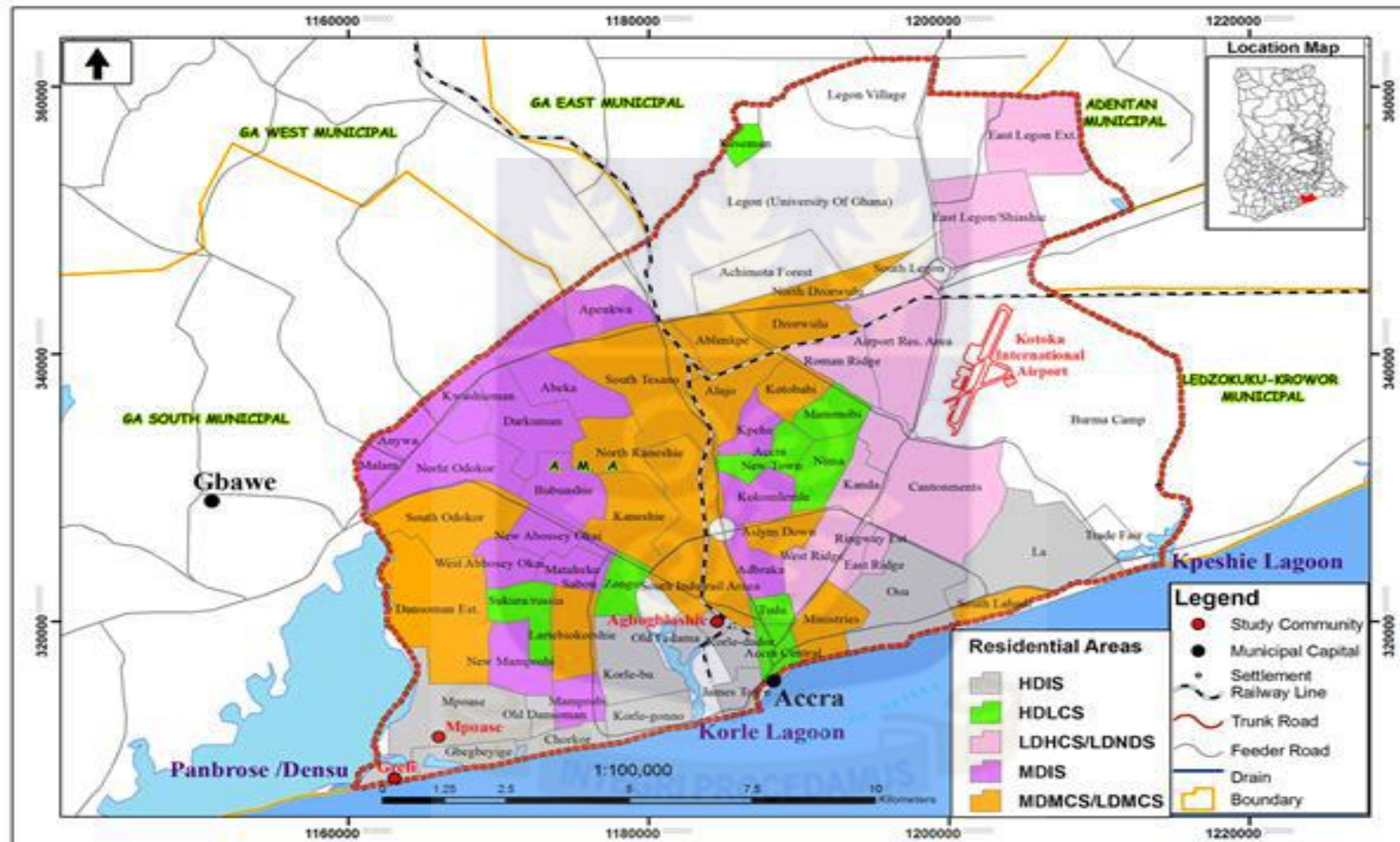
The declining trend in the growth rate of Accra is due to fixity of land in the metropolis but the hiving off of portions of the metropolis and constituting them into new municipalities has also affected population dynamics within the city (Owusu and Oteng-Ababio, 2015). L.I.1926 of 2007, for example, created the La Dadekotopon and Ledzokuku Krowor municipalities out of the AMA. By this legislation, the AMA seeded off densely populated growth centres like Teshie and Nungua to new municipal areas. Hence the sharp decline in the population growth rate between 2000 and 2010. Nevertheless, the population of Accra more than doubled (increased by 196.2%) between 1970 and 2010 causing gross densities to rise from 6.2 per persons hectare in 1970 to 69.3 per hectare currently (UN-HABITAT, 2009; www.ama.ghanadistrict.gov.gh).

4.3.2 Residential Classification of Accra

Broadly, the AMA has three (3) residential classes namely the low, medium and high-income zones (see Government of Ghana, 2011; Songsore, *et al.* 2009). According to this classification, the low-income zones are sub-divided into indigenous and low cost enclaves (Areas shaded grey and green in Figure 4.2 represent High Density Indigenous Sectors (HDIS) and the High Density Low Cost Sectors (HDLCS) respectively). These areas are heavily built-up with very little room for expansion, buildings are of poor quality and housing infrastructure like roads, and drains are underdeveloped. Noted for their informality, these high-density residential zones are attractive destinations for new migrants (UNDP, 1992). The poor in Accra tends to be concentrated in the high-density indigenous sectors (HDIS) and high-density low cost sectors (HDLCS) where access to environmental services are generally poor (Songsore, *et.al.* 2009).

In the middle-income areas of Accra, housing is of better quality compared to the high-density zones. The middle-income area is categorized into two residential classes; the medium class indigenous sector (MCIS) and the medium density middle-class sector (MDMCS). The high-income areas are well planned with superior housing infrastructure and modern architecture. Such areas consist of the low-density middle sector and the low-density high cost sectors. Housing development in the low-density medium sectors consists of estates developed by parastatals and government agencies like Social Security and National Insurance Trust (SSNIT). The high-density high cost sectors are Old European enclaves or areas inhabited by top civil servants and/or the ‘nouveaux riche’ (see Figure 4.2 for residential classification map of Accra).

Figure 4.2: Residential Classification map of Accra.



Source: Abeka, (2014).

4.3.3 Climate of Accra

Accra lies within the West African sub region. The El Niño-Southern Oscillation (ENSO) and the movement of the Inter Tropical Convergence Front influence the climate of this region (Conway, 2008; Ofori-Sarpong and Annor, 2001). The El Niño-Southern Oscillation is responsible for drought conditions over the region whereas the movement of the Inter Tropical Convergence Front determines seasonality (Le Barbe' *et al.* 2002; Ofori-Sarpong and Annor, 2001). Mean annual rainfall in Accra hovers around 800mm ($\mu=787.4\text{mm}$; S.D =243.92) occurring mostly in fewer than 80 days.

Accra is located within the coastal savannah ecological zone of Ghana. This zone is characterized by a double maxima (bi-modal) rainfall regime and high temperatures (Songsore *et al.* 2009). The average monthly temperature range is around 4°C throughout the year. Daily temperatures range from 19°C to 32°C from December to June. Between July and November, the days are cooler and temperatures range from 18°C to 29°C (Songsore *et al.* 2009). The relatively high temperature experienced in Accra predisposes solid waste to a high rate of decomposition. Thus, irregular and inadequate collection of solid waste which is highly organic in nature has disastrous effects on the quality of the environment and the health of residents.

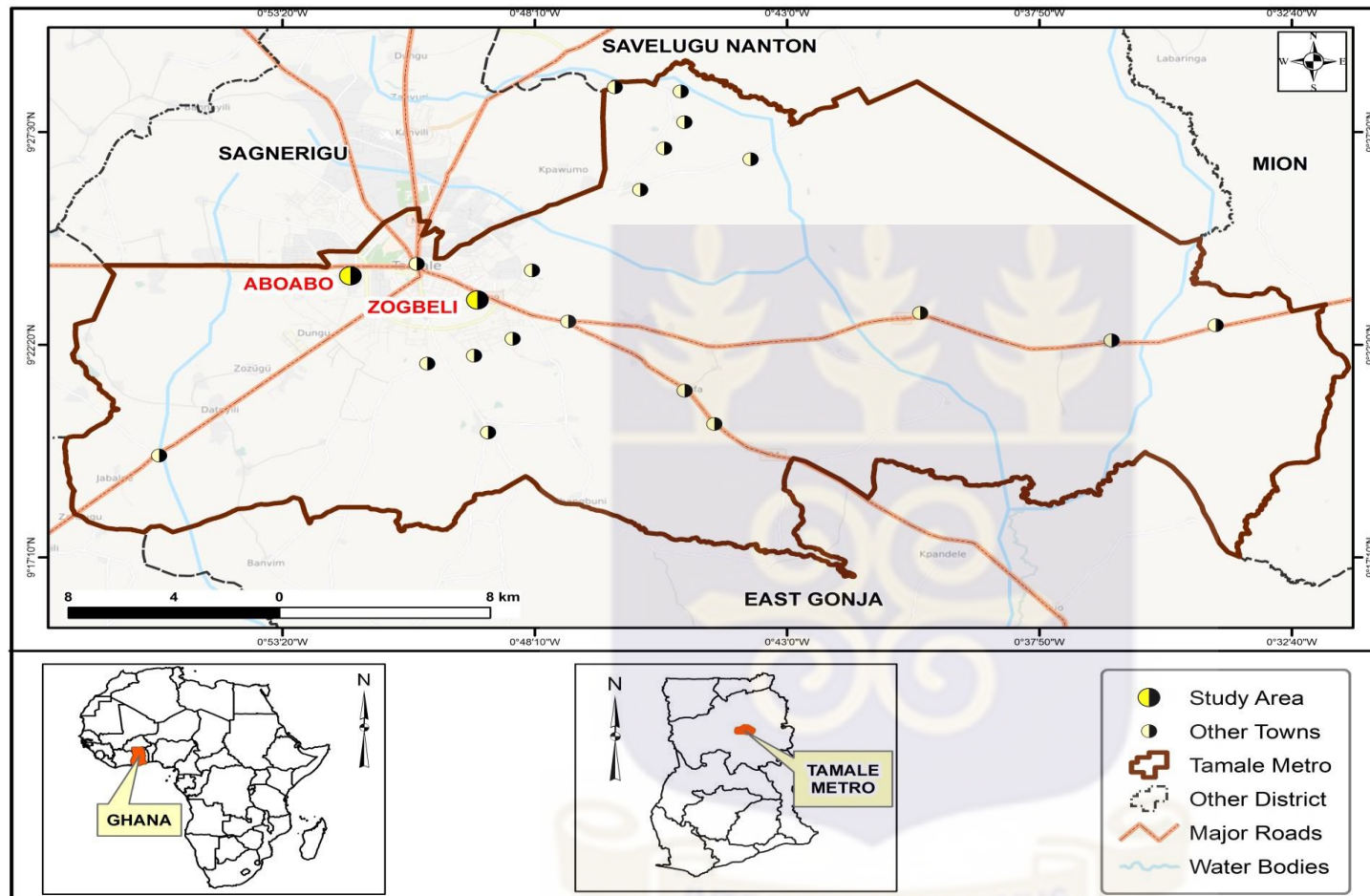
4.4 Profile of Tamale Metropolitan Area

TaMA is the only Metropolitan assembly in the Northern sector and was established under Legislative Instrument (L.I) 2068 of 2012. The Metropolis has a total estimated land size of 646.90180 sqkm (GSS, 2014b) and has two sub metros namely, Tamale South and Tamale Central. Tamale Metropolitan Area lies between latitude 9°16 and 9° 34 North and longitudes 0° 36 and 0° 57 west. The Metropolis shares boundary with

Sagnarigu to the North, Mion District Assembly to the East, Tolon to the West, Central Gonja to the South West and East Gonja to the South. Figure 4.3 represents the Tamale Metropolitan Area in the national and regional context.



Figure 4.3: Tamale Metropolitan Area in the Regional Context.



Source: Department of Geography and Resource Development, University of Ghana, (2017).

4.4.1 Population of Tamale

From a population of about 18,000 inhabitants in 1948, the population of Tamale increased to 83,657 in 1970, 135,952 in 1984 and more than doubling to 371,351 in 2010 (GSS, 2014b). Just like the other major cities and towns of Ghana, Tamale has a young population; about 38% of the total population was between 15-34 years in 2010. Males constitute 49.7% and females represent 50.3%. Tamale is a highly urbanized city about 80.8% of the population living in urban localities (GSS, 2014b).

4.4.2 Residential Classification

Generally, the TaMA has been classified into three (3) residential classes, namely low, medium and high-income zones (see Benneh *et al.* 1993; Songsore, *et al.* 2009). The low-income areas of Tamale are associated with heavily congested neighborhood with poor infrastructure and services. Majority of the residents live in compound houses which are poorly maintained and lack in-house facilities such as toilets, bathrooms, water supply, etc. In addition, access to most homes by vehicles is also impossible as there are very few streets.

In the middle-income areas, the compound housing type dominates but they are of higher quality and less congested compared to the low-income areas. There is limited use of outdoor public facilities such as water and toilet. The high-income areas are well-planned with clean surroundings. The residents in these areas are comparatively of high socio-economic status, typically high level government and managerial/ professional officials with higher education. The community is not congested, has a high amount of single houses, and the neighbourhood looks generally quite well planned and tidy.

4.4.3 Climate of Tamale

Tamale has a relatively dry climate, with a single rainy season that begins in May and ends in October. The climate in northern Ghana is driven by the El Niño–Southern Oscillation (ENSO) and the West African monsoon. The seasonal rainfall fluctuates considerably on inter-annual and inter-decadal timescales, due in part to variations in the movements and intensity of the Inter Tropical Convergence Zone (ITCZ), and in the timing and intensity of the West African monsoon (Gyasi, *et.al*, 2014).

Annual rainfall for Tamale varies between 900 mm and 1100 mm, with a long-term average annual rainfall of 1078 mm. Inter-annual variability of rainfall is up to 17 per cent (Gyasi, *et al*, 2014). The mean daytime temperature for Tamale is 28° C, with a range from 34° C for the March–April period to 21° C for the December–January period. Mean annual temperatures have risen by approximately 1° C between 1960 and 2010. The relatively high temperatures experienced in Tamale increase the rate of decomposition of the high organic content of waste generated at the metropolis. Thus, if this high biodegradable organic content of waste is not collected regularly and managed well it could produce odour and generate methane which is one of the greenhouse gas responsible for climate change. Subsequently, this phenomenon could affect the quality of the environment and the health of residents.

4.5 Research Design

Research design is the overall strategy that is used to integrate the different components of the research into a coherent and logical way, to address the research problem (De Vaus, 2001). It enunciates the type of data required, the methods used to collect and analyse the data and how this is going to answer the research questions (Creswell, 2003). The purpose of this study is to examine the factors influencing households' willingness-

to- pay (WTP) for improve SWM and further explore the factors that affect their source separation behaviour in the Accra and Tamale Metropolises in Ghana. The varied nature of the data required and the different sources from which they had to be gathered made the mixed methods approach appropriate (Creswell, 2003). In line with this methodological approach, research tools associated with both quantitative and qualitative approaches were used to collect and analyse the data.

The choice of mixed methods approach was informed by a number of reasons: (1) to achieve the ‘logic of triangulation’ (Denzin,1989:13) since no single method could completely capture all the relevant features of the study; (2) to make it possible to explore the research questions from different perspectives which could lead to broader understanding of the issues connected with households’ WTP and further participate in source separation of solid waste (Creswell, 2003) and (3) using different theories , methods of data collection and analysis provided the opportunity to obtain in-depth information from the different categories of participants including the service beneficiaries, service provider and regulators involved in SWM in the study areas.

4.5.1. Sampling and Sample size

A three-staged stratified probability sample design was used for the household survey. Compared to other sampling methods like simple random and systematic sampling, the three-staged stratified probability sampling allows the selection of respondents from different socio-economic background and ensures that the selection of samples relate to research objectives (Sarantakos, 1998). Based on the classification of residential and neighborhood into low, middle and high-income areas used in several studies in Ghana (see Benneh *et al.* 1993; Agyei-Mensah & Owusu 2010; Owusu and Agyei-Mensah 2011), one residential area each was randomly selected from each stratum, except in

Accra where two residential areas were randomly selected in low-income areas in order to capture the dynamics in low-income migrant area (Nima) and low-income indigenous area (Glefe). Given a total of seven (7) communities (as shown in Table 4.1). This consists of the first stage.

The second stage involved selecting enumeration areas (EAs) from a list of EAs that were used for Ghana's 2010 Population and Housing Census by the Ghana Statistical Service (GSS) the official agency in charge of census in Ghana. Using the list of the EAs as the sampling frame for the seven (7) selected communities in the two metropolises, 57 EAs (defined as primary sampling units (PSUs)) were selected through the probability proportional to size (PPS) method. This is based on each metropolis's share of the total population of the two metropolises. The selection of EAs was accomplished by carrying out sampling operations independently within each metropolitan area. However, to allow for intra-city analysis EAs were over-sampled in Tamale.

The third stage involved the listing of all the households in the selected EAs. Using the list as sample frame, 15 households were selected systematically with a random start and interval separately for each EA to produce a total of 855 households for the two study areas. The selected households are the secondary samplings units (SSUs) within which the household head and/or spouse were interviewed. The survey targeted heads of household because the decision to pay and participate in source separation of solid waste largely depends on the heads of household. However, effort was made to interview the wife of male-headed households since traditionally women are responsible for domestic SWM.

Table 4.1: Selected Communities and Sample Allocation

Metropolis	Community	SES Community	No. of Selected EAs	Sample Allocation to Households
Accra	Airport Area	Residential High-income	2	30
	Dansoman	Middle-income	11	165
	Glefe	Indigenous low-income	4	60
	Nima	Migrant low-income	18	260
Tamale	Russia Bungalow	High-income	3	45
	Zogbeli	Middle-income	11	165
	Aboabo	Low-income	8	120
TOTAL			57	855

4.5.2 Data Collection Method

The study used qualitative approach to identify the institutions involved in SWM in Accra and Tamale Metropolitan Areas and understand their experiences. Qualitative data were obtained from organizations identified in previous studies (see Oduro-Kwarteng, 2011; Puopiel, 2010) as organization involved in SWM in the study areas. These include; the Ministry of Local Government and Rural Development (MLGRD), Environmental Protection Agency (EPA) of the Ministry of Environment, Science, Technology and Innovation (MESTI), AMA, TaMA, WMD of AMA, WMD of TaMA, the Metropolitan Health Directorate, Environmental Health Department and private waste contractors. Additional organization identified through snowball sampling was, the Environmental Sanitation Provider Association (ESPA).

In-depth interviews were employed to elicit information from officials working with the organizations identified above because it helps obtain in-depth information about participant's experiences and meanings in their own words within a specific context. These interviews focused on their role and involvement of key stakeholders in the SWM system, existing SWM practices, public-private partnership, solid waste financing, regulatory mechanisms, policies on SWM and challenges. Other thematic areas of the in-depth interviews were factors influencing resident's WTP and source waste separation behaviour in the study areas.

Key-informant interviews were conducted to obtain information on actual matters from some well-informed people within the waste sector and the communities. These actors include an officer of Glefe Community Development Association, community leaders, assemblymen/women, sanitation guards, waste-pickers, informal waste collectors, scavengers, itinerant waste buyers and women. In addition, informal discussions were held with children in the low-income areas since they are responsible for carrying waste to the container sites.

At the community level, seven focus group discussions (FGDs) were conducted. One in each selected community in the study areas. The FGDs were conducted in all the communities in order to collect detailed information on their SWM practices. The participants were purposively selected based on their length of stay in the community (thus between ten (10) and fifty (50) years), and their knowledge of the subject matter under consideration. As argued by Sarantakos, (1998), one of the challenges associated with organizing FGDs is the constitution of a group large enough to engender reasonable discussions without compromising the validity of the outcomes. He therefore recommended a group with membership around ten (10) as ideal whereas a group with more than 20 members as overbearing. Based on this recommendation, all FGDs with the

exception of the one in Airport Residential Area consisted of 14 participants with between six to seven women. At Airport Residential area the number was reduced to 8 participants-six women and two men. Due to the busy schedules of these residents, it was difficult getting residents to participate and this accounted for the 8 participants rather than 14. The discussions centred on their current SWM practices, the factors that motivate or deter them from paying for solid waste service and participating in solid waste separation at source. Data was also collected on the current challenges they face in managing their solid waste sustainably.

Direct observations of the communities, landfill sites, communal container collection sites and the operations at uncontrolled dump sites were also employed. This provided an opportunity to observe at first hand the current solid waste practices and challenges in the study areas. In addition, digital photographs were taken during the fieldwork. Secondary data from published and unpublished works were also collected. Review of existing policies and strategic documents on waste-management practices in the two cities, including the analysis of waste-disposal practices based on available data were also collected.

Qualitative studies help capture and communicate participants' experiences and thoughts about happenings and meanings in their own words within a specific context. However, such research approach is limited when the research involves measurement or quantification of variables (Sim and Wright, 2000). A quantitative research design was introduced to make up for this deficiency of qualitative research. The quantitative research approach used is the cross-sectional design. This design allows for inference about a population at a point in time, but it is not applicable when trends are to be analysed (Frankfort-Nachmias and Nachmias, 1996). This design was used as the framework to investigate the determinants of households' WTP and participation in

source separation in the Accra and Tamale Metropolises. Structured questionnaire interviews were used to collect household data because it allows us to solicit the needed information from large number of respondents which allows for easy quantification of results. Data captured from the structured questionnaire included information on household's perception towards and the causes of improper SWM, SWM practices, source separation behaviour and preferences, question on theory of planned behaviour constructs, questions on households' WTP using the contingent valuation design, household socio-economic characteristics, and assets.

The contingent valuation method (CVM) was used to establish the economic value of SWC services because such services are often under-priced or non-priced and is difficult to infer economic values from market prices (Adamowicz, *et al.* 1994). Based on FGDs and literature review a hypothetical market was designed for an improved SWM service that collect separated solid waste at source. An open ended and iterative bidding game methods were used to elicit respondents maximum WTP in Ghana Cedis because it mimics the strong bargaining processes of both sellers and consumers in a developing country like Ghana (Anaman and Jair, 2001). In addition this method eliminates starting bid bias since the interviewer does not suggest any starting bid to respondents. In order to eliminate bid vehicle bias the respondents were informed that they would pay their monies through the same institutional mechanisms (i.e. direct monthly payment to service provider) that they normally used for the payments of their utilities. Lastly, the zero bid response was minimized by giving sufficient time to the valuation task.

4.6 Method of Analyses

Thematic analysis was used to analyse the qualitative data. For the quantitative data, the field questionnaires were checked for errors and were entered onto the computer. After

entering the data, it was cleaned before analysing with STATA version 14.0. Descriptive statistics such as frequencies and percentages were used to summarize and identify patterns in the data. The ordered regression and tobit regression models were used to examine households' WTP and source separation intentions' respectively.

4.6.1 Thematic analysis

Following Braun and Clarke (2006), thematic analysis was used to analyse the qualitative data because it allows for rich and detailed description of data. The audiotapes were transcribed verbatim and cleaned/edited for accuracy. Thematic codes were developed, iteratively reviewed, and applied to relevant segments of the study. Finally, the results were verified by going through the transcripts again personally and with the participants interviewed.

4.6.2 Determinants of Households' Source Separation Intention

In this study the determinants of households' source separation intention was estimated by following two main steps. In the first step, factor analysis with principal component analysis (PCA) was applied to the Theory of Planned Behaviour (TPB) constructs items (attitude, subjective norm, perceived behavioural control), solid waste separation intention and behaviour, and inconvenience factor items with the aim of summarizing large sets of data into meaningful groups. To extract the components from the 30 statements, Kaiser's criterion (KMO) (Kaiser, 1958), Bertlett's test (Bertlett, 1947), and scree test were used as suggested by Pallant (2005). The KMO measure was used to check the sampling adequacy whilst the Bertlett test was used to check the strength of the relationship among the statements in order to examine the factorability of the statements. The KMO statistic is a ratio that ranges from 0 to 1 and should be at least 0.7 for PCA to

be acceptable. The Bartlett test examines if the correlation matrix among the variables is significantly different from the identity matrix. If the hypothesis that these matrixes are equal is not rejected, PCA should not be applied. The scree plot, which was drawn using the eigenvalues, was then used to determine the number of components that could be retained. Subsequently the, Cronbach's alpha test was applied to evaluate the reliability of the likert- type scale questions with the aim of ensuring each question under a variable are all measuring the same underlying attributes.

In the second analytical step, ordered probit regression analysis was performed to analyse the determinants of households' source separation intention. This is because responses for source separation intention in this study are not continuous but ordinal. Consequently it renders the ordinary least squares regression estimation technique not appropriate because it can produce spurious probabilities (greater than unity or less than zero) and negative variance estimates (Greene, 2003). As a result of this, the ordered probit model was used for estimating the determinants of source separation intention. The five point likert-scale (strongly disagree (1) to strongly agree (5)) was used because it meets the minimum categories to ensure scale validity and reliability (Foddy, 1994).

4.6.2.1 Model specification

Following Greene, (2003), the ordered probit model is presented as:

$$y_i^* = x_i' \beta + \varepsilon_i \quad (4.1)$$

where y_i^* is a latent variable representing the source separation intention associated with household i , x_i is a vector of independent variables and β is the vector of regression coefficients to be estimated and ε is the random error term assumed to be standard normally distributed. Because y_i^* is latent, the observe discrete responses of the variable

y_i is presented as below:

$$y_i = 1 \text{ if } y_i^* \leq \theta_1, \quad (4.2)$$

$$y_i = 2 \text{ if } \theta_1 < y_i^* \leq \theta_2, \quad (4.3)$$

$$y_i = 3 \text{ if } \theta_2 \leq y_i^* \quad (4.4)$$

The θ_j are the unknown threshold parameters to be estimated simultaneously with the other coefficients β . The probability that the ordered dependent variable y takes different possible value is:

$$\Pr(y_i = 1|x) = 1 - \omega[\beta'x_i - \theta_1] \quad (4.5)$$

$$\Pr(y_i = 2|x) = \omega[\beta'x_i - \theta_1] - \omega[\beta'x_i - \theta_2] \quad (4.6)$$

$$\Pr(y_i = 3|x) = \omega[\beta'x_i - \theta_2] \quad (4.7)$$

where ω indicates a cumulative normal distribution and the cut-points θ_j , divide the categories of the dependent variable. The parameter of the ordered probit model is estimated by the maximum likelihood method. However, since we are not only concerned about the direction of the impact of the independent variables but also the magnitudes of their effects, the marginal effects are also estimated:

$$\frac{\partial \Pr(y_i=1|x)}{\partial x} = -\omega(\beta'x_i - \theta_1)\beta \quad (4.8)$$

$$\frac{\partial \Pr(y_i=2|x)}{\partial x} = [\omega(\beta'x_i - \theta_1) - \omega(\beta'x_i - \theta_2)]\beta \quad (4.9)$$

$$\frac{\partial \Pr(y_i=3|x)}{\partial x} = \omega(\beta'x_i - \theta_2)\beta \quad (4.10)$$

The empirical model is expressed as:

$$WS_{int} = \beta_0 + \beta_1 attitude + \beta_2 subjective \text{ norm} + \beta_3 perceived \text{ behavioural} + \\ \beta_4 income + \beta_5 education + \beta_6 gender + \beta_7 marital \text{ status} + \beta_8 tenancy +$$

$$\beta_9 \text{occupation} + \beta_{10} \text{householdsize} + \beta_{11} \text{age} + \beta_{12} \text{past expereince} + \beta_{13} \text{information} + \beta_{14} \text{inconvenience} + \beta_{15} \text{Location} + \varepsilon_i \quad (4.11)$$

Where

WS_{int} = Source separation intention is an ordered variable ranging from,

1=strongly disagree and disagree;

2=neutral and

3=agree and strongly agree

ε = Error term

4.6.2.2 Choice and Description of Variables

Based on previous studies and information collected from participants the variables used to determine households' source separation behaviour are presented in Table 4.2.

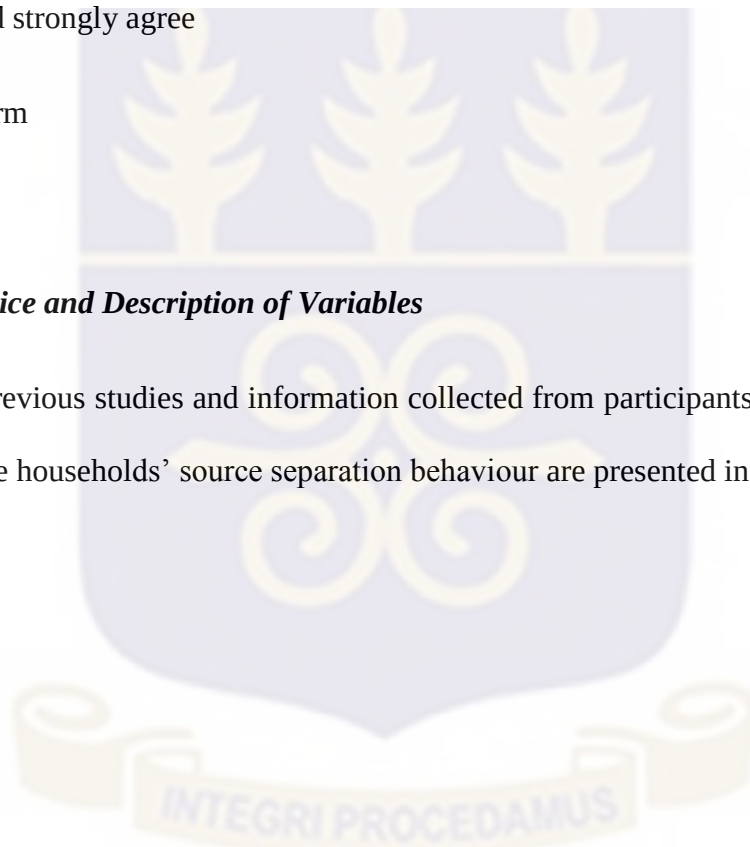


Table 4.2: Description of independent variables for ordered probit model

Independent Variables	Measurement	Expected sign
Demographic and Socio-economic factors		
Age of head of household	Number of years	-
Marital status of head of household	Married=1; Otherwise=0	+
Gender of head of household	Male=1; Female=0	-
Educational attainment of head of household	number of years in schooling	+
Occupation type of head of household	Sector of employment (Formal sector=1; Otherwise=0)	+
Household income	Monthly household expenditure used as a proxy for household income (in Ghana cedis)	+
Household size	Number of persons in respondent's household	+
Situational factors		
Information	Households' knowledge or awareness on solid waste separation (1=Yes; 0=Otherwise)	+
Inconvenience	Households' perception about the condition that makes waste separation difficult to adopt (mean value of a five-point likert scale)	-
Past experience with source separation	Whether household source separate solid waste or not (Yes=1; Otherwise=0)	+
Location	Metropolitan dummy (AMA=1; 0=TaMA)	-
Socio-psychological factors		
Attitude	Household attitude towards waste separation (mean value of a five-point likert scale)	+
Subjective norm	Perception of the respondent's social pressure to separate waste (mean value of a five-point likert scale)	+
Perceived behavioural control	Perception of the respondent's ability to perform the behaviour of waste separation at home (mean value of a five-point likert scale)	+

Source: Authour's own construct 2017.

4.6.3 Determinants of Households' WTP for Improved SWM services

Owing to the fact that the responses for households' WTP for improved SWM services in this study are continuous and not discrete, it renders the probit or logit regression estimation technique not appropriate because it would give unbiased estimates (Greene, 2003). Following Hagos *et al.* (2012), the tobit regression model was used for estimating households' WTP because the dependent variable WTP amount in Ghana cedis is a

continuous variable and is censored at zero. Following Greene, (2003), the tobit regression model is expressed as:

$$y_i^* = x_i' \beta + \mu_i \quad (4.12)$$

$y_i = y_i^*$ if $y_i^* > 0$, utility derived from paying for an improved SWM services.

$y_i = 0$ if $y_i^* \leq 0$, utility derived from not paying for an improved SWM services.

where y_i^* is unobserved latent variable, y_i is the dependent variable, x' is a set of independent variables, β is the coefficients yet to be estimated and μ_i is the error term assumed to be an independent and normally distributed random term with zero mean and constant variance (σ^2).

The log likelihood of the tobit model is specified as:

$$\ln L = \sum_{y_i > 0} -\frac{1}{2} \left[\log(2\gamma) + \ln \sigma^2 + \frac{(y_i - x_i' \beta)^2}{\sigma^2} \right] + \sum_{y_i = 0} \ln \left[1 - \varphi \left(\frac{x_i' \beta}{\sigma} \right) \right] \quad (4.13)$$

The maximum likelihood estimates of the parameters are obtained by maximizing the likelihood function with respect to β and σ . The first part of the equation is the linear regression model for the unlimited observations that uses the maximum likelihood estimator (MLE) procedure. The second part of the equation indicates the relevant probabilities for the limited observations (Green, 2003).

The empirical model for households' WTP is presented as:

$$\begin{aligned} WTP = & \beta_0 + \beta_1 \text{attitude} + \beta_2 \text{subjective norm} + \beta_3 \text{perceived behavioural} + \\ & \beta_4 \text{income} + \beta_5 \text{education} + \beta_6 \text{gender} + \beta_7 \text{marital status} + \beta_8 \text{tenancy} + \\ & \beta_9 \text{occupation} + \beta_{10} \text{householdsize} + \beta_{11} \text{age} + \beta_{12} \text{past expereince} + \\ & \beta_{13} \text{information} + \beta_{14} \text{satisfaction} + \beta_{15} \text{Location} + \varepsilon_i \end{aligned} \quad (4.14)$$

WTP = Maximum WTP amount in Ghana cedis

ε = Error term

The measurement of the independent variables and their priori expectations are presented in Table 4.3.



Table 4.3: Description of Independent Variables for tobit regression

Independent Variables	Measurement	Expected sign
Demographic and Socio-economic factors		
Age of head of household	Number of years	-
Marital status of head of household	Married=1; Otherwise=0	+
Gender of head of household	Male=1; Female=0	-
Educational attainment of head of household	number of years in schooling	+
Occupation type of head of household	Sector of employment (Formal sector=1; Otherwise=0)	+
Household income	Monthly household expenditure used as a proxy for household income (in Ghana cedis)	+
Household size	Number of persons in respondent's household	+
Situational factors		
Information	Households' knowledge or awareness on solid waste separation (1=Yes; 0=Otherwise)	+
Satisfaction	Household level of satisfaction with present SWM service (Satisfied=1; Otherwise=0)	+
Past experience	Whether household separate solid waste or not (Yes=1; Otherwise=0)	-
Location	Metropolitan dummy (Accra=1; 0=Tamale)	+
Socio-psychological factors		
Attitude	Household attitude towards source separation (mean value of a five-point likert scale)	+
Subjective norm	Perception of the respondent's social pressure to separate solid waste (mean value of a five-point likert scale)	+
Perceived behavioural control	Perception of the respondent's ability to perform the behaviour of solid waste separation ((mean value of a five-point likert scale)	+

Source: Authour's own construct 2017.

CHAPTER FIVE

INSTITUTIONAL ARRANGEMENTS FOR SOLID WASTE MANAGEMENT.

5.1 Introduction

Poor solid waste management is one of the major developmental problems confronting cities in most developing countries including Ghana. To overcome the problems of SWM, government over the years have adopted several policies and programme. This chapter examines the current institutional arrangements for SWM in AMA and TaMA. It looks into the current SWM practices and the problems inherent in the various interventions made by the assemblies in solving the SWM crisis in their jurisdictions. Lastly, these practices were evaluated using the ISWM concept, with the goal of identifying some opportunities for sustainable solution.

5.2 The current Institutional Arrangements

According to Obirih-Opareh, (2000:172), an institutional arrangement is defined as an enduring and potential pattern(s) or relationship(s) between two or more actors based on a written or verbal agreement and having a concrete, physical manifestation. This relationship is expressed in things such as, garbage bins and collection containers, transfer stations, disposal sites, and collection vehicles. Such arrangement may be either formal or informal, including those supported by law and those embedded in established social practices.

The study identified the actors in SWM in AMA and TaMA and grouped them into service users, service providers and local authorities. The local authorities are state actors which include public officials who formulate and implement SWM policies, the assembly members and politicians. The service users are non-state actors who participate in SWM by presenting their solid waste for collection at a fee or fee-free. The service

provider provides solid waste collection service to beneficiaries at a fee which is either paid directly by the beneficiaries or the assemblies. Two types of service providers were identified: formal private contractor and informal waste collectors (whose activities are prevalent in AMA). The formal private contractors have a formal arrangement through franchise or contract with the assemblies. The informal waste collectors or “Kaya Bola” (in the local parlance) have no formal arrangement with the assemblies. They are individual waste collectors who collect and transport solid wastes from residence, markets etc. using non-motorized tricycle, trucks, sacks, wheel-barrows etc. to a container or dumping sites for a fee (Oteng-Ababio, 2007). They also facilitate recycling and recovery activities by sorting plastics and metals prior to final disposal.

According to Oteng-Ababio,(2011b), the institutional arrangement adopted in a particular area is influenced by the socio-economic status of the area, the physical characteristics and the existing policy of local authorities, such as privatization. The next section describes in detail the current institutional arrangements for SWM in AMA and TaMA.

5.2.1 Institutional arrangements for SWM in AMA

Based on in-depth interview with an official of the WMD of AMA and literature review the study revealed that, after the privatization policy in the early 1990s, SWM continues to be a problem for the assembly because only 15 percent of the populace (i.e. high income areas) in the metropolis paid user fees for house-to-house (HtH) collection of their solid waste. The remaining 85 percent (within the middle to low income areas) who used the central communal container (CCC) system paid no user fees or paid user fees to assembly members who did not account for it to the Metropolitan assembly. This affected the quality of service and the financial sustainability of the SWM in AMA.

In an attempt to improve the quality of service and revenue mobilization, AMA in 2010 introduced the Fee-Performance Based (FPB) collection programme. Based on this policy, all residents of Accra are expected to pay for their solid waste collection. Consequently, the assembly got into franchising agreements with nine private waste contractors to provide solid waste collection services, namely; ABC Waste, Asadu Royal Waste Ltd, Daben Cleansing Ltd, Jekora Ventures, JSO, Liberty Waste Ltd, Meskworld, Yafuru/Almanuel/Catrol and Zoomlion Ghana Ltd. The WMD has re-zoned AMA into eleven (11) solid waste collection zones using the boundaries of the sub-metro districts. The each formal private waste company is assigned to a minimum of one zone.

These private contractors are responsible for SWC in the metropolis through HtH and CCC as is fully privatized. As per the franchise agreement, the contractors have the responsibility to register and collect the assigned fees and payments for services rendered to beneficiaries. Generally the HtH system operates in high and middle-income areas while the CCC operates in low-income areas. Service providers rendering HtH are supposed to collect solid waste at least once a week, while those rendering CCC system are supposed to empty the container daily. On user fees, areas serviced with HtH pay monthly user fees based on the socio-economic status of the area and is collected directly by the service provider. For areas serviced by CCC, the pay-as-you-dump (PAYD) system is used. Even though SWM in AMA is fully privatized and households' are expected to pay for SWM services, the assembly undertake refuse evacuation exercises to clear the community of refuse heaps, especially in low-income areas where cost recovery is low and has resulted in inadequate solid waste collection services. This places huge financial burden on the local government.

5.2.2 Institutional Arrangements for SWM in TaMA

Like AMA, TaMA is also delineated into two solid waste collection zones, which is based on the boundaries of the two sub-metro districts. Unlike AMA, TaMA is directly involved in solid waste collection. TaMA collaborate with Zoomlion Ghana Limited to provide solid waste collection services to beneficiaries (within the middle to low-income areas) through the CCC system. HtH services are provided by six franchised contractors which include Bazini Waste Management, Havana Waste Services, Zoomlion Ghana Limited, Home Refuse Company, Alhaji Takoradi Company Limited and Jam Waste Company.

The assembly assigned five private contractors to some communities in one sub-metro, while the assembly and the other private company operate in the other sub-metro and part of the sub-metro where the other five companies operate. The HtH system operates in high and middle-income areas, while the CCC operates in middle to low-income areas. Like AMA, service providers rendering HtH service are expected to collect solid waste at least once a week, while those rendering CCC service are supposed to empty the container daily. On user fees, areas serviced with HtH pay flat monthly user fees collected directly by the service provider; while area serviced by CCC pay no user fee. The full cost of SWM is the responsible of the assembly. The next section examines the current SWM practices in AMA and TaMA.

5.3 Current SWM Practices in AMA and TaMA

The institutional arrangements for SWM in AMA and TaMA are influence by the mode of collection (i.e. HtH and CCC) and the frequency of collection. This section examines the current SWM practices in AMA and TaMA, which includes primary storage of solid

waste, mode of solid waste collection and disposal, frequency of collection and financial arrangements.

5.3.1 Primary Storage

The study asked respondents to state the type of storage containers that they use for storing solid waste at home. The result revealed two major modes of primary storage for household solid waste: (1) standard plastic waste bin with a lid, associated with HtH system and (2) other unapproved storage facilities such as polythene bags, metal buckets, old plastic buckets and card board boxes, associated with CCC system. Table 5.1 shows the mode of solid waste storage (SWS) by metropolises.

Table 5.1: Mode of SWS by Metropolis (%)

Metropolitan	Standard waste bin with a lid	Polythene bag	Other containers	Do not store	Total
AMA	17.33	23.05	58.86	0.76	100
TaMA	17.27	18.18	64.55	0	100
AMA & TaMA (Pooled data), Total	17.31	21.17	61.05	0.47	100

Source: Field Data, 2016.

The results from the household survey (as shown in Table 5.1) revealed that, only 17.31% of the total respondents in AMA and TaMA used the standard waste bins with a lid. Most of the respondents (82.22%) used unapproved storage facilities such as polythene bags, old bucket, cardboard etc. In AMA, most of the respondents (81.91%) used unapproved storage containers such as polythene bag, old bucket, cardboard etc. This observation can be attributed to the unplanned nature of development in AMA (a wholly urbanized area) (Oteng-Ababio, 2007) which has resulted into poor access to

houses. This has made it difficult to operate the HtH system in most residential areas, which is associated with the use of standard waste bin with a lid.

Similarly, in TaMA majority of the respondents (82.73%) used unapproved storage containers such as polythene bag, old bucket, cardboard etc. The reason for the high usage of unapproved storage container in TaMA is partly attributed to the high incidence of poverty and the poor access to most residential areas. TaMA is one of the poorest urban areas in Ghana, with low ability to pay for SWM services and as a result of this the assembly finds it difficult to operate the HtH system (where service users pay a fee) which is associated with the standard waste bin with a lid. Second, the poor access to houses has made it difficult to operate the HtH system. The next section discusses the situation in AMA. Table 5.2 presents the modes of solid waste storage by residential areas in AMA.

Table 5.2: Mode of SWS by Residential Areas in AMA (%).

Classification	Standard waste bin with a lid	Polythene bag	Other containers	Do not store	Total
Indigenous low-income	0	28.33	70.00	1.67	100
Migrant low-income	4.07	31.85	64.07	0	100
Medium-income	30.30	10.91	56.97	1.81	100
High-income	100	0	0	0	100
TOTAL	17.33	23.05	58.86	0.76	100

Source: Field Data, 2016.

The results from the household survey (as shown in Table 5.2) revealed that, (100%) of the respondents in the high-income area, where HtH collection system is dominant used the standard plastic waste bin with a lid. None used polythene bags, cardboards, old bucket, etc.

This observation is attributed to their greater ability to pay for the HtH collection system, the planned nature and good road network of the high-income residential area that allows the use of HtH which is associated with the standard waste bin with a lid. In addition, the once a week collection of solid waste compel residents to store waste properly, hence the use of standard waste bin with a lid (Oteng-Ababio, 2007).

In the low-income residential areas, overwhelming percentage of respondents in indigenous low-income area (98.33%) and migrant low-income area (95.92%) use unapproved storage facilities such as polythene bags, cardboards, old bucket etc. Generally in low-income areas the ability to pay for SWM service is low and the unplanned nature of development makes access to houses by vehicle difficult. This makes it difficult to operate the HtH system which is associated with the standard waste bin with a lid. In addition, the CCC system which is prevalent in low-income area allows residents to store waste for a short time since residents can visit the container site more than once a day (Oteng-Ababio, 2007). It is important to state that, residents in Nima (a migrant low-income area) were given free standard waste bin with a lid, but was used to store water and clothes rather than solid waste. Table 5.3 presents the mode of solid waste storage by residential areas in TaMA.

Table 5.3: Mode of SWS by Residential Areas in TaMA (%).

Classification	Standard waste bin with a lid	Polythene bag	Other containers	Do not store	Total
Low-income	0	35.83	64.17	0	100
Medium-income	7.27	10.30	82.42	0	100
High-income	100	0	0	0	100
Total	17.27	18.18	40.57	0	100

Source: Field Data, 2016.

As shown in Table 5.3, all the respondents (100%) in the high-income residential area used standard waste bin with a lid. The fact that all the respondents in the high-income area used the standard waste bin with a lid could be attributed to their greater ability to pay, the planned nature and good road networks in the high-income area that allows the use of the HtH collection system which is associated with the use of standard waste bin with a lid.

In contrast, all (100%) the respondents in the low-income area used unapproved storage facilities like polythene bag, cardboard, old bucket etc. This observation is reasonable because most of the residents in low-income area are more likely to be poor and thus have a lower ability to pay for the HtH collection system (with a current user fee of GH¢20.00). Second, the unplanned nature of this low-income residential area prevent the use of HtH system and hence the use of unapproved storage facilities. The findings are consistent with past literature. Oteng-Ababio, (2011b), also found that 100% of the respondents in high-income area of Tema used the standard plastic waste bin due to the planned nature of the area. He argued that low-income areas are compelled to use unapproved waste storage facilities because of lack of economic capabilities, the involvement of children in waste disposal and the fact that the standard plastic waste bin is not well-suited with the prevailing institutional arrangements.

5.3.2 Mode of SWC and Disposal in AMA and TaMA

Table 5.4 shows the modes of solid waste collection and disposal in AMA and TaMA.

Table 5.4: Mode of SWC and Disposal by Metropolis (%)

Metropolitan	Informal waste collector	CCC	HtH	Others	Total
AMA	37.71	29.71	15.81	16.76	100
TaMA	0	57.58	17.27	25.15	100
AMA & TaMA , Total	23.16	40.47	16.37	20	100

Source: Field Data, 2016.

According to the results of the survey, about 40.47% of the total respondents in AMA and TaMA used the CCC system, while just 16.37 % used the HtH, which are the two main official arrangements for SWC and disposal. In AMA, as many as 37.71% of the respondents used the services of informal waste collectors. About 15% of the respondents use the HtH system and 29% use CCC system, which are the official mode of SWC and disposal. The high usage of informal waste collection is attributed to the low quality service received from the official arrangements. During the FGDs some participants indicated that the poor service they received from the formal private contractor compel them to use the services of the informal waste collectors which is perceived to be regular and reliable. As reported by a participant:

They (private waste contractor) don't come regularly to collect the waste, my dustbin become full and I have to keep extra waste in sacks which makes my house unkempt and dirty. At times I employed the services of kaya bolas. Since the private contractor has refused to render quality services [MA, 32-year Old Resident in Dansoman, Accra, Focus Group Discussion, 10th March, 2016]

Another participant argued that:

The private contractor assigned to my community is not reliable because they don't come regularly to collect our waste. For the Kaya Bola (informal waste collector), they always come on time to collect our waste,

that is why I used their services [SA, 45-year Old Resident in Nima, Accra, Focus Group Discussion, 23rd April, 2016]

Interview with an official of the WMD of AMA, revealed that the informal waste collectors are not integrated into the formal SWM and are not legally allowed to work within the jurisdictions where the formal waste companies are assigned. However, since the informal sector provides services to the almost neglected low-income and middle-income communities that receive unreliable waste collection services, is important for the local authorities to formalize and integrate the informal waste collector into the formal waste collection system. This reaffirm the argument made by Oteng-Ababio, (2013a), suggesting that the informal waste collectors are important service providers, because they tend to fill the gap and the inefficiency created by the current formal waste collection system.

In the case of TaMA, none of the respondents use the services of informal waste collectors. Majority of the respondents (57%) use the CCC system, while just 17% use the HtH system. The fact that none of the respondents in TaMA employed the services of informal waste collector is partly because they are not easily accessible and those that are accessible are not patronized because it is not fee-free. Instead, most residents tend to use the fee-free CCC system or dispose of indiscriminately on open space, drains, and forest.

Of much significance is the percentage of respondents that used other methods like burning, burying and indiscriminate disposal of solid waste into drains, open space and forest. In TaMA as many as 25% of the respondents used this method of disposal as against 16% in AMA who burn, bury and dispose of their solid waste indiscriminately into drains, open space and forest. This observation is attributed to the “throw-away” culture of Ghanaians. The next section presents the situation by residential area in AMA.

Table 5.5: Mode of SWC and disposal by residential area in AMA (%).

Classification	Informal waste collector	CCC	HtH	Others	Total
Indigenous low-income	1.67	0	0	98.33	100
Migrant low-income	38.89	57.78	3.33	0	100
Middle-income	55.76	0	26.67	17.58	100
High-income	0	0	100	0	100

Note: Chi-square (21) = 709.059; Pr (= 0.000)

Source: Field Data, 2016.

Table 5.5 presents the mode of solid waste collection and disposal by residential area in AMA. A chi-square test, conducted on the mode of SWC and disposal and the residential locations, gave a value of 709.059 and is statistically significant at 1%. This suggests that there is a high systematic relationship between the mode of SWC and disposal and the residential locations; in other words, the mode of SWC and disposal is influenced by residential areas and by extension economic status of the area under study (i.e. Low, Middle and High). As shown in Table 5.5, in AMA, about 57.78% of respondents from the migrant low-income area use the CCC system, while only 3.33% use the HtH system. This confirmed the earlier argument made in the study that, CCC is prevalent in low-income areas because of their unplanned nature and poor road networks which makes it difficult to operate the HtH system. Interestingly none of the respondents in the indigenous low-income area use the official arrangements of SWM (i.e. CCC and HtH), but overwhelming percentage (98.33%) of the respondents use other means such as disposal on open dump, open space and lagoon.

According to an Assemblyman, Glefe (indigenous low-income area) has not adopted the official arrangements for SWM because residents have declined to pay for SWM services provided by the assigned private contractor because they still perceive that SWM is the sole responsibility of local authority. Consequently, the private contractor

stopped providing SWM service to the residents because of low cost recovery. As stated by the Assemblyman:

Some believe that it is the responsibility of AMA to manage their waste for them. Immediately the public container is placed within the community, residents have the thinking that it is the government that brought it so it is the same government who has to lift the central container when it gets filled up with waste. So immediately you ask them to pay for waste they will insult you. [Interview with an Assemblyman, Glefe, Accra. 25th March, 2016].

Another reason for this behaviour is the availability of water bodies which are used for solid waste disposal. Based on the field observations, the study revealed that most of the residents dump their solid waste into the lagoon.

Plate 5.1: Indiscriminate disposal into Glefe lagoon.



Source: Field Data, 2016.

The result also indicate that as many as 38.89% of the respondents from the migrant low-income area (i.e.Nima) used the services of informal waste collector, compared to 1.67% of respondents from indigenous low-income area (i.e. Glefe) who used the service of informal waste collector. This observation is partly attributed to the differences in their economic activities and availability of alternative method of solid waste disposal. Glefe is traditionally a fishing community where their livelihood had been threatened by

indiscriminate disposal of solid waste into their water bodies. While Nima, a migrant Muslim-majority community has most residents engage in trading activities. This positively influences their ability to pay daily user fee for SWC services provided by the informal waste collectors. In addition, Nima is highly congested and lack open space for solid waste disposal while Glefe has lagoon where most residents dispose of their solid waste.

All the respondents (100%) from high-income area and about 26% of respondents in middle-income area used the HtH system. The fact that all the respondents in the high – income area used the HtH is attributed to their greater ability to pay, the planned and good road networks which makes it easy to use the HtH system. Majority of the respondents (55.67%) in the middle-income area used the services of informal waste collector. The higher percentage of respondents in middle-income area using informal waste collector is partly explained by the poor quality services provided by the formal private contractor which encourage the respondents to use the informal waste collectors which they perceived provide quality and affordable services. As reported by a participant during the FGDs:

... I am very happy with the services provided by Kaya-bola. They are reliable and collect waste regularly. [HS, 46-year Old Resident in Dansoman, Accra, 10th March, 2016]

Another participants reported that:

... as for the private contractors their service is very poor, for the Kaya-bola, they will very punctual and always come on time to collect my waste. They render quality services. [WA, 32-year Old Resident in Dansoman, Accra, 10th March, 2016]

Table 5.6 presents the mode of solid waste collection and disposal by residential area in TaMA. A chi-square test, conducted on the mode of SWC and disposal and the residential locations, gave a value of 319.722 and is statistically significant at 1%. This

suggests that there is a statistically significant relationship between the mode of SWC and disposal and the residential locations. This means that the mode of SWC and disposal is influenced by residential areas and by extension economic status of the area under study (i.e. Low, Middle and High).

Table 5.6: Mode of SWC and Disposal by residential area in TaMA (%).

Classification	Informal waste collector	CCC	HtH	Others	Total
Low-income	0	45.83	0	54.17	100
Middle-income	0	81.82	7.27	10.91	100
High-income	0	0	100	0	100

Note: Chi-square (6) value 319.722; Pr (0.000)

Source: Field Data, 2016.

From the survey, 45.8% of the respondents in low-income area used the CCC services, while none (0%) used the HtH system. Of much significant is the high percentage of respondents (54.17%) in the low-income area that disposed of their solid waste indiscriminately on open space, drains, forest or burn or buries their solid waste. This worrying observation is partly attributed to inadequate containers and the availability of open space and forest for disposing solid waste. During the FGDs a woman lamented that the lack of adequate containers for disposing solid waste causes overflowing of the waste containers making the surroundings dirty. This compels them to find an alternative method of solid waste disposal such as burning, burying and indiscriminate disposal on open space, forest etc. As she argued:

We don't have access to communal containers because they are inadequate. How can I dump the waste close to the communal container when I can burn or bury the waste? [MM, 41-year Old Resident Aboabo, Tamale, Focus Group Discussion, 18TH May, 2016]

Another participant argued that:

I don't understand the local authorities, they have refused to provide as adequate communal container dump our waste. As a result of this the container overflows forcing resident to dump waste around the container making the surrounding unkempt. Others also dispose of their waste into the forest [SAD, 35-year Old Resident Aboabo, Tamale, Focus Group Discussion, and 18th May, 2016]

The results also revealed that, the CCC system is the dominant system of SWC and disposal in the middle-income area with 82% of the respondents using it, as against 7% who used the HtH system. The fact that most respondents in middle-income area use the CCC system, which is fee-free, is because it is the official arrangement of solid waste disposal in the area. As stated by a participant during the FGDs:

I don't have any choice, I have to dump my waste into the central container because that is the waste collection and disposal arrangement kept in place by the Assembly in my community. [MH, 41-year Old Resident Zogbeli, Tamale, Focus Group Discussion, 11TH May, 2016]

5.3.3 Frequency of Solid Waste Collection

The official rate of SWC for the HtH system is at least once a week and should be regular. Accordingly, this section sought the views of service beneficiaries regarding the frequency of SWC since this influence the quality of service. Table 5.7 presents frequency of solid waste collection for HtH by Metropolis.

Table 5.7: Frequency of SWC for HtH by Metropolises (%)

Metropolis	Once/week, irregular	Once/week, regular	Twice /week regular	Total
AMA	59.04	39.76	1.20	100
TaMA	3.51	96.49	0	100
AMA & TaMA	36.43	62.86	0.71	100
TOTAL				

Source: Field Data, 2016.

The results revealed that 62.86% of the total respondents in AMA and TaMA received at least once a week, regular SWC services, while as many as 36.43% of the total respondents in AMA and TaMA received once a week, irregular SWC services. The higher percentage of respondents in AMA and TaMA who receive at least once a week, regular collection of solid waste services is attributed to the fact that the HtH system is prevalent in high-income area, where cost recovery is high. In addition the well planned nature of the neighbourhood allows for easy access by vehicle. These conditions encourage the service providers to adhere to the official frequency of collection.

In AMA, most of the respondents (59.04%) receive once-a-week, irregular collection. Even though residents in AMA have the capacity to pay for solid waste collection, the high population growth has resulted in continuous solid waste generation that have outstrips the capacity of the service provider to provide quality service. In contrast overwhelming percentage of respondents in TaMA (96.49%) confirmed a once-a-week regular collection. This observation is attributed to the fact that, the HtH system is prevalent in high-income residential area in TaMA where there is greater ability to pay and thus high cost recovery. This motivates service providers to render quality service. Table 5.8 presents the frequency of solid waste collection by residential areas in AMA.

Table 5.8: Frequency of SWC by residential areas in AMA (%)

Metropolis	Once/ irregular	Once/week, regular	Twice /week regular	Total
Low-income	100	0	0	100
Middle-income	72.73	27.27	0	100
High-income	26.67	70	3.33	100

Source: Field Data, 2016.

None of the respondents in the low-income areas of AMA received once-a-week regular collection service. However, most of the respondents (70%) in the high-income area had

a once-a-week, regular collection. This difference is attributed to the high cost recovery at high-income area and the good road networks which allow easy access to residential facilities. Like AMA, in TaMA all the respondents (100%) in the high-income area received the official rate of SWC (as shown in Table 5.9). This observation is attributed to the high cost recovery at high-income area and the planned nature of such neighbourhood which allows easy access to residential houses.

Table 5.9: Frequency of SWC by residential areas in TaMA (%)

Metropolis	Once/ irregular	Once/week, regular	Twice /week regular	Total
Low-income	0	0	0	0
Middle-income	16.67	83.33	0	100
High-income	0	100	0	100

Source: Field Data, 2016.

In the case of the low-income area, none of the respondents were using the HtH collection system. Based on the survey results, it can be concluded that, there is inequality in the provision of solid waste services among the rich and poor. Most of the high-income areas enjoyed the official rate of collection while a few of the respondents in the middle and low-income areas received once-a-week, regular collection services in AMA and TaMA. This finding is in tandem with the observations by Oteng-Ababio (2011a).

5.4 Final Disposal of Solid Waste

Sustainable SWM requires that the collected solid waste is transported, treated and disposed safely. It is in this light that this section examines the current practices of solid waste disposal at AMA and TaMA.

5.4.1. Solid Waste Disposal in AMA

Based on an in-depth interview with an official at the WMD of AMA, the study revealed that AMA has no engineered landfill site under its jurisdiction. Solid wastes collected in the metropolis are disposed of on Nsumia dump site which is located in Nsawam-Adoagyiri Municipality. As reported by an official of WMD of AMA:

Currently AMA has no engineered landfill site, but solid waste collected is disposed off at Nsumia dump site or Kpone landfill site [Interview with Official, Waste Management Department, Accra Metropolitan Assembly, Accra, May 5, 2016]

This was confirmed by the Private waste contractor providing services to beneficiaries at the metropolis:

AMA has no landfill site; the truck driver has to transport the waste to Nsumia dump site [Interview with an officer, Private waste contractor 1, AMA]

An official at the Environmental Protection Agency (EPA) also confirmed this:

There is no sanitary landfill site in the metropolis (i.e. AMA) [Interview with an official, Environmental Protection Agency, Accra]

It is however important to note that, AMA located a piece of land at Kwabenya for the construction of an engineered sanitary landfill in 1999. The project was financed by the World Bank. However, the land around the site was encroached upon and the project came to a halt. The community also expressed their reservations about the negative impact likely to arise as a result of siting the landfill in the community (Owusu, *et.al.*, 2012). Based on field observations, the study revealed that the basic requirements for safe disposal at the dump site were not adhered to. Table 5.10 present current practices at the disposal site.

Table 5.10: Current practices at the Nsumia dump site

Standard practices	Actual practices	Comments
Access control	The dump site is not fenced to keep people and animal away.	Poses danger to the public and animals.
Daily compaction and cover	Daily compaction and soil coverage of the waste is not practiced.	Encourage fly breeding; produce odour and blowing of litter by wind.
Methane management	No methane management; methane gas released into the atmosphere	Greenhouse gas that can cause climate change and fire at dump site.
Leachate management	No leachate management	Toxic liquid that can contaminate soil and pollute water bodies.
Weighing bridge	Functional	Enable accurate data on solid waste quantity for planning purposes.

Source: Field data, 2016.

As presented in Table 5.10, the minimum environmental safety standards for solid waste disposal are not adhered to by authorities at the Nsumia dump site. Apart from the presence of a functional weigh bridge (see plate 5.2) which is use to take accurate estimate of solid waste quantity for planning purposes, the methane gas produced was not properly managed.



Plate 5.2: Weigh-bridge in operation at Nsumia dump site .



Source: Field data, 2016.

The daily covering of refuse with sand was not practiced (see plate 5.3) and there was no leachate management (see plate 5.4). In addition, the dump site is close to human settlement and is not properly fenced to keep people and animals out. This has implications for public health and environmental hazards.

Plate 5.3: Uncovered waste at the Nsumia dump site



Source: Field data, 2016.

Plate 5.4: Untreated leachate flowing at Nsumia dump site



Source: Field data: 2016.

5.4.2 Solid Waste Disposal in TaMA

In TaMA, an interview with an official of the WMD revealed that, Tamale has an engineered landfill site at Gbahali, which started operation in 2006. A visit to the landfill

site revealed that the minimum environmental safety standards are not adhered to. Table 5.11 summarized the current solid waste disposal practices at the Gbahali dump site.

Table 5.11: Current practices at the Gbahali landfill site

Standard practices	Actual practice	Comments
Access control	The dump site is properly fenced off to keep people and animal	Protect human safety
Daily compaction and cover	Daily compaction and soil coverage of the waste is not practiced	Encourage fly breeding; odour and blowing of litter by wind
Methane management	No methane management; methane gas is released into the environment.	Greenhouse gas that can cause climate change and fire at dump site
Leachate management	No leachate management	Toxic liquid that can contaminate soil and pollute water bodies.
Weighing bridge	Has weigh bridge but non-functional	Accurate data on waste quantity for planning purposes is limited

Source: Field data, 2016.

There is no proper management of the leachate, the methane gas and the daily covering of waste with sand is not practiced. The weighing bridge is faulty and the volume of waste is estimated based on the volume of the container. However, the landfill site at Gbahali is well-fenced to prevent people and animals from getting easy access to the landfill.

Plate 5.5: Uncovered waste at the Gbahali landfill site in Tamale.



Source: Field data, 2016.

The study revealed that the final disposal of solid waste in AMA and TaMA do not follow the minimum requirements for safe management of landfill. According to Allotey (2011), poor landfill management has environmental and health challenges such as toxic groundwater contaminants. Thus, the current solid waste disposal practices in AMA and TaMA are environmentally unfriendly and goes to confirm the argument made by Oteng-Ababio, (2013b:208) that the “state of landfills is in a state of ambivalence and indeed in the intensive care unit”.

5.5 Resource Management- Reduce, Reuse, Recycle, Recovery.

Based on in-depth interviews with officials of WMD at AMA and TaMA, the study indicated that AMA and TaMA have no formal or organized source separation schemes at the households’ level.

As hinted by the official of the WMD at AMA:

The Assembly (AMA) has not invested much in recycling facilities, so there is no incentive for the private waste contractor to collect separated waste. There is no formal arrangement for households’ to separate waste at

source [Interview with an official, Waste Management Department, Accra Metropolitan Assembly, Accra, May 5, 2016]

Similarly, the official of the WMD of TaMA reported that:

The system does not encourage solid waste separation at source; mixed waste is collected because they are no laws in place supporting the collection of separated waste at source. [Interview with an official, Waste Management Department, Tamale Metropolitan Assembly, Tamale, June 16, 2016]

The study also observed that, most of the resource recovery activities are carried out by the informal sector. Based on field observations the study revealed that households' especially those in the low-income areas source separate plastics, metals and organic waste such as plantain, cassava and yam peel. According to the residents they source separate plastics and metal because there is market for them and they earn extra income from the sale of these materials to the itinerant buyers. Others reported that, they source separate cassava, plantain and yam peels to feed their livestock. During the FGDs a participant reported:

I do separate yam, cassava and plantain peels to feed the animals. [MH, 41-year Old Resident Zogbeli, Tamale, Focus Group Discussion, 11TH May, 2016]

Another participant stated that;

Plastics and metals have market and I separate these wastes because we earn extra money from the sale of plastics and metals. [JUD, 29-year Old Resident Nima, Accra, Focus Group Discussion, 23rd April, 2016]

Plate 5.6: Source separation of pure water sachet by a resident at Glefe



Source: Field data, 2016.

At the dump site, the study observed waste pickers and scavengers picking plastics and metals (see plate 5.6). Based on in-depth interviews the waste pickers indicated that they pick the plastic and metals and sell them to earn extra income.

Plate 5.7: Waste pickers at Nsumia dump scavenging for plastics & metals



Source: Field data, 2016.

5.6 Financial Arrangement

There were differences in the financial arrangements of SWM in AMA and TaMA. In AMA, under the FPB policy, the assembly has adopted the franchise system for both HtH and CCC systems, where the private contractor directly collect user charges from their beneficiaries at their zone of operations. Users of the CCC system pay GH¢0.20 and GH¢1.00 per head-load depending on the quantity of solid waste dispose. Under the HtH collection system, the cross-subsidization concept is used; user fees are based on the wealth status of the beneficiaries. Low, middle and high-income residential areas pay GH¢ 20.00, GH¢ 40.00 and GH¢ 60.00 for 240 litre container per month respectively. However, the assembly is responsible for refuse evacuation at community level and has engaged private waste contractors to collect and transport solid waste at a cost of GH¢18.00 per ton. Due to the public good nature of SWM, the assembly evacuates and clears solid waste accumulated, especially in low-income areas where service is inadequate and residents dump waste indiscriminately. This has placed huge financial burden on the assembly.

In the case of TaMA, the assembly has adopted the franchise system for the HtH operation. Under the franchise system the contractor collect a flat monthly user charge of GH¢ 20.00, irrespective of the beneficiary's wealth status. The beneficiaries of the HtH are given free 240 liters containers. With the CCC system, both the WMD and a private contractor contracted by the assembly provide services at designated areas in the low and middle-income areas. Residents using this system do not pay user fees and the assembly assumes financial responsibility for the CCC operation. Like AMA, the private contractor engaged by TaMA is paid GH¢18.00 per ton of solid waste.

The study also revealed that , in AMA and TaMA the service beneficiaries of the HtH collection service are not involve in fixing user fee. The decisions regarding the amount

and when to pay the user charges are often made by the local authority, and in some cases with the private contractor and voted at the fee-setting and Resolution meeting by stakeholders including the assembly men who are supposed to represent their community members. During the FGDs a participant reported that:

We are not involved in setting the user fees and the type of service that meet the demand of the community members. Usually it is the private waste contractor who just comes one day and inform as about the current user charges. If is too high we oppose and negotiate for reduction. [UM, 44-year Old Resident in Dansoman, Accra, 10th March, 2016]

This was confirmed by another participant:

Most often it is the service providers who comes around and inform us about the new user fees. I do not know how is determined because the community is not consulted before the price is determined. [KAM, 39-year Old Resident Zogbeli, Tamale, Focus Group Discussion, 11TH May, 2016]

The non-involvement of service users in determining user fees has serious implication for the financial sustainability of the SWM.

5.7 Perceptions of Stakeholders about SWM Practices in AMA and TaMA

For a livable, economic competitive and resilience city, the SWM system needs to be working well. According to UNEP, (2015), for the SWM system to be sustainable it should be an all-inclusive system that allows all stakeholders the opportunity to perform effectively as users, providers and enablers. Accordingly this section analyzes the perceptions of stakeholders about the current SWM practices in AMA and TaMA. This analysis will help identify the problems facing SWM from the perspectives of the stakeholders involved.

5.7.1 Perceptions of Service Providers on SWM Practices in AMA and TaMA.

Based on in-depth interviews with seven (7) private waste contractors at AMA and six (6) private waste contractors at TaMA, the problems facing the service providers include: resource constraints (i.e. financial, human and equipment), poor landfill management, attitudinal problems, weak enforcement of by-laws, lack of public education and poor and inaccessible road.

5.7.1.1 Resource Constraints (i.e financial, human and equipment)

From the perspective of the private waste contractors, inadequate fund is the most important cause of the poor solid waste situation in urban areas of the country. According to them, the failure of the assemblies to make regular payments to the waste contractors makes it difficult for the latter to provide quality services to beneficiaries. A private waste contractor admitted to their inability to provide a reliable service, especially in the low-income areas, and blamed the situation on the assembly tendency to delay contract payments. As reported by a waste contractor at TaMA:

The Assembly does not pay us on time. The delay in payment for work done makes it difficult to maintain our equipment and employ staff to carry out our mandate. Hence the poor solid waste quality service provided. [Interview with Senior Manager, Private Waste Contractor 1, Tamale, 2nd June, 2016].

A private contractor in AMA lamented that low cost recovery of SWM in low-income areas has affected his operations and currently the company owns fuel dealers. As stated by a private waste contractor in AMA:

...money is a problem in this waste business because residents, especially those using the central container system refuse to pay and this affects our financial standing. You know waste management is capital intensive, I need to fuel the truck and pay my workers but the low cost recovery in these communities has made it almost impossible to pay the fuel company that I currently owe. And that is why I cannot empty the container daily.

[Interview with an Officer, Private Waste Contractor 3, Accra, 10th May, 2016].

The equipment situations of the private waste contractor in AMA and TaMA are also poor. Most of the private waste contractors, who were interviewed for this study, indicated that their equipment for waste collection is inadequate. They rely on second hand or used vehicles for their operations because the cost of brand new vehicles for their operations is expensive. This situation is worsened by the fact that these vehicles are not manufacture or assembled locally and hence must be imported with foreign currency which is in itself a problem.

The vehicles that I used in transporting the wastes are old and break down frequently...

The equipment for solid waste management is inadequate. I have two trucks to collect the waste but one is broken down and this has affected the operations of the company. [Interview with an Officer, Private Waste Contractor 3, Accra, 10th May, 2016].

A private waste contractor in Tamale also stated that:

Due to lack of modern equipment I am not able to collect waste from my clients as scheduled. I cannot afford the heavy truck; I have only four tricycles which is inadequate. [Interview with an Officer, Private Waste Contractor 3, Tamale, 9th June, 2016].

From the in-depth interviews with the private contractors in AMA and TaMA, it emerged that most of the service providers lack operational staff such as drivers, waste collectors and labourers because the contractors are unable to employ and pay workers due to inadequate funds. This according to the service providers affects the quality of service. A private waste contractor stated:

Currently I need more drivers to collect and transport the waste ...but this is not possible because I don't have money to pay them. . [Interview with Senior Manager, Private Waste Contractor 2, Accra, 7th April, 2016]

In TaMA a private contractor stated:

Providing regular collection services to my client is hampered because I don't have enough staff. ... Those available are threatening to leave because I cannot pay them on time. [Interview with Senior Manager, Private Waste Contractor 5, Tamale, 16th May, 2016].

5.7.1.2. Poor landfill management

Poor management of landfill site and lack of landfill site for private contractors to tip the waste that they collect from the communities is another major problem that is confronting SWM in AMA. Private waste contractors at AMA argue that they have to travel long distance to dispose of their waste and this increase their operational cost. As a result of the high operational cost, coupled with inadequate equipment they found it difficult to collect waste regularly. As stated by a private waste contractor:

.... Waste collected at Dansoman, Sahara, has to be sent to Nsumia dump site at Nsawam, the Medie road for disposal. The driver has to transport the waste through this long distance ... and you can imagine the amount of money spent fuelling the truck. This increases the cost of operation significantly. AMA has to get a disposal site or even a transfer station close to our area of operation. [Interview with Senior Manager, Private Waste Contractor 2, Accra, 7th April, 2016]

Another private waste contractor argued that the road leading to the Nsumia dump site is untarred and is in poor condition. This makes it difficult to access the dump site in the rainy season.

A lot of work has to be done on the road leading to the dump site. During the rainy season my waste trucks get stuck in the muddy untarred road for days. [Interview with Senior Manager, Private Waste Contractor 5, Accra, 16th May, 2016]

In TaMA final disposal of solid waste was not a major problem to the service provider because TaMA has an engineered landfill at Gbahali where service providers dispose of waste. However a few complained of the poor road network leading to the landfill site especially during the rainy season. A private contractor reported that:

The road is untarred with huge potholes. When it rains the place becomes muddy making the landfill site inaccessible. [Interview with Senior Manager, Private Waste Contractor 3, Tamale, 9th June, 2016]

5.7.1.3 Attitudinal problem

Interviews with the service providers revealed that, resident in low-income communities in AMA, for example physically attacked workers of the assigned private waste contractor for attempting to place the container close to their shop because of the Not-In-My-Backyard (NIMBY) attitude of the people. As reported by a private contractor at AMA:

...because of their previous experience with the poor management of the sanitary sites, some residents vehemently oppose the placement of containers close to their shop... my staff was physically attacked for placing a container close to someone shop. [Interview with Senior Manager, Private Waste Contractor 3, Accra, 10th May, 2016]

Another private waste contractor also complained about indiscriminate disposal of solid waste in Tamale:

The “throw-away” culture of the people in Tamale has to change. It is now common to see people carelessly throwing refuse on streets, open spaces and even in the gutters. [Interview with Senior Manager, Private Waste Contractor 5, Tamale, 13th June, 2016]

5.7.1.4 Weak enforcement of by-laws

According to the private waste contractors, the weak enforcement of existing by-laws by local authorities has contributed to the poor SWM in AMA and TaMA. A private waste contractor at AMA reported that weak enforcement of the assembly by-law on SWM has encouraged the public to freely litter the streets and dump solid waste indiscriminately into drains, open space and water bodies. As reported by a private contractor at AMA:

The poor enforcement of the by-laws by assembly (thus AMA) has given the public impudence to dispose of waste in an unauthorized place like the

gutters, open space and waterbodies. Actually, indiscriminate disposal of solid waste has become the order of the day. [Interview with Senior Manager, Private Waste Contractor 5, Accra, 16th May, 2016].

A private contractor at TaMA lamented:

The people are not afraid to dispose of solid wastes into gutters, open spaces.....just because the assembly (TaMA) has refused to sanction those who dispose of waste into gutters, open space etc. [Interview with Senior Manager, Private Waste Contractor 4 , Tamale, 10th June, 2016]

5.7.1.5 Inadequate of Public education

The study also found that the main constraint in community participation in SWM in the AMA and TaMA is inadequate education of the negative impacts of improper SWM. The service providers lamented that the inability of the assemblies to conduct regular education on SWM practices impact negatively on households' attitude towards solid waste. A private contractor at AMA reported:

.. Households' poor solid waste management practices can also be attributed to the inadequate education on the negative impact of poor solid waste management. The assembly has to regularly educate the populace for them to appreciate the danger of their behaviour. . [Interview with Senior Manager, Private Waste Contractor 3, Accra, 10th May, 2016].

Another private contractor at TaMA stated:

In Tamale, people disposed of waste anywhere and anyhow just because they are not much informed about the effect of indiscriminate disposal of waste on their health, environment and livelihood. I think the assembly has to increase its educational campaign to get the people informed about the consequences of poor waste management. [Interview with Senior Manager, Private Waste Contractor 4, Tamale, 10th June, 2016]

5.7.1.6 Poor and inaccessible roads

The service providers in AMA and TaMA reported that, the unplanned nature of development, especially in the low-income areas in the cities impede access to residential facilities for the provision of services. A private contractor at AMA stated that the

narrow streets and pathway in most low-income areas constrain their solid waste collection services.

... our trucks find it difficult to access customers in low-income areas because the place is not well-plan. ... the streets and the pathway are narrow. [Interview with Senior Manager, Private Waste Contractor 2, Accra, 7th April, 2016]

A private contractor in TaMA lamented that the poor internal road network affect their operation negatively.

The internal road network is poor, it is not tarred... especially during the rainy season the waste truck and tricycle get stuck in muddy potholes for several hours when trying to collect waste from our customers. [Interview with Senior Manager, Private Waste Contractor 3, Tamale, 9th June, 2016]

5.7.2 Perceptions of service users about SWM practices

The service users are very important actors within the SWM system because they generate solid waste; present their solid waste for collection and sometimes pay for SWC services. Hence their views on the current SWM practices are critical in assessing the sustainability of the system.

5.7.2.1. Level of Satisfaction of HtH collection service.

Table 5.12 shows the respondents level of satisfaction of HtH services by Metropolis.

Table 5.12: Satisfaction of HtH services by metropolis (%)

Metropolis	Satisfied	Dissatisfied	Total (%)
AMA	62.65	37.35	100
TaMA	96.49	3.51	100
AMA & TaMA TOTAL	76.43	23.57	100

Source: Field Data, 2016.

From the results, majority (76.43%) of the total respondents in AMA and TaMA were satisfied with the quality of HtH service. Similar pattern was observed in AMA and

TaMA. About 62.65% of the respondents in AMA were satisfied with the quality of HtH service, compared to 96.49% of respondents in TaMA who stated they were satisfied with the quality of HtH service. As explained earlier in the study, the HtH is prevalent in high-income areas due to the planned nature of the area and the high cost recovery. These conditions encourage service providers to provide quality service. Hence, the high level of service user's satisfaction.

Table 5.13 shows the level of satisfaction of HtH services by residential areas in AMA. A chi-square test, conducted on the households' level of satisfaction of HtH service and the residential locations, gave a value of 355.66 and is statistically significant at 1%. This suggests that there is a high significant relationship between the level of satisfaction of HtH service and the residential locations; in other words, the level of satisfaction is influenced by residential areas and by extension economic status of the area under study (i.e. Low, Middle and High)

Table 5.13: Satisfaction of HtH services by residential areas in AMA (%).

Classification	Satisfied	Dissatisfied	Total
Low-income	0	100	100
Middle-income	54.55	45.45	100
High-income	93.33	6.67	100

Note: Chi-square (15) value 355.659; Pr(0.000)

Source: Field Data, 2016.

From the survey results (as shown in table 5.13), all the respondents (100%) in the low-income areas were not satisfied with the HtH service. In contrast majority of respondents (93.33%) in the high-income area were satisfied with the quality of HtH service. Like AMA, most of the respondents (83.33%) in the high-income area of TaMA were satisfied with the HtH collection services (as shown in table 5.14).

Table 5.14: Satisfaction of HtH services by residential areas in TaMA (%).

Classification	Satisfied	Not satisfied	Total (%)
Middle-income	83.33	16.67	100
High-income	100	0	100

Note: Chi-square (15) value 282.949; Pr(0.000)

Source: Field Data, 2016.

Table 5.14 shows the level of satisfaction of HtH services by residential areas in TaMA. A chi-square test, conducted on the households' level of satisfaction of HtH collection service and the residential locations, gave a value of 282.95 and is statistically significant at 1%. This suggests that there is a statistically significant relationship between the level of satisfaction of HtH service and the residential locations; in other words, the level of satisfaction is influenced by residential areas and by extension economic status of the area under study (i.e. Low, Middle and High). None of the respondents in the low-income area use the HtH system. The difference in observation is attributed to the high cost recovery and planned nature of high-income areas which encourage the service providers to give quality service in terms of frequency of collection.

5.7.2.2. Perception of quality of CCC system by Beneficiaries

Table 5.15, shows the level of satisfaction of households' using the CCC service by metropolises. Based on the survey results, majority (89.31%) of the total respondents in AMA and TaMA were not satisfied with the quality of the CCC system.

Table 5.15: Satisfaction with CCC services by metropolises (%)

Metropolis	Satisfied	Dissatisfied	Total (%)
AMA	23.72	76.28	100
TaMA	0	100	100
AMA & TaMA Total	10.69	89.31	100

Source: Field Data, 2016.

Similar pattern was observed in AMA and TaMA. In AMA, 76.28% of the respondents using the CCC system were dissatisfied with the current service. Whiles all (100%) of the respondents in TaMA using the CCC systems were dissatisfied with the current service. In AMA, the CCC system operate largely in low-income areas where most of the residents are poor and also still thinks that SWM is the sole responsibility of local authorities. Consequently, cost recovery is low in such areas and this constrains SWM collection service. In the case of TaMA, the CCC operates in low-income areas for free and the assembly takes the financial responsibility. This place huge financial burden on the assembly such that it is unable to pay the private contractor on time. The low cost recovery and tardy payment by the assemblies, makes it difficult for the service providers to provide quality service.

The study also asked the respondents to state the problems with the CCC system. Table 5.16 presents the problems with the CCC system by Metropolises.

Table 5.16: Problems with the CCC system by Metropolises (%)

Metropolis	Dirty surroundings/ overflowing container	Irregular collection	No ladder	Long distance	Total (%)
AMA	56.30	29.41	9.24	5.04	100
TaMA	43.16	36.32	7.89	12.63	100
AMA & TaMA Total	48.22	33.66	8.41	9.71	100

Source: Field Data, 2016.

As shown in Table 5.16, as many as 48.22% of the total respondents in AMA and TaMA cited overflowing container as a problem with the CCC system. Whiles 33.66% reported that the container was not emptied regularly. In AMA, most of the respondents (56.30%) cited overflowing of container as a problem with the CCC system. As many as 43.16 % of the respondents in TaMA reported that the containers overflow whiles 36.32% cited irregular collection as a problem associated with the CCC system. Generally the CCC system is prevalent in low-income areas where the cost recovery is low. This affects the financial conditions of the service provider negatively. Consequently, they are not able to empty the container regularly leading to the overflowing of the containers.

In AMA, all the respondents (100%) in the low-income area using CCC were not satisfied with the quality of service. There was no response from the middle and high-income areas in AMA, because none of the respondents in these areas used the CCC system. When asked to state the problems with the CCC system most of the respondents (56.30%), cited overflowing of container as problem associated with CCC system, followed by irregular collection (29.41%). The results from the FGDs confirmed these observations. As lamented by a resident during the FGDs:

...the whole community is engulfed with waste. The contractor does not empty the container regularly. This is affecting our health. Last week I have to send my son to hospital because of malaria. [AA, 47-year Old Resident in Nima, Accra, and 23rd April, 2016]

As reported by another participant;

The local authorities have made life uncomfortable. I have to trek more than 20 minutes to access the communal waste container. As a result, I sometimes dispose of the waste into the drains. [HF, 32-year Old Resident in Nima, Accra, 23rd April, 2016]

Generally the CCC system is prevalent in low-income areas where the cost recovery is low. This affects the financial conditions of the service provider negatively.

Consequently, they are not able to empty the container regularly leading to the overflowing of the containers.

The study also revealed that, all the respondents (100%) in the low-income and middle-income areas in TaMA were not satisfied with the quality of services received from the CCC system. The respondents were asked to state the problems associated with the CCC system. Table 5.17 presents the major problems associated with the CCC system as stated by the respondents in TaMA. A chi-square test, conducted on the problems associated with the CCC system and the residential locations, gave a value of 121.11 and is statistically significant at 1%. This means that there is a statistically significant relationship between households' perception about the problems associated with CCC system and the residential location; in other words, problems with CCC system are influenced by residential areas and by extension economic status of the area under study (i.e. Low, Middle and High).

Table 5.17: Problems with CCC system by residential areas in TaMA (%)

Residential areas	Dirty surroundings/ overflowing container	Irregular collection	No ladder	Long distance	Total (%)
Low	52.73	27.27	0	20	100
Middle	39.26	40	11.11	9.63	100

Note: Chi-square (10) value 121.114; Pr(0.000)

Source: Field Data, 2016.

Most (52.73%) of the respondents in the low-income area cited overflowing container as a major problem with the CCC system, while 27.27% cited irregular collection as a problem associated with the CCC system. In the middle-income area, as many as 40% cited irregular collection as a problem as against 39.26% who said overflowing container was a problem. Of importance is the appreciable percentage (20%) of respondents who stated long distance as a problem associated with the CCC system.

The results from the FDGs confirmed this observation. A participant complained of overflowing of waste container:

... I don't like the way waste is managed in this community. The containers are not emptied regularly and overflow. When the wind blows you see flies all over. The poor management of waste in this community is making as get sick. [HAM, 50-year Old Resident Aboabo, Tamale, 18TH May, 2016].

It is evident from the above findings that there are inadequate SWC services, particularly in middle and low-income areas in AMA and TaMA. Resident in low and middle-income areas (where the CCC system is prevalent) are highly dissatisfied with the current services they receive. SWC is irregular and unreliable resulting in overflowing container. As a result of the poor SWC services in the low-income communities, majority of the urban poor in AMA and TaMA live in filthy conditions that are not only health and life-threatening, but also degrading.

5.7.3 Perceptions of Local authorities about SWM practices

Based on in-depth interviews with the local authorities the problems identified with the current SWM practices include resource constraints (financial, human and equipment), and attitudinal problems.

5.7.3.1 Resource constraint

The issue of inadequate funds is a fundamental problem affecting solid waste disposal practices in AMA and TaMA. The study revealed that, the assemblies lack the necessary financial resources to manage solid waste effectively. The lack of financial resources has

made it difficult or almost impossible for the assemblies to practice standard waste disposal operation and maintenance. An official reported:

...due to inadequate financial resources, the assembly cannot observe the basic requirements for safe disposal of waste on a landfill. Safe practices such as daily compaction and cover, fumigation of disposed waste to reduce odour and insects, gas monitoring and leachate treatment, monitoring the movement of disposal trucks and tonnage of waste disposed is not practiced [Interview with official, Landfill Site, Tamale, 14th June, 2016]

An official at Nsumia dump site reported that:

... managing land fill is capital intensive. The lack of funds has made it difficult to follow the minimum standard of proper waste disposal. The current tipping/dumping fee of GH¢18.00 per tonnage is inadequate to maintain the landfill. The lack of fund is a big issue. [Interview with an official, Landfill Site, Accra, 11th May, 2016]

An official of the WMD of TaMA lamented that the assembly is not able to empty the containers regularly due to lack of funds:

Due to lack of funds the assembly is not able to empty the container daily leading to the overflowing of the waste containers. [Interview with an Official, WMD, Tamale Metropolitan Assembly, Tamale, June 16, 2016]

Interviews with officials of the WMDs of AMA and TaMA revealed that, the Assemblies lack the logistics required for the collection and transportation of solid waste to disposal sites. As reported by an official of the WMD of AMA:

The equipment holdings of the assembly are inadequate. The assembly has to contract Zoomlion to undertake evacuation of heap of waste in case of emergency. [Interview with an Official, WMD, Accra Metropolitan Assembly, Accra, May 5th, 2016]

It also emerged from the interviews that, inadequate equipment at the disposal site contributes to the poor landfill management in the study areas. An official at the Gbahali landfill site in TaMA stated that, due to inadequate equipment at the disposal site, the daily covering, leveling and compaction of waste are not carried out.

The final disposal site has one compactor truck and one bulldozer. This affect the daily covering and compaction of waste [Interview with an official, Landfill Site, Tamale, 14th June, 2016]

An official at the Nsumia dump site also conceded that the daily level and compaction of cells are not done because of inadequate equipment.

Daily covering and compaction of waste is not done because the equipment is inadequate. The only compactor truck is broken down. [Interview with an Official, Landfill Site, Accra, 11th May, 2016]

The study also revealed that the lack of logistic prevent the assemblies from carry out regulatory and monitoring. According to an official at the WMD of the TaMA, they are not able to carry out their regulatory and monitoring roles because of inadequate vehicle.

The department has only one pick-up. This situation impedes our activities because one pick-up cannot be used to monitor the activities of service providers in the whole metropolis. Consequently, monitoring becomes difficult. [Interview with an Official, WMD, Tamale Metropolitan Assembly, Tamale, June 16, 2016]

Apart from inadequate funds and equipment, inadequate human resources and qualified personnel were cited as one of the problems of poor SWM. An official at AMA reported that:

The staff strength of the department is weak. the assembly is not able to monitor the activities of the service provider effectively because we don't have the capacity to do so. [Interview with an Official, WMD, Accra Metropolitan Assembly, Accra, May 5th, 2016]

An official at TaMA confirmed this assertion:

The solid waste management problem is compounded because the department is understaffed. . [Interview with an Official, WMD, Tamale Metropolitan Assembly, Tamale, June 16, 2016]

5.7.3.2 Attitudinal problem

The WMD of AMA face great difficulties in their efforts to acquire suitable land space for solid waste disposal. In Accra, the growing concern of Not-In-My-Backyard (NIMBY) attitude or civil society protests against the siting of waste disposal facilities are making it extremely difficult for the assembly to acquire suitable land space for waste disposal. An official of the WMD of AMA insinuated:

...acquiring land to construct landfill site in the city is almost impossible. The Kwabenya landfill project was not successful because residents and other civil society oppose the siting of such facility in their community. As a result, we have to trek outside AMA to dispose of waste onto the Nsumia or the Kpone landfill. [Interview with an Official, Waste Management Department, Accra Metropolitan Assembly, Accra, May 5, 2016]

According to an official at the WMD of TaMA the poor SWM is an attitudinal problem. Most of the residents in the low-income area have the perception that SWM is the sole responsibility of the assembly.

Especially those in the low-income areas still think solid waste management is the sole responsibility of the assembly. Because of this the assembly cannot implement the pay-as-you-dump system in Tamale. If we do they decline to pay for solid waste services and dispose of their waste indiscriminately. [Interview with an Official, WMD, Tamale Metropolitan Assembly, Tamale, June 16, 2016]

5.8 An Appraisal of SWM Practices in AMA and TaMA

The study has examined the institutional arrangements for SWM and the perception of the service providers, service users and local authorities' on the current SWM practices in AMA and TaMA. In this section, the concept of ISWM is use to assess the current SWM practices and institutional arrangements for SWM in AMA and TaMA in a systematic way, with the goal of identifying some opportunities for sustainable solutions. The details will be captured under the sub-headings, public health impact, environmental impact, resource management and SWM governance.

5.8.1 Public Health Impact

The provision of regular and reliable solid waste collection service to urban population is driven primarily by public health. Poor and inadequate solid waste collection service has a direct health impact on residents and can be severe (UNEP, 2015). This is because uncollected solid waste and indiscriminate solid waste disposal into drains encourage vectors to breed, resulting in the spread of cholera, malaria and other infectious diseases and are major contributing factor to flooding. Thus a city with adequate solid waste collection to all resident is a healthy and pleasant place to live.

However, this study revealed that there is inadequate SWC, particularly in middle and low-income areas in AMA and TaMA. Residents in low and middle-income areas (where the CCC system is prevalent) are highly dissatisfied with the current services they receive. SWC is irregular and unreliable resulting in overflowing container. The poor SWM services have implication for public health and environmental protection.

5.8.2 Environmental Impact

The Ghana Landfill Guidelines (2002), enjoins the WMD of the assemblies to acquire and operate a sanitary landfill site for effective solid waste disposal. The Guideline describes a sanitary landfill as one that has been properly acquired and located from human settlements, has an impermeable lining and covered daily. It must also have a leachate and gas management system.

The study also observed that the final disposal sites were poorly managed by the local authorities. The current practices at the final disposal site at AMA and TaMA do not follow the minimum requirements for safe management of landfill. For instance, methane gas and leachate were not managed properly and the daily covering and

compaction of the solid waste were not practiced. This according to Allotey, (2011) may pose several environmental and health challenges, such as water pollution.

5.8.3 Resource management

Resource management which includes source separation, solid waste prevention, reuse, recycle and recovery may be a source of income; help conserve scarce resources; reduce the quantities of solid waste going to the landfill and the cost of managing solid waste (UNEP, 2015). Despite the advantages of source separation, the study showed that the current institutional arrangements for SWM in AMA and TaMA do not encourage source separation. Generally, mixed solid waste is collected and sent to disposal sites. Source separation, reuse, recycle and recovery are usually carried out by the informal sector. However, source separation is critical to the goals of efficient and effective resource management through increased reuse, recycle and recovery.

5.8.4 Solid Waste Management Governance

The study revealed that, SWC service is reliable and very regular in high-income areas, where the HtH collection system operates. In contrast, some middle-income and all low-income communities who used the HtH collection services have inadequate and erratic SWC services. This observation contradicts the tenets of good SWM governance, which argued that for good SWM governance there should be equity in the provision of SWM services.

According to UNEP, (2015:172), “a new or revised service provisions have a higher chance of success if they are discussed, negotiated and agreed with those whose needs they are to address”. However, the study observed that service users were not involved in

setting user fees. The non-involvement of service users in determining user fees has serious implication for the financial sustainability of SWM. Even though the study was not able to undertake any meaningful financial analysis due to lack of data and/or the unwillingness of the participants to share financial information, it has been established that the CCC system which is fee-free in TaMA is not financially sustainable. The local authority bears the financial responsibility because of the public good nature of SWM service.

In AMA, even though householders' are expected to pay for SWC and disposal, most especially those in low-income areas refuse to pay for dumping their solid waste because they think it is the responsibility of the local government. Consequently, the service providers are unable to provide quality service, due to low cost recovery. This compels the service users to indiscriminately dispose of solid waste into open dump, open space, drains and water bodies. Due to the public good nature of SWM the assembly is also compel to contract and pay private contractors to evacuate communities out of refuse, especially in low-income areas. Equally worrying observations in the current SWM governance system relates to the issue of provider inclusivity. The study revealed that the informal waste collectors who collect and recover solid waste materials are not recognized, regulated and protected under the SWM system. Finally the study revealed that due to poor logistics, inadequate financial and human resources, the local authorities in AMA and TaMA are unable to effectively regulate and monitor the service quality and sanitary conditions; enforce by-laws and regularly educate the public on proper SWM practices.

5.9 Conclusion

This chapter examined the current institutional arrangements for SWM and the views of service providers, service users and local authorities on the current SWM practices in AMA and TaMA. Findings from this study show that the current SWC and disposal practices have serious implications for public health and environmental hazards. Generally, SWC in low-income areas in AMA and TaMA is inadequate. The poor management of final disposal sites makes it fraught with a plethora of serious human and environmental problems emerging from landfill gases, leachates and odours.

The study has demonstrated that the SWM governance in AMA and TaMA is weak. There is inequity in SWM, where SWC from residential areas is skewed in favour of the rich. Generally, high-income residential neighbourhoods in AMA and TaMA receive regular and reliable services while most poor residential neighbourhoods receive inadequate SWM services. Solid waste minimization strategies such as source separation, reuse, recycle and recovery are given little attention in terms of practice, but are carried out informally at the household, public skip and landfill site. However, source separation is critical to the goals of efficient and effective resource management through increased reuse, recycle and recovery.

The low cost recovery in SWM, especially in low-income area has placed huge financial burden on the assemblies and service providers, making the SWM systems in AMA and TaMA financially unsustainable. Service users are not also involved in setting user fees, and the informal waste collectors involved in SWM in AMA, are not recognized, regulated and protected under the current SWM system. However, to improve cost recovery it is critical that service users are involve in setting user fees because their involvement would promote social acceptability and participation. Integrating the informal waste collectors who usually collect, transport and recover solid waste material

can improve SWM and financing. Lastly, the study established that assemblies are unable to enforce by-laws effectively and educate the public on proper SWM owing to lack of resources.



CHAPTER SIX

DETERMINANTS OF HOUSEHOLDS' SOURCE SEPARATION BEHAVIOUR

6.1 Introduction

The previous chapter discussed the institutional arrangements for solid waste management in Accra and Tamale metropolises with a critical look at the challenges and opportunities. The findings reveal that despite the SWM crises facing the country, there is no formal arrangement for households' source separation. However, source separation increases the lifespan of landfill sites, reduce the cost of SWM and provide quality material for reuse, recycle and recovery. It is against this background that this chapter sought to examine the determinants of households' source separation behaviour. First, the chapter looks into the distribution of responses by respondents on source separation behaviour, information and the theory of planned behaviour variables which include attitude, subjective norms and perceived behavioural control. Finally, ordered probit regression model was used to examine the factors that influence households' source separation intentions.

6.2 Households' Source Separation Behaviour

6.2.1 *Source separation behaviour among respondents*

Table 6.1 presents households' source separation behaviour by Metropolises. A chi-square test, conducted on household source separation behaviour and the metropolis gave a chi square value of 24.34 for source separate, reuse and recycle of metals and is statistically significant at 1%. Regarding source separation, reuse and recycle of plastics the chi-square value is 29.13 and is statistically significant at 1%. The variable source separate cassava, plantain and yam peels to feed livestock has a chi-square value of 9.42 and is significant at 5% , while the chi-square value for source separation and reuse of leftover food is 14.88 and is statistically significant at 1%. The relation between total source separation behaviour and

the metropolis the respondent is located is statistically significant at 10% and has a chi-square value of 8.05. This suggests that there is a high systematic relationship between household source separation behaviour and the metropolis they are located. The results from the survey also reveal that 40.67% of the total respondents in AMA and TaMA (the entire study area) agree they source separate waste, compare to 15.91% of the respondents who disagree they source separate waste. The observed source separation behaviour among respondents in AMA and TaMA could be attributed to the high demand for plastics and metals which motivate householders to source separate because they earn extra money from selling the separated solid waste.



Table 6.1: Households source separation behaviour by Metropolis (%)

Response	AMA	TaMA	AMA & TaMA, Total
Source separate, reuse and recycle of metals (metal can, scrap metals etc)			
1 (Strongly disagree)	3.24	4.24	2.46
2 (Disagree)	19.05	23.64	20.82
3 (Neutral)	21.52	18.79	18.13
4 (Agree)	47.24	45.15	46.43
5 (Strongly agree)	8.95	8.18	12.16
Total (%)	100	100	100
Note: Chi-square = 24.339; degree of freedom=4 ; Pr(0.000)			
Source separate, reuse and recycle plastics (i.e pure water sachet, plastic bottles etc)			
1 (Strongly disagree)	1.33	1.52	1.40
2 (Disagree)	10.48	19.70	14.04
3 (Neutral)	11.62	14.24	12.63
4 (Agree)	59.43	46.97	54.62
5 (Strongly agree)	17.14	17.58	17.3
Total (%)	100	100	100
Note: Chi-square= 29.128; degree of freedom=4 ; Pr(0.000)			
Source separate, reuse cassava , plantain, yam peels etc to feed livestock			
1 (Strongly disagree)	20.95	0.91	13.22
2 (Disagree)	41.14	4.55	27.02
3 (Neutral)	16	16.06	16.02
4 (Agree)	19.43	60.61	35.32
5 (Strongly agree)	2.48	17.88	8.42
Total (%)	100	100	100
Note: Chi-square= 9.422; degree of freedom=4 ; Pr(0.051)			
Source separate and reuse leftover food rather throwing it away			
1 (Strongly disagree)	0.76	0.61	0.70
2 (Disagree)	2.09	1.21	1.75
3 (Neutral)	16.38	6.36	12.51
4 (Agree)	23.62	30.61	26.32
5 (Strongly agree)	57.14	61.21	58.71
Total (%)	100	100	100
Note: Chi-square= 14.884; degree of freedom=4 ; Pr(0.005)			
Total Source Separation behaviour			
1 (Strongly disagree)	6.57	1.82	4.45
2 (Disagree)	18.19	12.28	15.91
3 (Neutral)	16.38	13.86	14.82
4 (Agree)	37.43	45.84	40.67
5 (Strongly agree)	21.43	26.21	24.15
Total (%)	100	100	100
Total respondents	525	330	855
Note: Chi-square= 8.053; degree of freedom=4 ; Pr(0.090)			

Source: Field Data, 2016.

In AMA, 37.43% of the respondents agree they participate in source separation activities, compared to 18.19% who disagree. In TaMA, 45.84% of the respondents agree they source

separate their waste, compare to just 12.28% who disagree they source separate waste. This means that respondents in TaMA are more likely to source separate waste. The differences in source separation behaviour could be attributed to the heavily congested housing and busy lifestyles of respondents in AMA, which have made space for storing segregated waste and time for engaging in source separation a barrier.

A look at the various sub-components of source separation behaviour reveal that, 46.43% of the total respondents in AMA and TaMA agree they source separate, reuse and recycle metals, compare to 20.82% who disagree they engage in source separation, reuse and recycle of metals in AMA and TaMA (see Table 6.1). In AMA, 47.24% of the respondents agree they engage in source separation, reuse and recycle of metals whilst 19.05% of the respondents in AMA disagree they engage in source separation, reuse and recycle of metals. For TaMA, 45.15% of the respondents agree they source separate, reuse and recycle metals as against 20.82% of the respondents who disagree they source separate, reuse and recycle metals. This means that respondents in AMA are more likely to source separate, reuse and recycle metals. The difference in behaviour could be due to the high demand for metals in AMA. Compared to TaMA, most of the recycling companies are located in Greater Accra Region, where AMA is located and this has increased the demand for metals in AMA. In addition the high standard of living in AMA has made resident to take up source separation of metals as a survival strategy because they earn extra money from the sales of metals.

Source separation, reuse and recycle of plastics, is stronger among the total respondents in AMA and TaMA given that close to 54.62% of the total respondents in the entire study area agree they source separate, reuse and recycle plastics. Respondents in AMA are found to have a higher percentage of respondents (59.43%) who agree they engage in source separation, reuse and recycle of plastics, compare to 46.97% of respondents in TaMA who agree they source separate, reuse and recycle plastics. This could be partly attributed to the

high demand for pure water sachet and other plastics in AMA because of the presence of recycling companies.

The result also revealed that 35.32% of the total respondents in AMA and TaMA agree they source separate and reuse cassava, plantain and yam peels etc to feed livestock, compare to 27.02% of the total respondents in AMA and TaMA who disagree they source separate, reuse cassava, plantain or yam peels to feed livestock. Source separation and reuse of cassava, plantain and yam peels for feeding livestock is found to be stronger in TaMA as majority of the respondents (60.61%) agree they source separate and reuse cassava, plantain or yam peels to feed livestock. In AMA, only 19.43% of the respondents agree they source separate and reuse cassava, plantain or yam peels to feed livestock. The population of Tamale is quite homogeneous, consisting largely of Dagombas who are mostly Muslim (GSS, 2012) and traditionally involved in livestock rearing. They thus source separate and reuse cassava, plantain and yam peels to feed their livestock. AMA is quite heterogeneous; wholly urbanized; heavily congested and with a lot of economic activities. Thus most people in AMA are engaged in trading activities rather than livestock rearing because of lack of space and time to keep the livestock.

Concerning source separation and reuse of leftover food, 58.71% of the total respondents in AMA and TaMA strongly agree they source separate and reuse leftover food. Source separation and reuse of leftover food is found to be stronger in TaMA as 61.21% of the respondents strongly agree they source separate and reuse leftover food. In AMA, 57.14% of the respondents strongly agree they source separate and reused leftover food. This difference in observation is attributed to the fact that TaMA is one of the poorest urban centre in the country with most of the residents having larger household size and this condition makes households to reuse leftover food in order to conserve their limited resources.

6.2.2 Source separation behaviour among residential areas in AMA.

Table 6.2 presents households source separation behaviour by residential areas in AMA. A chi-square test, conducted on household source separation behaviour and the residential locations gave a chi-square value of 56.62 for source separate, reuse and recycle of metals; 52.22 for source separate, reuse and recycle of plastics; 119.62 for source separate and reuse of cassava, plantain and yam peels to feed livestock and 59.19 for source separate and reuse of leftover food and is statistically significant at 1% for each. This suggests that there is a statistical significant relationship between household source separation behaviour and residential locations. Based on the survey, 48.33% of the respondents in indigenous low-income area agree they source separate, reuse and recycle of metals. About 55.93% of the respondents in migrant low-income area agree they source separate, reuse and recycle of metals.

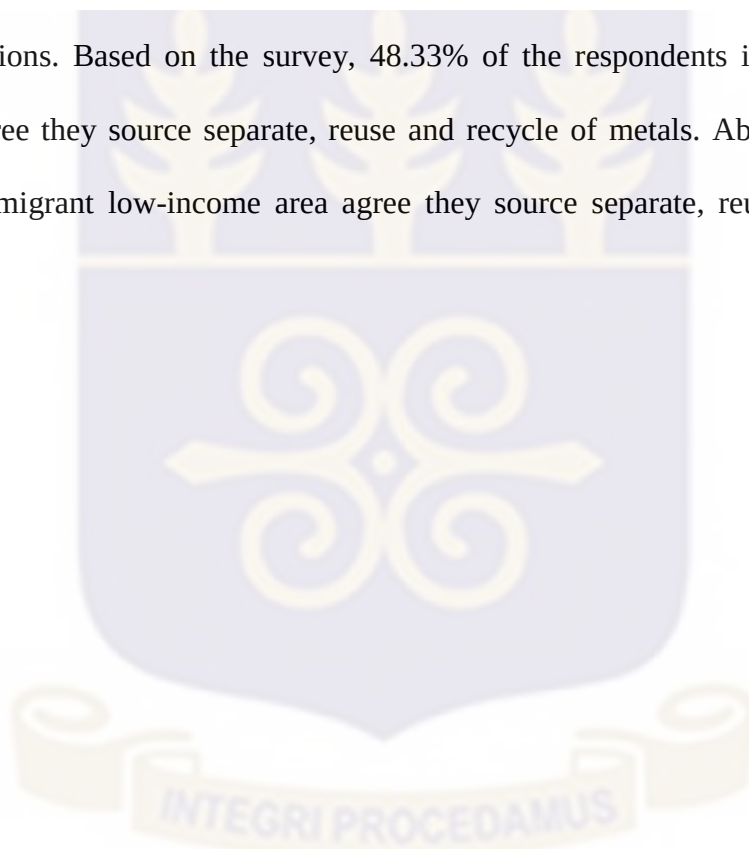


Table 6.2: Source separation behaviour by Residential areas in AMA (%)

Response	Indigenous low-income	Migrant low-income	Middle-income	High-income
Source separate, reuse and recycle of metals (metal can, scrap metals etc)				
1 (Strongly disagree)	1.67	1.48	3.03	50
2 (Disagree)	3.33	5.93	18.18	30
3 (Neutral)	6.67	8.89	14.55	13.33
4 (Agree)	48.33	55.93	44.85	6.67
5 (Strongly agree)	40	27.78	20	0
Total (%)	100	100	100	100
Note: Chi-square = 56.62; degree of freedom=12; Pr(0.000)				
Source separate, reuse and recycle plastics (i.e pure water sachet, plastic bottles etc)				
1 (Strongly disagree)	1.67	1.48	1.21	33.33
2 (Disagree)	5	7.41	18.18	36.67
3 (Neutral)	8.33	11.48	16.97	16.67
4 (Agree)	56.67	55.19	46.67	10
5 (Strongly agree)	28.33	24.44	16.97	3.33
Total (%)	100	100	100	100
Note: Chi-square= 52.22; degree of freedom=12; Pr(0.000)				
Source separate, reuse cassava , plantain, yam peels etc to feed livestock				
1 (Strongly disagree)	48.33	37.04	46.06	50
2 (Disagree)	35	31.11	41.21	36.67
3 (Neutral)	11.67	10.74	7.27	10
4 (Agree)	3.33	15.19	4.24	3.33
5 (Strongly agree)	1.67	5.93	1.21	0
Total (%)	100	100	100	100
Note: Chi-square =119.62; degree of freedom=12; Pr(0.000)				
Source separate, reuse leftover food rather throwing it away				
1 (Strongly disagree)	0	0	0	10
2 (Disagree)	0	0	0	13.22
3 (Neutral)	5	1.85	6.06	40
4 (Agree)	33.33	8.52	27.27	16.67
5 (Strongly agree)	61.67	89.63	66.67	20
Total (%)	100	100	100	100
Note: Chi-square = 59.19; degree of freedom=12; Pr(0.000)				

Source: Field Data, 2016.

As shown in Table 6.2, the high-income area had the least number of respondents (10%) who agree they source separate, reuse and recycle plastics. Most of the respondents in the indigenous low-income (56.67%) and migrant low-income (55.19%) areas respectively agree they engage in source separation, reuse and recycle of plastics.

According to the results of the survey (see Table 6.2), in AMA, only 3.33% of the respondents in indigenous low-income area agree they source separate and reuse cassava, plantain and yam peels to feed livestock compared to 15.19% of the respondents in the migrant low-income area who agree they source separate and reuse cassava, plantain and yam peels to feed livestock. About 4.24% and 3.33% of the respondents in middle-income and high income areas respectively agree they source separate and reuse of cassava, plantain and yam peels to feed livestock. Regarding source separation and reuse of leftover food, majority of respondents in indigenous low-income area (61.67%) and migrant low-income area (89.63%) strongly agree they source separate and reuse leftover food. In the case of middle-income area, 66.67% of the respondents strongly agree they source separate and reuse leftover food. Only 20% of the respondents in high-income area strongly agree they source separate and reuse leftover food.

The above distributions reveal generally, households in low-income area reported stronger source separation behaviour than those in the high-income area. The observed difference in behaviour is partly attributed to time and poverty. Generally, resident of high-income area work in the formal sector, earn higher and regular income, have busy schedules and thus attach a higher opportunity cost to time spent on source separation. However, people in low-income areas are more likely to work in the informal sector, earn low income and thus view source separation as a survival strategy. This is because they earn extra income from the sale of the separated solid waste which they used to supplement their income. During the FGDs

the discussants reported that they source separate plastic and metals because they sell them to itinerant buyer for extra cash.

As opine by one of the discussants:

For instance the itinerant waste buyers come around and we sell our broken plastic chair for money or exchange it for a plastic bucket or bowl. [AA, 50-year Old Resident Glefe, Accra, Focus Group Discussion, 26th March, 2016].

An opinion leader during the focus group discussion reported that:

I sell the separated plastic waste to the waste collector and use the money to offset the cost of the solid waste collection charges. [HW, 49-year Old Opinion leader in Nima, Accra, Focus Group Discussion, 23rd April, 2016]

6.2.3. Source separation behaviour among residential areas in TaMA

Table 6.3 presents households source separation behaviour by residential areas in TaMA. A chi-square test conducted on household source separation behaviour and the residential locations gave a chi-square value of 170.01 for source separate, reuse and recycle of metals; 166.18 for source separate, reuse and recycle of plastics and 30.26 for source separate and reuse of cassava, plantain and yam peels and is statistically significant at 1% for each. This means that there is statistical significant relation between households' source separation, reuse and recycle of metals, plastics, cassava, plantain and yam peels and the residential locations. Regarding source separate and reuse of leftover food the chi-square value is 8.20 and is statistically insignificant. This suggests that there is no relation between source separate and reuse of leftover food and residential locations.

From the table 6.3, it appears source separation, reuse and recycle of metals is stronger among low-income neighbourhood. About 53.33% of the respondents in the low-income area agree they source separate, reuse and recycle metals, compare to only 15.56% in the high-income area who agree they source separate, reuse and recycle metals. Similar pattern is

observed with source separation, reuse and recycle of plastics, reuse of plantain, cassava and yam peels to feed livestock and reuse of leftover food. About 58.33% of respondents in low-income area strongly agree they source separate, reuse and recycle plastics compared to 4.44% of respondents in high-income area who strongly agree they source separate, reuse and recycle plastics. As many as 52.50% of the respondents in the low-income area strongly agree they source separate and reuse plantain, cassava, yam peels to feed livestock, while 11.11% of respondents in high-income area strongly agree they source separate and reuse plantain, cassava, yam peels to feed livestock. Most (65.83%) of the respondents in the low-income area strongly agree they source separate and reuse leftover food and only 13.13% of respondents in high-income area strongly agree they source separate and reuse leftover food.



Table 6.3: Source separation behaviour by Residential areas in TaMA (%).

Response	Low-income	Middle-income	High-income
Source separate, reuse and Recycle of metals (metal can, scrap metals etc)			
1 (Strongly disagree)	0.83	1.82	33.33
2 (Disagree)	8.33	5.45	28.89
3 (Neutral)	9.17	20	13.33
4 (Agree)	53.33	47.27	15.56
5 (Strongly agree)	28.33	25.45	8.89
Total (%)	100	100	100
Note: Chi-square= 170.01; degree of freedom=8; Pr(0.000)			
Source separate, reuse and recycle plastics (i.e pure water sachet, plastic bottles etc)			
1 (Strongly disagree)	2.5	6.06	40
2 (Disagree)	9.17	23.64	24.44
3 (Neutral)	13.33	10.91	17.78
4 (Agree)	16.67	29.09	13.33
5 (Strongly agree)	58.33	30.30	4.44
Total (%)	100	100	100
Note: Chi-square= 166.18; degree of freedom=8; Pr(0.000)			
Source separate, reuse cassava , plantain, yam peels etc to feed livestock			
1 (Strongly disagree)	0.83	1.21	33.33
2 (Disagree)	11.67	19.39	26.67
3 (Neutral)	8.33	6.06	22.22
4 (Agree)	26.67	41.82	6.67
5 (Strongly agree)	52.5	31.52	11.11
Total (%)	100	100	100
Note: Chi-square= 30.26; degree of freedom=8; Pr(0.000)			
Source separate, reuse leftover food rather throwing it away			
1 (Strongly disagree)	1.67	2.42	8.89
2 (Disagree)	5	4.24	15.56
3 (Neutral)	10	6.67	33.33
4 (Agree)	17.5	10.91	28.89
5 (Strongly agree)	65.83	75.76	13.33
Total (%)	100	100	100
Note: Chi-square= 8.19; degree of freedom=6; Pr(0.224)			

Source: Field Data, 2016.

Having more low-income area involved in source separation behaviour than high-income area is not surprising in the sense that the former are more likely to work in the informal sector, earn low income and may practice source separation to earn extra money to supplement their income. Furthermore, traditionally respondents in TaMA are engaged in livestock rearing and reuse cassava, yam and plantain peels to feed their animals. During the FGDs a participant stated that she source separate cassava, plantain and yam peels to feed her husband's livestock.

I source separate the cassava and yam peels from other waste because I use them to feed my husband's sheep and goats [MK, 38-year Old Resident at Aboabo, Focus Group Discussion, 18th May, 2016]

Another resident at Aboabo, in Tamale reported that:

...because plastics have value, we get money from selling the plastics. [MF, 26-year Old Resident Aboabo, Tamale, Focus Group Discussion, 18th May, 2016]

6.3 Theory of Planned Behaviour (TPB) variables and information

Table 6.4 shows the TPB variables which include attitude, subjective norms and perceived behavioural control by metropolis. A chi-square test, conducted on attitude, subjective norms, perceived behavioural control and information, and the metropolis the respondent is located gave a chi-square value of 105.24 for attitude; 99.48 for subjective norms and 287.38 for perceived behavioural control and is statistically significant at 1% for each. This means that there is statistical significant relation between attitude, subjective norms and perceived behavioural control and the metropolis the respondent is located. The variable information has a chi-square value of 0.44 and is statistically insignificant. This suggests that there is no relation between information and the metropolis the respondents are located.

As shown in the table 6.4, 32.16% of the total respondents in AMA and TaMA (the entire study area), 38.48% in AMA and 22.12% in TaMA, indicated a stronger positive attitude

towards source separation of waste. From the results respondents in AMA have a stronger attitude towards source separation than those in TaMA. Residents in AMA are more likely to be highly educated and more exposed and this tends to help them appreciate the social, economic and environmental benefits of source separation and thus have stronger attitude towards source separation.

Table 6.4: Theory of Planned Behaviour variables by Metropolis (%)

Response	AMA	TaMA	AMA & TaMA, Total
Attitude			
1 (Strongly disagree)	12.38	11.52	12.05
2 (Disagree)	11.05	19.70	14.39
3 (Neutral)	15.24	26.70	19.77
4 (Agree)	38.48	22.12	32.16
5 (Strongly agree)	22.86	18.18	21.05
Total (%)	100	100	100
Note: Chi-square =105.24; degree of freedom=20; Pr(0.000)			
Subjective norms			
1 (Strongly disagree)	18.48	20.91	19.42
2 (Disagree)	21.52	18.18	20.23
3 (Neutral)	18.67	16.06	17.66
4 (Agree)	24.76	27.58	25.85
5 (Strongly agree)	16.57	17.27	16.84
Total (%)	100	100	100
Note: Chi-square= 99.48; degree of freedom=18 ; Pr(0.000)			
Perceived behavioural control			
1 (Strongly disagree)	23.24	19.09	21.64
2 (Disagree)	29.90	20.09	26.43
3 (Neutral)	19.23	26.36	21.99
4 (Agree)	13.33	16.06	14.39
5 (Strongly agree)	14.29	17.58	15.56
Total (%)	100	100	100
Note: Chi-square= 287.37; degree of freedom=19; Pr(0.000)			
Information			
Yes	42.29	40	41.40
No	57.71	60	58.60
Total (%)	100	100	100
Note: Chi-square= 0.44; degree of freedom=1; Pr(0.509)			

Source: Field Data, 2016.

Based on the results (see Table 6.4), 25.85% of the total respondents in AMA and TaMA agree subjective norms do have significant influence on their source separation behaviour. About 24.76% of the respondents in AMA agree subjective norms influence their source separation behaviour. In TaMA, 27.58% of the respondents agree subjective norms do have significant influence on their source separation. This suggests that, compare to AMA subjective norm is stronger among respondents in TaMA. The fact that more households in TaMA indicate that their source separation behaviour is influenced by subjective norm than those in AMA is due to the fact that TaMA is quite homogeneous, predominantly comprises of Dagombas who are mostly Muslims. This situation promotes community social cohesion and bonding which help in positively impacting on their source separation behaviour. AMA on the other hand, is quite heterogeneous and is noted for its complex and individualistic way of living. Hence family members, friends, neighbours and opinion leaders have less influence on households' source separation behaviour in AMA.

Table 6.4 reports that about 15.56% of the total respondents in AMA and TaMA strongly agree they have control of their source separation behaviour. The small percentage of total respondents in AMA and TaMA who indicate they have control over their source separation behaviour could be attributed to the lack of skills, opportunity and facilities to encourage source separation. Currently, formal source separation scheme is virtually non-existent in AMA and TaMA, as a result mixed solid waste is collected by the service provider. This condition makes them not to have control of their source separation behaviour.

About 14.29% respondents in AMA strongly agree to have control of their source separation behaviour compare to 17.58% of respondents in TaMA who strongly agree they have control of their source separation behaviour. The percentage of respondents in TaMA exceeds that of the study area (15.56%) who perceived to have control over source separation. The difference in the distribution of responses is linked to the availability of extra space for storing separated

waste and time. AMA, a wholly urbanized area and has high population densities per hectare causing a state of massive congestion and inadequate space to store separated waste. In addition, the busy lifestyles of the people make them attach high opportunity cost to time spent on source separation. Hence the relatively low perceived behavioural control observed at AMA.

Regarding source separation related information, about 41.40% of the total respondents in AMA and TaMA are informed about source separation issues. Approximately 42.29% of the respondents are much informed in AMA, compared to 40% in TaMA. It is not surprising to have more households in AMA informed on source separation issues than those in TaMA as households in the former have easy access to internet, higher levels of education and are more exposed to modern ways of managing solid waste. In addition, source separation programmes and campaigns in the country are a bit biased towards households in AMA. For instance the 2013 National Source Segregation programme was launched and piloted in AMA and has not been piloted in TaMA.

Table 6.5 presents the result on the TPB variables by residential areas in AMA. A chi-square test was conducted on attitude, subjective norms, perceived behavioural control and information, and residential locations. The result reveals that the chi-square value for attitude is 106.24 and is statistically significant at 1%. For subjective norms the chi-square value is 136.65 and is statistically significant at 1%. In the case of perceived behavioural control and information the chi-square value is 70.59 and 40.89 respectively and is statistically significant at 1% for each. This suggests that there is statistical significant relation between attitude, subjective norms, perceived behavioural control and information and the residential locations. From the results, about 40% of the respondents in high-income area have stronger positive attitude towards source separation.

Table 6.5: TPB variables by Residential Areas in AMA (%).

Response	Indigeneous low-income	Migrant low- income	Middle income	High income
Attitude				
1 (Strongly disagree)	8.33	8.15	18.18	3.33
2 (Disagree)	6.67	6.67	6.06	10
3 (Neutral)	50.00	46.30	18.79	26.67
4 (Agree)	31.67	24.07	34.55	20
5 (Strongly agree)	3.33	14.81	22.42	40
Total (%)	100	100	100	100
Note: Chi-square = 106.24; degree of freedom = 48; Pr(0.000)				
Subjective norms				
1 (Strongly disagree)	13.33	8.89	15.15	20
2 (Disagree)	18.33	24.81	26.67	30
3 (Neutral)	26.67	33.33	30.30	26.67
4 (Agree)	33.33	25.93	18.18	16.67
5 (Strongly agree)	8.33	7.04	9.70	6.67
Total (%)	100	100	100	100
Note: Chi-square= 136.65; degree of freedom = 45; Pr(0.000)				
Perceived behavioural control				
1 (Strongly disagree)	20	9.26	17.58	10
2 (Disagree)	25	24.44	18.18	36.67
3 (Neutral)	31.67	42.59	36.97	16.67
4 (Agree)	5	17.04	19.39	23.33
5 (Strongly agree)	18.33	6.67	7.88	13.33
Total (%)	100	100	100	100
Note: Chi-square = 70.59; degree of freedom = 42; Pr(0.004)				
Information				
Yes	30	37.04	42.42	83.33
No	70	62.96	57.58	16.67
Total (%)	100	100	100	100
Note: Chi-square= 40.89; degree of freedom = 45; Pr(0.000)				

Source: Field Data, 2016.

About 3.33% and 14.81% of respondents in indigenous low-income and migrant low-income areas respectively have stronger positive attitude towards source separation of waste. This suggests that respondents in high-income area have a stronger positive attitude towards source separation compared to respondents in the low-income area. This observation is attributed to the higher level of educational attainment and easy access to internet among

high-income households in AMA which gives them the opportunity to get informed about the social, economic and environmental benefits of source separation of waste.

Regarding subjective norms, about 33.33% and 25.93% of the respondents in indigenous low-income and migrant low-income areas respectively agree subjective norm do have influence on their source separation behaviour. For high-income area, only 16.67% of the respondents agree subjective norms do have significant influence on their source separation behaviour. Observing households in low-income areas reporting stronger subjective norm than high-income area is not surprising. This is because houses in low-income neighbourhoods in AMA are mostly compound houses and the population share facilities such as courtyard, bathroom etc and this allows free mixing of the population. This condition promotes community cohesion and bonding, which impacts positively on households' source separation behaviour. The high-income neighbourhood on the other hand is noted for its sophisticated bungalows and detached houses characterized by high walls. This condition reduces the interaction among people, which reduce community cohesion and bonding and rather promote individualistic way of living. Consequently, the expectations of friends, family members, neighbours and opinion leaders on households' source separation behaviour are less relevant among high-income areas.

Concerning households perceived behavioural control, 23.33% of the respondents in high-income area agree to have control over their source separation behaviour. About 5% of respondents from indigenous low-income area agree to have control over source separation behaviour, compare to 17.04% of the respondents in migrant low-income area who agree to have control over source separation behaviour. Having more high-income areas having control of their source separation behaviour than those in the low-income areas can be partly attributed to space for storage and access to information on source separation issues. Residents in low-income area apart from having low educational level, most live in

compound houses which are heavily congested with limited space to keep separated waste. Unlike low-income area, respondents in high-income area generally are more educated, and have easy access to modern means of accessing information. This makes them more informed and more likely to appreciate environmental management in terms of social, economic and environmental externalities. The high income area is also noted for its well-developed bungalows and detached houses with enough space to store the separated waste.

Based on the survey, it appears respondents in high-income area are much informed about source separation compared with respondents in the low-income area. Overwhelming percentage of the respondents (83.33%) in the high-income area indicated they are informed about source separation issues, compared to 30% and 37.04% of respondents in indigenous low-income and migrant low-income area respectively indicating they are much informed about source separation. The fact that more households in high-income area are much informed than households in low-income area can be attributed to the high level of educational attainment and the easy access to modern form of accessing information among the high-income respondents.

Table 6.6 shows the result for the TPB variables by residential areas in TaMA. A chi-square test was performed on attitude, subjective norms, perceived behavioural control and information, and residential locations. The results reveal that the chi-square value for attitude is 138.94 and is statistically significant at 1%. For subjective norm and perceived behavioural control the chi-square is 150.82 and 152.54 respectively and is statistically significant at 1% for each. In the case of information, the chi-square value is 6.11 and is statistically significant at 5%. This suggests that there is statistical significant relation between attitude, subjective norms, perceived behavioural control and information and the residential locations.

Based on the results, households' attitude toward source separation is stronger among high-income area as 40% of the respondents agree source separation is a good activity. Only 15.83% of the respondents in the low-income agree source separation is a good activity. This suggests that respondents in high-income area have stronger positive attitude towards source separation of waste compare to those in the low-income area. This is attributed to the fact that, generally resident in high-income area are more educated, more exposed, have easy access to modern means of accessing information and tend to have much information on source separation issues than those in low-income area.



Table 6.6: TPB variables by Residential Areas in TaMA (%).

Response	Low-income	Middle-income	High-income
Attitude			
1 (Strongly disagree)	15	30.30	4.44
2 (Disagree)	40.83	19.39	17.78
3 (Neutral)	20.83	14.55	22.22
4 (Agree)	15.83	13.33	40
5 (Strongly agree)	7.5	22.42	15.56
Total (%)	100	100	100
Note: Chi-square = 138.94; degree of freedom= 24; Pr(0.000)			
Subjective norms			
1 (Strongly disagree)	12.5	18.18	26.67
2 (Disagree)	19.17	10.91	28.89
3 (Neutral)	18.33	27.27	24.44
4 (Agree)	29.17	25.45	15.56
5 (Strongly agree)	20.83	18.18	4.44
Total (%)	100	100	100
Note: Chi-square 150.82; degree of freedom= 22 ; Pr(0.000)			
Perceived behavioural control			
1 (Strongly disagree)	12.5	27.27	20
2 (Disagree)	19.17	24.85	11.11
3 (Neutral)	41.67	18.18	22.22
4 (Agree)	9.17	15.15	17.78
5 (Strongly agree)	17.5	14.55	28.89
Total (%)	100	100	100
Note: Chi-square= 152.54; degree of freedom= 20; Pr(0.000)			
Information			
Yes	37.5	39.39	62.22
No	62.5	60.61	37.78
Total (%)	100	100	100
Note: Chi-square= 6.11; degree of freedom= 2; Pr(0.047)			

Source: Field Data, 2016.

In TaMA (see Table 6.6), 20.83% of the respondents in the low-income area strongly agree subjective norms do have influence on their source separation behaviour, compare to 4.44% of the respondents in high-income area who strongly agree subjective norms do influence their source separation behaviour. The higher percentage of respondents in low-income area reporting that subjective norm has influence on their source separation behaviour could be to

the high level of ethnic homogeneity of the low-income neighbourhood and the predominance of compound houses with shared facilities such as courtyard, bathroom etc. This condition allows for frequent interactions which enhances community cohesion and bonding. The high-income neighbourhood on the other hand is characterized by bungalows and detached houses which produce weak interaction among the population and reduce community cohesion and bonding.

Regarding the variable perceived behavioural control, 28.89% of the respondents in high-income area strongly agree they have control over source separation, compare to 17.5% of the respondents in low-income area who strongly agree to have control over source separation of waste. Having more high-income area indicate they have control over their source separation behaviour than those in the low-income area can be partly attributed to space for storage and access to information on issues about source separation. Residents in low-income area mainly live in compound houses which are heavily congested and lack space to keep separated waste. The high-income area, on the other hand, lives in detached houses and bungalows with enough space to store the separated waste. Furthermore, respondents in high-income area, tend to have higher education and have easy access to modern means of accessing information which makes them to be much informed on source separation issues. Based on the results of the survey, in TaMA, 62.22% of the respondents in high-income area are much informed about source separation compared with 37.5% in low-income area who indicates they are informed. This observation is expected because typically residents in high-income area tend to have higher education, are more exposed and have easy access to modern means of accessing information.

6.4 Determinants of Households' Source Separation Intention

Table 6.7 shows the results from the ordered probit regression for respondents in AMA, TaMA and the entire study area (i.e combine). Based on the results the LR Chi-square value for AMA is 184.87, TaMA is 203.65 and the entire study area (i.e. combine) is 550.80 and is statistically significant 1% for each. The significance of the LR Chi-squared value shows that all the variables jointly determined the dependent variable.



Table 6.7: Ordered Probit Regression estimations

Independent variable	AMA	TaMA	COMBINE (Entire study area)
	Coefficient	Coefficient	Coefficient
Gender of head of household	-0.3095** (0.1245)	-0.1977 (0.2367)	-0.0113 (0.1024)
RC: Female			
Age of head of household	0.0088 (0.0066)	-0.0124 (0.0101)	0.0033 (0.0049)
Household size	0.0144 (0.0313)	0.0433** (0.0211)	-0.0028 (0.0221)
Marital status	0.1719 (0.1561)	0.2298 (0.2503)	0.1008 (0.1099)
Educational attainment of head of household	0.0456** (0.0197)	0.0038 (0.0213)	0.0025** (0.0012)
Total household income	-0.6614*** (0.2657)	0.2777 (0.5374)	-0.0373** (0.0180)
Occupation type	-0.4425*** (0.1351)	-0.2998* (0.1759)	-0.1944* (0.1186)
RC: Informal sector			
Tenancy status	-0.1221 (0.1233)	-0.0502 (0.2384)	-0.0715 (0.0933)
Information	0.0418*** (0.0123)	0.0705 (0.1557)	0.1117*** (0.0388)
Past experience with source separation	0.2588** (0.1334)	0.6797*** (0.1959)	0.5554*** (0.1051)
Attitude	0.5574*** (0.1094)	0.7481*** (0.1118)	0.7101*** (0.0653)
Subjective norm	0.3653*** (0.1232)	0.2426** (0.1073)	0.4133*** (0.0706)
Perceived behavioural control	-0.0719 (0.1122)	0.0391 (0.1342)	-0.0816 (0.2820)
Inconvenience	0.1477** (0.0671)	0.3016*** (0.0928)	-0.3118*** (0.0854)
Location	na	na	-0.2505** (0.1043)
RC: TaMA			
Observations	525	330	855
LR chi-sq.	184.87***	203.65***	550.80***
Log likelihood	-505.7307	-213.792	-758.26616

***, **, * respectively represents 1%, 5% and 10% level of significance; standard error in parenthesis.

Dependent variable is household source separation intention, ranging from strongly disagree and disagree (1), neutral (2) and agree and strongly agree (3); RC= reference category.

From the results (as shown in Table 6.7) the determinants of households' source separation intention in the entire study area (i.e combined) are educational attainment of head of household, total income of household, occupation type of head of household, information, past experience with source separation, inconvenience in terms of time, space and availability

of formal source separation scheme, attitude towards source separation, subjective norm and the location of the respondents. Educational attainment of head of household has a positive relation with source separation intention and is statistically significant at 1%. The effect of occupation type is negative and is statistically significant at 10%. Total income of household has negative relation with source separation intention and is statistically significant at 5%. The coefficient of the variable past experience with source separation is positive and is statistically significant at 1%. As expected, the variable information has a positive relation with source separation intention and is also statistically significant at 1%. As expected, the coefficient of attitude and subjective norm is positive and statistically significant at 1% for each. The variable inconvenience is statistically significant at 1% and has negative coefficient. The coefficient for location has a negative sign and is statistically significant at 5%.

Regarding households' at AMA, the results from the estimation indicate that gender of head of household, educational attainment of head of household, total income of household, occupation type of head of household, information, past experience with source separation, attitude towards source separation, subjective norm and inconvenience, are the statistically significant variables that influence households' source separation intention. The coefficient of gender is negative and significant at 5%. Educational attainment affects source separation intention positively and is statistically significant at 5%. Income has a negative effect on source separation and is statistically significant at 1%. Occupation type has a negative relation between source separation intentions and is statistically significant at 1%. The variable past experience with source separation has positive relation with source separation intention and is statistically significant at 5%. The variable information has positive effect on source separation intention and significant at 1%. The coefficient of attitude is positive and statistically significant at 1%. As expected, the coefficient of subjective norm is also positive

and significant at 1%. The variable inconvenience is significant at 5% and has negative coefficient.

In the case of TaMA, household size, occupation type of head of household, past experience with source separation, inconvenience, attitude towards source separation and subjective norm are the statistically significant variables that influence households' source separation intention. The study revealed that the relation between household size is positive and statistically significant 5%. The relation between occupation type and source separation intention is negative and statistically significant at 10%. The variable past experience with source separation is positive and significant at 1%. As anticipated, the coefficient of attitude is positive and statistically significant at 1%. The study also observed that the coefficient of subjective norm is positive and significant at 5%. However, the variable inconvenience has a negative relation with source separation intention and is statistically significant at 1%.

Although Table 6.7 presents the regression coefficients, these are of little relevance in ordered probit analysis, as they do not provide any insight into the strength of the individual independent variables (Greene, 2003). The marginal effects of the independent variables at their respective means provide this information as it measures small changes in the independent variable on the outcome variable. This notwithstanding, in the case of a dummy variable the marginal effect represents a change of the dummy (0) to one (1) on the outcome variable. The marginal effects for respondents in AMA, TaMA and the entire study area are presented in Table 6.8.

Table 6.8: Marginal effects of ordered Probit Model

Independent variable	AMA			TaMA			Combine (Entire study area)		
	Strongly disagree to disagree Outcome=1	Neutral Outcome=2	Agree to strongly agree Outcome=3	Strongly disagree to disagree Outcome=1	Neutral Outcome=2	Agree to strongly agree Outcome=3	Strongly disagree to disagree Outcome=1	Neutral Outcome=2	Agree to strongly agree Outcome=3
Gender of head of household	0.0406**	0.0344**	-0.075**	0.0218	0.0299	0.0517	-0.0037	-0.0065	0.0102
Age of head of household	-0.0008	-0.0007	0.0015	0.0014	0.0019	-0.0032	0.0002	0.0004	-0.0007
Household size	0.0039	0.0033	-0.0072	-0.0048**	-0.0066**	0.0113**	0.0003	0.0006	-0.0009
Marital status	-0.0610	-0.0518	0.1128	-0.0253	-0.0348	0.0602	-0.0049	-0.0087	0.0136
Educational attainment of head of household	-0.0029**	-0.0025**	0.0054**	-0.0004	-0.0006	0.0010	-0.0003**	0.0005**	0.0008**
Total household income	0.0312***	0.0264***	-0.0576***	-0.0307	-0.0420	0.0727	0.0161**	0.0278**	-0.0439**
Occupation type	0.0267***	-0.0264***	-0.0494***	0.0055*	0.0076*	-0.0131*	0.0118*	0.0205*	-0.0323*
Tenancy status	0.0037	0.0032	-0.0069	0.0331	0.0454	-0.0785	0.0127	0.0220	0.0347
Information	-0.0281***	0.0238***	0.0519***	-0.0078	-0.0106	0.0184	-0.0099***	-0.0172***	0.0270***
Past experience with source separation	-0.0614**	-0.0521**	0.1135**	-0.0750***	-0.1028***	0.1779***	-0.0490***	-0.0851***	0.1342***
Attitude	-0.1394***	-0.1182***	0.2576***	-0.0826***	-0.1132***	0.1958***	-0.0504***	-0.0875***	0.1379***
Subjective norm	-0.1239***	-0.1051***	0.2291***	-0.0267**	-0.0367**	0.0635**	-0.0415***	-0.0719***	0.1135***
Perceived behavioural control	0.0077	0.0065	-0.0142	-0.0043	-0.0059	0.0102	0.0037	0.0063	-0.0099
Inconvenience	0.0260***	0.0221***	-0.0481***	0.0333***	0.0456***	-0.0789***	0.0405***	0.0703***	-0.1107***
Location							0.0092***	0.0160***	-0.0252***

***, **, * respectively represents 1%, 5% and 10% level of significance. Dependent variable is household source separation intention, ranging from strongly disagree and disagree (1), neutral (2) and agree and strongly agree (3).

The marginal effects for each outcome (as presented in Table 6.8) largely confirm the results in Table 6.7. Concentrating on outcome 3 (i.e agree to strongly agree) for TaMA and the entire study area gender has no effect on source separation intention. In AMA, the effect of gender on source separation intention indicates that male headed household decreases household source separation intention by 7.5 %. This is expected because traditionally women are responsible for domestic waste management and are thus more likely to adopt source separation (Oteng-Ababio, 2007). In previous studies, Vicente and Reis, (2008) and Ekere *et al.*, (2009) argued that females are more likely to undertake recycling activities while Hage *et al.*, (2009) had contrary evidence.

An increase in household size increase household source separation intention by 1.3% in TaMA. For AMA and the entire study area household size has no effect on source separation intention. TaMA is one of the poorest urban areas in Ghana with Dagombas as majority who are largely Muslims. Traditionally, there have larger family size and engaged in livestock rearing to supplement their income. Consequently the role of source separation of solid waste such as cassava, plantain and yam peels used to feed livestock would not rely on one person, but every member of the family making it less burdensome. Furthermore, individual members will also be willing to monitor each other on the issue of solid waste separation.

Educational attainment has no influence on source separation intention among households in TaMA. However, a year increase in education of head of household increases source separation intention by 0.54% in AMA and 0.08% in the entire study area. This observation is attributed to the fact that well-educated people generally are more exposed; have easy access to information and tends to appreciate the social, economic and environmental benefits of proper SWM than the less educated. The positive effect of education on source separation intention confirm the observation of

Saphores *et.al.*, (2006), that educated people are associated with stronger recycling behaviour. On the contrary, Meneses and Palacio, (2005) found no significant association between recycling behaviour and education.

The results also reveal that household total income has no influence on source separation intention in TaMA. In contrast, a unit increase in household total income, decreases source separation intention by 5.8% in AMA and 4.4% at the entire study area. The result suggests that affluent households are less likely to participate in source separation compared to poorer households. This goes to confirm earlier findings that source separation is prevalent among low-income areas in AMA and they undertake the activity to supplement their income. The negative effect of income on source separation intention compares favourably with previous study by Hage and Soderholm, (2008). However contradict the evidence by Martin *et al.*, (2006) and Berglund, (2006) who found a positive effect of income on recycling behaviour. They argued that source separation and recycling is mandatory in UK.

Working in the formal sector, decrease households source separation intention by 4.9% in AMA, 1.3 % in TaMA and 3.3% at the entire study area. This suggests that heads of household who are in formal employment are less likely to adopt source separation compare to those in the informal sector. This is reasonable because those in the formal employment tend to have busy schedules and attach a higher opportunity cost to time spent on source separation activities. While those in the informal sector, generally are poor and may engage in source separation to supplement their income. In the case of TaMA, generally households' who are employed in the formal sector are less likely to engaged in livestock rearing at home which demands that they source separate cassava, plantain and yam peels (which is the common source separation activities observed in previous findings) to feed their livestock.

Information has no influence on source separation intention among households in TaMA. However, households' source separation intention increases by 5.2% in AMA and 2.7% at the entire study area when they are much informed on source separation issues. This could be due to the fact that access to information on issues regarding source separation improves household awareness of source separation which then translates into higher source separation intention. The fact that information does not have a significant influence on source separation intention among respondents in TaMA means that source separation programmes, education and campaigns such as the National Source Segregation Programme in 2013 have not yielded much result for source separation activities in TaMA. One can also reason that, although the respondents in TaMA may have some valuable information on source separation, they may as well have other ideas and beliefs about the activity which influence their source separation intention rather than the information received. In addition, programme, education and campaign on source separation is biased towards AMA. In previous study, Hornik *et al.*, (1995) observed a positive relation between information and recycling behaviour.

Having past experience with source separation, increases household source separation intention by 11.4% in AMA, 17.8% in TaMA and 13.4% at the entire study area. This is plausible because people who have previous experience with source separation in AMA are more likely to be poor and undertake the activity to supplement their income. In TaMA, source separation is largely practiced by low-income areas and cassava, plantain and yam peels is predominantly separated to feed livestock. Hence with this previous experience which is largely motivated by the resource value of the solid waste, they would thus have strong intention about performing the activity. Scholars including Barr *et al.*, (2003) and Tonglet *et al.*, (2004) found past behaviour to be an important determinant of recycling behaviour and intention.

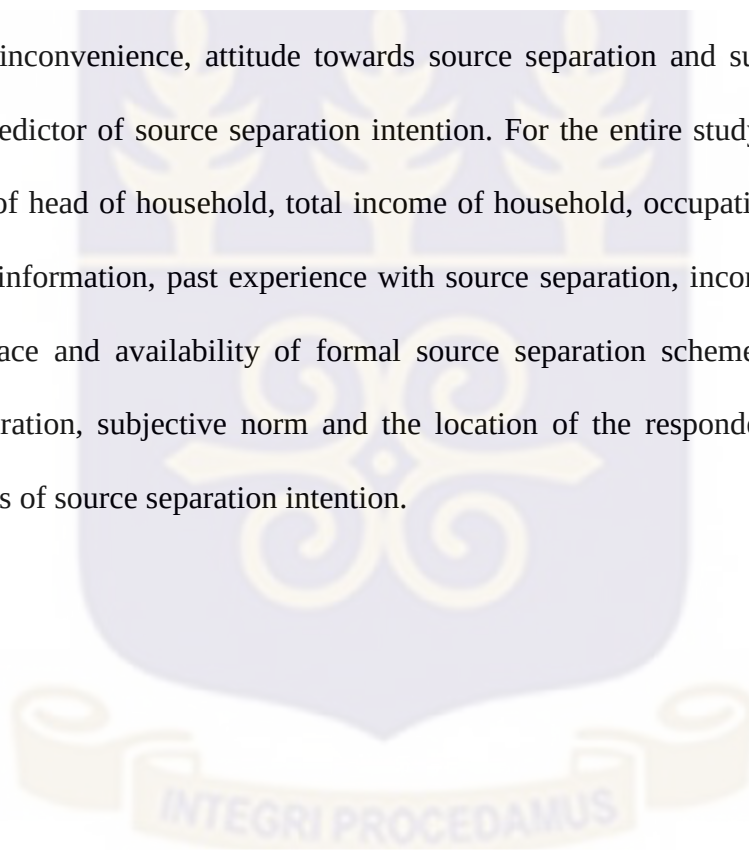
Positive attitude towards source separation increases source separation intention by 25.8% in AMA, 19.6% in TaMA and 13.8% among households at the entire study area. This is reasonable because households' who have positive attitude towards source separation are more likely to be much informed about source separation issues and tends to appreciate the social, economic and environmental benefits of source separation. Compared with previous works, Barr *et al.*, (2003), Tonglet *et al.*, (2004) and Nigur *et al.* (2010) found a positive relation with attitude and source separation behaviour. In contrast Davies *et al.*, (2006) established no significant effect for attitude. As expected, subjective norm increases households' source separation intention by 22.9% in AMA, 6.4% in TaMA and 11.4% among householders' at the entire study area. As observed in earlier findings, subjective norm is greater among low-income areas in AMA where there is strong interaction among residents because they live in compound houses and share facilities such as bathrooms. This condition creates strong social cohesion and bonding which impacts positively on their source separation behaviour. For TaMA, the population of is quite homogenous, comprising largely of Dagombas who are predominately Muslims (GSS, 2012). This situation promotes strong communal living and social cohesion in TaMA which impact positively on their source separation behaviour. Hence the higher source separation intention associated with subjective norm. Scholars including Barr *et al.*, (2001) and Knussen and Yule (2008) have observed that subjective norm affect households' recycling behaviour. In contrast, Tonglet *et al.*, (2004) found no significant relation between subjective norm and recycling behaviour. Tonglet *et al.*, (2004), argued that subjective norms has no influence on recycling behaviour because the residents have been recycling for a long time such that their attitude towards recycling is formed and thus the expectation of close ties has no influence on their recycling behaviour.

Having the perception that lack of time, space and formal source separation arrangement is a constraint, decreases household source separation intention by 4.8% in AMA, 7.9% in TaMA and 11.1% among households at the entire study area. This suggests that, households who perceive time, space and lack of formal source separation arrangement as a barrier are less likely to participate in source separation. Currently Ghana has no formal arrangement for collection of separated solid waste and this discourage households from adopting source separation because only mixed wastes are collected. The result of this study is in tandem with the observation of Domina and Koch, (2002) and Saphores *et al.*, (2006). The negative sign of the location variable suggest that, being a resident at AMA decrease source separation intention by 2.5%. This is reasonable because compare to TaMA, AMA is a wholly urbanized area with high population density and heavily congested. Consequently, there is limited space to store separated solid waste. It also goes to confirms earlier findings that the lack of space and time in a wholly urbanized and busy area such as Accra has negative impact on source separation behaviour. Previous study by Ekere *et al.* (2010) reported that households in crowded urban areas find space a constraint in separation of garbage in cases where storage is necessary.

6.5 Conclusion

This chapter examined the determinants of households' source separation intentions in AMA and TaMA in Ghana. The study was partly motivated by the fact that despite the benefits associated with source separation, little attention has been given to formal source separation in Ghana. Moreover, there are limited studies on source separation behaviour in Ghana using the TPB as the theoretical framework. The study revealed that household source separation intentions are stronger among respondents in TaMA. The

estimation results from the ordered probit regression models revealed that socio-economic, socio-psychological and situational factors play significant roles in households' source separation intention in AMA and TaMA. For instance, gender of head of household, educational attainment of head of household, total income of household, occupation type of head of household, information, past experience with source separation, attitude towards source separation, subjective norm and inconvenience are the main drivers of source separation intention in AMA. In the case of TaMA, household size, occupation type of head of household, past experience with source separation, inconvenience, attitude towards source separation and subjective norm are the main predictor of source separation intention. For the entire study area, educational attainment of head of household, total income of household, occupation type of head of household, information, past experience with source separation, inconvenience in terms of time, space and availability of formal source separation scheme, attitude towards source separation, subjective norm and the location of the respondents are the major determinants of source separation intention.



CHAPTER SEVEN

DETERMINANTS OF HOUSEHOLDS' WILLINGNESS-TO-PAY FOR IMPROVED SOLID WASTE MANAGEMENT.

7.1 Introduction

The previous chapter examined the determinants of households' source separation intentions in AMA and TaMA. This chapter seeks to examine the factors influencing households' willingness to pay (WTP) for improved SWM service. It begins by briefly describing the distribution of the respondents WTP for improved SWM service and the total economic value attached to improved SWM in AMA and TaMA. The factors influencing households' WTP are examined using the tobit regression model.

7.2 Willingness-to-pay (WTP) for improved SWM service in AMA.

Table 7.1 presents the mean WTP and the amount households' are willing to pay for improved service by residential areas in AMA.

Table 7.1: Monthly WTP for improved SWC in AMA (in %)

Price/Month (GH¢)	Indigenous low-income	Migrant income	low-	Middle income	High-income
0	31.67	20.37		23.03	0
1-10	51.67	37.41		10.91	0
11-20	16.67	36.67		26.06	0
21-30	0	2.22		15.15	0
31-40	0	3.33		12.73	0
41-50	0	0		12.12	0;
51-60	0	0		0	33.33
61-70	0	0		0	66.67
TOTAL	100	100		100	100
Mean WTP per month by residential areas(in (GH¢)					
Classification	Indigenous low-income	Migrant income	low-	Middle income	High-income
Mean WTP (GH¢)	5.82	10.30		18.99	66.61

Source: Field Data, 2016.

Based on the results, the monthly modal price range that households' in the low-income area are willing-to-pay for improved SWM service is GH¢1-10. For the middle-income area the monthly modal price range is GH ¢11-20, while respondents from the high-income area are willing-to-pay GH¢ 61-70 for improved service. In the high-income area, 66.67 % indicate their WTP between GH¢61-70. As shown in Table 7.1, the mean WTP value for the respondents in the high-income area is GH¢66.61, which is about 8.33% higher than the current user charges of GH¢60.00. While that for the indigenous low-income area is GH¢5.82 and migrant low-income area is GH¢10.30. The fact that the high-income area has a high modal price range and mean WTP amount could be attributed to their high ability to pay and their busy schedules which make them attach a high opportunity cost to time spent managing solid waste. Consequently they would be willing to pay more to have their solid waste collected. In addition, generally affluent households' are more satisfied with the solid waste collection services and thus motivated to pay more for this service.

About 31.67% and 20.37% of respondents in the indigenous and migrant low-income areas respectively are not prepared to pay for the improved service. Approximately 23.03% of respondents in the middle-income area are not prepared to pay for the improved service. All the respondents in the high-income area are WTP for the improved SWM services. Of much significance is the percentage (23.03%) of respondents in middle-income area who have zero WTP value for the improved SWM service. This observation could be explained by the current low quality service provided by the service provider in the area which has made them lost trust in the formal arrangement for solid waste collection. Currently, they engage the services of informal waste collectors which they perceive provide quality service and want to maintain the status quo.

The low modal price range and mean WTP amount in the low-income area is not surprising. This goes to confirm earlier findings that, most residents in this community have enjoyed fee-free solid waste collection services and still have the perception that the payment of solid waste collection service is the sole responsibility of local authorities. Second, their attitude towards solid waste also influences their behaviour. During the FGDs a participant iterated that she cannot pay for solid waste collection because it is a useless material:

I will not pay for something (thus waste) I don't want and is of no use. [MAF, 49-year Old Resident in Nima, Accra, Focus Group Discussion, 23rd April, 2016]

In addition, these communities have alternative means for disposing of their solid waste illegal into drains, lagoons and open spaces, in order to avoid payment.

7.3 Willingness-to-pay for improved SWM service in TaMA

Table 7.2 presents the mean WTP and the amount households' are willing to pay for improved service by residential areas in TaMA.

Table 7.2: Monthly WTP for improved SWC in TaMA (%).

Price/Month (GH¢)	Low-income	Middle-income	High-income
0	29.17	17.58	0
1-10	64.17	61.82	0
11-20	6.67	15.76	15.56
21-30	0	4.85	84.44
TOTAL	100	100	100
Mean WTP by residential area in TaMA (in GH¢)			
Low-income	Middle-income	High-income	
Mean WTP (GH¢)	5.11	8.26	21.98

Source: Field Data, 2016.

From the results, the monthly modal price range that households' in the low-income area are willing-to-pay for improved service is GH¢1-10. For middle-income area the

monthly modal price range is GH¢11-20 for improved SWM service. While high-income area is willing-to-pay GH¢21-30 for improved service. About 84.44% of respondents in the high-income area indicate their WTP between GH¢ 21-30. While 29.17% of respondents in the low-income area have zero WTP, compared to 17.58% of respondents in the middle-income area who are not prepared to pay for the improved service (GH¢0 WTP). As shown in Table 7.2, the mean WTP for respondents in the high-income area is GH¢21.98, which is about GH¢1.98 higher than the current user charges of GH¢20.00. While that for the middle and low-income areas are GH¢5.11 and GH¢8.26 respectively. The low modal price range and mean WTP value observed in low-income area in TaMA is attributed to the fact that most of the respondents in this community enjoy fee-free solid waste collection service and thus believe that proper SWM is the sole responsibility of the local authority. This goes to confirm earlier findings.

7.4 WTP for improved SWM service by Metropolis

Table 7.3 presents the mean WTP amount per month for solid waste collection by metropolis.

Table 7.3: Mean monthly WTP per household per month by metropolis.

Location	AMA	TaMA	Combine (Entire study area)
Mean WTP (95% interval) (Ghana Cedis)	15.71 (14.241 – 17.185)	8.99 (8.166 – 9.809)	13.129 (12. 145 -14.112)
Number of households*	450,748	219,971	670,719
Estimated monthly revenue	7,081,251	1,979,739.00	8,806,540

Source: Field Data, 2016. *Source: 2010 Population and Housing Census.

The results show that the mean WTP for the entire study area (i.e. combine) is GH¢13.13. While the mean WTP value for AMA and TaMA are GH¢15.71 and GH¢8.99 respectively. The difference in the mean WTP amount is not surprising. Accra doubles as the regional capital of Greater Accra and the national capital of Ghana and is associated with a lot of economic activities. Consequently, consumption of goods and services is higher resulting in an increase in solid waste generation, which increases the demand for improved SWM service. Furthermore, residents in AMA are more likely to be well-educated; have higher income and much more informed about the benefits of good environmental management. This condition enhanced their appreciation of improved environmental condition, hence the high value placed on improved SWM service.

The mean WTP can be used to estimate the total value of the proposed improved SWM services. The total benefit value of the improved SWM service can be estimated by finding the product of the number of households and the mean household WTP value. As shown in Table 7.3, the total monthly WTP amount that households in AMA are willing-to-pay to have improved SWM service is GH¢7,081,251.00. In TaMA households are willing-to-pay GH¢1,979,739.00 to obtain improved SWM service. These are the amounts that households in AMA and TaMA are willing to give up in order to avoid the cost of poor SWM by improving SWM services.

7.5 Determinants of households' WTP for improved SWM service

Table 7.4 presents the tobit regression estimates on factors that influence households' WTP for SWM in AMA, TaMA and the entire study area (i.e. combine). The Wald chi-square (χ^2) of the log likelihood is a measure of the overall significance of the model. As shown in Table 7.4, the model is statistically significant at 1% ($\chi^2=961.54$ $p=0.0000$) for the entire study area, 1% for AMA ($\chi^2=647.89$ $p=0.0000$) and 1% ($\chi^2=385.44$ $p=0.0000$)

for TaMA. The significance of the Wald Chi-squared value shows that all the variables jointly determined the dependent variable.

Table 7.4: Tobit Regression estimations for Households' WTP

Independent variable	AMA	TaMA	Combine (Entire study area)
	Coefficeint	Coefficient	Coefficient
Gender of head of household	-4.1083*** (1.0789)	-2.1809*** (0.7987)	-3.4554*** (0.7877)
RC: Female			
Age of head of household	-0.0142 (0.0559)	-0.0829** (0.0359)	-0.0531 (0.0394)
Household size	-0.3404 (0.2736)	0.0430 (0.1484)	-0.1328 (0.1769)
Marital status	0.8929 (1.1559)	0.8716 (0.8034)	0.9148 (0.8429)
Educational attainment of head of household	0.6016*** (0.1651)	0.2351*** (0.0719)	0.2655*** (0.0934)
Total household income	0.0061*** (0.0004)	0.0028*** (0.0008)	0.0067*** (0.0003)
Occupation type	4.8189*** (1.3351)	1.8491** (0.8498)	4.9025*** (0.8987)
RC: Informal sector			
Tenancy status	0.4723 (1.0523)	0.9926* (0.6021)	1.0676 (0.7099)
Information	1.2590 (1.0486)	0.2746 (0.5477)	0.9749 (0.6756)
Satisfaction	3.6460*** (1.0308)	11.5979*** (1.1021)	1.8116*** (0.7389)
Past experience with source separation	-1.4992 (1.1309)	0.3912 (0.3940)	-0.7341 (0.7973)
Attitude	2.6547*** (0.9461)	1.2739* (0.7783)	1.6521*** (0.4879)
Subjective norm	3.3166*** (1.1392)	2.7749*** (0.3866)	4.2241*** (0.5519)
Perceived behavioural control	1.5126 (0.9692)	-1.3419*** (0.4705)	0.2994 (0.6256)
Location	na	na	1.8674** (0.8434)
RC: TaMA			
Constant	-36.0125*** (4.4451)	-1.7932 (2.3751)	-21.6116*** (3.1287)

Diagnostic test

Observations	525	330	855
LR chi-sq.	647.89***	385.44***	961.54***
Log likelihood	-1583.0921	-836.59216	-2545.3278

***, **, * respectively represents 1%, 5% and 10% level of significance; standard error in parenthesis; RC= reference category

The results from the estimations (as shown in Table 7.4) indicate that gender of head of household, educational attainment of head of household, total household income, occupation type of head of household, level of satisfaction with SWM services, attitude, subjective norm and location are the significant determinants of households' WTP for improved SWM among households in the entire study area (i.e combine). The variable gender of head of household has a negative relation with households' WTP and is statistically significant at 1%. As expected the variable total household income is positive and statistically significant at 1% level. Education attainment of head of household and occupation type has a positive relation with households' WTP and is highly significant at 1% for each. Households' level of satisfaction with SWM services has a positive coefficient and is statistically significant at 1%. The variable attitude toward source separation has positive effect on WTP and is significant at 1%. The coefficient of the location dummy is positive and statistically significant at 5% level.

The main drivers of households' WTP for improved SWM services in AMA are gender of head of household, educational attainment of head of household, total household income, occupation type of head of household, level of satisfaction with SWM services, attitude and subjective norm. As expected gender has a negative relation with WTP and is statistically significant at 1%. Educational attainment of head of household shows a positive relationship with the amount households' are willing-to-pay and is highly significant at 1% level. Whiles total households' income is positive and statistically significant at 1% level. The variable occupation type has positive relation with WTP and is statistically significant at 1%. As anticipated the variable households' level of satisfaction with SWM services has a positive coefficient and is statistically significant at 1%. On the socio-psychological variables, attitude toward source separation and subjective norm have positive effect on WTP and is significant at 1% for each.

The determinants of households' WTP for improved SWM in TaMA are gender of head of household, age of head of household, educational attainment of head of household, total household income, level of satisfaction with SWM services, attitude, subjective norm and perceived behavioural control. The finding shows that gender of head of household has a negative relation with households' WTP for improved SWM and is statistically significant at 1% level. Age of the head of household has a negative relation with households' WTP and is statistically significant at 5%. The coefficient of income is positive and statistically significant at 1% level. As expected, education attainment of head of household has a positive relation with households' WTP and is highly significant at 1% level. The variable occupation type has a positive relation with WTP and is also statistically significant at 1%. Households' level of satisfaction with SWM service has positive sign and is statistically significant at 1%. Household attitude toward source separation has positive effect on WTP and is significant at 10%. Subjective norm has positive relation with WTP and is statistically significant at 1%. While perceived behavioural control has a negative relation with WTP and is also statistically significant at 1% level.

The results from the estimations indicate that a male headed household is willing- to-pay GH¢4.11 less in AMA, GH¢2.18 less in TaMA and GH¢3.46 less in the entire study area for improved SWM, holding all other variables constant. Traditionally, women are responsible for domestic SWM and ensuring cleanliness at home. This according to Oteng-Ababio, (2007) makes women develop interest in the payment of SWC bills than men. Hence, their WTP more for improved SWM service. Scholars including Alhassan and Mohammed (2013), Awunyo-Vitor *et al.*, (2013) and Ojok *et al.*, (2012) have reported that women are willing to pay more for improved SWM than men.

On the age effect, the study find that an older headed household is willing-to-pay GH¢0.08 less for improved SWM than younger headed household in TaMA, holding all other variables constant. At the entire study area and AMA, age has no effect on WTP for improved SWM. This could be due to the fact that payment for solid waste collection is relatively new in TaMA and older people have enjoyed fee-free service since immemorial. They are therefore accustomed to this practice and consider SWC as the government responsibility. This result is consistent with the previous findings by Rahji and Oloruntoba (2009) and Banga *et al.*, (2011), but contradicts that of Afroz, (2011) and Awunyo-Vitor, *et al.* (2013).

An increase in total monthly household income by GH¢ 100.00 increase household WTP for improved SWM by about GH¢ 0.60 in AMA, GH¢ 0.28 in TaMA and GH¢ 0.67 in the entire study area, holding all other variables constant. The result confirmed the theoretical hypothesis that households with higher income consume more goods and generate more solid wastes. This increases their demand for SWM services. In addition, rich households' have the ability to pay and are more likely to have busy schedules which makes them attach a high opportunity cost to time spent in managing solid waste at home. Thus they would be willing-to-pay more to have their solid waste collected. Other earlier studies including Jin *et al.*, (2006), Anaman and Jair, (2001), Hagos *et al.*, (2012), and Rahji *et al.*, (2009) reported significant effect of income on households' WTP.

Holding all other variables constant, a year increase in educational level of head of household increase monthly WTP for improved SWM by about GH¢0.60 in AMA, GH¢0.24 in TaMA and GH¢0.27 in the entire study area. This is because highly educated people are more likely to have easy access to modern means of accessing information and tends to appreciate the social, economic and environmental benefits of

proper SWM. The positive relation between WTP and education also reflects the position of Oteng-Ababio (2010b) that highly educated people attach a higher opportunity cost to time spent in remedying environmental related negative impacts, and will therefore pay more for improved SWM. This observation is in tandem to the findings of Asenso-Okyere and Asante (2003) who argued that higher education increase households WTP for environmental services.

It was observed from the study that in AMA head of households who are employed in the formal sector are willing-to-pay GH¢4.82 more for improved SWM, than those engaged in the informal sector, all other things being equal. Similar results are observed for households' in TaMA and the entire study area. In TaMA and the entire study area, head of households employed in the formal sector are willing-to-pay GH¢1.85 and GH¢4.90 more respectively for improved SWM, than those engaged in the informal sector, all other things being equal. This is attributed to the fact that those in formal employment tend to be better educated and well informed on proper SWM. This situation strengthens their knowledge on proper SWM and their appreciation of the social, economic and environmental benefits of proper SWM. Second, formal sector workers are more likely to have busy lifestyles which make them place a high opportunity cost to time spent managing solid waste. This observation can be further explained by the argument raised by Oteng-Ababio, (2010b), that those in formal employment earn monthly incomes which incidentally coincide with the billing cycle of the service providers.

Households who are satisfied with the current SWM services are willing-to-pay GH¢3.65, GH¢11.60 and GH¢1.81 more for improved SWM in AMA, TaMA and entire study area respectively than those who are not. This is reasonable because when households have value for money in terms of quality of SWC service, they are motivated

to pay more. The observed result compares favourably with that of Kassim and Ali, (2006) but contradict with the findings of Hagos *et al.* (2012) who argued that households who receive an unsatisfactory service are willing-to-pay more in order to receive a better service.

Also, the study reveals that households' that have positive attitude towards source separation are willing-to-pay GH¢2.65 more for improved SWM in AMA; GH¢1.27 more for improved SWM in TaMA and GH¢1.65 more for improved SWM the entire study area, than those with negative attitude towards source separation. This is reasonable because those with positive attitude towards source separation are more likely to be much informed on source separation issues and appreciate the economic, social and environmental benefits of source separation as observed in earlier findings. The earlier findings in this study also reveal that high-income area in TaMA has a stronger attitude towards source separation. These households' apart from having higher ability to pay, they are much informed about source separation issues which develop into positive attitude towards source separation. Consequently they are willing-to-pay more for improved SWM that include source separation. The positive effect of attitude on WTP collaborates with the finding of earlier study by Jin *et al.* (2006).

Holding all other variables constant, perceived social pressure increase households' WTP for improved SWM by GH¢3.32 in AMA, GH¢2.77 in TaMA and GH¢4.22 in the entire area. According to the 2010 Population and Housing Census report, most urban dwellers live in compound houses (80.6% for TaMA and for 67.7% AMA) (GSS, 2014) and with shared facilities which result in easy interaction among them. This condition promotes strong social cohesion and bonding. Consequently family, friends and opinion leaders positively impact on households' decision to pay for improved SWM services. The result reveals that perceived behavioural control over source separation decreases

households' WTP for improved SWM by GH¢1.34 in TaMA. For AMA and the entire study area perceived behaviour control has no effect on households' WTP for improved SWM. The probable reason for this finding could be that, those who have control over source separation are more likely to adopt the practice. As observed in earlier findings low-income areas in TaMA have stronger source separation behaviour and their ability to pay is low. Second, SWM service in this community is fee-free, so they still have the perception that SWM is the sole responsibility of the local authority. In addition, they have the perception that since they separate their solid waste at source, they should not be responsible for the cost of its disposal. All these situations impact negatively on their WTP. Hence the low WTP for improved SWM for households' that have stronger perceived behavioural control. The study also observed that residents in AMA are willing to pay GH¢ 1.87 more, than those in TaMA, all other things being equal. Accra doubles as the capital of Ghana and the regional capital of Greater Accra. It is the social, economic and administrative hub of Ghana. This situation results in consumption of more goods and more solid waste is generated, which increase the demand for SWM services. Furthermore, the respondents in AMA are more likely to be well-educated and much informed to appreciate the social, economic and environmental benefits of proper SWM. They also have greater ability to pay and their busy lifestyles make them place high opportunity cost to time spent managing solid waste at home. These conditions impact positively on their WTP for SWM services.

From the results, information has no significant effect on households' WTP for improved SWM service in AMA, TaMA and the entire study area. The fact that information does not influence households WTP means educational programmes and campaigns on improved SWM by state agencies and NGOs have not been successful. One can reason that, although the respondents may have a lot of valuable information on proper SWM,

they may as well have other ideas and beliefs that are inaccurate and incomplete resulting in the poor SWM practices and their WTP. For instance residents, especially those in low-income area throw waste into drains because they believe the rains will carry the waste away. This attitude may be changed when residents' knowledge about SWM is strengthen and upgraded to enable them make decisions geared towards enhancing SWM.

7.6 Conclusion

This chapter examined the factors that influence households' WTP for improved SWM service in AMA and TaMA. The study employed the contingent valuation method to elicit households' WTP for improved SWM service. An analysis of the data sampled shows households' in AMA have higher mean WTP amount (GH¢ 15.71) than their counterpart in TaMA (GH¢8.99). Generally the mean WTP is higher among high-income areas than the low-income areas in AMA and TaMA. The study also observed that households' in AMA and TaMA are ready to pay a total monthly amount of GH¢ 7,081,251 and GH¢1,979,739 respectively to have an improved SWM service. The estimation results from the tobit regression model reveal that socio-economic characteristics, socio-psychological and situational factors significantly determinant respondents WTP for improved SWM services in AMA and TaMA.

The results also reveal that gender of head of household, educational attainment of head of household, total household income, occupation type of head of household, level of satisfaction with SWM services, attitude and subjective norm influence households' WTP for improved SWM in AMA. Gender of head of household, age of head of household, educational attainment of head of household, total household income, level of satisfaction with SWM services, attitude, subjective norm and perceived behavioural

control are the predictors of households' WTP for improved SWM services in TaMA. In the case of the entire study area, gender of head of household, educational attainment of head of household, total household income, occupation type of head of household, level of satisfaction with SWM services, attitude, subjective norm and location are the major determinants of households' WTP for improved SWM services.



CHAPTER EIGHT

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

8.1 Introduction

The study examines the factors that influence households' WTP and participation in source separation of solid waste in Accra and Tamale Metropolises in Ghana. It highlights the institutional arrangements for SWM and documents the drivers that motivate households' WTP and source separation intention in Accra and Tamale Metropolises. This chapter summarizes the main findings and draws theoretical implications for this study. It draws some policy implications from the study as well as area for further research.

8.2 Summary

Generally, in the developed countries solid waste is managed sustainably by separating it at source. This practice reduces the cost of solid waste management, environmental pollution and increase lifespan of landfill. However, in developing countries including Ghana, where solid waste financing is a major problem, formal source separation has received little attention. The study examined the factors that influence households' WTP for improved SWM services and participation in source separation of solid waste in Accra and Tamale Metropolises in Ghana. Specifically, the objectives were as follows:

- i. to examine the institutional arrangements for solid waste management in Accra and Tamale Metropolises.
- ii. to analyse the factors influencing households' participation in formal source separation of solid waste.

- iii. to examine the factors influencing households' willingness-to-pay for improved solid waste services.

The study employed the mixed methods research design. Qualitative data collection methods used were in-depth interviews, focus group discussions, and secondary data collection and field observations. The quantitative aspect of the study involved structured questionnaire interviews with 855 households selected through multi-stage sampling. The ordered probit regression was used to estimate the determinants of households' source separation behaviour, while the tobit regression model was employed to estimate the determinants of households' WTP for improved SWM services. This study identified two basic types of official institutional arrangements for SWC in AMA, namely: privately provided house-to-house (HtH) collection services and privately provided CCC services. In TaMA three basic official institutional arrangements for solid waste collection were identified, namely: privately provided HtH collection services, publicly provided CCC system and privately provided CCC services. The HtH system is prevalent in well-planned, easy accessible high and middle-income residential areas where ability to pay is high. Consequently, beneficiaries use the approved standard plastic waste bin with a lid. Beneficiaries of the HtH, pay user fees and are generally very satisfied with the quality of service provided. All (100%) the respondents in high-income area were satisfied while about 54.55% of respondents in middle-income area said they were satisfied with the quality of service provided. The cost recovery is relatively higher with the HtH system. The CCC system operates largely in densely populated, middle and low income neighbourhoods that are more difficult to access by road and the ability to pay is relatively low. Cost recovery under the CCC system is relatively low because beneficiaries in AMA who are required to pay for dumping their waste, most often than not refuse to pay. While in TaMA, the CCC system is fee-free. This has placed a huge

financial burden on the assemblies and private contractors, such that they are unable to empty the container regularly, resulting in overflowing of containers. Generally, beneficiaries of the CCC system are highly dissatisfied with the quality of services received because the service is unreliable and irregular. For instance in AMA and TaMA, all (100%) the respondents in the low-income areas were dissatisfied with the SWC service received. In AMA, 38.89% and 55.76% of respondents in low and middle-income area respectively have resort to the services of informal waste collector because of the poor services received from the formal private waste contractor.

On the final disposal of solid waste, AMA has no sanitary landfill site under her jurisdictions, but dump it solid waste on the Nsumia dump site located at Nsawam Adoagyiri Municipality. In contrast, TaMA has a sanitary landfill at Gbahali which started operation in 2006. The study reveals that both, the Nsumia dump-site and Gbahali landfill site are poorly managed. It was discovered that the minimum safety standard for environmental protection is not adhered to: leachate and methane gas are not properly managed and the daily covering and compaction of waste with soil is not practiced because of resource constraints. The poor management of the dump makes it fraught with a plethora of serious human and environmental problems, such as water pollution.

Findings from this study show that both Accra and Tamale Metropolises use the “end-of pipe approach” of SWM system, where practice focus mainly on SWC and disposal at the expense of minimizing activities that are vital for sustainable management outcomes. Source separation is carried out informally at household and dump site to facilitate reuse, recovery and recycling. This activity is motivated by economic interests rather than coordinated waste minimization policy by legislation.

It further reveals that SWM governance in AMA and TaMA is in sharp contrast with the tenets of the governance aspect of the ISWM concept. The study observed that participation by solid waste generators is superficial and limited to the payment of user tariff and presenting of solid waste for collection. Service users are directly not involved in fixing user fees and this has implication for the financial sustainability of the system. Setting user charges without consulting the beneficiaries could lead to high default rate by beneficiaries. The current SWM system is not financially viable because the CCC system in TaMA is fee-free, which place a huge financial burden on the assembly. In AMA, the low cost recovery associated with the CCC system has made the assembly takes up the financial responsibility of SWM because of the public good nature of SWM. There is also inequity in the provision of SWM services. Solid waste collection service from residential areas is skewed in favour of the rich. Generally, wealthy residential neighbourhoods receive regular and reliable HtH collection services while poor residential neighbourhoods receive very poor services with some areas getting no service at all. The informal waste collectors involved in SWM in AMA are not incorporated into the city's mainstream SWM system. The study also revealed that the poor SWM observed in the study areas is as a result of resource constraint (i.e financial, human and equipment), poor landfill management, weak enforcement of by-laws, attitudinal problems and inadequate public education.

On household source separation behaviour, the analysis of the survey data revealed that households' in TaMA (with 72% who have adopt source separation activities) tends to have stronger source separation behaviour than their counterpart in AMA (58.9% who have adopt source separation activities). The result reveals that generally, households in low-income area have stronger source separation behaviour than those in the high-income area in the study locations, and the source separation activity was mainly

motivated by economic incentives. For instance, about 56.67% and 55.19% of the respondents in indigenous and migrant- low-income areas in AMA respectively agree they source separate, reuse and recycle of plastics. Whiles only 10% of respondents in high-income area agree they source separate, reuse and recycle plastics. For TaMA, 58.33% of the respondents in the low-income area strongly agree they source separate, reuse and recycle plastics, whiles only 4.44% of respondents in the high-income area strongly agree source separate, reuse and recycle plastics. Regarding the theory of planned behaviour variables, attitude towards source separation was stronger among respondents in AMA, compared to TaMA. Subjective norm and perceived behavioural control were stronger among respondents in TaMA, compared to AMA. For residential locations, attitude towards source separation and perceived behavioural control were stronger among high-income areas in AMA and TaMA. In contrast, subjective norm was stronger among low-income areas in AMA and TaMA. For example, in AMA about 33.33% and 25.93% of the respondents in indigenous low-income area and migrant low-income area agree subjective norm do have influence on their source separation behaviour. For high-income area, just 16.67% agree subjective norms do have significant influence on their source separation behaviour. For TaMA, 20.83% of the respondents in the low-income area strongly agree subjective norms do have influence on their source separation behaviour, compare to 4.44% in high-income area who strongly agree subjective norms do influence their source separation behaviour.

The estimation results from the ordered probit revealed that socio-economic characteristics, socio-psychological and situational factors play vital roles in households' source separation intention. The major determinants of source separation intention in AMA include gender of head of household, educational attainment of head of household, total income of household, occupation type of head of household, information, past

experience with source separation, attitude towards source separation, subjective norm and inconvenience. In TaMA, household size, occupation type of head of household, past experience with source separation, inconvenience, attitude towards source separation and subjective norm are the main predictor of source separation intention. For the entire study area, educational attainment of head of household, total income of household, occupation type of head of household, information, past experience with source separation, inconvenience in terms of time, space and availability of formal source separation scheme, attitude towards source separation, subjective norm and the location of the respondents are the major determinants of source separation intention. For instance, male headed household decreases household source separation intention by 7.5 % in AMA, whiles household total income, decreases source separation intention by 5.8% in AMA and 4.4% at the entire study area. Households' source separation intention increases by 5.2% in AMA and 2.7% at the entire study area when they are much informed on source separation issues. Having the perception that lack of time, space and formal source separation arrangement is a constraint decreases household source separation intention by 4.8% in AMA, 7.9% in TaMA and 11.1% among households' at the entire study area. With reference to socio-psychological factors, positive attitude towards source separation increases source separation intention by 25.8% in AMA, 19.6% in TaMA and 13.8% at the entire study area. Whiles subjective norm increases households' source separation intention by 22.9% in AMA, 6.4% in TaMA and 11.4% at the entire study area.

The study employed the contingent valuation method to elicit households' WTP for improved SWM service. The findings show that the mean WTP is relatively higher in AMA (GH¢15.71) compared to TaMA (GH¢8.99). Generally the mean WTP is higher among high-income areas than the low-income areas in both AMA and TaMA. Also,

households' in AMA and TaMA are ready to pay a total amount of GH¢7,081,251 and GH¢1,979,739 per month respectively to have an improved SWM service.

The results from the tobit regression model show that gender of head of household, educational attainment of head of household, total household income, occupation type of head of household, level of satisfaction with SWM services, attitude and subjective norm are the major determinants of households' WTP for improved SWM in AMA. Whilst gender of head of household, age of head of household, educational attainment of head of household, total household income, level of satisfaction with SWM services, attitude, subjective norm and perceived behavioural control are the predictors households' WTP for improved SWM services in TaMA. In the case of the entire study area, gender of head of household, educational attainment of head of household, total household income, occupation type of head of household, level of satisfaction with SWM services, attitude, subjective norm and location are the major determinants of households' WTP for improved SWM services. For example, male headed household is willingly to pay GH¢4.11 less in AMA, GH¢2.18 less in TaMA and GH¢3.46 less in the entire study area for improved SWM. Whiles households' that have positive attitude towards source separation are willing to pay GH¢2.65, GH¢1.27 and GH¢1.65 more for improved SWM in AMA, TaMA and the entire study area respectively.

8.3 Conclusion

The study examined the factors that influence households' WTP and source separation behaviour in Accra and Tamale Metropolises in Ghana. The findings revealed that the SWM in the study area do not follow the tenets of ISWM. It further established that the SWM governance in AMA and TaMA is weak. Service users are not involved in fixing

user fees; the informal sector is not integrated into the formal system and the system is not financially viable because a greater proportion of the population do not pay for SWC. These had led to inequity in the provision of SWM services, with service skewed in favour of the rich or affluent communities.

The contribution of this study in this context is that it has brought to fore the factors that influence households' WTP and participation in source separation of solid waste. The theory of planned behaviour and the neoclassical consumer theory were found to be applicable in the Ghanaian case. The findings and conclusion suggest that households' attitude, subjective norms and perceived behavioural control influence households' WTP and source separation intentions, and indeed households' WTP and source separation intention responses are directly related to and shaped by situational factors such as inconvenience, satisfaction, information, past experience with source separation and the socio-economic conditions such as education, income, gender, age, household size and occupation type of the households. Secondly, it has provided conceptual clarity on how households' attitude, subjective norms, perceived behavioural control, inconvenience, information, satisfaction, past experience with source separation, education, income, household size, gender and occupation type explain households' WTP and source separation intentions in AMA and TaMA. By so doing, the study has provided an alternative conceptual framework that explains households' WTP and source separation intention in AMA and TaMA.

8.4 Policy Recommendation

This study has identified three key and interconnected parts of SWM system that need to be given equal prominence in terms of policy, strategy and practice. These include SWC, waste minimization activities and final disposal. Practice have so far concentrated on

SWC, and disposal at the expense of waste minimization activities that is critical for preventing or reducing waste at source (Oteng-Ababio, 2014a). To resolve this issue, waste minimization policies and strategies such as waste prevention and reduction at source, reuse, composting and recycling that are emphasized by the waste management hierarchy is required to promote waste minimization activities. The neglected, unregulated and unprotected informal waste collectors should be formalized and integrated into the formal SWM system. The sector does not only provide services to the neglected low-income communities but also undertake waste minimization activities and serves as a source of livelihood for thousands of urban poor. Proper integration of the sector into the existing SWM, can lead to sustainable management practices and possible helps alleviate poverty.

The study has also showed that there is inequity in SWC services between the affluent and poor residential neighbourhoods in both study areas. The level and quality of services provided was directly related with the institutional arrangements adopted and was also a reflection of the economic status of service beneficiaries. Second, user fees are determined by the assembly in consultation with the private waste contractor and not beneficiaries, although their representatives the Assembly men/women were involved. This has negative impacts on the ability of lower-income residents to accept, participate and pay for this service. To overcome this problem, service beneficiaries and other opinion leaders and community members should be included in the decision making around rates to be charged, mode of payment and the service type best suited to be delivered. This will improve public participation, equity in solid waste services and also make the system sustainable.

For successfully implementation of solid waste separation schemes, there is a need for frequent publicity and dissemination of information to stakeholders at the earliest

possible time so as to encourage acceptance and participation rates. Hence there is the need to organize frequent educational program to upgrade and strengthen residents knowledge about proper SWM, which will also help to redirect the minds and attitudes of people towards a new level of appreciating that solid waste can be a resource if separated from other waste. In addition, the by-law on illegal disposal of solid waste should be enforced alongside charging for SWC. There is the need to resource the WMDs to make it more responsive to the challenges of SWM. The environmental health officers from the environmental health unit can be attached to the private companies to enforce by-laws on payment for SWM service and prevention of illegal dumping of solid waste in open space, drains, water bodies and forest.

To tackle the solid waste problem effectively, the WMDs should be strengthen and well-resourced to enable them carry out their functions of planning, supervising, monitoring and evaluating SWM in their respective metropolises. Also, the private waste contractors should be paid on time for work done, since the delay in payment affect the quality of services rendered.

The financial arrangements for SWM in AMA and TaMA were found to be unsustainable. The current financial system depends mainly on the direct user charges paid by service beneficiaries and subsidies from government. Those using the CCC system dump freely in TaMA, while the PAYD system employ in AMA is not successful. This situation has place huge financial burden on the assemblies. The empirical findings also show that households' WTP were positively and significantly determined by the gender, type of occupation and education of the household head as well as household total income. A key policy implication of this result is that a flat rate cannot be charged across households; rather the cross-subsidization concept is appropriate. In the case of cross-subsidization, the educated and rich should pay more to

cover some of the cost of SWM and the other directly by local authorities, obtained through property and income taxes rather than through fixed tariffs. This would ensure that certain urban poor, who cannot afford the user fee, are serviced by SWC and thus reflects a social equity in service delivery. In addition, solid waste must be source separated to minimize solid waste disposal and reduce SWM cost as well as generate revenue from the sale of recyclable materials.

Situational factors were also seen as playing a role in influencing households' solid waste separation intentions. Providing source separation schemes and making the system as convenient as possible and adapt it according to the needs and dwellings of the local population would promote source separation of solid waste. Recycling drop-off centers at convenient locations within the community should be provided and additional waste bins provided for easy separation. The study also revealed that economic benefits are vital to participation in source separation. Monetary rewards such as rebates and incentives could be utilized to motivate households' to separate solid waste at source. With regards to socio-economic factors, it was concluded that female headed households, have higher source separation intentions. Local authorities should take advantage of the higher interest exhibited by female heads of households' by involving women's groups such as Christian Mothers, active environmental organizations and other social associations to promote source separation of solid waste.

8.4 Areas of Further Research

This study examined the phase where a good, which has been purchased and utilised, is transformed into solid waste and has to be separated into different fractions before it is eventually taken away. In this study an analysis was made about what motivates or deters households' to source separate solid waste and a conclusion was reached as to which factors would operate best in the study area.

Further research should go a step before solid waste is produced and examine the possibility of reducing solid waste at source and what could motivate households to decrease the amount of solid waste produced. Solid waste increase is a problem in AMA and TaMA and therefore reducing solid waste at source would reduce the cost of managing it and divert solid waste from landfill.



REFERENCES

- Abgemabiawo, I. K. (1996). Socio-economic and institutional dimensions of solid waste management in Tema, Ghana. MSc thesis, Norwegian University of Science and Technology, Trondheim.
- Abraham, E., Drechsel, P. and Cofie, O. (2006). *The challenge of urban flood control: The case of Accra's Korle Lagoon*. Accra: International Water Management Institute.
- Abeka, A.E. (2014). Adaptation to urban floods among the poor in the Accra metropolitan area. A PhD Thesis submitted to the ISSER, University of Ghana.
- Achankeng E. (2003). Globalization, urbanization and Municipal Solid Waste Management in Africa. In: Proceedings of the African Studies Association of Australasia and the Pacific Conference-Africa on a Global Stage.
- Adamowicz, W., Louviere, J., & Williams, M. (1994). Combining revealed and stated preference methods for valuing environmental amenities. *Journal of environmental economics and management* ,26 , 271-292.
- Adarkwa K. K. (2005). The reality of decentralisation implementation in Ghana and some emerging concerns. In Egziabher T. G. and Dijk M. P. van (eds). Issues and challenges in local and regional development, Addis Ababa,
- Afroz, R. & Masud, M. M. (2011). Using Contingent Valuation Approach for Improved Solid Waste Management Facility: Evidence from Kuala Lumpur, Malaysia. *Waste Management*, 31: 800-808.
- Adjei, S.M., (2013). Municipal solid waste minimization through household waste segregation in Bantama, Kumasi. A thesis submitted to the Department of Environmental Science, Kwame Nkrumah University of Science and Technology, Kumasi, in partial fulfillment of the requirement for the award of Master degree in Environmental Science.
- Agyei-Mensah, S. and Owusu, G. (2010). Segregated by Neighbourhoods? A portrait of Ethnic Diversity in the Neighbourhoods of the Accra Metropolitan Area, Ghana. *Population, Space and Place* 16(6), 499-516.
- Alhassan, M. & Mohammed, J.(2013). Households' Demand for better Solid Waste Disposal Services: Case study of Four Communities in the New Juaben Municipality, Ghana. *Journal of Sustainable Development*. 6(11).

- Allotey, S.A. (2009). Assessment of Environmental Hazards of the Oblogo Dumpsite: Institute for Development Studies University of Cape Coast.
- Alpizar, F., Carlsson, F., and Martinsson, P. (2001). Using choice Experiments for Non-Market Valuation, Working Paper in Economics no. 52, Department of Economics, Göteborg University.
- AMA/Colan Consult (1995). Public and private sector management of solid waste in Accra: An evaluation and prospects for sustainable service delivery.
- Amfo-Otu, R., Wiafe, E.D., Kwakwa, P.A., and Akpah-Yeboah, S. (2012). Willingness to Pay for Solid Waste Collection in Semi-Rural Ghana: A Logit Estimation. *International Journal of Multidisciplinary Research*, Vol.2, No.7.
- Amemiya T. (1984). Tobit models: a survey. *Journal of Econometrics* 24: 3-61.
- Anaman, K. A., & Jair, M. R. (2001). Contingent valuation of solid waste collection services for rural households in Brunei, Darussalam. *The Singapore economic review*, 45(2) , 233-240.
- Anschutz, J.M. (1996). Community-based solid waste management and water supply projects: problems and solutions compared. A survey of the literature. UWEP Working Document no. 2. Gouda, WASTE.
- Antipolis, S. (2000), Policy and Institutional Assessment of Solid Waste Management in Five Countries: Cyprus, Egypt, Lebanon, Syria and Tunisia, Blue Plan Regional Activity Centre, Valbonne.
- Asase, M.A.D., 2011. Solid waste separation at source: A case study of the Kumasi Metropolitan Area, a thesis submitted to the Chemical Engineering Department, Kwame Nkrumah University of Science and Technology, Kumasi, in partial fulfillment of the requirements for the Degree of Doctor of Philosophy, Faculty of Chemical and Materials Engineering, College of Engineering.
- Asenso-Okyere, K and F.A. Asante (2003). "Economic Burden of Malaria in Ghana", A Technical Report Submitted to the World Health Organisation Africa Regional Office (AFRO), Zimbabwe.
- Ajzen, I. (1991). The theory of planned behaviour. *Organizational Behaviour and Human Decision Processes*, 50(2), 179-211.
- Armah, N. A. (1993). Waste Management. *The Future of Our Cities. Proceedings of the Ghana Academy of Arts and Sciences*. XXVIII. 78-83. Accra. GAAS.

- Asomani-Boateng, R. (2007). Closing the Loop: Community-Based Organic Solid Waste Recycling, Urban Gardening, and Land Use Planning in Ghana, West Africa. *Journal of Planning Education and Research*, 27(2). 132-145.
- Awortwi N. (2002). Managing multiple modalities of delivering basic services in Ghanaian cities. *African development* XXVII (3) 76 – 105.
- Awortwi N. (2003). Getting the fundamentals wrong: Governance of multiple modalities of basic services delivery in three Ghanaian Cities. PhD Thesis. ISS.
- Awortwi, N. (2004). Getting the Fundamentals Wrong: Woes of Public-Private Partnerships in Solid Waste Collection in Three Ghanaian Cities. *Public Administration and Development*, 24(3), 213-224
- Baabereyir, A. (2009). Urban environment problems in Ghana. A case study of social and environmental injustice in solid waste management in Accra and Sekondi-Takoradi. A PhD Thesis submitted to the School of Geography, University of Nottingham.
- Bamberg, S. (2012). Understanding and promoting bicycle use - insights from psychological research. In J. Parkin (Ed.), *Cycling and sustainability* (pp. 219 - 246). Bingley, UK: Emerald Publishing Group Limited.
- Banga, M., Lokina, R. B. & Mkenda, A. F. (2011). Households' Willingness to Pay for Improved Solid Waste Collection Services in Kampala City, Uganda. *Journal of Environment and Development*, 20(4): 428-448.
- Boyle, K. (2003), 'Contingent valuation in practice', in P. Champ, K. Boyle and T. Brovn (eds). *A Primer on Nonmarket Valuation*, Boston, MA: Kluwer Academic.
- Bortoleto A. P., Kurisu K. H., Hanaki K. (2012). Model development for household waste prevention behaviour. *Waste Manage.*;32:2195–2207.
- Barr, S., Gilg, A. W. & Ford, N. (2001). Differences between household waste reduction, reuse and recycling behaviour. *Environ Waste Manage.* 4 (2), 69-82.
- Barr, S. Ford, N. J. & Gilg, A. (2003). Attitude towards recycling household waste in Exeter, Devon: quantitative and qualitative approaches. *Local Environment*. 8, 407- 428.
- Barr, S., Gilg, A. & Ford, N. (2005). Conceptualizing and analyzing household attitudes and actions to a growing environmental problem: Development and application of a framework to guide local waste policy. *Applied Geography*. 25, 226-247.

- Bartone, C., Bernstein, J., & Wright, F. (1990). Investments in solid waste management. Infrastructure and Urban Development Department, The World Bank, Washington.
- Bartlett, M. (1947). Multivariate analysis. *Journal of the Royal Statistical Society*, 9(2), 176-197.
- Bateman, I.J., Carson, R.T., Day, B., Hanemann, W.M., Hanley, N., Hett, T., et al., (2002). *Economic Valuation with Stated Preference Techniques: A Manual*. Edward Elgar, Cheltenham
- Bennagen EC, Nepomuceno G, & Ramil C. (2002). Solid Waste Segregation and Recycling in Metro Manila: Households' Attitude and Behavior. In: Resource, Environment and Economic Centre for Studies (REECS).
- Benneh, G., Songsoore J., Nabila J.S., Amuzu TA., Tutu K.A. & Yangyuoru Y. (1993). *Environmental Problems and Urban Households in the Greater Accra Metropolitan (GAMA)-Ghana*, Stockholm Environmental Institute, Stockholm
- Berglund, C. (2006). 'The assessment of households' recycling costs: the role of personal motives'. *Ecological Economics*, 56(4): 560–569
- Bennagen Ma, Eugenia, C., Nepomuceno G., & Covar R. (2002). Solid waste segregation and recycling in metro Manila: household attitudes and behavior. EEPSEA Research Report 2202-RR3.
- Ben-Akiva, M., & S. R. Lerman. (1991). *Discrete Choice Analysis: Theory and Application to Travel Demand*. The MIT Press, Cambridge, Mass.
- Botkin, D. B., & E. A. Keller. (2011). *Environmental Science: Earth as Living Planet* (8th Ed.). John Wiley and Sons, Inc.
- Boldero, J. (1995). The prediction of household recycling of newspapers: The role of attitudes, intentions, and situational factors. *Journal of Applied Social Psychology*, 25, 440-462.
- Blacksmith Institute, (2013). *The worlds worst 2013: the top ten toxic threats. Cleanup, progress and ongoing challenges*. New York.
- Braun, V. & Clarke, V. (2006) Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3 (2). pp. 77-101.
- Carson, R. T., & Hanemann, W. M. (2005). Contingent valuation. In *Handbook on Environmental Economics*, Vol 2. Edited by Mäler, K.G., Vincent, J.R. North-Holland, Amsterdam.

- Creswell, J. W. (2003). *Research design: Qualitative, quantitative and mixed methods approaches* (2nd Ed.). Thousand Oaks: Sage.
- Cronbach, L. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika* 16, 297–334.
- Cronbach, L. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika*, 16, 297-334.
- Davies, J. Foxall, G. R. & Pallister, J. (2002). Beyond the intention- behavior mythology: an integrated model of recycling. *Market Theory* .1. 29-113.
- Davis, G., Philips, P.S., Read, A.D. & Iida, Y. (2006). Demonstrating the need for the development of internal research capacity: understanding recycling participation using the theory of planned behaviour in West Oxfordshire, UK. *Resources, Conservation and Recycling* 46, 115–127.
- Denzin, N. (1989). *The Research Act: A Theoretical Introduction to Sociological Research Methods* (3rd edition, first published on 1970), Prentice Hall.
- De Vaus, D. (2001). *Research design in social science*. SAGE Publication, London.
- Domina, T., & Koch, K. (2002). Convenience and frequency of recycling: implications for including textiles in curbside recycling programs. *Environment and Behavior*, 34, 2, 216-238.
- do Valle, P. O., Reis, E., Menezes, J. and Rebelo, E. (2004). Behavioral determinants of household recycling participation. *Environment Behavior* 36,505–540.
- Dwivedy, M. & Mitta, R. K. (2013). Willingness of residents to participate in e-waste recycling in India. *Environmental Development*, 6:48-68.
- Ebreo, A. & Vining, J. (2001). How similar are recycling and waste reduction? Future Orientation and Reasons for Reducing Waste as Predictors of Self-Reported Behaviour. *Environment and Behaviour*, 33(3).424-448.
- Echegaray, F. & Hansstein, F. V. (2016). Assessing the intention-behavior gap in electronic waste recycling: the case of Brazil. *Journal of Cleaner Production*. xxx: 1-11
- EPA/BED (2015). Draft Final M&E Report of Pilot Source Segregation Programme, BED/EPA.

- Ekere, W. J. Mugisha; & Drake. L. (2009). "Factors Influencing Waste Separation and Utilization among Households in the Lake Victoria Crescent, Uganda. *Waste Management* 29, 3047-3051
- Environmental Service Provider Association (ESPA)(2014). Sustainable waste management financing in Ghana-a political or economic decision. A report compiled by Society for Managing Initiatives and Leadership Enhancement (SMILE), Ghana.
- Ezeah, C. & Roberts, C. L. (2012). Analysis of Barriers and Success Factors affecting the Adoption of Sustainable Management of Municipal Solid Waste in Nigeria. *Journal of Environmental Management*, 103: 9-14.
- FAO. Statistics (2013). Available at: Food and Agriculture Organisation of the United Nations <<http://faostat3.fao.org/faostat-gateway/go/to/home/E>>. Accessed October 2015.
- Foddy, W. H. (1994). Constructing questions for interviews and questionnaires: Theory and practice in social research (New ed.). Cambridge, UK: Cambridge University Press.
- Fishbein, M. & Ajzen, I. (1975). Belief, Attitude, Intention, and Behavior: An Introduction to Theory and Research. Reading, MA: Addison-Wesley
- Fobil, J. N., Armah, N. A., Hogarh, J. N. & Carboo, D. (2008). The Influence of Institutions and Organizations on Urban Waste Collection Systems: An Analysis of Waste Collection System in Accra, Ghana. *Journal of Environmental Management*, 86(1): 262-271.
- Frankfort-Nachmias, C. & Nachmias, D. (1996). *Research methods in social science*. London: Arnold.
- Fuseini, I., & Kemp, J. (2016). Characterising urban growth in Tamale, Ghana: an analysis of urban governance response in infrastructure and service provision. *Habitat International*, 56, 109–123.
- Gamba, R.J., & Oskamp, S. (1994). Factors influencing community residents' participation in commingled curbside recycling programs. *Environ. Behav.* 26, 587-612
- Ghana Statistical Service (2012). *2010 population and housing census: Summary report of results*. Accra: Ghana Statistical Service.
- Ghana Statistical Service (2002). *2000 population and housing census: Special report on urban localities*. Accra: Ghana Publishing Company.

- Ghana Statistical Service (2013). 2010 Population and Housing Census. National Analytical Report. Accra, GSS.
- Ghana Statistical Service (2014a). 2010 Population and Housing Census. District Analytical Report. Accra Metropolitan. Accra, GSS
- Ghana Statistical Service (2014b). 2010 Population and Housing Census. District Analytical Report. Tamale Metropolis. Accra, GSS
- GSS (Ghana Statistical Service). (2011). *2010 Population and Health Census Provisional Results: Summary of Findings*. Accra: GSS.
- Ghana News Agency, (2013). <http://ghwashtimes.blogspot.com/2013/12/ghana-launches-waste-segregation-project.html>. Access in 25th October, 2014.
- Girling, R. (2005). *Rubbish! Dirt on Our Hands and Crisis Ahead*. Eden Project Books. London, Transworld Publishers Ltd.
- Gonzalez-Torre, P. L., Adenso-Diaz, B., & Ruiz-Torres, A. (2003). Some comparative factors regarding recycling collection systems in regions of the USA and Europe. *Journal of Environmental Management*, 69(2), 129-138.
- Government of Ghana (2011). *Ghana Housing Profile*. Accra: Ministry of Water Resources, Works and Housing and Nairobi: UNHABITAT.
- Government of Ghana (1992). *The Constitution of the Republic of Ghana*. Accra: Government Printer.
- Gugssa, B.T. (2012). The cycle of solid waste: a case study on the informal plastic and metal recovery system in Accra. Maste Thesis submitted to the Department of Earth Sciences, Uppsala University.
- Greene, (2003). *Econometric Analysis*, fifth ed. New York University.
- Guerrero, A. L., Maas, G. & Hogland, W. (2013). Solid Waste Management Challenges for Cities in Developing Countries. *Waste Management*, 33:220-232.
- Gutberlet, J. (2008). *Recovering Resources – Recycling Citizenship: Urban Poverty Reduction in Latin America*. Oxson: Ashget Publishing group.
- Gyasi, E. A., Fosu, M., Kranjac-Berisavljevic, G., Mensah, A. M., Obeng, F., Yiran, G. A. B. & Fuseini, I. (2014). Building Urban Resilience: Assessing Urban and Peri-

- urban Agriculture in Tamale, Ghana. [Padham, J. and J. Jabbour (eds.)]. United Nations Environment Programme (UNEP), Nairobi, Kenya.
- Hage, O. & P. Soderholm (2008). An econometric analysis of regional differences in household waste collection: the case of plastic packaging waste in sweden. *Waste Management* 28 (10), 1720–1731.
- Hage, O., Söderholm, P., & Berglund, C. (2009). Norms and economic motivation in household recycling: Empirical evidence from Sweden. *Resources, Conservation and Recycling*, 53(3):155-165.
- Hagos, D., Mekonnen, A., & Gebreegziabher, Z. (2012). Households' Willingness to Pay for Improved Urban Waste Management in Mekelle City, Ethiopia. *Environment for Development, Discussion Paper Series*.
- Henry, R.K., Yongsheng, Z., & Jun, D., (2006). Municipal solid waste management challenges in developing countries – Kenyan case study. *Waste Manage.* 26 (1),92–100.
- Hirschhorn, J., Jackson, T., & Baas, L. (1993). Towards Prevention: the emerging environmental management paradigm. In: Jackson, T. (Ed.), *Clean Production Strategies: Developing Preventative Environmental Management in the Industrial Economy*. Lewis, Chelsea, MI.
- Hoehn, J. P., & Randall, A. (1987). A satisfactory benefit cost indicator from contingent valuation. *Journal of environmental economics and management*, 14 , 226-247.
- Holmes, Thomas P.; Adamowicz, Wiktor L. (2003). Attribute-Based Methods. In: A Primer on Nonmarket Valuation. Champ, Patricia A.; Boyle, Kevin J.; Brown, Thomas C. eds. Kluwer Academic Publishers. Dordrecht
- Hoornweg, D, Bhada-Tata, P, & Kennedy, C. (2013).Waste Production must Peak this Century. *Nature*: 502-615.
- Hornik J., Cherian J., Madansky M. & Narayana C. (1995). Determinants of recycling behavior: A synthesis of research results. *Journal of Socio-Economics*, 24 (1). 105-127.
- Houber, A. L. (2010). Moving Towards Sustainable Solid Waste Management in Accra: Bridging the Formal-Informal Divide. Dissertation, Amherst College.

- Janeen Tang, (2004). A case study of a hotel solid waste management program in Bali, Indonesia. (MSc study in Planning, University of Waterloo, Canada), 178.
- Hyytiä, N and Kola, J. (2006). Finnish citizens' attitudes towards multifunctional agriculture. *International Food and Agribusiness Management Review*, 9 (3).
- Jaya Dhindaw, (2004). Developing a framework of best practices for sustainable solid waste management in small tourist islands (MSc thesis in Community Planning, University of Cincinnati, USA), 207.
- Jin, J., Wang, Z. & Ran, S. (2006) 'Estimating the public preferences for solid waste management programs using choice experiments in Macao', *Waste Management and Research*, Vol. 24, No. 3, pp.301–309.
- Kaiser H. F. (1958). The varimax criterion for analytic rotation in factor analysis. *Psychometrika* 1958;23:187–200.
- Karikari, O. (1999). Community participation and choice of technology in municipal solid waste management: Case study of Accra. MSc thesis, Vrije Universiteit, Brussels.
- Karim Ghani, W. W., Rusli, I. F., Awang Biak, D. R. & Idris, A. (2013). An application of the theory of planned behaviour to study the influencing factors of participation in source separation of food waste. *Waste Management*. 33:1276-1281.
- Kassim, S. M. & Ali, M. (2006). 'Solid waste collection by the private sector: households' perspective – findings from a study in Dar es Salaam City, Tanzania', *Habitat International*, 30, (4).769–780
- Katusiimeh, M. W., Burger, K. and Mol, A. P. J. (2013). Informal waste collection and its co-existence with the formal waste sector: the case of Kampala, Uganda. *Habitat International*, 38, 19.
- Kollmuss, A. & Agyeman, J. (2002). Mind the gap. Why do people act environmentally and what are the barriers to pro-environmental behaviour?. *Environmental Education Research*, 8(3),239-260.
- Kolstad, C. D. (2000). *Environmental economics*. Oxford: Oxford University Press. 296-310
- Kolikkathara, N., Feng, H., & Stern, E. (2009). A preview of waste management evolution: special emphasis on USA. *Waste Management* 29 (2), 974–985.

- Konadu-Agyemang, K., (2001). "A Survey of Housing Conditions and Characteristics in Accra, An African City", *Habitat International*, 25: pp. 15-34.
- Knussen, C., F. Yule, J. MacKenzie, and M. Wells (2004). An analysis of intentions to recycle household waste: The roles of past behaviour, perceived habit, and perceived lack of facilities. *Journal of Environmental Psychology* 24 (2), 237–246.
- Knussen, C., & Yule, F. (2008). 'I'm not in the habit of recycling': The role of habitual behavior in the disposal of household waste. *Environment and Behavior*, 40, 683-702.
- Kranjac-Berisavljevic, G. & Ganda, Z. B. (2013). Business Opportunities in Safe and Productive Use of Waste in Tamale. *Urban Agriculture Magazine*, 26.
- Lee, S. & Paik, H. S. (2011). Korean household waste management and recycling behaviour. *Building & Environ.* 46(5), 1159-1166.
- Loewenstein, G. (2000). Emotions in economic theory and economic behaviour. *The American Economic Review*, 90(2), 426.
- Lohse, U. (2003). Improving Municipal Finance – A Global Challenge. *Habitat Debate. Innovative Urban Financing*. UN-HABITAT 9 (1).
- Lohri, C.R., Camenzind, J.E. & Zurbrugg, C.(2014). Financial sustainability in municipal solid waste management – Costs and revenues in Bahir Dar, Ethiopia. *Waste Management* 34, 542-552.
- Louis, G.E., (2004). A historical context of municipal solid waste management in the United States. *Waste Management & Research* 22 (4), 306–322.
- Loomis, J., Kent, P., Strange, L., Fausch, K. & Covich, A. (2000). Measuring the total economic value of restoring ecosystem services in an impaired river basin: results from a contingent valuation survey. *Ecol. Econ.* 33, 103–117.
- Mahmud, S.N.D. & Osman, K. (2010). The determinants of recycling intention behavior among the Malaysian school students. *Procedia Soc. Behav. Sci.*, 9, 119–124
- Marshall, R. E. & Farahbakhsh, K. (2013). Systems Approaches to Integrated Solid Waste Management in Developing Countries. *Waste Management*, Vol.23, 988-1003.

- Martin, M., Williams, I. D. & Clark, M. (2005). Social, cultural and structural influences on household waste recycling: a case study, resources. *Conservation and Recycling*, 48, 357-395
- Mbiba, B. (2014). Urban solid waste characteristics and household appetite for separation at source in Eastern and Southern Africa. *Habitat International*. Vol. 43; 152-162.
- Mbuligwe, S.E., Kassenga, G.R., Kaseva, M.E., Chaggu, E.J., 2002. Potential and constraints of composting domestic solid waste in developing countries: findings from a pilot study in Dar es Salaam, Tanzania. *Resources, Conservation and Recycling*, Vol. 36, pp. 45 - 59.
- Midaba, Y., (2009). Factors Affecting Collection of and Willingness to Pay for Solid Waste: A Case of Ilala Municipality, Dar-es-Salaam. Thesis.
- McDougall, Forbes R. White, Peter R. Franke, and Marina, H. P. (2008). *Integrate Solid Waste Management: A life cycle inventory*. Chichester: Wiley
- McDonald S, & Oates C. (2003). Reasons for non-participation in a kerbside recycling scheme. *Resour Conserv Recycle* 39(4):369–85.
- Memon, M. A., (2010). Integrated solid waste management based on the 3R approach. *J. Mater. Cycles Waste Manage*. 12 (1), 30–40.
- Meneses G.D, & Palacio A.B. (2005). Recycling behavior: a multi-dimensional approach. *Environment and Behavior* 37:837–60.
- Miezah, K., Obiri-Danso, K., Kádár, Z., Fei-Baffoe, B., and Mensah, M.Y. (2015) Municipal solid waste characterization and quantification as a measure towards effective waste management in Ghana. *Waste Manag* **46**, 15–27 (2015)
- Ministry of Local Government and Rural Development (MLGRD) (1999). Environmental Sanitation Policy. Accra: Government of Ghana. P 3, 17-20.
- Ministry of Local Government and Rural Development (MLGRD). (2010a). National Environmental Sanitation Strategic Action Plan (NESSAP). Accra, Ghana: Government of Ghana.
- Ministry of Local Government and Rural Development (MLGRD). (2010b). Strategic Environmental Sanitation Investment Plan (SESIP). Accra, Ghana: Government of Ghana.

- Ministry of Local Government and Rural Development (MLGRD). (2010c). National Environmental Sanitation Policy. Accra, Ghana: Government of Ghana
- Nagabooshnam, J. K. (2011). Solid waste generation and composition in Gaborone, Botswana, Potential for resource recovery, Master thesis, Energy and environmental engineering, Department of Management Engineering, Linkoping University, Sweden.
- Nigbur, D., Lyons, E., & Uzzell, D. (2010). Attitudes, norms, identity and environmental behavior: using an expanded theory of planned behavior to predict participation in a kerbside recycling programme. *British Journal of Social Psychology*, 489(2), 259e284.
- Nixon, H. & Saphores, J.-D.M. (2007). Financing electronic waste recycling Californian households' willingness to pay advanced recycling fees. *Journal of Environmental Management* 84, 547–559.
- Obirih-Opareh, N. (2000) Institutional arrangements and stakeholders' perspectives of solid waste management in Accra. Report to NIRP.
- Obirih-Opareh, N. (2003). Solid Waste Collection in Accra: The Impact of Decentralization and Privatization on the Practice and Performance of Service Delivery, *A study conducted at the Amsterdam Research Institute for Global Issues and Development Studies (AGIDS)*, University of Amsterdam, The Netherlands.
- Obirih-Opareh, N., and Post, J. (2002). Quality assessment of public and private modes of solid waste collection in Accra, Ghana. *Habitat International*, 26(1); 95-112.
- Odame-Larbi, W. (1996). Spatial planning and urban fragmentation in Accra. *Third World Planning Review*, 18(2)
- Oduro-Appiah, K. & Aggrey, B.E. (2013). Determinants of source separation on municipal solid waste in developing countries: the case of Ghana. *Journal of Sustainable Development in Africa*, 15(3). 47-60.
- Oduro-Kwarteng, S. (2011). *Private Sector Involvement in Urban Solid Waste Collection: Performance, Capacity and Regulation in Five Cities in Ghana*. CRC Press/Balherma, The Netherlands.

- Ofori-Sarpong, E. and Annor, J. (2001). Rainfall over Accra 1901-90. *Weather*, 56, 55-62.
- Ogawa, H. (2000). Sustainable Solid Waste Management in Developing Countries, World Health Organisation, Geneva.
- Ojeda-Benitez S, Vega CA, Marquez-Montenegro MY (2008) Household solid waste characterization by family socioeconomic profile as unit of analysis. *Resources, Conservation and Recycling* 52:992–999.
- Ojok, J., Koech, M. K., Tole, M. & Okot-Okumu, J. (2012). Households' willingness-to-pay for improved municipal solid waste management services in Kampala, Uganda. *Science Journal of Environmental Engineering Research*, 1-8. doi: 10.7237/sjeer/143
- Okot-Okumu, J. (2012). Solid waste management in African cities – East Africa, Waste Management – An Integrated Vision, ISBN: 978-953-51-0795-8, InTech, <http://dx.doi.org/10.5772/50241>.
<<http://www.intechopen.com/books/waste-management-an-integrated-vision/solid-waste-management-in-african-cities-east-africa>>.
- Oteng-Ababio, M. (2007). Public-private partnership in solid waste management in the Greater Accra Metropolitan Area. A PhD Thesis submitted to the department of geography and resource development, University of Ghana, Legon, Ghana.
- Oteng-Ababio, M. (2010a). Private Sector Involvement in Solid Waste Management in the Greater Accra Metropolitan Area. *Waste Management and Research*. 28. 322-329.
- Oteng-Ababio, M. (2010b). Solid Waste Management in Ghana: Willingness-to-Pay for Improved Services. *Ghana Journal of Geography*, 2: 86-108.
- Oteng-Ababio M (2011a). Governance Crisis or Attitudinal Challenges? Generation, Collection, Storage and Transportation of Solid Waste in Ghana, Integrated Waste Management – Vol. I, Mr. Sunil Kumar (Ed.), ISBN: 978-953-307-469-6, InTech. Available from: <http://www.intechopen.com/books/integrated-wastemanagement-volume-i/governance-crisis-or-attitudinal-challenges-generation-collection-storage-andtransportation-of-soli>.
- Oteng-Ababio, M. (2011b). Missing Links in Solid Waste Management in the Greater Accra Metropolitan Area in Ghana. *Geo Journal*, 76, pp. 551-560.

- Oteng-Obabio, M. (2011c). The role of the informal sector in solid waste management in the GAMA, Ghana. *Tijdschrift voor Economische en Sociale Geografie*, 103(4), 412e425.
- Oteng-Ababio, M., Owusu, K., & Addo, K. A. (2011). The vulnerable state of the Ghana coast: The case of Faana-Bortianor. *Jàmbá: Journal of Disaster Risk Studies*, 3(2), 429-442.
- Oteng-Ababio, M. (2012). *Spatial Inequality in Waste Management in a Millennium City: The Nexus between Governance and Poverty*. Araujo, A.S.F. In *Waste Management: New Research*. New York, NY: Nova Science Publishers, Inc.
- Oteng-Ababio, M. (2013a). Solid Waste Management in Ghana: The Past, the Present and the Future. *Social Sciences Series*, 1, University of Ghana.
- Oteng-Ababio, M. (2013b). Unscripted (in) justice: Exposure to Ecological Hazards in Metropolitan Accra. *Environment and Planning*, 45. 1199-1218.
- Oteng-Ababio, M. (2014a). Rethinking Waste as a Resource: Insights from a Low-Income Community in Accra, Ghana. *City, Territory and Architecture*, 1.10
- Oteng-Ababio, M. (2014b). Guilty with Explanation: Rethinking the destiny of Landfills in a Millenium City in Ghana. *Management of Environmental Quality*, 25(2). 200-215.
- Oteng-Ababio, M., Arguello, J. E. M. & Gabbay, O. (2013). Solid Waste Management in African Cities: Sorting the Facts from the Fads in Accra, Ghana. *Habitat International*, 39.96-104.
- Owusu, G. & Agyei-Mensah, S. (2011). Comparative study of ethnic residential segregation in Ghana's two largest cities, Accra and Kumasi. *Population and Environment* 32(4), 332-352.
- Owusu, G., & Oteng-Ababio, M. (2015). Moving unruly contemporary urbanism toward sustainable urban development in Ghana by 2030. *American Behavioral Scientists (ABS)*, 59(3), 311–327.
- Owusu, G., Oteng-Ababio, M. & Afutu-Kotey, R. (2012). Conflicts and Governance of Landfills in a Developing Country city, Accra. *Landscape and Urban Planning*, 104:105-113.
- Owusu, V., Adjei-Addo, E., & Sundberg, C. (2013). Do economic incentives affect attitudes to solid waste source separation? Evidence from Ghana. *Resources, Conservation and Recycling*, 78(2013), pp.115-123.

- Othman, S., Noor, Z., Abba, A., Yusuf, R. & Hassan, M. (2013). Review on Life Cycle Assessment of Integrated Solid Waste Management in some Asian Countries. *Journal of Cleaner Productio*, 41: 251-262.
- Pallant, J., (2005). SPSS survival manual: a step by step guide to data analysis using SPSS for windows (Version 12). 2nd ed. Maidenhead: Open University Press.
- Pearce, D., Giles A. and Mourato, S. (2006). *Cost-Benefit Analysis and the Environment*. Paris: OECD Publishing.
- Peavy, H.S., Rawe, D.R., Tchobanoglous, G., 1985. Environmental Engineering. McGraw-Hill Book Company, Singapore.
- Pongrácz E. (2002). Redefining the concepts of waste and waste management. Evolving the theory of waste management (PhD thesis in Environmental Engineering, University of Oulu, Finland), 166.
- Post, J. (1999). The Problems and Potentials of Privatizing Solid Waste Management in Kumasi, Ghana. *Habitat International*, 23(2):201-216.
- Post, J., Broekema, J. & Obirih-Opareh, N. (2003). Trial and Error in Privatization: Experiences in Urban Solid Waste Collection in Accra (Ghana) and Hyderabad (India). *Urban Studies*, 40 (4), 835-852.
- Puopiel, F. (2010). Solid waste wanagement in Ghana: the case of Tamale Metropolitan Area. Unpublished dissertation submitted to the Department of Planning, Kwame Nkrumah University of Science and Technology, Kumasi Ghana.
- Rahji, M. A. Y. & Oloruntoba, O. (2009). Determinants of households' willingness-to-Pay for Private Solid Waste Management Services in Ibadan, Nigeria. *Waste Management and Research*.27. 961-965.
- Saphores, J.D.M., Nixon, H. and Ogunseitan, O.A.(2006). Household willingness to recycle electronic waste. An application to California. *Environment and Behaviour*, 38(2), 183-208.
- Sarantakos, S. (1998). *Social research*, New York, NY: Macmillan Press Limited.
- Scheinberg A, Wilson D.C. & Rodic L. (2010). Solid Waste Management in the World's Cities. Earthscan for UN-Habitat.
- Sidique, S. F., Lupi, F. J. & Satish V. (2010). The effects of behavior and attitudes on drop-off recycling activities. *Resources, Conservation and Recycling*, 54(3), 163-170.

- Sim, J. & Wright, C. (2000). *Research in health care: concepts, designs and methods*. Cheltenham: Nelson Thornes.
- Skumatz, L. A. & Freeman D. J. (2006). Pay-As –You-Throw (PAYT) in the US: Update and Analyses. Prepared for USEPA and SERA by Skumatz Economic Research Associates Inc., Superior CO. Available from: <http://www.epa.gov/osw/conserve/tools/payt/pdf/sera06.pdf>. [Last accessed on 2015 October 22].
- Songsore, J. (2003). Towards a Better Understanding of Urban Change: Urbanisation, National Development and Inequality in Ghana. Accra. Ghana Universities Press
- Songsore, J. and McGranahan, G. (1993). Environment, wealth and health: Towards an analysis of intra-urban differentials within the Greater Accra Metropolitan Area–Ghana. *Environment and Urbanisation*. 5(2), 10-34.
- Songsore, J., Nabila, J. S., Yangyouro, Y., Avles S., Hamilton, E. K. B., Amponsah, P. E. & Alhassan, O. (2009). Integrated disaster risk and environmental health monitoring in the Greater Accra Metropolitan Area. In Pelling, M. & Wisner, B. (Eds.), *Disaster risk reduction: Cases from urban Africa*. London: Earthscan Publications.
- Strazzer, E., Scarpa, R., Calia, P., Garrod, G. & Willis, K. (2003). Modeling zero values and protest responses in contingent valuation surveys. *Applied Economics*, 35(2), 133-138.
- Sumukwo, J., Kiptui, M., and Cheserek, G.J. (2012). Economic Valuation of Improved Solid Waste Management in Eldoret Municipality. *Journal of Emerging Trends in Economics and Management Sciences*, Vol.3,No.6: pp.962- 970.
- Tadesse, T. (2009). Environmental concern and its implication to household waste separation and disposal: Evidence from Mekelle, Ethiopia. *Resources, Conservation and Recycling*, 53(4), 183–191. [http://dx. doi: 10.1016/j.resconrec.2008.11.009](http://dx.doi.org/10.1016/j.resconrec.2008.11.009)
- Tchobanoglous, G., Theisen, H. & Vigil, S. A. (1993). *Integrated Solid Waste Management*. New York, McGraw Hill
- Tchobanoglous, G., Kreith, F. & Williams, M. E. (2002). Introduction. In G. Tchobanoglous and F. Kreith (Eds.), *Handbook of Solid Waste Management Second Edition*. New York: McGraw-Hill Handbooks.

- Tonglet, M., Philips, P.S., and Read, A.D.(2004). Using the theory of planned behaviour to investigate the determinants of recycling behaviour: a case study from Brixworth, UK. *Resources, Conservation and Recycling*, 41, 191–214.
- The Ghanaian Times. (2015). Monday, 10th June, 2015:p.4
- Turaga, R. M. R., Howarth, R. B., & Borsuk, M. E. (2010). Pro-environmental behavior. *Annals of the New York Academy of Sciences*, 1185(1), 211-224.
- United Nations (UN), Department of Economic and Social Affairs, Population Division (2015). *World Population Prospects: The 2015 Revision, Key Findings and Advance Tables*. Working Paper No. ESA/P/WP.241.
- United Nations Development Programme (UNDP) (1992). *Human Development Report 1992*. UNEP, Oxford University Press, New York.
- United Nations Environment Programme (2005). *Solid waste management*. UNEP.
- United Nations Human Settlements Program (UN-Habitat) (2008). *State of the world's cities: 2008/2009: Harmonious cities*. London: Earthscan.
- United Nations, Department of Economic and Social Affairs, Population Division (2015). *World Population Prospects: The 2015 Revision, Key Findings and Advance Tables*. Working Paper No. ESA/P/WP.241.
- UN-HABITAT (2010). *Solid Waste Management in the World's Cities. Water and Sanitation in the World's Cities 2010*. Earthscan Publisher, London and Washington, DC.
- UNEP (2013). *Municipal Solid Waste Management*. Available at: Newsletter and Technical Publications.
(<http://www.unep.or.jp/Ietc/ESTdir/Pub/MSW/index.asp>). Accessed 22 October, 2015.
- United Nations Environment Programme (UNEP) (2015) . *Global Waste Management Outlook*. Nairobi, Kenya.
- United Nations Human Settlements Programme (UN-HABITAT), (2009). *Ghana:Accra Urban profile*. UNEP, Nairobi, Kenya.
- US. EPA, (2008). *Hazardous Waste Listings. A User-Friendly Reference Document*. Draft March 2008. Accessed at:
<http://www.epa.gov/epaoswer/hazwaste/listingref>. pdf. 01/07/16.
- van de Klundert, A. & Anschutz, J. (1999). *Integrated Sustainable Waste Management: the selection of appropriate technologies and the design of sustainable systems is*

- not (only) a technical issue. *CEDARE/IETC Inter-Regional Workshop on Technologies for Sustainable Waste Management*. Alexandria, Egypt.
- van de Klundert, A. & Anschutz, J. (2001). Integrated sustainable waste management – the concept: tools for decision-makers. Experiences from the Urban Waste Expertise Programme (1995–2001). In: Scheinberg, A. (Ed.), Gouda. Urban Waste Expertise Programme, Netherlands
- Vicente, P., and Reis, E., (2008). Factors influencing households' participation in recycling. *Waste Manag Res.*, 26, 140-146.
- Vining, J. and Ebreo, A. (1992). Predicting recycling behavior from global and specific environmental attitudes and changes in recycling opportunities. *J. Appl. Soc. Psychol.*, 22, 1580–1607.
- WEDC (2003). Application of tools to support national sanitation policies. Water, Engineering and Development Centre,
- Williams, I.D. and Kelly, J. (2003). Green waste collection and the public's recycling behaviour in the Borough of Wyre, England. *Resour. Conserv. Recycl* 38, 139-159.
- Whittington, D., Briscoe, J., Mu, X., & Barron, W. (1990). Estimating the willingness to pay for water services in developing countries: A case study of the use of contingent valuation surveys in Southern Haiti. *Economic Development and Cultural Change*, 38, 293-311.
- Wilson, D. C., Araba, A., Chinwah, K. and Cheeseman, C. R. (2009). Building Recycling Rates through the Informal Sector. *Journal of Waste Management*, 29:629–635.
- Wilson, D. C., Rodic L., Scheinberg, A., Velis, C. A. & Alabaster, G. (2012). Comparative analysis of solid waste management in 20 cities. *Waste Management & Research*, 30, 237-254.
- World Bank (2012) .What a Waste. A Global Review of Solid Waste Management. The Urban Development Series Knowledge papers. Washington, DC, USA.
- World Bank (2014). *Rising through Cities in Ghana: Ghana Urbanization Review Overview Report*, Washington DC: World Bank.
- World Health Organization (WHO) (2015). Situation Report on Cholera Outbreak in Ghana as of 19th April, 2015. WHO, Country Office, Ghana.

Wooldridge JM. (2005). *Introductory Econometrics: (A Modern Approach*. 3rd ed. Australia: South-Western College Publishing

Zhang, D. Q., Tan, S. K. & Gersberg, R. M. (2010). Municipal solid waste management in China: Status, problems and challenges. *J. Environ. Manage.* 91(8), 1623-1633. [http://dx. doi: 10.1016/j.jenvman.2010.03.012](http://dx.doi.org/10.1016/j.jenvman.2010.03.012)

Zurbrügg C., Becker, B., Voegeli, Y.(2007). Cash Flow in Solid Waste Management. *Sandec News*, 8, 14–15. Eawag, Dübendorf.

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APPENDICES

Appendix 1: Initial Factor Extraction with Eigenvalues and Percentages of Variances for AMA and TaMA.

	Factor	Eigen value	Difference	Proportion	Cumulative
AMA	1	4.20331	0.38930	0.2404	0.2404
	2	3.81400	0.27982	0.2182	0.4586
	3	3.53419	1.41780	0.2022	0.6607
	4	2.11639	0.83963	0.1211	0.7818
	5	1.27675	0.23144	0.0730	0.8548
	6	1.04531	0.00330	0.0598	0.9146
	7	1.04200	0.43816	0.0596	0.9742
LR test: independent vs. saturated : $\chi^2(435)=1.0e+04$ Prob> $\chi^2=0.000$					
TaMA	Factor	Eigen value	Difference	Proportion	Cumulative
	1	5.66525	3.39402	0.3063	0.3063
	2	2.27123	0.02502	0.1228	0.4291
	3	2.24620	0.16213	0.1215	0.5506
	4	2.08407	0.16403	0.1127	0.6633
	5	1.92004	0.18669	0.1038	0.7671
	6	1.73335	0.63939	0.0937	0.8608
	7	1.09396	0.28076	0.0592	0.9200
LR test: independent vs. saturated : $\chi^2(435)=1.8e+04$ Prob> $\chi^2=0.000$					
AMA and TaMA (pooled data)	Factor	Eigen value	Difference	Proportion	Cumulative
	1	5.21149	2.55829	0.2906	0.2906
	2	2.65321	0.44333	0.1479	0.4385
	3	2.20987	0.19595	0.1232	0.5617
	4	2.01393	0.06699	0.1123	0.6740
	5	1.94694	0.27434	0.1086	0.7825
	6	1.67260	0.64684	0.0933	0.8758

	7	1.02577	0.26817	0.0572	0.9330
LR test: independent vs. Saturated: $\chi^2(435)=1.7e+04$ Prob> $\chi^2=0.000$ Only Eigen values greater than 1 were retained.					



Appendix 2: Rotated Component Matrix for the AMA and TaMA

Variables	AMA						
	Factor						
	1	2	3	4	5	6	7
Behaviour							
I regularly source separate, reuse and recycle metals (metal can, scrap metals) waste by selling to the recyclable collector.	0.8157						
I regularly source separate, reuse and recycle my plastics (i.e. pure water sachet, plastic bottles etc.)	0.8185						
I regularly source separate, reuse my organic waste (i.e. cassava, yam peels) to feed livestock.	0.7752						
I regularly dispose of my organic waste separately from other waste.							
If I make too much food, I source separate and reuse rather than throwing it away.	0.7307						
Intentions							
I plan to participate in solid waste separation if the separated waste is collected regularly by the service provider.			0.4175				
I intend to separate solid waste if it is made mandatory			0.5186				
I will make effort to separate solid waste at home if local authorities' enforces public participation			0.6937				
I intend to separate solid waste if service providers give							

satisfactory services							
I will try my best to separate solid waste at home if am convinced of the benefits of solid waste separation.						0.7114	
Attitude							
In my opinion , source separation of solid waste is a good activity						0.6224	
I think that solid waste separation at home is interesting task						0.5733	
For me, solid waste separation at home is useful							
Solid waste separation should be formalized in Ghana						0.4721	
Solid waste separation should be promoted in Ghana.						0.5488	
Subjective Norms							
My family thinks I should separate solid waste at home.		0.4267					
My neighbours expect me to participate in source separation of solid waste		0.6116					
My friends think I should be involved in source separation of solid waste		0.4076					
If my neighbours separate their solid waste, I will too.		0.5345					
I will separate my solid waste if I see my community doing the same.							

Perceived Behavioural Control							
The decision to separate solid waste is completely up to me					0.6401		
Separating solid waste at home would be an easy task					0.7160		
I have complete control in deciding whether or not to separate solid waste at home					0.5292		
If I wanted to , I could separate solid waste at home					0.6197		
I don't need anyone approval to separate solid waste at home.							
Situational Factors							
Not having enough space would make it difficult to separate solid waste at home.				-0.4521			
Not having enough time would make it difficult to separate solid waste at home				0.9440			
Not having proper knowledge on waste separation would make it difficult to separate solid waste				0.9193			
Not having collection centres will discourage me from practicing source separation							-0.6292
No having service provider collecting separated waste would discourage me from practicing source separation.							-0.5267
TaMA							
Variables	Factor						
	1	2	3	4	5	6	7
Behaviour							

I regularly source separate, reuse and recycle metals (metal can, scrap metals) waste by selling to the recyclable collector.	0.8812						
I regularly source separate, reuse and recycle my plastics (i.e. pure water sachet, plastic bottles etc.)	0.8721						
I regularly source separate, reuse my organic waste (i.e. cassava, yam peels) to feed livestock.	0.7314						
I regularly dispose of my organic waste separately from other waste.							
If I make too much food, I source separate and reuse rather than throwing it away.	0.7460						
Intentions							
I plan to participate in solid waste separation if the separated waste is collected regularly by the service provider.							0.5184
I intend to separate solid waste if it is made mandatory							0.6300
I will make effort to separate solid waste at home if local authorities' enforces public participation							0.5203
I intend to separate solid waste if service providers give satisfactory services							
I will try my best to separate solid waste at home if am convinced of the benefits of solid waste separation.							
Attitude							
In my opinion , source separation of solid waste is a good activity							
I think that solid waste separation at home is interesting task						0.6039	

For me, solid waste separation at home is useful						0.6211	
Solid waste separation should be formalized in Ghana						0.4102	
Solid waste separation should be promoted in Ghana.							
Subjective Norms							
My family thinks I should separate solid waste at home.							
My neighbours expect me to participate in source separation of solid waste		0.4345					
My friends think I should be involved in source separation of solid waste		0.6487					
If my neighbours separate their solid waste, I will too.		0.6611					
I will separate my solid waste if I see my community doing the same.							
Perceived Behavioural Control							
The decision to separate solid waste is completely up to me					0.6877		
Separating solid waste at home would be an easy task					0.8052		
I have complete control in deciding whether or not to separate solid waste at home					0.5191		
If I wanted to , I could separate solid waste at home							
I don't need anyone approval to separate solid waste at home.							
Situational Factors							
Not having enough space would make it difficult to separate solid waste at home.							

Not having enough time would make it difficult to separate solid waste at home					0.9031		
Not having proper knowledge on waste separation would make it difficult to separate solid waste					0.8934		
Not having collection centres will discourage me from practicing source separation			0.9346				
No having service provider collecting separated waste would discourage me from practicing source separation.			0.9347				

AMA and TaMA (pooled data)

Variables	Factor						
	1	2	3	4	5	6	7
Behaviour							
I regularly source separate, reuse and recycle metals (metal can, scrap metals) waste by selling to the recyclable collector.	0.8732						
I regularly source separate, reuse and recycle my plastics (i.e. pure water sachet, plastic bottles etc.)	0.8649						
I regularly source separate, reuse my organic waste (i.e. cassava, yam peels) to feed livestock.	0.7299						
I regularly dispose of my organic waste separately from other waste.							
If I make too much food, I source separate and reuse rather than throwing it away.	0.7397						

Intentions							
I plan to participate in solid waste separation if the separated waste is collected regularly by the service provider.							0.4895
I intend to separate solid waste if it is made mandatory							0.5842
I will make effort to separate solid waste at home if local authorities' enforces public participation							0.6009
I intend to separate solid waste if service providers give satisfactory services							0.5272
I will try my best to separate solid waste at home if am convinced of the benefits of solid waste separation.							
Attitude							
In my opinion , source separation of solid waste is a good activity							
I think that solid waste separation at home is interesting task			0.6646				
For me, solid waste separation at home is useful			0.6704				
Solid waste separation should be formalized in Ghana			0.4412				
Solid waste separation should be promoted in Ghana.							
Subjective Norms							
My family thinks I should separate solid waste at home.							
My neighbours expect me to participate in source separation of solid waste		0.4188					
My friends think I should be involved in source separation of solid waste		0.6278					

If my neighbours separate their solid waste, I will too. I will separate my solid waste if I see my community doing the same.		0.6289					
Perceived Behavioural Control							
The decision to separate solid waste is completely up to me Separating solid waste at home would be an easy task I have complete control in deciding whether or not to separate solid waste at home If I wanted to , I could separate solid waste at home I don't need anyone approval to separate solid waste at home.				0.6938 0.7987 0.4972			
Inconvenience Factors							
Not having enough space would make it difficult to separate solid waste at home. Not having enough time would make it difficult to separate solid waste at home Not having proper knowledge on waste separation would make it difficult to separate solid waste Not having collection centres will discourage me from practicing source separation No having service provider collecting separated waste would discourage me from practicing source separation.					-0.4209 0.8900 0.8795 0.7553 0.7824		

Appendix 3: Household Survey Questionnaire

Households' Questionnaire **HOUSEHOLDS' WILLINGNESS TO PAY AND PARTICIPATE IN SOURCE** **SEPARATION OF SOLID WASTE IN TAMALE AND ACCRA METROPOLITAN** **AREAS, GHANA.**

Household Questionnaire

A: Informed Consent Form

Note: To be administered to HOUSEHOLD HEAD or/and SPOUSE.

Good Morning/ Afternoon. My name is and I am working on a student project on Households' Willingness to Pay and Participate in Source Separation of solid waste. The study is taking place in Tamale and Accra Metropolitan Areas. Four communities were selected in Accra Metropolis: Airport Residential Area, Dansoman, Glefe and Nima and three in Tamale Metropolis: Russian Bungalow, Aboabo and Zogbeli. In these communities, a number of households have been selected randomly to participate in this research and your household happens to be one of them. I would like to ask you questions about your current solid waste management practices, perceptions on source separation and your willingness to pay and participate in source separation of solid waste. I will also ask questions on your household asset base and other socio-economic issues.

Your responses and the information you provide will strictly be treated as anonymous and confidential and will be used for academic purposes. Your participation in this study is very important to enable me gather the relevant information needed for my research. Your participation in this survey is voluntary and it will take about 45 minutes of your time. You are free to skip questions and stop the interview if you are not comfortable. You may also ask any question about this study if you so wish. Please, are you willing to participate in this study based on the information I have given you?

YES = 1, NO = 2

1. **SURVEY CODE NUMBER:**
2. **METROPOLITAN AREA:**
3. **EA NUMBER:**
4. **NAME OF COMMUNITY:**
5. **NAME OF ENUMERATOR:**
6. **DATE OF INTERVIEW [DDMMYYYY]:**.....
7. **STATUS OF RESPONDENT IN HOUSEHOLD:**

Head [] Spouse [] Adult []

SECTION A: GENERAL INFORMATION

A1. Do you think that improper collection and disposal of solid wastes in public places like beaches, roads, rivers, forests, recreational parks and around buildings and houses is a problem in your Community? Please indicate the level of seriousness of the problem.

1. Very serious [] 2. Serious [] 3. Moderately serious [] 4. Low []
5. Not serious at all []

A2. Please indicate in terms of importance the causes of improper disposal and collection of solid wastes in public places like beaches, roads, rivers, forests, recreational parks and around building and houses in your town. Please circle the number most closely representing your opinion noting that a score of 5 is "extremely important", 4 is "very important", 3 is "modestly important", 2 is "less important" and 1 "not important").

	Causes of improper solid waste management	5	4	3	2	1
1	Inadequate laws to deal with the problem					
2	Weak enforcement of existing laws					
3	Lack of adequate information on the human costs of improper and unhygienic disposal of wastes					
4	Inadequate numbers of collection bins in public places					
5	Long distances of houses to community solid waste disposal sites					
6	Attitude problem due to lack of care of the environment in general					
7	Low incomes of people					
8	High costs or fees charged by solid waste Service provider.					
9	Others (please explain)					
10	Others (please explain)					
11	Others (please explain)					

SECTION B: HOUSEHOLD SOLID WASTE MANAGEMENT PRACTICES

B1. Do you have a **receptacle (s)** for solid waste storage in your house?

1. Yes [] 2. No []

B2. If **yes to question B1**, what is it made of?

1. Plastic bag [] 2. Plastic bucket [] 3. Metal container []
4. Wooden container [] 5. Plastic waste bin [] 6. Other (specify):

B3. If **no to question B1**, how do you handle solid waste generated in your household?
Explain:

.....
.....

B4. What are the major solid wastes that your household averagely generates per week? (**Rank** them in terms of higher proportion in volume of all of the solid wastes with **1** being the least and **5** the highest).

Waste form	5	4	3	2	1
Food waste					
Yard waste (grasses, leaves etc.)					
Paper					
Metals (empty food cans etc)					
Plastics (plastic bottles, polythene bag, sachet water plastic etc)					
Glass					
Textiles					
Inert Material (sand,stones,ashes,dirt,etc)					
Hazardous waste (batteries, chemicals, pesticides etc.)					
Other (specify):					

B5. Normally who does the collecting and placing of solid wastes for disposal?

1. Husband/father [] 2. Wife/mother [] 3. Child []
4. Maid [] 5. Other (please specify):

B6. For the collection and disposal of your household solid wastes, what ways do you use to dispose of your household solid wastes? (Please tick).

Method of households' solid waste disposal	✓ Tick	
Private Solid Waste Collector		Go to question B7
Unregistered individuals (kaya bola)		Go to question B12
Communal Container Collection (CCC)		Go to question B15
Dump the solid waste in the sea/lagoon		
Dump on open space, gutters and drain		
Burying		
Burning		
Others (please specify)		

HOUSEHOLDS HIRING PRIVATE COMPANIES TO COLLECT AND DISPOSE OF THEIR SOLID WASTES

B7. If you use **private company** to collect and dispose of your household solid wastes, could you please indicate the name of the company?

.....

B8. How often does the solid waste service provider actually collect your solid waste?

1. Once a week irregular [] 2. Once a week regular [] 3. Twice a week []
 4. Three times a week [] 5. Four times a week [] 6. Once a month []
 7. Once a fortnight [] 8. Others (please specify):

B9. How much do you currently pay to the company for the solid waste collection and disposal service? _____cedis per month

B10. On a scale of 1 to 5 with 1 being very poor and 5 being excellent, how would you rate the quality of service provided by the company?

1. Excellent (5) [] 2. Good (4) [] 3. Fair (3) [] 4. Unsatisfactory(2) []
 5. Very poor(1) []

B11. Please give reasons for your choice:

HOUSEHOLDS USING THE SERVICES OF UNREGISTERED INDIVIDUAL FOR COLLECTON AND DISPOSAL OF SOLID WASTES

B12. If your household disposes its solid waste by engaging the services of unregistered **individual**, how often do you engage this service?

1. Once a week [] 2. Twice a week [] 3. Three times a week []
 4. Four times a week [] 5. Every day [] 6. Once a fortnight []

B13. How much do you pay for the services of this **Unregistered Individuals**?
 _____cedis/_____

B14. Are you happy with the current service you are getting from the unregistered service provider? Please state the reason?

1. Yes []:

.....

2. No []:

.....

HOUSEHOLDS USING COMMUNAL CONTAINER COLLECTION (CCC) FOR DISPOSAL OF SOLID WASTES

B15. If your household disposes its solid waste through the **Communal Container Collection**, how often do you or any family member or any person dispose it?

2. Once a week [] 2. Twice a week [] 3. Three times a week [] □
5. Four times a week [] 5. Every day [] 6. Once a fortnight []

B16. Do you pay for dumping your solid waste into the communal container?

1. Yes [] 2. No []

B17. If **yes to question B16**, how much do you currently pay for dumping solid waste at communal container? Ghana cedis per

B18. Approximately, how many minutes does it take you to get to the site?mins

1. 5-10mins. [] 2. 11-15mins. [] 3. 16-20mins [] 4. 21-25mins. []
5. More than 25mins []

B19. Are you happy with the current service you are getting from the community solid waste disposal site? Please state the reason?

1. Yes []:
2. No []:

SECTION C: SOLID WASTE SOURCE SEPARATION BEHAVIOUR

C1. Does your household practice source separation of solid waste?

1. Yes [] 2.No []

C2. If **yes to question C1**, how do you separate your solid waste?

Explain:

.....
.....

C3. Why do you practice solid waste segregation at home?

1. Commitment to a clean environment [] 2. Use as compost/mulch []
3. Sold for extra cash [] 4. Fed to livestock [] 5. Reuse empty bottles []
6. Others (specify):.....

C4. What are some of the challenges you face in separating solid waste in your house? Please state.
.....
.....

C5. If **no to question C1**, why do you not separate your solid waste at source?

1. No time to separate waste []
2. Had not thought of sorting of solid wastes []
3. It is unsanitary to store the separated solid waste at home []
4. No storage receptacles []
4. No recyclable collection centre []
5. Not aware of how to separate solid waste []
6. Do not generate enough solid waste []
7. Will not reuse waste generated []
8. Other (specify):

C6: Would you like to separate your solid wastes at the house into separate containers for collection?

1. Yes []
2. No []

C7. Why will you separate your solid wastes (or NOT separate solid waste)?

.....

C8. If **yes to question C6**, what type of service do you prefer in terms of the degree or level of source separation?

1. Two-stream []
2. Three-stream []
3. Four stream []
4. More than four stream []

C9. What type of service do you prefer in terms of the fractions or categories of solid waste to be separated at source? (Please tick)

Preferred categories of source separation					
	Two stream		Three stream		Four stream
1	Food waste and Plastics	4	Food waste, Plastic & Glass	6	Food waste, plastic, glass and metals
2	Food waste and Paper	5	Food waste, plastic & paper	7	Food waste , plastic , glass and paper
3	Paper and Plastic				

C10: If **yes to question C6**, which of the following will motivate you to sort and separate solid wastes for collection?

1. Buy your own separate bins for storing separated solid waste and pay a reduced user charge []
2. Those NOT separating solid wastes should pay unreduced user charge []
3. You would like to be provided with free bins []
4. You would like solid waste to be collected frequently []
5. You would like to see clean environment and unchoked drains []

6. You would like to receive cash incentives []
7. Others (specify) :

C11. Have you ever received any information/lesson/sensitization regarding solid wastes separation and its importance?

1. Yes [] 2. No []

C12. If **yes to question C11**, what sources of information do you use to learn about source separation of solid waste in your area?

1. Television [] 2. Radio [] 3. Newspapers []
4. Assembly [] 6. Other (specify):

C13. What was the content of the information (you can tick more than one)?

1. The impact solid of waste on environment []
2. The importance of appropriate solid waste separation []
3. Disease because of inappropriate solid waste disposal []
4. The way to separate solid waste effectively []
5. Others (specify):

SECTION D: QUESTIONS ON THEORY OF PLANNED BEHAVIOUR

Please share your opinion about the following statements on source separation of solid waste by ticking the boxes that best apply to you:

	Statements	Opinion				
		1	2	3	4	5
		Never	Seldom	Some times	Often	Always
		Strongly disagree	Disagree	Neutral	Agree	Strongly agree
	Behaviour					
D1	I regularly source separate, reuse and recycle metals (metal can, scrap metals) waste by selling to the recyclable collector.					
D2	I regularly source separate, reuse and recycle my plastics (i.e. pure water sachet, plastic bottles etc.)					
D3	I regularly source separate, reuse my organic waste (i.e. cassava, yam peels) to feed livestock.					
D4	I regularly dispose of my organic waste separately from other waste.					

D5	If I make too much food, I source separate and reuse rather than throwing it away.					
	Intention					
D6	I plan to participate in solid waste separation at home if I am satisfied with the solid waste collection measures by the local authorities.					
D7	I will try my best to separate solid waste at home if am convinced with the benefits of solid waste separation at home.					
D8	I will make an effort to separate solid waste at home if the local authority enforces public participation in solid waste separation at homes					
D9	I intend to separate solid waste at home if the local authority provides satisfactory services for the separated solid waste collection.					
	Attitude					
D10	In my opinion, to separate solid waste at home is a good activity.					
D11	I think that solid waste separation at home is an interesting task.					
D12	Solid waste separation at home should be formalized and promoted in Ghana.					
D13	For me, solid waste separation at home is useful.					
	Subjective norms					
D14	My family thinks I should separate solid waste at home.					
D15	My neighbours think I should participate in source separation of solid waste.					

	Statement	Opinion				
		1	2	3	4	5
		Never	Seldom	Some times	Often	Always
		Strongly disagree	Disagree	Neutral	Agree	Strongly agree
	Subjective Norms					
D16	My colleagues think I should be involved in source separation of solid waste.					
D17	If my neighbours separate their solid waste, I will, too.					
	Perceived behavioural control					
D18	The decision to separate solid waste is completely up to me.					
D19	Separating solid waste at home would be an easy task.					
D20	I have complete control in deciding whether or not to separate solid waste at home.					
D21	If I wanted to, I could separate solid waste at home.					
	Situational factors					
D22	Not having enough space in my house to deal with the separated solid waste would make it difficult for me to separate my waste at home.					
D23	Not having enough time to properly separate my solid waste would make it difficult for me to separate my waste at home.					
D23	Not having proper knowledge on how to separate solid waste would make it difficult for me to separate my solid waste at home.					

D24	Not having the local authority enforcing solid waste separation at homes would make me less motivated to separate my waste at home.					
D25	Lack of cooperation from other members of the house in performing waste separation would make it difficult for me to separate my waste at home.					
	Outcome					
D26	Household solid waste separation helps to protect the environment.					
D27	Separating solid waste at home reduces the amount of waste that goes into landfill.					
D28	Separating solid waste at home preserves natural resources.					

SECTION E: HOUSEHOLDS' PREFERENCES AND WILLINGNESS TO PAY FOR IMPROVED SOLID WASTE MANAGEMENT

CONTINGENT VALUATION DESIGN

Assume hypothetically that in the future, the Assembly institute a new bye-law that requires householders to hire a company of their choice to collect and dispose their household solid wastes. Assuming that the service provider has **TWO DIFFERENT (A &B)** types of waste services and the attribute of each service provided by the solid waste service provider is as follows:

VERSION A: Improved Collection frequency and No Source Separation of Solid Waste

Collecting your solid waste by the house **TWICE EVERY WEEK**, transport the solid waste safely where it is going to be disposed of.

Implication	Option 1(Status quo)	Option 2(improved plan)
Collection frequency	Once a week , irregular	Twice a week regular

However, implementing this program involves cost; therefore, households are required to pay for this service. The payment vehicle is such that service recipients make direct payment

to the service providers the same way it has been paid for other utilities like electricity, water etc.

E1. Would your household be willing to pay for this improved solid waste management service?

1. Yes [] 2. No []

E2. If **yes to question E1**, what is the *maximum amount* of money per month that you will be willing to pay for this service given your current income and family situation?

..... Ghana cedis per month (starting bid given by respondent)

(b) Increase the initial bid by 1.00 Ghana cedis per month till the respondent finally refuses to accept any more increases.

.....Ghana cedis per month (final bid given by respondent)

E3. If **no to question E1**, could you please tell me the reason why your household does not want to pay anything for this improved solid waste management service?

1. We are poor and we cannot pay []
2. The price is too high, otherwise I would pay []
3. I do not believe that this program would bring any change to the environment []
4. We are satisfied with the current situation (it does not need improvement) []
5. Proper management of solid waste is the responsibility of the government []
6. Other (specify):

VERSION B: Improved Collection Frequency and Mandatory Source Separation of Solid Waste.

Implications	Option 1 (Status quo)	Option 2 (improved plan)
Collection frequency	Once a week , irregular	Twice a week regular
Separation of waste at source	No separation	Mandatory separation with free two dust bins provided

Collecting your solid waste by the house **TWICE EVERY WEEK**, transport the solid waste safely where it is going to be disposed of and the disposal involves making quality compost from the biodegradable waste and manage the inorganic waste separately by recycling those which can be recycled and the rest will be dumped at the landfill site. This will reduce the amount of solid waste going to the landfill, reduce the cost of solid waste management and also improve the environmental condition of your area. The service provider will provide two free waste bins for every household to facilitate **MANDATORY** waste separation into organic (food etc.) waste and inorganic (plastic, glass, etc.) waste.

However, implementing this program involves cost; therefore, households are required to pay for this service. The payment vehicle is such that service recipients make direct payment

to the service providers the same way it has been paid for other utilities like electricity, water etc.

E4. Would your household be willing to pay for this improved solid waste management service?

1. Yes []

2. No []

E5. If **yes to question E4**, what is the *maximum amount* of money per month that you will be willing to pay for this service given your current income and family situation?

..... Ghana cedis per month (starting bid given by respondent)

(b) Increase the initial bid by 1.00 Ghana cedis per month till the respondent finally refuses to accept any more increases.

.....Ghana cedis per month (final bid given by respondent)

E6. If **no to question E4**, could you please tell me the reason why your household does not want to pay anything for this improved solid waste management service?

1. We are poor and we cannot pay []

2. The price is too high, otherwise I would pay []

3. I do not believe that this program would bring any change to the environment []

4. We are satisfied with the current situation (it does not need improvement) []

5. Proper management of solid waste is the responsibility of the government []

6. Other (specify):

SECTION F: HOUSEHOLD DATA

F1. Gender of household head: 1. Male [] 2. Female []

F2. Marital status of household head: 1. Married [] 2. Single []

3. Consensual union [] 4. Divorced/Separated [] 5. Widowed []

6. Other (specify):

F3. Age of household head is _____ (years)

1. 20-30 []

2. 31- 40 []

3. 41-50 []

4. 51-60 []

5. More than 60 []

F4. Educational status of household head is _____ (years)

1. No formal education []

2. Primary []

3. Middle/JHS []

4. Voc / Comm. /Tech []

5. Senior High School []

6. Tertiary education []

7. Others (specify):

F5. What is the total number of members of your household?

1. Adults

2. Children below 15 years of age.....

F6. Occupation of household head is:

1. Trader []

2. Artisan []

3. Farmer []

4. Fisherman []

5. Government sector employee [] 6. Private sector employee [] 7. Unemployed []
 8. Other (specify):

F7. What is your average monthly income ?

1. Less than GH 500 2. GH 500 – GH 2000 3. GH2001 - GH4000 3. GH 4001 – GH 6000

4. above GH 6000

F7. Which of the following categories do your household belong to?

1. Landlord [] 2. Relative of Landlord [] 3. Tenant [] 4. Percher []
 5. Caretaker [] 6. Others:

F8. How long have you lived in the community? years

1. Below 5yrs [] 2. 5-15yrs [] 3. 16- 25yrs [] 4. Over 25yrs []

F9. Indicate your religious affiliation (if any):

1. Christian [] 2. Muslim [] 3. Traditionalist [] 4. No Religion
 5. Other (specify):

F10. What ethnic group do you belong to?

1. Dagomba [] 2. Ga [] 3. Ga Adamgbe [] 4. Ewe [] 5. Guan []
 6. Akan [] 7. Grussi [] 8. Grumma [] 9. Hausa [] 10. Wala []
 11. Frafra []

F11. Type of dwelling

1. Compound house [] 2. Detached/Separate House [] 3. Semi-detached []
 4. Storey [] 5. Others (Specify) _____



G.HOUSEHOLD ECONOMY AND ASSETS

G1. Which of the following assets does your household own (Enter 1, when household have these assets in a working condition and 0, when the household does not have the asset or it is not in a working condition)?

Items	Enter 1=Assets in working conditions ; 0=have no asset or not in working condition	Item	Enter 1=Assets in working conditions; 0=have no asset or not in working condition	Items	Enter 1=Assets in working conditions; 0=have no asset or not in working condition	Items	Enter 1=Assets in working conditions ; 0=have no asset or not in working condition	Items	Enter 1=Assets in working conditions; 0=have no asset or not in working condition
Television		Car		Mobile phone		Computer/ computer accessories		Sheep/goat	
Radio		Motor bike		Electric iron		Sewing machine		Fowl /guinea fowl	
Video deck		Bicycle		Box Iron		Gas stove		Cattle	
DVD/home theatre		Standing fan		Freezer		Kerosene stove		Mattress	
Radio cassette player		Furniture		Refrigerator		Coal pot		Suitcase	
Electric stove									

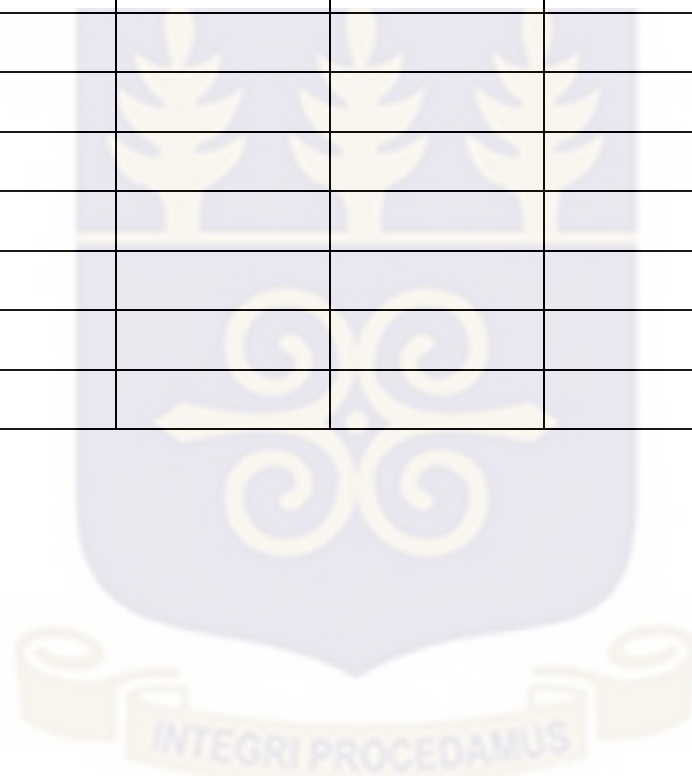
H. DEMOGRAPHIC CHARACTERISTICS OF HOUSEHOLD MEMBERS. Reference point: 2015

ID	Name	Sex	Age	Relhead	Marital status	Educational status	Ethnicity	Occupation	Religion
	Write complete list of all members of this household, starting with the <u>HEAD</u> of the household	1.Male 2.Female	Age in completed years (under1=0)	Relationship with current head of household. Code: 1=head 2=spouse 3=son/daughter 4=parent 5=other relative 6=unrelated	Marital status for members 15yrs and above). Code: 1=Never Married 2=Married 3=Consensual Union 4=Separated 5=Divorced 6=Widowed 7=Other (specify) 8=Not Applicable	Highest educational level. Code: 1=No education 2=Pre-school 3=Primary 4=Middle/JHS 5=Voc/Com/Tech 6=Secondary (SHS) 7= O' level 8=A' level 9=Training college 10=Post sec/nursing 11=Polytechnic	Code: 1=Akan 2=Ga 3=Ga Adamgbere 4= Ewe 5= Guan 6= Dagbani 7=Grussi 8=Grumma 9=Hausa 10=Gonja 11=Wala 12=Frafra	For Household members with AGE 15 years and above.	Code: 1=No religion 2=Atheist 3=Traditionalist 4=Muslim 5=Christian 6=Other (specify)

						ic 12=Universit y 13=Koranic 14=Other (specify)	13=Othe r(specify)		
	H1	H2	H3	H4	H5	H6	H7	H8	H9
1(Head)									
2									
3									
4									
5									
6									
7									
8									
9									
ID	Name	Sex	Age	Relhead	Marital status	Educational status	Ethnicit y	Occupatio n	Religion
	Write complete	1.Ma	Age in completed	Relationship with current	Marital status for	Highest educational	Code:	For Househol	Code:

	list of all members of this household, starting with the <u>HEAD</u> of the household	le 2.Female	years (under1=0)	head of household. Code: 1=head 2=spouse 3=son/daughter 4=parent 5=other relative 6=unrelated	members 15yrs and above). Code: 1=Never Married 2=Married 3=Consensual Union 4=Separated 5=Divorced 6=Widowed 7=Other (specify) 8=Not Applicable	level. Code: 1=No education 2=Pre-school 3=Primary 4=Middle/JHS 5=Voc/Com/Tech 6=Secondary (SHS) 7= O' level 8=A' level 9=Training college 10=Post sec/nursing 11=Polytechnic 12=University 13=Koranic 14=Other	1=Akan 2=Ga 3=Ga Adamgbere 4= Ewe 5= Guan 6= Dagbani 7=Grussi 8=Grumma 9=Hausa 10=Gonja 11=Wala 12=Other(specify)	d members with AGE 15 years and above.	1=No religion 2=Atheist 3=Traditionalist 4=Muslim 5=Christian 6=Other (specify)
--	---	----------------	---------------------	--	---	--	--	--	--

						(specify)			
	H1	H2	H3	H4	H5	H6	H7	H8	H9
10									
11									
12									
13									
14									
15									
16									
17									
18									



I. HOUSEHOLD INCOME**I1. What was the household's income total income last year?****I2. Allocate source(s) of income by contributor(s)?**

ID	Employment	Farm-income	Non-Farm self employment	Rental	Remittances	Other income	Total
1							
2							
3							
4							
5							

J. HOUSEHOLD EXPENDITURE

Expenditure Sources Of Household Expenses Last Month	Ghana Cedis
J1. Food expenditure (actual)	
J2. Food expenditure (imputed) (total wage income paid in the form of food+ consumption of home produced food)	
J3. Expenditure on housing (actual and imputed)	
J4. Non-food expenditure (actual & imputed)	
1. Education (find for the year and divide by 12)	
2. Health(find for the year and divide by 12)	
3. Water	
4. Garbage (solid waste) disposal	
5. Toilet facility	
6. Clothing and toiletries (find for the year and divide by 12)	
7. Farm equipment (find for the year and divide by 12)	
8. Farmer labour (find for the year and divide by 12)	
9. Others (eg. Transportation, rechargeable units etc)	
J5. Other Non food expenditure (imputed)	
1. Wage paid in other form	

2. Value of nonfarm products consumed (e.g. other trade)	
3. Funerals (find for the year and divide by 12)	
4. Out doorings (find for the year and divide by 12)	
5. Marriages (find for the year and divide by 12)	
6. Other (specify)	
J6. Expenditure on Remittances	
TOTAL EXPENDITURE LAST MONTH (sum J1 to J6)	

THANK YOU FOR YOUR RESPONSE!



Appendix 4: INTERVIEW GUIDE FOR STAKEHOLDERS

A: Informed Consent Form

Good Morning/ Afternoon. My name is **Hamdiyah Alhassan** and I am working on a student project on Households' Willingness to Pay and Participate in Source Separation of solid waste. The study is taking place in Tamale and Accra Metropolitan Areas. I would like to ask you questions about current institutional arrangements for solid waste management and financing, perceptions on source separation and your willingness to pay and participate in source separation of solid waste.

Your responses and the information you provide will strictly be treated as anonymous and confidential and will be used for academic purposes. Your participation in this study is very important to enable me gather the relevant information needed for my research.

Your participation in this study is voluntary and it will take about 45 minutes of your time. You are free to skip questions and stop the interview if you are not comfortable. You may also ask any question about this study if you so wish. Please, are you willing to participate in this study based on the information I have given you?

YES = 1, NO = 2

A. BACKGROUND INFORMATION

Date and Time of Meeting.....

Name of Officer

Position of Officer

Educational status

Location

CHECKLIST OF ISSUES TO BE DISCUSSED

WASTE MANAGEMENT DEPARTMENTS AT AMA AND TAMA

Name of Metropolis: Accra [] Tamale []

A. Current Solid Waste Management Practices

1. How is solid waste management done in the metropolis in terms of:

- i. Collection
- ii. Source separation
- iii. Transportation
- iv. Treatment
- v. Disposal

2. Has the Assembly adopted the 4 R's (Solid waste reuse, reduction, recovery and recycling) in solid waste management?

3. What are the programs or activities currently in place to encourage solid waste reduction, reuse, recovery and recycling?
4. Please do you have an idea on the composition (types, percentage of organic and inorganic waste generated) of solid waste generated in the Metropolis?
 - a. What percentage in organic?
 - b. What percentage is inorganic?
5. Please is there any existing private-public partnership in solid waste management in the Metropolis? eg. Partnership between private waste companies and the Assembly.
6. If yes, can you name the private companies who are involved in the partnership with the Metropolis?
7. Is there formal solid waste disposal sites located in the Metropolis? If yes, site location.
8. Is the disposal site an engineered landfill or non-engineered?

B. Resource

9. How do you acquire equipment for waste management/ who provides them?
.....

10. What equipment do you have for waste management operations?

Equipment type	No. required	No. available

11. Please can you tell me the monthly or annual budgetary allocation for solid waste management?

12. What are your sources of funding municipal solid waste management?

13. What categories of staff work in the institution? (e.g. engineers, health inspectors, labourers)

Category of staff	No. employed	No. required

C. Challenges militating against effective solid waste management

14. What are the major problems confronting the department in solid waste management in terms of:

- i. Human resources
- ii. Physical infrastructures (eg. Building, disposal site etc.)
- iii. Technical infrastructure (eg. Vehicles, bins, containers etc.)
- iv. Finance

D. Attitude of People towards Solid Waste Management (generation, reduction, reuse, recycling and disposal)

14. Considering the current state of solid waste in the metropolis, what can you say about the attitude of people towards?

- i. Solid waste generation
- ii. Solid waste separation
- iii. Solid waste reduction(minimization)
- iv. Solid waste reuse
- v. Solid waste disposal

15. Are people in the metropolis willing to pay for collection / disposal of their waste?

E. Measures / Recommendations

16. Please do you have any measure or recommendations on what can be done to improve the current state of solid waste management?

PRIVATE WASTE CONTRACTORS

A. Current Waste Management Practice

- 1. What specifically are your duties as a private waste Company?
- 2. Please is there any existing private-public partnership between your company and the assembly?
- 3. If yes, please can you tell me how the partnership is executed. Eg. Payment of fees, supply of waste bins and containers
- 4. How is solid waste management done in the metropolis in terms:
 - i. Collection
 - ii. Solid waste separation
 - iii. Transportation

- iv. Treatment
- v. Recycling
- vi. Disposal

5. (a) Where do you send the waste after collection?
(b) Is it an engineered landfill?
6. How will you describe the sanitary state of the current site where waste is disposed off.

B. Resource

7. What are your sources of funding and how do you generate revenue?
8. Are households willing to pay for waste collection and disposal?
9. (a) How much fees do you charge for waste collection services?
(b) Are the fees paid promptly?
17. How do you acquire equipment for waste management/ who provides them?
.....

18. What equipment do you have for waste management operations?

Equipment type	No. required	No. available

19. What categories of staff work in the institution? (e.g. engineers, health inspectors, labourers)

Category of staff	No. employed	No. required

C. Challenges militating against effective solid waste management.

20. What are the major problems confronting your work in terms of
 - i. Human resources
 - ii. Physical infrastructures (eg. Building, disposal site etc.)

- iii. Technical infrastructure (eg. Vehicles, bins, containers etc.)
- iv. Finance

D. Attitude of People towards Solid Waste Management (generation, reduction, reuse, recycling and disposal).

21. Considering the current state of solid waste in the metropolis, what can you say about the attitude of people towards?
- i. Solid waste generation
 - ii. Solid waste separation
 - iii. Solid waste reduction(minimization)
 - iv. Solid waste reuse
 - v. Solid waste disposal
 - vi. Burning of waste

E. Measures / Recommendations

22. What do you think can be done to improve the current state of solid waste in the metropolis?

THANK YOU!

INTEGRI PROCEDAMUS