Do socio-psychological factors influence households' willingness-to-pay for improved solid waste management services? Evidence from Ghana

Hamdiyah Alhassan*

Department of Agricultural and Resource Economics,
Faculty of Agribusiness and Communication Sciences,
University for Development Studies,
Tamale, Ghana
Email: abena567@yahoo.co.uk
*Corresponding author

Felix Ankomah Asante

Institute of Statistical, Social and Economic Research (ISSER),
University of Ghana,
Legon, Ghana
Email: fasante@ug.edu.gh

Martin Oteng-Ababio

Department of Geography and Resource Development,
University of Ghana,
Legon, Ghana
Email: moababio@ug.edu.gh

Simon Bawakyillenuo

Institute of Statistical, Social and Economic Research (ISSER),
University of Ghana,
Legon, Ghana
Email: bawasius@isser.edu.gh

Abstract: Generally, studies on households' willingness-to-pay for improved solid waste management services by economists have concentrated on external variables which include education, income, among others, such that the effect of socio-psychological factors like attitude, social norms and perceived behavioural control are weakly understood. This study examined the effect of both external and socio-psychological factors on households' willingness-to-pay for improved solid waste management services in Accra and Tamale metropolises in Ghana. The estimation results from the Tobit regression model indicated that sex of head of household, educational attainment of head of household, total household income, occupation type of head of household, level of satisfaction with solid waste collection services, attitude, subjective norm and location of household significantly influenced households' willingness-to-

pay for improved solid waste management services in the entire study area. Acknowledging the fact that willingness-to-pay is dependent on different factors, the study cautions against adopting one-size fit all policies.

Keywords: solid waste management; willingness-to-pay; Tobit regression; contingent valuation method; Ghana.

Reference to this paper should be made as follows: Alhassan, H., Asante, F.A., Oteng-Ababio, M. and Bawakyillenuo, S. (2017) 'Do socio-psychological factors influence households' willingness-to-pay for improved solid waste management services? Evidence from Ghana', *Int. J. Green Economics*, Vol. 11, Nos. 3/4, pp.183–203.

Biographical notes: Hamdiyah Alhassan is an environmental economist and a lecturer at the Department of Agricultural and Resource Economics, at the University for Development Studies. She has a BSc in Civil Engineering and an MPhil in Economics from Kwame Nkrumah University of Science and Technology (KNUST) and University of Ghana respectively. Her research interests include Environmental and resource economics, waste management, energy, and food security.

Felix Ankomah Asante is a Professor of Agriculture Economics and currently the Director of the Institute of Statistical, Social and Economic Research (ISSER), University of Ghana, Legon. He has conducted research and also published extensively on critical economic and developmental issues. He had his Master of Philosophy (MPhil) in Agriculture Economics at the University of Ghana, Legon and continued to University of Bonn in Germany where he attained Doctor of Philosophy (PhD) in Agriculture Economics in 2002. He has also provided professional services in many capacities locally and internationally, notably, the International Food Policy Research Institute (IFPRI), USA, the World bank and the UNAIDS and WHO both of the United Nations.

Martin Oteng-Ababio is an Associate Professor and Coordinator of the Urban Disaster Risk Reduction Programme, Department of Geography and Resource Development, University of Ghana, Legon. His specialised areas of study include urban environmental management, urban disaster risk reduction, and the problem of informality. Among other topics, he has studied E-waste scavenging as an economic opportunity for youth in Accra. He has written widely on urban issues in Ghana. He received his PhD in Geography and Resource Development from the University of Ghana.

Simon Bawakyillenuo is a Human Geographer, and currently a senior research fellow at the Institute of Statistical, Social and Economic Research (ISSER), University of Ghana, Legon, Ghana. He attained his PhD in Human Geography and MSc in Environmental Policy and Management from the University of Hull, UK, in 2007 and 2003 respectively. His research interests include different forms of energy and their interrelationships with health and the environment; energy policy; renewable energy dissemination and utilisation discourses; climate change; environmental policy; green economy. He is currently leading in two research projects at ISSER, funded by DFID and EPSRC: "Supporting Sub-Saharan African Municipalities with Sustainable Energy Transitions" (SAMSET) and "Green Growth Diagnostics for Africa".

1 Introduction

Solid waste is a product of human development agenda. Globally, solid waste generation continues to increase in tandem with rapid urbanisation, population growth and increasing economic growth (Wilson et al., 2012; UNEP, 2015). Studies have shown that the world's waste generation has increased significantly from 1.1 billion tonnes in 2008 (Hoornweg et al., 2013) to about 2 billion tonnes per year in 2015 and is projected to reach 2.2 billion by 2025. In addition, almost 2 billion people in the world still lack access to solid waste collection, with a greater proportion from Africa (World Bank 2012; UNEP, 2015).

Ghana is also experiencing increasing solid waste generation with population growth, rapid urbanisation and increase economic growth (Songsore, 2003; Owusu and Oteng-Ababio, 2015). According to the Ghana Statistical Service (2013), the total population of Ghana in 2010 was 24,658,823 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 (Songsore, 2003; Oteng-Ababio, 2011). For instance, the amount of solid waste generated daily in Accra in 1994 was 750–800 tons per day (Asomani-Boateng, 2007), it increased to 2200 tons per day in 2010 and projected to reach 4419 tons per day by 2030 (Oteng-Ababio, 2010a). Such a situation is worrying, because there is a tendency for the projected future increase in solid waste generation to overburden the existing management systems and impact on the environment negatively (Wilson et al., 2012; UNEP, 2015).

Proper and efficient solid waste management (SWM) is essential to public health and environmental protection. In Ghana, 70–85% of out-patient cases such as malaria, diarrhoea and typhoid fever reported at health facilities are related to poor environmental sanitation (MLGRD, 2010). 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 (WHO, 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 Ghana Cedis (The Ghanaian Times, 10 June 2015). 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).

In an attempt to resolve the solid waste crisis in Ghana, a privatisation policy was initiated in early 1990s. Before the policy, local government authorities were solely responsible for municipal SWM (Post, 1999; 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 including Obirih-Opareh (2003), Oteng-Ababio (2010a), and Oduro-Kwarteng (2011) have partly attributed the failure of the PPP policy on low cost recovery and inadequate funds. Typically, SWM in Ghana has been financed through government

subsidies, direct user charges and cross-subsidisation. 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-subsidisation approach on the other hand, charges residents of high-income areas more to subsidise for the poor. Under this system, users are billed monthly for SWM services regardless of the quantity of solid waste generated and are practised in most high and middle-income areas (Oteng-Ababio, 2010a; Oduro-Kwarteng, 2011).

However, 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. For example, as at 2014 the Accra Metropolitan Assembly (AMA) was in arrears of not less than 15 months of payment to private contractors (Environmental Sanitation Provider Association, ESPA, 2014). Consequently, private contractors were unable to provide quality and reliable solid waste collection services to beneficiaries because of inadequate resources. 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.

Thus a study to examine the factors that influence households' WTP for improved SWM service in Accra and Tamale Metropolises in Ghana cannot be overemphasised. The expectation is that the study will contribute to efforts geared towards improving solid waste financing in Accra and Tamale Metropolises. Identifying service user's preferences, fee-schedules and factors influencing their WTP would help service providers design SWM systems that meets the needs of the service beneficiaries. 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 reduce urban poverty.

The structure of the paper is as follows: Section 2 presents a review of previous WTP studies and research gap; Section 3 focuses on the methodology which includes the study area, sampling technique, data collection and estimation techniques; Section 4 presents the empirical results and discussions; and Section 5, concludes with policy implications.

2 Literature review and research gap

Studies on households' 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 maximising agents who make decisions based on available information (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. 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 individuals make rational decisions based on perfect information. However in economic terms, it is assumed that economic agents are autonomous; 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). This was confirmed in previous empirical studies. 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 traditionally, 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) found no relation between WTP and gender. Age was reported to influence households' WTP by Afroz and Masud (2011) and Amfo-Otu et al. (2012). Amfo-Otu et al. (2012) indicated that older people in Ghana were not willing-to-pay more for improved SWM because they are accustomed to free solid waste collection services and consider solid waste collection as government's responsibility. In contrast, Hagos et al. (2012) found no significant relation between WTP and age.

The relationship between income and education and WTP is consistent. Education was found to have statistically significant relation with WTP by Oteng-Ababio (2010b), Afroz and Masud (2011) 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. Income was also observed to have statistically significant effect on 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) indicated that the affluent are willing-to-pay more for improved SWM services than the poor because they have greater ability to pay. Afroz and Masud (2011), argued that the rich consume more goods, generate more solid waste and this increases their demand for improved SWM. The variable household size was also found to have positive relationship with WTP by Ojok et al. (2012). The authors argued that larger households are more likely to generate larger volumes of solid waste than smaller households, hence the higher demand for improved SWM service. In contrast, 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 likely

to pay more because they are likely to have larger family size and thus face higher risks than those not married. In contrast, 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 in Ghana. Oteng-Ababio (2010b) also argued that households who live in their own house favour improvements in SWM services than those in rented houses because in Ghana landlords are held responsible for unclean house not tenants.

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 were more willing-to-pay for improved waste collection services. Oteng-Ababio (2010b) found that residents serviced by private service operators were more willing- to-pay 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 application of neoclassical consumer model in explaining households' WTP for improved SWM services 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 bundle 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. It is one of the most well established psychological models of individual decision making. Proponents of the TPB hypothesised that an individual behaviour is directly influenced by his/her intention. Generally, a stronger intention to perform a 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 behavioural control reflects the individual's perception of the ease or difficulty with which the individual can perform a particular behaviour. Empirically, these variables (attitude, subjective norms and perceived behavioural) are rarely used in WTP for improved SWM studies. 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 emphasised in social psychology. This study intends to fill this research gap by adopting the neoclassical consumer theory and TPB to examine the factors that influence households' WTP for improved SWM services.

3 Study area and methodology

3.1 The study area and sampling technique

The study was conducted in Accra and Tamale Metropolises in Ghana. The selection of two different urban areas located in different ecological zones with different socio-cultural characteristics, population size and resource base offered a basis of comparison of SWM practices within the geographical setting in the country. Accra, Ghana's national capital is the largest city and also serves as the administrative, political and economic hub of the country. It hosts a number of industries, oil companies as well as corporate organisations, and this has attracted people from other regions and different socio-economic background (GSS, 2014a). Consequently, Accra has become the most urbanised, populated and most cosmopolitan city in Ghana. It lies in the coastal savannah zone with annual rainfall averaging 810mm. The city has grown significantly over time, from about 20,000 in 1891, to135,800 in 1948, reaching 1.6 million in 2000 (Konadu-Agyemang, 2001) and almost 1.9 million in 2010 (GSS, 2014a). 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, p.205).

Tamale, a medium-sized city, is the Northern regional capital and largest urban centre in the three northern regions of Ghana. Tamale is the economic hub of the northern region, and it hosts a number of corporate organisations and this has attracted people from the northern sector and other neighbouring countries. The Tamale Metropolitan Assembly (TaMA) lies within the Guinea-savannah belt of Ghana with an average annual rainfall of about 1033mm (GSS, 2014b). 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**.** As reported by Gyasi et al. (2014, p.13), "Tamale is among the fastest-growing cities in Ghana with an annual growth rate of 3.3%". 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, p.47).

A three-staged stratified probability sample design was used for the household survey. Compared to other sampling methods like simple random 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 neighbourhood into low, middle and high-income areas used in several studies in Ghana (see Benneh et al., 1993; Owusu and Agyei-Mensah, 2011), a 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 1). This consists of the first stage.

Table 1 Selected communities and sample allocation

Metropolis	*Community*	*SES Community*	*No. of Selected EAs*	*Sample Allocation to Households*
Accra	Airport Residential Area	High-income	2	30
	Dansoman	Middle-income	11	165
	Glefe	Indigenous low-income	4	60
	Nima	Migrant low-income	18	270
Tamale	Russia Bungalow	High-income	3	45
	Zogbeli	Middle-income	11	165
	Aboabo	Low-income	8	120
TOTAL			57	855

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. 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 survey targeted heads of household because the decision to pay for improved SWM service 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.

3.2 Data collection

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. Guided by past studies and information collected from key-informant interviews and focus group discussions (FGDs) with the selected communities, data captured from the structured questionnaire included information on household's perception towards SWM, current SWM practices, question on theory of planned behaviour constructs, the contingent valuation design, household socio-economic characteristics, and assets.

The contingent valuation method (CVM) was used to establish the economic value of SWM 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; Whittington, 2010). Based on FGDs and literature, 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 did 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 (Whittington et al., 1993; Whittington, 2010). Lastly, the zero bid response was minimised by giving sufficient time to the valuation task.

3.3 Econometric approach

Taking inspiration from the theory of planned behaviour (TPB) developed by Ajzen (1991), the neoclassical consumer theory and learning from past literature on WTP for improved SWM, the study argued that households' WTP for improved SWM services is influenced by three main factors: households' socio-economic characteristics, socio-psychological factors and situational factors. Consequently, the main model is presented as:

$$y_i = \alpha + \beta x_i + \mu_i \tag{1}$$

where y represent the amount in Ghana cedis that a household is willing to pay for improved SWM services; α is the intercept, βs are the coefficients to be estimated, μ_i is the error term and x, represent the independent variables.

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. The Tobit regression model is expressed as:

$$y_i^* = x_i^{'}\beta + \mu_i \tag{2}$$

where y_i^* is unobserved latent variable, $x^{'}$ and, β is as defined previously 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).

Since y_i^*, is a latent variable, the observed responses of the variable y_i is presented as:

$$y_i = y_i^* \; if \; y_i^* > 0\,,$$

$$y_i = 0 \; if \; y_i^* \le 0\,,$$

The log likelihood of the Tobit model is specified as:

$$InL = \sum_{y_i>0} -\frac{1}{2}\left[log\left(2\gamma\right) + \ln\sigma^2 + \frac{\left(y_i - x_i^{'}\beta\right)^2}{\sigma^2} \right] + \sum_{y_i=0} \ln\left[1 - \varphi\left(\frac{x_i^{'}\beta}{\sigma} \right) \right] \tag{3}$$

The maximum likelihood estimates of the parameters are obtained by maximising 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 (Greene, 2003).

The empirical model for households' WTP is presented as:

$$\begin{aligned} WTP = {} & \beta_0 + \beta_1 attitude + \beta_2 subjective\,norm + \beta_3 perceived\,behavioural \\ & + \beta_4 income + \beta_5 education + \beta_6 sex + \beta_7 marital\,status + \beta_8 tenancy \\ & + \beta_9 occupation + \beta_{10} householdsize + \beta_{11} age + \beta_{12} information \\ & + \beta_{13} satisfaction + \beta_{14} Location + \varepsilon_i \end{aligned} \tag{4}$$

The measurement of the independent variables and their priori expectations are presented in Table 2.

Table 2 Description of independent variables for Tobit regression

Independent Variables	*Measurement*	*Expected sign*
	Socio-economic factors	
Age of head of household	Number of years	–
Marital status of head of household	Married=1; Otherwise=0	+
Sex 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	Household's knowledge or awareness on solid waste separation (1=Yes; 0=Otherwise)	+
Satisfaction	Household's level of satisfaction with present SWM service (Satisfied=1; Otherwise=0)	+
Location	Metropolitan dummy (Accra=1; Tamale=0)	+
	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: Author's own construct, 2017

4 Results and discussions

Table 3 presents a summary statistics of the demographic characteristics of the respondents.

Table 3 Summary characteristics of households surveyed

Variables	*AMA*		*TaMA*		*Entire study area*	
	Freq.	*%*	*Freq.*	*%*	*Freq.*	*%*
Sex of Head of Household						
Male	321	61.14	225	68.18	546	63.14
Female	204	38.86	105	31.82	309	36.14
Total	525	100.00	330	100.00	855	100.00
Education Attainment of Head of Household						
No Education	67	12.76	60	18.18	127	14.85
Primary Education	37	7.05	69	20.91	106	12.40
Junior High School	150	28.10	48	14.55	198	23.16
Senior High School	89	16.95	46	13.94	135	15.79
Voc./Comm./Tech	19	3.62	20	6.06	39	4.56
Tertiary	163	31.05	87	26.36	250	29.24
Total	525	100.00	330	100.00	855	100.00
Tenancy status of Households						
Landlord/lady	222	42.29	170	51.52	392	45.85
Relative of Landlord/lady	124	23.62	57	17.27	181	21.17
Tenants	169	32.19	91	27.58	260	30.41
Caretakers	10	1.90	12	3.64	22	2.57
Total	525	100.00	330	100.00	855	100.00
Marital Status						
Married	360	68.57	251	76.06	611	71.46
Single	47	8.95	34	10.30	81	9.47
Divorced/Separated	50	9.53	20	6.06	70	8.19
Widowed	68	12.95	25	7.58	93	10.88
Total	525	100.00	330	100.00	855	100.00

Source: Field Data, 2016

Based on the survey results, there was a bias in the sample towards male-headed households (61.14%), married (68.57%) and house-owners (42.29%) in AMA. In addition, as many as 28.10% of the respondents in AMA had received Junior High education, compared 31.05% that has tertiary education. In TaMA, most of the respondents (68.18%) were males, house-owners (51.52%) and married (76.06%). About 14.55% of the respondents in TaMA had received Junior high education as against 26.36% who had tertiary education. For the entire study area, the sample was bias towards male-headed households (63.14%) and married (71.46%). In addition, about 45.85 % of the respondents were house-owners and as many as 23.16% had received Junior high education.

Table 4 presents the percentage and the mean WTP value by residential areas in AMA.

Table 4 Monthly WTP for improved SWM in AMA (in percentage)

Price/Month (GH₵)	*Indigenous low-income*	*Migrant low-income*	*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 low-income*	*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 and high-income area the monthly modal price range is GH ₵11-20, and GH₵ 61-70 respectively for improved SWM services. The mean WTP value for the respondents in the high-income area is GH₵66.61 or using the local USD exchange rate for 19th September, 2017 (1USD=4.405 Ghana cedis) is about USD 15.12. In the indigenous low-income area the mean WTP amount is GH₵5.82 or USD 1.32, and that for the migrant low-income area is GH₵10.30 (USD 2.34). 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 residents in the high-income area are willing-to-pay more to have their solid waste collected. In addition, generally affluent households' are more satisfied with improved solid waste collection service and thus motivated to pay more for this service.

The low modal price range and mean WTP amount in the low-income area is not surprising. 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. Secondly, their poor attitude towards solid waste also influences their behaviour. During the FGDs, a participant iterated that she cannot pay for solid waste collection service because waste 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, such as, illegal dumping into drains, lagoons and open spaces, in order to avoid payment.

As shown in Table 4, about, 31.67% of respondents in the indigenous low-income area have a zero WTP value, compared to 20.37% of respondents in the migrant low-income who said they cannot pay for improved SWM service. As many as 23.03% of respondents in the middle-income area are not prepared to pay for the improved service. In contrast, all the respondents in the high-income area are willing-to-pay for the improved SWM services. Of much significance is the percentage (23.03%) of respondents in middle-income area who had zero WTP value for the improved SWM service. This observation could be attributed to 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, residents in the middle-income area engage the services of informal waste collectors which they perceive provide quality service.

Table 5 presents the percentage and the mean WTP value by residential areas in TaMA.

Table 5 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 for improved SWM service is GH₵11-20, and that for the high-income area is GH₵21-30. The mean WTP value for respondents in the high-income area is GH₵21.98 or USD 4.99. In the case of the middle and low-income areas the mean WTP values are GH₵5.11 (USD1.16) and GH₵8.26 (USD1.88) respectively. Also, about 84.44% of respondents in the high-income area are willing-to-pay between GH₵ 21-30. As many as 29.17% of respondents in the low-income area are not prepare to pay for improved SWM service, compared to 17.58% of respondents in the middle-income area with zero WTP value. 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 the local authority should be responsibility for proper SWM.

Table 6 presents the mean WTP amount per month for solid waste collection by metropolis.

Table 6 Mean monthly WTP per household per month by metropolis

Location	*AMA*	*TaMA*	*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; *2010 Population and Housing Census

The results show that the mean WTP for the entire study area is GH₵ 13.13 or USD 2.98. In the case of AMA and TaMA the mean WTP values are GH₵15.71 (USD 3.57) and GH₵8.99 (USD 2.04) 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 good is higher resulting in an increase in solid waste generation, which increases the demand for improved SWM service.

In WTP studies, 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 WTP value. As shown in Table 6, the total monthly WTP amount that households in AMA are willing-to-pay to have improved SWM service is GH₵7,081,251 (or USD1,607,548.47). In TaMA households are willing-to-pay GH₵1,979,739.00 (USD 449,429.97) 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.

4.1 Determinants of households' WTP for improved SWM service

Table 7 presents the Tobit regression estimates on factors that influence households' WTP for SWM services in AMA, TaMA and the entire study area. 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, 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.

The results from the estimations indicate that sex 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 of the respondents are the significant determinants of households' WTP for improved SWM services in the entire study area. The variable sex of head of household has a negative relation with households' WTP and is statistically significant at 1%. As expected the coefficients of the variables total household income, education attainment of head of household and occupation type are positive and statistically significant at 1% level. Households' level of satisfaction with SWM services, attitude and subjective norm has positive effect on WTP and are statistically significant at 1%. The coefficient of the location dummy is positive and statistically significant at 5% level.

Table 7 Tobit regression estimations for households' WTP

Independent variable	*AMA*	*TaMA*	*Entire study area*
	Coefficient	*Coefficient*	*Coefficient*
Sex of head of household	–4.1083*** (1.0789)	–2.1809*** (0.7987)	–3.4554*** (0.7877)
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)
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 (Accra=1; Tamale=0)	Na	Na	1.8674** (0.8434)
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

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

The main drivers of households' WTP for improved SWM services in AMA are sex 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 the coefficient of sex has a negative sign 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. The variables total households' income and occupation type have 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 and subjective norm have positive effect on WTP and is significant at 1%.

The determinants of households' WTP for improved SWM in TaMA are sex 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 sex 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, education and occupation type are positive and statistically significant at 1% level. Furthermore, households' levels of satisfaction with SWM service, attitude and subjective norm have positive sign and are statistically significant at 1%. In contrast, perceived behavioural control has a negative relation with WTP and is also statistically significant at 1% level.

The results from the estimations indicate that 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 solid waste collection bills than men. Hence, their WTP is more for improved SWM service. Scholars including Alhassan and Mohammed (2013), Awunyo-Vitor et al. (2013) and Ojok et al. (2012) had similar observation.

On the age effect, the study find that 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 solid waste collection as the government's responsibility. This result is consistent with the previous findings by Rahji and Oloruntoba (2009) and Banga et al. (2011), but contradicts that of Afroz and Masud (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, which increases their demand for SWM services. In addition, affluent 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 wastes collected.

Other earlier studies including Anaman and Jair (2001), Hagos et al. (2012), and Rahji and Oloruntoba (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 improved SWM. This observation is in tandem with the findings of Asenso-Okyere and Asante (2003) who argued that higher education increase households WTP for environmental services.

The study also observed 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 observation can be 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 solid waste collection services, 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 in 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. 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 study 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, 2014a) 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 also 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. In TaMA, source separation is prevalent among low-income areas where solid waste collection services are fee-free, so they still have the perception that SWM is the sole responsibility of the local

authority. In addition, adopters of source separation are of the view that since they separate their solid waste at source, they should not be responsible for the cost of its disposal. 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 and is wholly urbanised. These conditions increase the demand and consumption of goods and more solid waste is generated, which increase the demand for SWM services. Secondly, residents in AMA are more likely to have busy lifestyles that make them place high opportunity cost to time spent managing solid waste at home. These conditions impact positively on their WTP for SWM services.

5 Conclusion and policy implications

Generally, studies on WTP have concentrated on socio-economic factors to explain WTP behaviour, contrarily; socio-psychological factors such as attitude, subjective norm and perceived behavioural control are rarely used in WTP studies. This study examined the effect of socio-economic, socio-psychological and situational factors on households' WTP for improved SWM service in Accra and Tamale metropolises in Ghana. The study employed the contingent valuation method to elicit households' WTP for improved SWM service and the Tobit regression model was used for the estimation. The estimation results from the Tobit regression model reveal that socio-economic factors, such as income and education increase households' WTP for improved SWM services in AMA, TaMA and the entire study area. In addition, female-headed households were willing-to-pay more for improved SWM services in AMA, TaMA and entire study area. However, age was found to decrease households' WTP for improved SWM services in TaMA. Regarding socio-psychological factors, attitude and subjective norm significantly increase the amount households were willing-to-pay for improved SWM services in AMA, TaMA and the entire study area. In contrast, perceived behavioural control decrease the amount households were willing-to-pay for improved SWM services in TaMA. In addition, households who were satisfied with the current SWM services were willing-to-pay more for improved SWM services in AMA, TaMA and the entire study area. The contribution of this study in this context is that, it has brought to fore the factors that influence households' WTP for improved SWM services. Both the theory of planned behaviour and the utility maximisation theory were found to be applicable in the Ghanaian case. Secondly, it has provided conceptual clarity on how socio-psychological, socio-economic and situational factors translate into households' WTP in Accra and Tamale metropolises. By so doing, the study has provided an alternative conceptual framework that explains households' WTP in Accra and Tamale metropolises.

The findings have several policy implications. The fact that, households' WTP for improved SWM services were significantly influenced by type of occupation and education of the household head as well as household total income, suggest that a flat rate cannot be charged across households; rather the cross-subsidisation concept is appropriate. Poorer and uneducated households should be charge a lower rate than relatively affluent and educated households. In addition, daily or weekly billing system should be instituted to encourage payment for SWM services by residents working in the informal sector. In order to instil good environmental behaviour into the public, it is

necessary to organise frequent educational program geared towards enlightening the populace on the problems posed by improper waste management. This will reinforce the positive attitudes of those who are already committed to proper waste management and change the attitudes of those who view waste negatively. During such programmes community leaders, family members and role models in the study areas should be involved to help encourage residents to practice improved SWM behaviour. Furthermore, satisfaction with current SWM services, in terms of collection frequency was also seen as playing a role in influencing households' WTP for improved SWM service. Providing SWM services that meet the demand of service users in terms of collection frequency will encourage service users to pay for solid waste collection services.

Acknowledgement

The German Academic Exchange Programme (DAAD) and the Association of African Universities (AAU) provided financial support for this research.

References

Adamowicz, W., Louviere, J. and Williams, M. (1994) 'Combining revealed and stated preference methods for valuing environmental amenities', *Journal of Environmental Economics and Management*, Vol. 26, pp.271–292.

Afroz, R. and Masud, M.M. (2011) 'Using contingent valuation approach for improved solid waste management facility: evidence from Kuala Lumpur, Malaysia', *Waste Management*, Vol. 31, pp.800–808.

Ajzen, I. (1991) 'The theory of planned behaviour', *Organizational Behaviour and Human Decision Processes*, Vol. 50, No. 2, pp.179–211.

Alhassan, M. and 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*, Vol. 11.

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.

Anaman, K.A. and Jair, M.R. (2001) 'Contingent valuation of solid waste collection services for rural households in Brunei, Darussalam', *The Singapore Economic Review*, Vol. 45, No. 2, pp.233–240.

Asenso-Okyere, K. and Asante, F.A. (2003) *Economic burden of malaria in Ghana*, A Technical Report Submitted to the World Health Organisation Africa Regional Office (AFRO), Zimbabwe.

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*, Vol. 27, No. 2, pp.132–145.

Awunyo-Vitor, D., Ishak, S. and Jasaw, S.G. (2013) 'Urban households' willingness to pay for improved solid waste disposal services in Kumasi Metropolis, Ghana', *Urban Studies Research*, pp.1–8.

Banga, M., Lokina, R.B. and Mkenda, A.F. (2011) 'Households' willingness to pay for improved solid waste collection services in Kampala city, Uganda', *Journal of Environment and Development*, Vol. 20, No. 4, pp.428–448.

Benneh, G., Songsore, J., Nabila, J.S., Amuzu, T.A., Tutu, K.A. and Yangyuoru, Y.(1993) *Environmental Problems and Urban Households in the Greater Accra Metropolitan (GAMA)-Ghana*, Stockholm Environmental Institute, Stockholm.

Ben-Akiva, M. and Lerman, S.R. (1991) *Discrete Choice Analysis: Theory and Application to Travel Demand*, The MIT Press, Cambridge, MA.

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.

Ghana Statistical Service (GSS) (2014a) *2010 Population and Housing Census. District Analytical Report. Accra Metropolitan*, Accra, GSS.

Ghana Statistical Service (GSS) (2014b) *2010 Population and Housing Census. District Analytical Report. Tamale Metropolis*, Accra, GSS.

Greene, W.H. (2003) *Econometric Analysis*, 5th ed., New York University Press.

Gyasi, E.A., Fosu, M., Kranjac-Berisavljevic, G., Mensah, A.M., Obeng, F., Yiran, G.A.B. and Fuseini, I. (2014) *Building urban resilience: assessing urban and peri-urban agriculture in Tamale, Ghana*, United Nations Environment Programme (UNEP), Nairobi, Kenya.

Hagos, D., Mekonnen, A. and Gebreegziabher, Z. (2012) *Households' willingness to pay for improved urban waste management in Mekelle city, Ethiopia*, Environment for Development, Discussion Paper Series.

Hoornweg, D., Bhada-Tata, P. and Kennedy, C. (2013) 'Waste production must peak this century', *Nature*, pp.502–615.

Hyytiä, N. and Kola, J. (2006) 'Finnish citizens' attitudes towards multifunctional agriculture', *International Food and Agribusiness Management Review*, Vol. 9, No. 3.

Jin, J., Wang, Z. and 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.

Kassim, S.M. and Ali, M. (2006) 'Solid waste collection by the private sector: households' perspective – findings from a study in Dar er Salaam City, Tanzania', *Habitat International*, Vol. 30, No. 4, pp.769–780.

Konadu-Agyemang, K. (2001) 'A survey of housing conditions and characteristics in Accra, an African city', *Habitat International*, Vol. 25, pp.15–34.

Kranjac-Berisavljevic, G. and Gandaa, Z.A. (2013) 'Business opportunities in safe and productive use of waste in Tamale', *Urban Agriculture Magazine*, No. 26.

Loewenstein, G. (2000) 'Emotions in economic theory and economic behaviour', *The American Economic Review*, Vol. 90, No. 2, pp.426.

Midaba, T. (2009) *Factors Affecting Collection of and Willingness to Pay for Solid Waste: A Case of Ilala Municipality, Dar-es-Salaam*, MA Thesis, Department of Health Policy and Management, Muhimbili University of Health and Allied Sciences, Tanzania.

Ministry of Local Government and Rural Development (MLGRD) (2010) *National Environmental Sanitation Strategic Action Plan (NESSAP)*, Accra, Ghana, Government of Ghana.

Obirih-Opareh, N. and Post, J. (2002) 'Quality assessment of public and private modes of solid waste collection in Accra, Ghana', *Habitat International*, Vol. 26, No. 1, pp.95–112.

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.

Ojok, J., Koech, M.K., Tole, M and Okot-Okumu, J. (2012) 'Households' willingness-to-pay for improved municipal solid waste management services in Kampala, Uganda', *Science Journal of Environmental Engineering Research*, pp.1–8.

Oteng-Ababio, M. (2007) *Public-private partnership in solid waste management in the Greater Accra Metropolitan Area*, PhD Thesis, 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*, Vol. 28, pp.322–329.

Oteng-Ababio, M. (2010b) 'Solid waste management in Ghana: willingness-to-pay for improved services', *Ghana Journal of Geography*, Vol. 2, pp.86–108.

Oteng-Ababio, M. (2011) 'Missing links in solid waste management in the Greater Accra Metropolitan Area in Ghana', *Geo Journal*, Vol. 76, pp.551–560.

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*, Vol. 45, pp.1199–1218.

Owusu, G. and Agyei-Mensah, S. (2011) 'Comparative study of ethnic residential segregation in Ghana's two largest cities, Accra and Kumasi', *Population and Environment*, Vol. 32, No. 4, pp.332–352.

Owusu, G. and Oteng-Ababio, M. (2015) 'Moving unruly contemporary urbanism toward sustainable urban development in Ghana by 2030', American Behavioral Scientists, Vol. 59, No. 3, pp.311–327.

Post, J. (1999) 'The problems and potentials of privatizing solid waste management in Kumasi, Ghana', *Habitat International*, Vol. 23, No. 2, pp.201–216.

Post, J., Broekema, J. and Obirih-Opareh, N. (2003) 'Trial and error in privatization: experiences in urban solid waste collection in Accra (Ghana) and Hyderabad (India)', *Urban Studies*, Vol. 40, No. 4, pp.835–852.

Rahji, M.A.Y. and Oloruntoba, O. (2009) 'Determinants of households' willingness-to-pay for private solid waste management services in Ibadan, Nigeria', *Waste Management and Research*, Vol. 27, pp.961–965.

Sarantakos, S. (1998) *Social Research*, Macmillan Press Limited, New York, NY.

Skumatz, L.A. and 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 online at: http://www.epa.gov/osw/conserve/tools/payt/pdf/sera06.pdf (accessed on 22 October 2015).

Songsore, J. (2003) *Towards a better understanding of urban change: urbanisation, national development and inequality in Ghana*, Ghana Universities Press, Accra.

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.

Turaga, R.M.R., Howarth, R.B. and Borsuk, M.E. (2010) 'Pro-environmental behavior', *Annals of the New York Academy of Sciences*, Vol. 1185, No. 1, pp.211–224.

United Nations Environment Programme (UNEP) (2015) *Global Waste Management Outlook*, Nairobi, Kenya.

Whittington, D. (2010) 'What have we learned from 20 years of stated preference research in less-developed countries?' *Annual Review of Resource Economics*, Vol. 2, pp.209–236.

Whittington, D., Lauria, D., Wright, A., Choe, K., Hughes, J. and Swarna, V. (1993) 'Household demand for improved sanitation services in Kumasi, Ghana: a contingent valuation study', *Water Resour. Res*, Vol. 29, No. 6, pp.1539–60.

Wilson, D.C., Rodic, L., Scheinberg, A., Velis, C.A. and Alabaster, G. (2012) 'Comparative analysis of solid waste management in 20 cities', *Waste Management & Research*, Vol. 30, pp.237–254.

World Health Organization (WHO) (2015) *Situation Report on Cholera Outbreak in Ghana as of 19th April, 2015*, WHO, Country Office, Ghana.