International Journal of Development and Sustainability
Online ISSN: 2168-8662 – www.isdsnet.com/ijds
Volume 2 Number 2 (2013): Pages 629-639
ISDS Article ID: IJDS13013105

Special Issue: Development and Sustainability in Africa – Part 2

Fee-based solid waste collection in economically developing countries: The case of Accra metropolis

Kwaku Oduro-Appiah [1*], Daniel Ohene Aidoo [2], Graham Sarbah [2]

[1] *Water and Sanitation Group, University of Cape Coast, Cape Coast, Ghana*
[2] *Second Urban Environmental Project (UESP II), Accra Metropolitan Assembly, Accra, Ghana*

Abstract

Fee-based solid waste collection, a system that holds great promise to reducing the financial burden of solid waste management on the municipalities of developing countries is reviewed in this research study. It is to promote financial sustainability through partial or full cost sharing of solid waste collection services and intended to serve as a guide to policy makers and waste management authorities in Ghana and other countries with developing economies. Information through survey and questionnaires from residents across the socio-economic divide was collected to determine willingness and ability to pay for solid waste collection services. A critical assessment of the various capital and operational cost components that come into play in the collection process were considered and computed to determine the economic and social tariff that will be enough to offset the cost of collection, transportation and disposal of solid waste unto landfills. Residents of the metropolis have the ability and are willing to pay an economically affordable user charge of US$1.10 per household per month to offset and remove the financial burden of solid waste collection off the metropolitan assembly. Consistent and efficient collection service is recommended to ensure residents cooperation towards implementation of the system in Ghana.

Keywords: Solid waste, Fee-based solid waste collection, Financial sustainability, Developing economies, Accra metropolis

Cite this paper as: Oduro-Appiah, K., Aidoo, D.O. and Graham, S. (2013), "Fee-based solid waste collection in economically developing countries: The case of Accra metropolis", *International Journal of Development and Sustainability,* Vol. 2 No. 2, pp. 629-639.

* Corresponding author. *E-mail address:* koduro-appiah@ucc.edu.gh, oduroak@yahoo.co.uk

1. Introduction

Municipal solid waste (MSW) management is one of the most immediate and serious problems confronting urban governments in most developing countries. The system in Ghana as in most counties with developing economies has often been characterised by inadequate collection services, little or no treatment and uncontrolled dumping (McDougall et al., 2001). Despite the fact that municipal solid waste management services in countries with developing economies draws a significant share of municipal budget, it is unreliable and provide inadequate coverage to support improvement in public health and the environment (Bartone, 1999).

The main solid waste management system in Accra, Ghana, has been collection, transportation and disposal unto uncontrolled landfills. Of the three sub-systems, collection has proven over the years to be the costliest (UNEP, 2005). An estimated US$307,340 out of US$471,250 is spent monthly only on solid waste collection in Accra (Oteng-Ababio, 2011). The main financier has been the local government through the Metropolitan, Municipal and District Assemblies (MMDAs) and other project specific interventions by development partners with more than 80% of service beneficiaries (within the middle-to-low-income bracket) paying no user fees towards the financial sustainability of the system (MLGRD, 2010a). The source of revenue for operations has been property tax, markets tolls, fines, and the district assemblies common fund which are highly limited in addition to donor supports (UNEP, 2005).

Inadequate funding for capital investment and poor cost recovery capabilities have always been a frequent challenge to waste management authorities in Ghana (Asase et al., 2009). While average daily generation rates in Accra are about 3 to 4 times lower than that in developed countries, most solid waste in the metropolis is not collected by municipal collection systems because of poor management, fiscal irresponsibility or malfeasance, equipment failure, or inadequate waste management budgets (EGSSA, 2009). “Rapid urbanisation, low levels of revenue collection and competing needs have combined over recent decades to place an inordinate strain on the capacity of many local authorities to deliver efficient waste management services, steadily reducing their areas of service coverage and diminishing the quality of services offered” (UN-HABITAT, 2010). The situation leaves the MMDAs indebted to private solid waste collection contractors resulting in low collection coverage and overflow of communal containers at sanitary sites with its attendant public health and environmental effects. The need for a more sustainable means of financing environmental sanitation has become imperative as current sources of funding are unsustainable (MLGRD, 2010a).

A more sustainable approach in recent times is the increasing recognition of the possibility of greater household and community resources through full or partial cost sharing for collection services (Mehta and Knapp, 2004). (McDougall et al., 2001) recommend that, all beneficiaries -the public, the recycling industry and local authority- should pay for solid waste services. It is preferable to implement user charges to raise public awareness about the cost associated with providing the service and to make the service agency accountable.

(UNEP, 2005) suggest that prior to the introduction of user charges, well designed surveys aimed at determining the willingness and capacity of beneficiaries to pay must be conducted. A survey on residents’

willingness to pay for refuse and solid waste collection in Accra showed that more than 51% of city households regardless of the type of collection system were generally willing to pay a fee or a higher fee for better collection services. 31% of respondents were not sure of paying a fee but are likely to pay if assured access to a reliable, good quality service (WB, 2010). In order to reduce and or remove the financial burden of solid waste management from the local government and to ensure the financial sustainability of the system in developing countries, it would be essential among other things to determine the willingness and ability of beneficiaries of waste collection services to pay user charges. Of much significance is the determination of the necessary contributing capital and operational cost factors and the setting of economically viable user charges that can be met by households and at the same time ensure full or partial cost recovery of any fee-based solid waste management system.

2. Description of the city of Accra

Accra is the capital city of Ghana and lies along the southern coast of the country with a coast line of approximately 225 kilometres. It is characterized by a dry equatorial climate with temperatures ranging between 20° and 30° Celsius and annual rainfall ranging from 635 mm along the coast to 1,140 mm in the northern parts (Ghanadistricts, 2012). There are two rainfall peaks notably in June and October. The Greater Accra Region is further divided into two metropolitan areas (being the Accra Metropolitan Assembly (AMA) and the Tema Metropolitan Assembly (TMA), six municipal assemblies and two district assemblies. The AMA has been sub-divided into 11 sub-metropolitan areas with a projected daytime population of 2,200,000 as of 2010 at a growth rate of 4.4% per annum (Ghana Statistical Service, 2005).

3. Municipal solid waste management overview in Accra

The waste management department of the AMA is responsible for waste management in the metropolis. The estimated daily per capita generation rate is 0.6 kg. The composition of waste in Accra is predominantly made up of 67% biodegradables 20% plastics, 5% textiles, 4% paper, 2% glass, and 2 % (Oteng-Ababio, 2011). The main MSW management strategy has been collection, transportation and disposal of co-mingled solid waste on dumpsites. Collection of MSW –largely undertaken by private contractors - has been house-to-house (kerbside) where compactor collection vehicles move from one house to the other collecting stored solid waste once a week at a monthly cost to the service beneficiaries. The other mode of collection has been the use of central communal containers where skip trucks go in to hoist skip containers placed at sanitary sites within the communities. Such containers are filled with solid waste by householders who do not have access to the house-to-house services. The frequency of collection here depends on the rate at which the containers become full. In some cases, collection can be eight times per day. Collected MSW is transported over an average distance of 14 km to the only dumpsite in the metropolis.

Any salvageable items are removed from the waste by 50 to 70 scavengers operating at the site. Disposed refuse is spread and compacted by bulldozers but no soil cover is applied. A strong odour of decomposing organic waste, flies and windblown litter are permanent features at the dumpsite and its surroundings.

Industrial establishments are responsible to dispose waste in their own terms. No waste transfer station exists in Accra. Waste recovery and recycling of metals, glass and certain types of plastics are carried out on a small scale by scavengers. Since 2005, plastic recycling companies have been set up by private investors to recycle the highly increasing amount of high density plastics in the waste stream to low density equivalents which are used as carrier bags. Recovered plastics are sold to recycling companies for a fee agreed upon between the scavengers and the companies. In most cases, 10 kg of recovered polyethylene terephthalate (PET) bottles go for US$1.30. The absence of source separation of solid waste as part of the solid waste management system has been a major challenge to recycling companies. The raw materials for the plants recovered by scavengers after dumping, increases the operation cost of recycling.

The average waste collection cost is about US$320,000 per month. Funding for waste collection and disposal in Accra has been mostly provided by government subsidies through the local government and metropolitan revenue. Unfortunately, the local government has extremely limited sources of revenue. 20% of collection cost is paid for by households who enjoy the house-to-house collection service. 80% of households who use the central container collection system however unofficially pay to unauthorised agents stationed at the sanitary sites by various assembly members. At each instance, agents collect a fee ranging between US$0.13 and US$0.33 from households upon each visit. The effect of the existing funding method has been the inability of the AMA to consistently pay collection contractors resulting in overflow of waste containers at various sanitary sites in the metropolis. Lessons learnt over the years have established funding as a major obstacle to an improved solid waste management option in the metropolis with the AMA unable to sustain the current funding practices. It has however been realised that beneficiaries of solid waste collection services are willing to pay user charges towards an effective and efficient waste collection service.

4. Materials and methods

4.1. Research design

The research was designed using a stratified multistage probability sample. The explicit stratum was the Ablekuma South sub-metropolitan area. The primary sampling units were the 2000 population and housing census electoral areas (EAs). 4 EAs were drawn from the sample. The secondary sampling units were approximately 1346 households systematically drawn from each EA. In total, a sampling size of 5382 households was used to first determine the willingness and ability to pay user charges towards the collection of solid waste. Of significance to the study was the determination of the affordable amount across the socio-economic divide that could also ensure full cost recovery. The focus of the study was to assess and analyse all possible capital and operational cost components that culminate into the total cost of solid waste collection and disposal and share amongst the various households based on their socio-economic status. The research

study was also interested in determining the most efficient mode of fee collection from households in addition to the major motivational factors that could increase efficiency and participation rates. Further emphasis was placed on the challenges likely to be encountered by revenue collectors and households alike and possible motivational measures that may promote public acceptance and increase coverage of the process.

4.2. Interview, survey and development of questionnaire

The focus of the interview was to obtain first hand information relevant to the development of the questionnaires. Specific information and documentary evidence of relevance sought included the spatial distribution of households in the metropolis; the number of houses and households; the population densities; and the socio-economic status of residents; the per capita solid waste generation rates; and evidence of households paying user charges for solid waste collection services in the metropolis.

The survey was carried out in 145 sanitary sites in the 11 sub-metropolitan areas to determine the amount paid by households to unauthorized agents upon disposing their solid waste into collection containers. It was also to help determine the average number of visits per day and the approximate average amount paid in a month by households. The survey served as a guide in the determination of the appropriate user charge that would be affordable to households.

The questionnaire was designed taking into consideration the level of literacy of households in the various communities. The questionnaire explicitly explained the need for payment of user charges towards solid waste collection. It was also intended to create awareness on the current solid waste management practices and its financial and environmental implications on the citizens. The questions were prepared to meet the objectives of the study. Questions were on the willingness and ability to pay official user charges for solid waste collection services to be provided by the assembly through private contractors. Other information sought was the choice of solid waste collection scheme; the preferred frequency of solid waste collection, the user charges amount that householders were willing to pay in addition to the mode and frequency of payment of such charges. Although not specifically related, respondents were given the chance to comment on the quality of solid waste services they receive from the assembly and their expectation for an improved service. A draft version of the survey questions was pilot tested to 30 randomly selected households in the study area to ensure that the questions were clear, easily comprehended by respondents, and that they gathered the expected information.

4.3. Administration of questionnaire

Questionnaires, printed in English were administered by 36 trained and experienced Environmental Health Officers proficient in English and at least two native languages to households across the socio-economic divide in the 4 EAs (Mamprobi, Korle Gonno, Chorkor and Chemunaa) within the sub-metropolitan area (SM area) for 2 consecutive weeks. The 4 EAs were further zoned into 31 blocks with each block made up of hundred houses. Each block was given a serial number based on the initials of the EA and the number of the

block. Questionnaires were administered in 73% of houses with a total household coverage of 5382. The target of questioning was the head and most importantly the female head of each household. This target was influenced by the fact that, in almost all households in the country, females held the responsibility of solid waste management. An average of 13 minutes was spent per household. Re-visitation forms for repeat visits were developed for heads of households who were absent during questioning which later turned out to be the major challenge of the questionnaire administration process. Accuracy of the process was monitored by 6 field supervisors who randomly passed through the EAs to authenticate responses from households.

4.4. Determination and computation of cost components

The source of the various capital and operational cost components (collection trucks, collection containers, tyres, insurance, maintenance, fuel and lubricants, disposal, asset depreciation and labour) to solid waste management in the metropolis were identified and estimated. The number of trucks required for a 100% collection of the city's solid waste was estimated from the per-capita generation rate (0.6 kg per day), the total population, and the average capacity of collection trucks. Skip trucks of container-carrying capacity of 12 m^3 (6 tonnes) was adopted.

Table 1. Number of trucks and distance computations in each sub-metropolitan (SM) area

SM Area	Contribution to Waste (%)	Amount Collected (tons)	Number of trucks	Round trip distance per truck (km)	Total round trip distance per year (km)
Ashiedu Keteke	19.63	259	9	28	440,152
Osu Klottey	14.49	191	7	36	324,901
Ablekuma South	8.33	110	4	20	186,779
Ablekuma North	2.38	31	2	18	53,365
Ablekuma Central	7.95	105	4	20	178,258
Okaikoi South	13.95	184	7	24	312,792
Okaikoi North	10.60	140	5	20	237,677
Ayawaso Central	6.33	84	3	38	141,937
Ayawaso West	1.76	23	2	40	39,463
Ayawaso East	9.68	128	5	42	217,049
La	4.39	58	2	44	98,434

The existing unit cost of US$45,000 and US$4,000 respectively for collection trucks and containers were used in all calculations. Total fuel and lubricant (F & Lub.) cost was estimated based on consumption capacities of trucks, existing market cost of a litre fuel and the average round trip distance of collection zones to disposal sites. Maintenance and Insurance (MI) was estimated at 1% and 2% of the cost of trucks respectively. Dumping cost (DC) for a 12 m^3 container full of solid waste was computed as US$6. Labour cost was determined based on a reasonable staff number and remuneration in a typical private solid waste

management firm in Ghana. The key staff considered included, one manager, one environmental health officer, two technicians, one accountant, one secretary, two revenue collectors, one driver and one driver apprentice per truck in addition to 2 container attendants per sanitary site. The aforementioned staff composition was limited to only a sub-metropolitan assembly. Remuneration amounts used in labour cost computations was 40% higher than the existing remuneration levels during the period of research and met the minimum wage requirements of the country. Annual depreciation charges (Depr.) on trucks and containers were computed by means of the straight line depreciation method over 5 years and treated as part of the total cost of management. 10% contingency (Cont.) and 10% profit margins of the overall cost of management were added to arrive at the total cost of management (Table 2).

Table 2. Summary of annual expenditure

SM Area	F&Lub. ($US)	MI ($US)	DC ($US)	Labour ($US)	Depr. ($US)	Cont. ($US)	Profit ($US)	Total ($US)
AK	160,452	13,950	18,656	153,000	117,000	46,306	46,306	555,670
OK	118,866	10,850	13,771	127,000	91,000	36,149	36,149	433,785
AS	68,408	6,200	7,917	88,000	52,000	22,242	22,242	266,906
AN	20,544	3,110	2,262	62,000	26,000	11,391	11,391	136,687
AC	65,404	6,200	7,556	88,000	52,000	21,919	21,919	262,996
OS	114,749	10,850	13,259	127,000	91,000	35,686	35,686	428,229
ON	86,810	7,750	10,074	101,000	65,000	27,063	27,063	324,761
ACL	51,857	4,650	6,016	75,000	39,000	17,652	17,652	211,828
AW	15,818	3,100	1,673	62,000	26,000	10,859	10,859	130,308
AE	79,797	7,750	9,200	101,000	65,000	26,275	26,275	315,292
La	35,868	3,100	4,172	62,000	26,000	13,114	13,114	157,368

AK= Ashiedu Keteke, OK= Osu Klottey, AS= Ablekuma South, AN=Ablekuma North, AC=Ablekuma Central, OS= Okaikoi South, ON= Okaikoi North, ACL=Accra Central, AW=Ayawaso West, AE= Ayawaso East, F&Lub.= Fuel and Lubricant, MI=Maintenance and Insurance, DC= Dumping Cost, Depr.=Depreciation, Cont.= Contingency

The total cost of management was then divided by the total number of households in each sub-metropolitan area to arrive at the average cost of collection service to each household (Table 3).

5. Results and discussion

The survey at sanitary sites showed that households in low income areas where such sites are predominant paid an average US$4.00 per month. High-to-middle-income beneficiaries of solid waste collection services also pay an average of US$6.67 per month for once a week collection frequency. The questionnaire process established that households who were willing to participate and had the ability to pay for solid waste collection services were 98.2% and 98.3% respectively.

Table 3. Annual and monthly fees for households

SM Area	Total Cost ($US)	Number of Households	Annual User Charge ($US)	Monthly User Charge ($US)
AK	555,670	20,440	27.19	2.27
OK	433,785	23,122	18.76	1.56
AS	266,906	50,618	5.27	0.44
AN	136,687	29,972	4.56	0.38
AC	262,996	43,438	6.05	0.50
OS	428,229	13,727	31.20	2.60
ON	324,761	30,586	10.62	0.88
ACL	211,828	34,419	6.15	0.51
AW	130,308	9,179	14.20	1.18
AE	315,292	28,498	11.06	0.92
La	157,368	35,325	4.45	0.37

AK= Ashiedu Keteke, OK= Osu Klottey, AS= Ablekuma South, AN=Ablekuma North, AC=Ablekuma Central, OS= Okaikoi South, ON= Okaikoi North, ACL=Accra Central, AW=Ayawaso West, AE= Ayawaso East

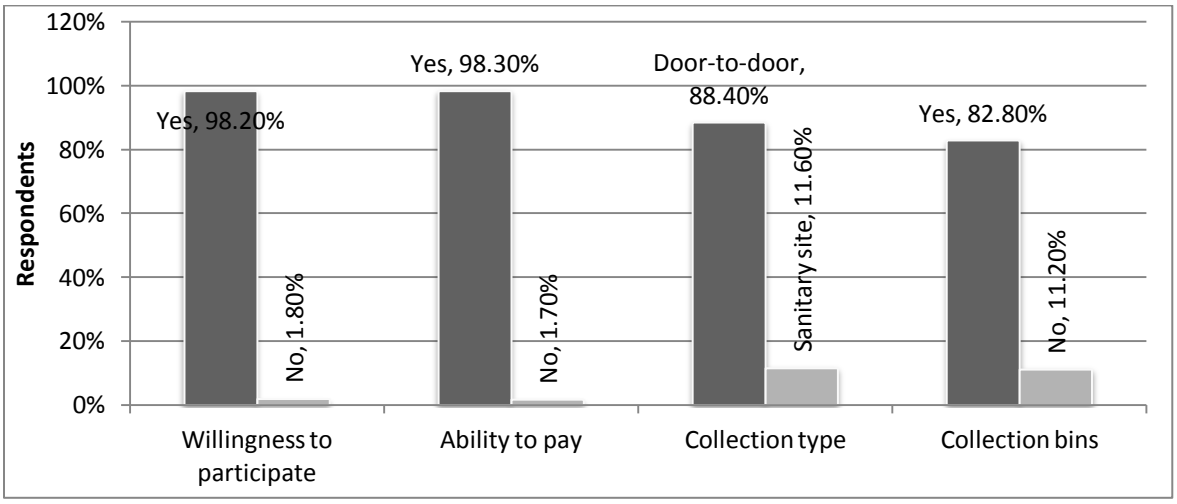

Figure 1. Households willingness and ability to participate in fee-based solid waste collection services

65.4% of respondents were willing to pay the minimum monthly user charge target of US$2.00. The differences in the ability of respondents to paying varying user charges are illustrated in Figure 2 below:

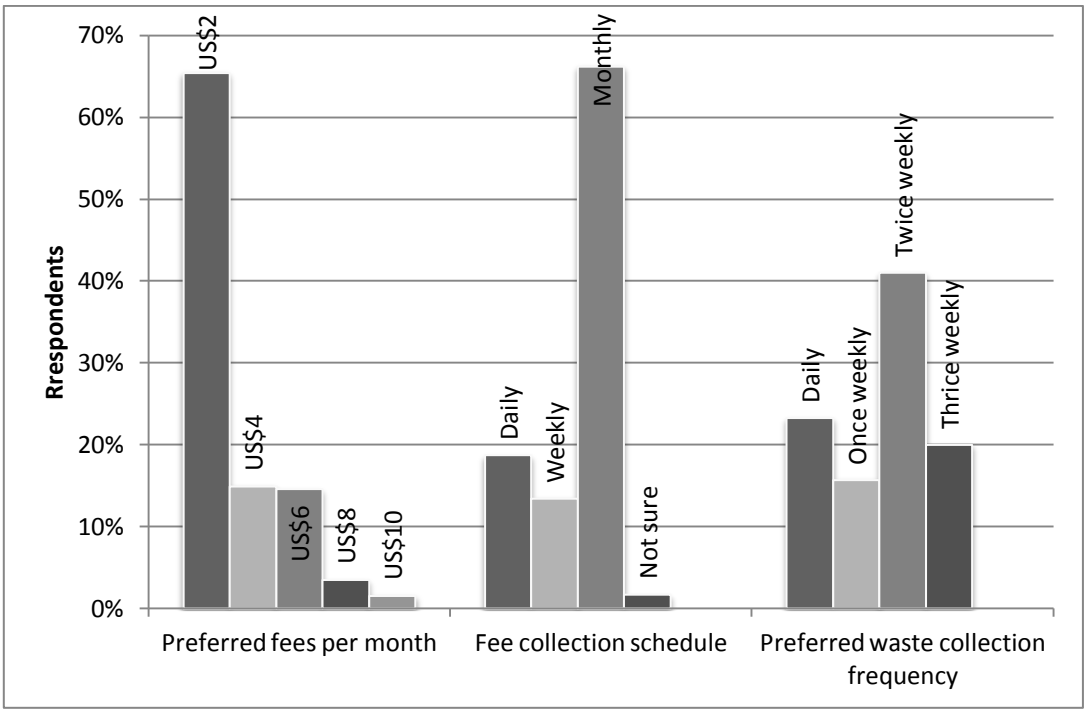

Figure 2. Households preferred user charges and collection schedule

(MLGRD 2010b) recommends the application of direct cost recovery from users where it is possible to charge a full commercial price covering all operational and capital costs, for environmental sanitation services. Where full direct cost recovery is not possible, the shortfall or the cost for any services not charged for is to be subsidised by the municipality. Whilst full cost recovery is to be a major factor for achieving financial sustainability, setting of tariffs are to be done in such a manner as not to discourage the use of the services, especially where such a case is most likely to cause health risk.

Estimate of cost components in this study resulted in an average monthly user fee of US$1.10 per household in the metropolis for total collection cost recovery. This amount still falls below the US$4.00 paid unofficially by households to sanitary sites attendants in low income areas and the US$6.67 paid to collection companies by households in middle-to-high income areas across the metropolis. This indicates that beneficiaries of any fee-based solid waste collection service with user charges below existing charges may have the ability to pay. The highest user charge per household is US$ 2.27 in Ashiedu Keteke (a densely populated low income area habouring the central business district) with the lowest user charge of US$ 0.37 from La, a middle income area. The presence of the main market of the metropolis in Ashiedu Keteke is the basic reason for its large contribution to solid waste and the resultant highest user charge. Specific user charges from the market will reduce the fee burden on the households.

Clearly, a 100 percent user fee collection rate removes the financial burden of waste collection from the metropolitan authorities giving them the opportunity to invest the erstwhile cost of management in other developmental ventures. However, a 100 percent user fee collection rate at the initial stages of

implementation will be highly optimistic. The metropolitan authorities may adopt user fee collection efficiency of 70% in the first year of implementation with a yearly increment of 10% in subsequent years as education and sensitisation is intensified. Subsidisation of the cost of management will be required in such a scenario. However, it may not be advisable since the total burden (subsidised amount) on the Assembly at 70% user-fee collection rate will be more than the existing total cost of management. The disparity in user charges that has resulted in low income dwellers paying more than their high-to-middle-income neighbours in some cases can be eliminated by adopting a fee fixing resolution where the rich pay more than the poor. Tendering of services which combines at least a high-income and low-income area as a packaged lot would eliminate this effect.

6. Conclusion and recommendation

In this study, the results has established and provided guidelines for consideration for the adoption of a fee-based solid waste collection system where beneficiaries of solid waste collection services will pay fees towards management. An average monthly user fee of US$1.10 (300% lower than what is unofficially paid by residents) per household in Accra is enough to remove the financial burden of collection of solid waste from municipalities in Ghana and other developing countries with similar characteristics. The study has also established that residents are willing to participate and have the ability to pay for user charges. A combination of house-to-house collection by private contractors in easily accessible high to middle-income areas in addition to collection at sanitary sites in relatively inaccessible low-income areas will be an ideal situation. The frequency of solid waste collection and user charges in high to middle-income areas will be once weekly and once monthly respectively. In low income areas, frequency of collection will be dependent on when containers at sanitary sites become full. Residents in these areas will pay user fees daily as and when they go to dispose off their solid waste.

Continuous sensitisation and education of residents by the municipality in addition to the supply of standard bins of volume based on household size and per capita solid waste generation rates to residents would improve participation rates. User fee collection efficiency will improve with efficient service provision. Registration of households by contractors will improve solid waste and user fee collection efficiency. For the purposes of achieving any practical success on fee-based solid waste collection in municipalities that could lead to a nation-wide adoption of the process, it would be beneficial if waste mangers, engineers and policy makers aim at providing the required resources and motivation to help pilot and sustain the practice. This will enable implementers to ascertain the progress and real challenges of the process since in many survey processes, what people claim they will do, and what they actually do when reality dawns are not always the same.

Acknowledgements

We are grateful to the waste management department and the office of the second urban environmental sanitation project of the Accra metropolitan assembly for their help in interviewing. We are also grateful to

Mr. Thomas Ateh Donkor, a public health engineer of the sanitation directorate of the ministry of local government and rural development for checking and proof reading the article on our behalf.

References

Asase, M., Yanful, K.E., Mensah, M., Stanford, J. and Amponsah, S. (2009), "Comparison of municipal solid waste management systems in Canada and Ghana: A case study of the cities of London, Ontario, and Kumasi, Ghana", *Waste Management*, Elsevier, Vol. 29 No. 2, pp. 779-786.

Bartone, C.R. (1999), "Financing solid waste management projects in developing countries: Lessons from a decade of World Bank lending", in proceedings of organic recovery and biological treatment, ORBIT 99, Part 3, Rhombus, Berlin, pp. 757-765

Environmental Guidelines for Small-Scale Activities in Africa (EGSSAA) (2009), "Solid waste: generation, handling, treatment and disposal" (IRG) under USAID Africa Bureau's Environmental Compliance and Management Support (ENCAP) Program.

Ghana districts (2012), "Accra city profile", available at: http:www.ama.ghanadistricts. gov.gh/ (accessed, 23 December 2012).

Ghana Statistical Service (2005), "*2000 Population and Housing Census of Ghana: The Gazetteer"*, Vol. 1-5, Government of Ghana, Ghana.

McDougall, F., White, P., Franke, M. and Hindle, P. (2001), "*Integrated Solid Waste Management: A Life Cycle Inventory"*, Blackwell Science, Oxford, UK.

Mehta, M. and Knapp, A. (2004), "The challenge of financing sanitation for meeting the millennium development goals", *in 12th session of the United Nations commission on sustainable development (CSD-12)*, New York, 2004, pp. 1-28.

Ministry of Local Government and Rural Development (MLGRD) (2010a), "*Strategic Environmental Sanitation Investment Plan (SESIP)"*, Government of Ghana, Accra.

Ministry of Local Government and Rural Development (MLGRD) (2010b), "*Environmental Sanitation Policy"*, Government of Ghana, Accra.

Oteng-Ababio, M. (2011), "Governance crisis or attitudinal changes? Generation, collection, storage and transportation of solid waste in Ghana", in Kumar, S. (Er.), *Integrated Solid Waste Management*, *Vol. 1*, InTech, Croatia, pp. 3-22.

United Nations Centre for Human Settlements (UN-HABITAT) (2010), "*Collection of Municipal Solid Waste in Developing Countries"*, UN-HABITAT, Malta.

United Nations Environment Programme (UNEP) (2005), "*Solid Waste Management"*, *Vol. 1*, UNEP, CalRecovery Inc., USA.

World Bank (WB) (2010), "*Ghana Consultative Citizens Report Card"*, World Bank, Washington DC.