Management of domestic solid waste in Ghana: Perception of households

Abena Abrafi Agyei [1], Augustine Awuah Peprah [*2], Kwame Frimpong Sekyere [3]

[1] *Department of Marketing and Corporate Strategy, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana*

[2] *Department of Management, Ca' Foscari University of Venice, Italy*

[3] *Tropenbos International Ghana, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana*

Abstract

The rapid economic development and population growth in Ghana have resulted in waste management problems as major cities battled with tons of uncontrolled rubbish, polythene bags spotted all over and waste disposal sites are full of refuse which causes serious health hazards and disease outbreak. This study therefore sought to examine the perception of stakeholders on domestic solid waste management in the Kumasi metropolis of Ghana. Data for the study were obtained by the use of semi-structured questionnaire and interviews with key informants. The results indicated that the frequency of waste collection was daily for communal waste sites and varied from daily, once, twice to three times per week for house-to-house collection. It was also revealed that inadequate equipment, poor roads, inadequate funds and inadequate trained staff were identified to be the key constraints that local authority and waste collection companies faced. The study recommends that to improve waste management within the metropolis, education and awareness creation concerning reduction of wastes should be carried out. Also the local authority should make funds available to secure the needed logistics to improve waste management.

Keywords: Waste Management; Domestic Solid Waste; Perception; Household; Kumasi; Ghana

* Corresponding author. *E-mail address:* pepraha3@gmail.com

1. Introduction

The rapid population growth, urbanization and industrial growth have led to waste management problems in the cities of developing countries of which Ghana is no exception. Domestic solid waste management is currently a worldwide challenge in urban centres, especially in the cities and towns of the developing countries characterised by rapid growth patterns (Foo, 1997).

Major cities in Ghana are battling with waste management problem such as tons of uncontrolled rubbish; polythene bags spotted all over and waste disposal sites overflowing with refuse which creates health hazards and disease outbreak such as cholera, malaria and typhoid to the populace who live close to these dumping sites. Kumasi, the second largest city in Ghana like other cities in developing countries succumbs to this major problem of domestic solid waste and its management.

The aim of this study is to examine the perception of stakeholders on domestic solid waste management in the Kumasi metropolis. Hence the study seeks to address the following research questions:

1- What is the level of satisfaction of stakeholders on the collection of domestic solid waste?
2- What is the perception of stakeholders about solid waste management service delivery to households?
3- What is the perception of stakeholders on domestic solid waste collection charges?
4- What is the perception of stakeholders of the key constraints to effective solid waste collection?

This study contributes to the improvement of solid waste management as it affords the stakeholders of waste management especially Kumasi Metropolitan Assembly (KMA) and sanitation companies to reengineer and redesign creatively their solid waste management processes and strategies from the customer's viewpoint. The customer stands to gain if it leads to better services revealing the pitfall of the waste collection companies for rectification. Also, the study will be useful to researchers who in future undertake similar study as will serve as a source of reference.

2. Solid waste management

Solid waste management starts with disposal activities that start from point of waste generation to dumping. Hill (1997) describes the world as finite and that the continued pollution of environment will if not controlled be difficult to rectify in the future, hence the subject of solid waste management is both timely and important. Currently, the world is confronted with the challenge of dealing with solid waste, and the problem is even more serious in urban areas in the developing world with high population growth trends (Foo, 1997).

Waste has been described as anything emanating from the activities of man, which at a specific location and time, is considered to be of no value or use to the one that owns it, and it is hence discarded (Pongr´acz and Pohjola, 2004). However, solid waste is any substance that arises from animal and anthropogenic activities and which is often discarded as being without value (Tchobanoglous et al., 1993). Domestic solid waste, which is the focus for this study could therefore be described as any of the solid waste that is generated within the domestic environment.

Waste generation encompasses all activities that yield materials, which are of no value to the owner and for that reason, are thrown away or gathered together and subsequently disposed off (Momoh and Oladebeye, 2010). The world produces municipal solid waste in large quantities: the quantity generated in 2006 alone was 2.02 billion tonnes, representing an annual increase of 7% from 2003 (UNEP, 2009).

The collection and subsequent storage of solid waste is another important activity in the process of solid waste management. This generally follows the generation of waste. Prior to collection of household solid waste to disposal destinations, it is necessary to have a temporary storage for it (Tchobanoglous et al., 1993). Skips and dustbins are widely used for this temporary storage to prevent indiscriminate discarding of solid household waste (Kreith, 1994). However, there are situations where collection of solid waste from residential and commercial areas is done in concrete-made receptacles which are strategically positioned, and waste conveyed by trucks at periodic intervals to prevent overflow of waste (USPS, 2000).

Kreith (1994) describes this conveyance (transfer and transport) of solid waste as involving two stages which include waste transfer from smaller collection vehicles to relatively larger trucks as the first stage and second stage being the hauling of the waste, generally covering longer distances to the final sites of disposal. Residential facilities in some developed countries such as the United States enjoy collection services mostly in the form of curb, "set out-setback" and "backyard carry". These systems, although appropriate, are likely to require huge financial commitments to put them in place and this may pose a challenge to a less developed country such as Ghana.

Processing and recovery of solid waste are essential processes in solid waste management. It encompasses all the various technologies, and facilities used to make other operations more efficient. It also includes the resources and technologies for the recovery of reusable materials, manufacturing new products or generating energy from the solid waste (Tchobanoglous et al., 1993). The process of recovery involves separating the different components of the solid waste during which valuable resources are recovered from the solid wastes at transfer stations or solid waste processing plants (Enayetullah et al., 2005).

The management and the governance of urban development is an essential tool for the governance of a whole nation (Gough, 1999). However, problems and constraints of waste disposal continue to increase in the developing parts of the world given increasing urbanization. This points to the fact that governance in these parts are less effective (Asase et al., 2009). In many solid waste management systems, solid waste, regardless of its type usually ends up in landfill sites.

There are many solid waste management methods, which vary with respect to types of waste and prevailing local conditions. These conditions also influence the choice of final disposal practice in a given situation (Centre for Environment and Development, 2003). This process (solid waste disposal), and for that matter what happens at the disposal sites is very important since careless handling of waste at such site can result in health problems for the public (Nordberg, 1990; Henry et al., 2006).

2.1. Policy and regulation on solid waste management

Although Ghana's Environmental Protection Agency (EPA) has the legal mandate to regulate waste related activities, the Local Government is in charge of managing waste and this duty is discharged through the Assemblies in the various districts, municipalities and metropolises through their departments specially designated for managing waste (MLGRD, 2004).

Collection of solid waste in Kumasi is therefore undertaken by the Kumasi Metropolitan Assembly (KMA) and other private institutions mandated by KMA (such as Zoomlion Ltd.). About a decade ago a national environmental sanitation plan was developed with the aim of creating a healthy environment within settlements. As a result, the individual local governments were mandated to come up with strategic plans for undertaking the activities prescribed by the policy (Japan International Cooperation Agency, 1999).

Currently, the Environmental Protection Agency Act of 1994, the Pesticide Control and Management Act of 1996 as well as the Act establishing the local governance system are the major legislations that regulate the handling and disposal of harmful waste in Ghana (MLGRD, 2004). In addition, there are separate guidelines developed for the disposal of biomedical waste and for landfill management and development.

The National Environmental Sanitation Policy (NESP) is another important guideline for managing waste in Ghana, and the Environmental Action Plan serves as the parent document from which these regulations originate (MLGRD, 2009). Considering the various laws and policies laid down by the government and its regulatory agencies, it might be concluded that Ghana has no problem with waste management. However, because of problems and issues in implementing policies such as inadequate funds, unskilled and weak institutions, garbage continues to be a serious urban problem in Ghana (Boadi and Kuitunen, 2004; Asase et al., 2009).

2.2. Customer satisfaction of domestic solid waste collection services

According to Mittal and Kamakura (2001), customer satisfaction is an essential factor in formation of customer's desires for purchase. Hence, the satisfied customers will probably talk to others about their good experiences. Although satisfaction has been defined as the difference between expectation and performance, there are differences between quality and satisfaction.

Customer satisfaction explicitly includes elements related to customer value and customer loyalty. Satisfaction is a necessary, but not considered as a sufficient condition to establish customer loyalty (Brandt, 1996). According to Brandt (1996), customer loyalty is not repeated use of a product or service. Many customers may repeatedly choose a service because of convenience, necessity and/or habit. If substitutes become available, these customers may swiftly change to that service or mode.

Fauziah et al. (2007) have reported that customers are highly satisfied with solid waste management services in Malaysia. Akaateba and Yakubu (2013) have reported that customers especially households are moderately satisfied with most waste management services delivered by Zoomlion Ghana Ltd in the Wa Municipality indicating an acceptable level of service delivery.

2.3. Constraints to effective solid waste management

Inadequate human and financial resources, coupled with the existence of weak institutions are key problems facing solid waste management in Ghana (Boadi and Kuitunen, 2004). In many parts of the developing world, money for solid waste management often comes from the government through special taxes and development levies, but the funds provided by the governments of these developing states have often been woefully inadequate (Parrot et al., 2009).

The sharp disparity among different classes of settlements results in a situation where household collection of solid waste is only available to a few high class and middle class settlements (i.e. settlements with well-organized built environment and residents mostly being of high socio-economic statuses) that form the minority of the public (Boadi and Kuitunen, 2004; Asase, et al., 2009). A greater number of the people who happen to stay in low class settlements therefore have no access to these collection services, leading to irresponsible waste disposal behaviours (Boadi and Kuitunen, 2004).

In brief, it could be said that solid waste management activities which are not well planned, together with limited technology and equipment are part of the major challenges facing solid waste management in Ghana (MLGRD, 2004; Boamah, 2011). Other challenges include inadequate personnel with expertise in managing solid waste, lack of sites and appropriate facilities for proper solid waste disposal and a bad attitude of the public towards environmental sanitation (MLGRD, 2004). Parrot et al. (2009) on their part contend that with similar socioeconomic structures, developing countries are likely to face similar challenges in their efforts to manage domestic solid waste effectively. They further suggested that in many cases, inadequate funding, institutional obstacles as well as inappropriate logistics and infrastructure have been mentioned as the main constrain.

2.3.1. Funding of solid waste management projects

For many of the less developed nations, the government through special taxes and development levies usually provides money for solid waste management but the funds given by governments normally happen to be far below the needed amounts (Parrot et al., 2009). Solid waste management in Nigeria and Cameroon, for instance, is funded through sanitation and waste collections taxes, respectively (Agunwamba, 1998; Parrot et al., 2009).

In some cases, the central governments provide an amount of money to support the revenue from the taxes which are usually administered by the local governments (Agunwamba, 1998). Also, in some countries, waste collection fees are collected directly from households and this system has often led to low collection in areas of low socioeconomic status (Al-Khatib et al., 2007). These systems are usually ineffective because they do not take into consideration the different solid generation levels of individuals (Parrot et al., 2009).

Moreover, the small budgetary allocation for solid waste management is often for collecting and transporting the waste without considerations of recycling and treating it (Vij, 2012). It has been observed that governments' provision of waste management services to the public have usually not worked well, hence the need to involve private entities (Kinley, 1992).

2.3.2. Institutional constraints

This constraint usually results from the unclear assignment of duties to institutions in the sector. This brings about overlapping responsibilities and confusion in the course of executing work (Parrot et al., 2009). Often, agencies involved in this service provision are owned by the state and are inefficient (Agunwamba, 1998). Well-trained labour is lacking in this sector and so making effective solid waste management hardly attainable in the developing world (Agunwamba, 1998; Asase et al., 2009). Also the poor management of solid waste in the developing countries could partly be attributed to the absence of well built and maintained road (Parrot et al., 2009).

3. Methodology

The study was carried out in four sub-metropolitan areas (Oforikrom, Bantama, Asokwa and Nyiaeso) in Kumasi. These sub-metros were randomly selected out of the nine sub-metros. The sample size for the study however consisted of 210 participants comprising of 50 respondents (households) from each of the selected sub-metros, 2 members of staff from each of the waste collection companies in each sub-metros and 2 members of staff from the waste department of the Kumasi Metropolitan Assembly (KMA). Convenience sampling approach was employed in selecting the households and the respondent from each household. The staffs from waste management companies and KMA were purposively selected to allow the researcher to gather the appropriate data for the study.

The data were obtained through the use of interviews and semi-structured questionnaires. Before the development of the questionnaire instruments, the study sites were visited to gather first-hand information about how solid wastes are been managed. There was also an informal discussion with staffs of the KMA's waste Department and waste collection companies to understand the key variables to include in the questionnaire instrument and interview guide. The questionnaire was pre- tested, refined and finally administered through personal contact by the researcher. Informed Consent information was attached to each questionnaire. An in-depth interview was carried out to gather data from the staffs of the waste collection companies and KMA by the help of interview guide. The gathered data was analysed using SPSS (version 16) and the results were presented using tables.

4. Results and discussion

4.1. Level of satisfaction in domestic SWM in the Kumasi metropolis

The first research question was answered by addressing issues relating to frequency of waste collection from the study area which consequently result in whether the waste container overflows or not.

It was realized that the frequency of waste collection depended on the community and the location of the house within the community. For the house-to-house collection method, motorist collects refuse every day from areas where the roads are easily accessible. On the other hand, the households sent their refuse to the

skip container every day for the communal collection (skip container in the neighbourhood). Everyday collection of domestic solid waste was the most prevalent in all the four sub metros. There is also the situation of every 3 days and once a week collection in Kumasi.

The interviews revealed that, domestic solid waste is collected from transfer sites in skips, and individual households. These transfer sites are where skips are located for residents to dump their waste in the communal collection. From the transfer sites, the waste is transported from the Sub-Metropolitan areas to a landfill site at Oti, a community on the outer part of Kumasi. In the case of zones where the house-to-house system worked, the transfer sites were locations where small collections from individual households were accumulated and subsequently carried to the landfill by heavier vehicles.

In the case of the house-to-house collection system, the creation of transfer sites is likely to speed up work. This is because, instead of having to transport small quantities that are collected from households to landfill sites before returning to repeat the process, collected waste is accumulated at these transfer sites. Larger vehicles are then used to convey waste to landfill sites.

Furthermore, the Waste Management Department of the KMA indicated that the communal skips were cleared every day while the house-to-house collection was done weekly. However, it was conceded that these collection schedules were not always met due to logistic and financial constraints faced by the Department. This is consistent with Asase et al. (2009) who reported that weekly collection for house-to-house is consistent with the frequency indicated by the KMA. For the communal collection, most of the respondents sent their waste to the communal site every day.

Respondents gave various frequencies at which waste was disposed from their houses. This ranged from daily to more than once a week, with the highest number of respondents having weekly collection for the house-to-house and the least number of respondents having everyday collection, which affirms the scheduled weekly collection data reported by the Kumasi Metropolitan Assembly for all house-to-house collections.

The study further showed that the overflow of waste containers depends on the frequency of waste collection from the communities and capacity of the waste containers to accommodate the solid waste generated. In areas where the wastes were collected daily there were no issues of overflow. On the other hand overflow occurred in situations where the wastes were collected three times or once a week. Such situation poses health challenge to the community especially houses closer to the waste collection container.

4.2. Stakeholders' perception of solid waste management service delivery

At this point of the research, the respondents were to indicate their views on the quality of refuse collection services in their sub metros. Table 1 shows the elements used to determine the quality of service and respondents perception on each element.

The Mean score shows that the items 'Reliability of refuse collection', 'Neatness of refuse collection crew, wearing of protective clothing', 'Neatness of waste collection vehicles' and 'Behaviour/ attitude of collection crew towards residents' were significant and the standard deviations indicate less dispersion in the opinions of the respondents except the case of the 'neatness of waste collection vehicles'. On the other hand the items

'Sanitary conditions at bin/container site' and 'Quick response to residents' complaints' were found not be significant with means the score of 2.90 and 2.63 respectively and standard deviations of less than 1.5. This means that response to complaints was not quick and sanitary conditions at the bin sites were poor. It was also realized that 90 of the respondents did not answer the questions under the service delivery section because the households do not patronize the waste collection services and hence they did not know about the quality of collection services. They however indicated that, they either burnt or buried their refuse in their backyard.

Table 1. Respondents Perception of SWM Service Delivery

Elements of service delivery	Mean	Std. Deviation
Reliability of refuse collection	3.65	.672
Sanitary conditions at bin/container site	2.90	.649
Neatness of refuse collection crew, wearing of protective clothing	3.21	.987
Neatness of waste collection vehicles	3.50	2.976
Quick response to residents' complaints	2.63	.765
Behaviour/ attitude of collection crew towards residents	3.65	.783

The interview conducted showed that the services delivered by the private waste management companies to households in the study area is not the best. But there is little they can do because the government does not pay them early enough and hence they lack sufficient logistics to enable them adequately serve their customers (households).

4.3. Method of waste disposal

The study shows that the major methods of domestic solid waste disposal in Kumasi are House-to-House; Communal Collection; Open dump (waste is not collected); and Burning. However communal waste collection was found to be the most preferred means of waste disposal since in some cases, this method has no or very little disposal fee compared to house-to-house method. This is consistent with Anomanyo (2004)

views of waste disposal method that exist in other parts of Ghana, such as Accra and urban centres in other developing countries (Kumar et al., 2009; Parrot et al., 2009).

4.4. Stakeholder perception of SWM charges

The respondents were asked about their perception of solid waste collection charges. The study showed that majority of the respondents see the solid waste management charges to be high indicating that they were concerned about the current charges for the collection of waste. This is consistent with Al-Khatib et al., (2007) assertion that high waste collection fees has often led to low collection in areas of low socioeconomic status. Asase et al. (2009) adds that high fees do not favour the poor or low income areas and so there is a high tendency that waste collection services in these areas would be low.

The responses of the interview conducted indicated that, the amount charged for the collection depended on the quantity of refuse and the bargaining power of the person disposing off the waste. This situation gives an indication of a disorganized collection system in some of the sub-metros. This is because the waste collection company could not serve all the residents as scheduled. There were some instances where respondents within the same sub metro and even same community had different collection frequencies mainly because they were served by different collection entities, many of them being informal.

For instance, Asokwa Sub Metro had a combination of official and unofficial (not contracted by the KMA) entities that collected solid waste from households. The unofficial ones were individuals that used vehicles and sometimes motorized tricycles with container attachments to collect waste from houses. These entities collect fees ranging from 50 Ghana pesewas to 1Ghana cedi depending on the quantity of waste collected. For both official and unofficial collection, the fees were received at the time of waste collection. The residents therefore had to be present at collection time, or else had to wait until the next visit of the collector. On the other hand, the formal collection institutions had the fees for their services paid by the local authority (KMA).

4.5. Stakeholders' perception of the key constraints of effective waste management

The Kumasi Metropolitan Assembly is the public institution responsible for waste management in Kumasi. It discharges waste management duties through its Waste Management Department. The KMA's landfill manager indicated through personal communication that because the Assembly does not have adequate resources, especially in the area of equipment, it contracts some private waste management institutions to help in the official collection of waste, both from houses and communal dump sites. The private institutions assigned for the four sub metros are ABC Co. Ltd (Oforikrom), Meskworld Co. Ltd (Bantama), SAK-M Co. Ltd (Asokwa), and Kumasi Waste Management Limited (Nyiaeso). The area is zoned by the Assembly and allocated to these institutions for collection purposes.

The institutions could not collect all the waste expected and also cover their entire zones allocated to them due to challenges they face. The involvement of private institutions is expected to help make waste collection more effective (Agunwamba, 1998). The inability of the private entities in this case to serve residents adequately is likely to be the result of the failure of the KMA to pay contracted institutions regularly

to cater for operational costs. Figure 1 shows a communal collection skip in the Asokwa sub metro. The picture depicts skip containers, which have untidy surroundings. This can have negative health implications on the residents.

Figure 1. Skip containers positioned for communal waste collection

5. Limitations and future research

As observed in any study, this study was with limitations. The scope of the study is restricted to the sub-metros within the Kumasi Metropolitan Assembly of the Ashanti region of Ghana. It would have been interesting to cover more sub-metros with this study, however the study was limited to four sub-metros; the two most populated (Oforikrom and Bantama) and the two less populated (Asokwa and Nyiaeso) to enable a detailed study. Further studies are suggested, to consider other districts in the region in order to give a clear picture of the domestic solid waste management situation of the entire Ashanti Region. However, to help improve the domestic solid waste management situation in Kumasi Metropolis, some steps need to be taken to change some of the existing situations.

6. Conclusion

Domestic waste management is and has been a persistent problem confronting the people of Kumasi and Ghana as a whole. To cope with these present and future challenges of waste management, the Kumasi Metropolitan Assembly will need to play a key role in educating and creating a culture of waste reduction supported at both household and the community level. At the national level, the development and adoption of technology such as waste recycling will in long term improve the sanitation problem confronting the country.

References

Agunwamba, J.C. (1998), "Solid Waste Management in Nigeria: Problems and Issues", *Environmental Management*, Vol. 22 No. 6, pp. 849–856.

Akaateba, M.A. and Yakubu, I. (2013), "Householders' satisfaction towards solid waste collection services of Zoomlion Ghana Ltd in the Wa Municipality, Ghana", *European Scientific Journal*, Vol. 9 No. 32, 198

Al-Khatib, I.A., Arafat, H.A., Basheer, T., Shawahneh, H., Salahat, A., Eid, J. and Ali, W. (2007), "Trends and problems of solid waste management in developing countries: A case study in seven Palestinian districts", *Waste Management*, Vol. 27, pp. 1910–1919.

Anomanyo, D.E. (2004), "Integration of Municipal Solid Waste Management in Accra, Ghana: Biofactor treatment technology as an integral part of the management process", MSc thesis, Lund University, Sweden.

Asase, M., Yanful, E.K., 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*, Vol. 29, pp. 2779–2786.

Boadi, K.O. and Kuitunen, M. (2004), "Municipal Solid Waste Management in the Accra Metropolitan Area", *Environmentalist Journal*, Vol. 23, pp. 211–218.

Boamah, A.L. (2011), "The Environmental Sanitation Policy of Ghana (2010) and Stakeholder Capacity: A Case Study of Solid Waste Management in Accra and Koforidua", MSc thesis, Uppsala University.

Brandt, D.R. (1996), *Customer satisfaction index*. American Marketing Association, Chicago

Centre for Environment and Development (2003), "Study of the Attitude and Perception of Community towards Solid Waste Management.A case study of Thiruvananthapuram city-Phase II", A report submitted to Kerala Research Program on Local Level Development, India.

Enayetullah, I., Sinha, A.H.M.M. and Khan, S.S.A. (2005), "Urban Solid Waste Management Scenario of Bangladesh: Problems and Prospects", Waste Concern Technical Documentation, Dhaka, Bangladesh, pp. 18.

Fauziah S.H., Khairunnisa, A.K., SitiZubaidah, B. and Agamuthu, P. (2009), "Public Perception on Solid Waste and Public Cleansing Management Bill 2007 towards Sustainable Waste Management in Malaysia", In: Proceeding of ISWA/APSB 2009 World Congress, Lisbon, Portugal, pp. 12-15.

Foo, T.S. (1997), "Recycling of domestic waste: early experiences in Singapore", *Habitat International*, Vol. 21, pp. 277–289.

Gough, K. (1999), "The changing nature of urban governance in peri-urban Accra, Ghana", *Third World Planning Review*, Vol. 21 No. 4, pp. 397-414

Henry, R.K., Yongsheng, Z. and Jun, D. (2006), "Municipal solid waste management challenges in developing countries – Kenyan case study", *Waste Management*, Vol. 26, pp. 92–100.

Hill, M. K. (1997), *Understanding Environmental Pollution*, Cambridge University Press.

Japan International Cooperation Agency (1999), JICA Country profile on environment, Ghana. Japan International Cooperation Agency.

Kinley, D. (1992), "Kumasi's people pay for better sanitation services" *Source*, Vol. 4 No. 1, pp. 4-9

Kreith, F. (1994), *Handbook of Solid Waste Management*, McGraw Hill, New York, USA, pp. 15-21.

Kumar, S., Bhattacharyya, J.K., Vaidya, A.N., Chakrabarti, T., Devotta, S. and Akolkar, A.B. (2009), "Assessment of the status of municipal solid waste management in metro cities, state capitals, class I cities, and class II towns in India: an insight", *Waste Management*, Vol. 29, pp. 883- 895.

Mittal, V. and Kamakura, W.A. (2001), "Satisfaction, Repurchase Intent, and Repurchase Behavior: Investigating the Moderating Effect of Customer Characteristics", *Journal of Marketing Research,* Vol. 38 No. 1, pp. 131-142.

MLGRD (2004), *Sanitation Country Profile Ghana,* MLGRD, Accra- Ghana.

MLGRD (2009), National Report for Ghana Waste Management, Report presented at the 18th session of the United Nations Commission on Sustainable Development.

Momoh, J.J. and Oladebeye, D.H. (2010), "Assessment of Awareness, Attitude and Willingness of People to Participate in Household Solid Waste Recycling Programme in Ado-Ekiti, Nigeria", *Journal of Applied Sciences in Environmental Sanitation,* Vol. 5 No. 1 pp. 93-105.

Nordberg, G. (1990), "Human effects of metals in drinking water: Relationship to cultural acidification", *Environmental Toxicology and Chemistry,* Vol. 9, pp. 887–894.

Parrot, L., Sotamenou, J. and Dia, B.K. (2009), "Municipal solid waste management in Africa: Strategies and livelihoods in Yaoundé, Cameroon" *Waste Management*, Vol. 29, pp. 986–995.

Pongr´acz, E. and Pohjola, V.J. (2004), "Re-defining waste, the concept of ownership and the role of waste management", *Resources, Conservation and Recycling*, Vol. 40 No. 2, pp. 141–153.

Tchobanoglous, G., Theisen, H. and Vigil, S.A. (1993), *Integrated Solid Waste: Engineering principles and management issues*, McGraw-Hill, New York, USA, pp. 40 – 135.

UNEP (2009), Developing Integrated Solid Waste Management Plan Training Manual, Volume 2: Assessment of Current Waste Management Systems and Gaps Therein, Osaka/Shiga, Japan.

USPS (2000), *Solid Waste Management Plan for Thimphu City, Bhutan, Draft version, April 2000. Bhutan,* Urban Sector Programme Support Secretariat.

Vij, D. (2012), "Urbanization and solid waste management in India: Present practices and future challenges", *Social and Behavioural Sciences*, Vol. 37, pp. 437–447