Assessing the Challenges Affecting Solid Waste Management System in the Kumasi Metropolis

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ABSTRACT

In every aspect of human life, several unwanted materials are generated and these materials are discarded simply because they are considered waste. Waste is a serious problem in developing countries where generation of waste per unit of output is much higher than that in the developed countries because of inefficiency in manufacturing processes, bad design, and ultimately, bad decision-making. The purposes of this paper were to identify the challenges facing solid waste management in Kumasi Metropolitan Assembly and its effectsonsolid waste management practices.This research is both exploratory and causal. Out of a total population of 350 a sample size of 200 was used. Self-Administered Questionnaire instrument was used to collection data for the study. Quantitative data analysis technique (such as mean, percentages, frequencies and standard deviation) and qualitative data analysis technique (such as content analysis) were used to analyse the collected data. It was found out that, all the challenges facing solid waste management practices only institutional arrangement and adequate solid waste management laws were found not to be major challenges. The rest are all major challenges facing solid waste management practices in the KMA. On the effects, seemingly, the effect of the challenges to waste management practices leads to inefficiency in the solid waste management practices. The correlation coefficient between them is 0.51 and correlation of determination is 0.26 0r 26% meaning the higher the challenges, the higher the inefficiency in the waste management system. However, this relationship seems moderate since 74% of the inefficiencies are accounted for by other factors than those identified in this study. Based on the findings of this study, it is recommended that, the management must put measures in place to overcome the challenges facing solid waste management practices.

1.0 Introduction

Municipal Solid Waste Management constitutes one of the most crucial health and environmental problems facing governments of African cities (Achankeng, 2003). This is because, even though these cities are using 20-50% of their budget in solid waste management, only 20-80% of the waste is collected. The uncollected or illegally dumped wastes constitute a disaster for human health and environmental degradation. According to Tsiboe and Marbell (2004).the problem of waste in urban cities of Africa can be better understood in the light of recent rapid urbanization worldwide and political pressures from outside Africa to deal with the governance and management problems related to waste (urbanization creates the waste and market forces serves as a panacea to the waste problem). Whilst urbanization is not a new phenomenon in Africa, the current rate of uncontrolled and unplanned urbanization in Africa has given rise to a huge amount of liquid and solid wastes being produced, so much so that these wastes have long outstripped the capacity of city authorities to collect and dispose of them safely and efficiently (Wetherel, 2003).

Most of the cities in Ghana practice the open dump system of waste disposal, which is in a more or less uncontrolled manner. Since the system is not highly engineered, it poses numerous challenges to both public health and the environment (Abagale, et.al 2012). The city of Kumasiis estimated to generate about

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500,000kg of solid waste daily based on the2006 projected population of 1,610,867. According to Mrs. Partricia Appiah Agyei, the then chief executive of KMA, Kumasi records a current daily solid waste generation of 1,200 tonnes, from 600 tonnes in 2000 (Kumasi Metropolitan Assembly, 2013).The Waste Management Department of Kumasi Metropolitan Assembly (KMA) appears to be overwhelmed by the task of hauling all the solid waste produced in the city. The task is so daunting that KMA has become synonymous with Waste Management. In another development, Asase, et al, (2009) asserted that KMA is confronted with many challenges affecting the efficient management of solid waste in the Metropolis. If these challenges are not adequately solved, then the Metropolis will continue to witness refuse heaps, poor sanitation sites and its consequences that have bedevilled the city. The result has been the huge expenditure by both citizens and government alike on health related issues. In addition poor solid waste management practices in Ghana has led to both national and local government committing huge financial resources on providing primary health care, public health campaigns, and others. These resources thus limit the available financial commitment that could be spent on more productive sectors of the economy. It must be noted that, in today's scientific and global world, proper solid waste management practices can contribute towards the socio-economic development of cities in terms of revenue generation, conversion of waste into energy, fertilizer, among others.

It is in the light of these problems and its resultant negative effects that informed the researchers to undertake this study to look into the challenges and effects of solid waste management practices in the Kumasi metropolis and to recommend effective and efficient ways of addressing those challenges. The paper was also guided by the following questions: What are the challenges affecting solid waste management in KMA? What is the effect of the challenges on solid waste management practices of KMA?It is hoped that this paper would help the KMA particularly the waste management department and other Districts/ Municipals/ Metropolitan Assemblies in Ghana and beyond to effectively address the challenges of solid waste management and its resultant negative effect to enhance the socio economic development of Ghana. Finally, the study will contribute to existing knowledge on waste management and serve as a springboard for further studies.

2.0 Literature Review

2.1 Solid Waste Management Concept.

The business of keeping our environment free from the contaminating effects of waste materials is generally termed waste management. Solid waste management is the process of collecting, storing, treatment and disposal of solid wastes in such a way that they are harmless to humans, plants, animals, the ecology and the environment generally. The unhealthy disposal of solid waste is one of the greatest challenges facing developing countries (Kofoworola, 2007). Gbekor(2003) for instance indicated that, waste management involve "the collection, transport, treatment and disposal of waste including after care of disposal sites". Similarly, Gilpin (1996) has defined waste management as "purposeful, systematic control of the generation, storage, collection, transportation, separation, processing, recycling, recovery and disposal of solid waste in a sanitary, aesthetically acceptable and economical manner"

It can be deduced from these definitions that waste management is the practice of protecting the environment from the polluting effects of waste materials in order to protect public health and the natural environment. Thus, the priority of a waste management system must always be the provision of a cleansing service which helps to maintain the health and safety of citizens and their environment (Cooper, 1999). Further, Gilpin (1996) regards the business of waste management as a professional practice which goes beyond the physical aspects of handling waste. It also "involves preparing policies, determining the environmental standards, fixing emission rates, enforcing regulations, monitoring air, water and soil quality and offering advice to government, industry and land developers, planners and the public" (Gilpin, 1996). Waste management, therefore, involves a wide range of stakeholders who perform various functions to help maintain a clean, safe and pleasant physical environment in human settlements in order to protect the health and well-being of the population and the environment. Effective waste management is, however, a growing challenge to all municipal governments, especially in developing countries.

For the first time in the history of mankind, we are witnessing an unprecedented phenomenon in the development of places of habitat: the balance of human settlement patterns have shifted from more people inhibiting rural areas to more people living in cities (UNFPA, 2001). This is especially so in developing

countries such as Ghana. Urbanisation in Ghana has made the management of solid waste very crucial in the areas of public health and environment, especially in the capital cities, since these areas serve as the gateways to the country for foreign investors and tourists. Poor form of these cities can deter foreign investors Nevertheless; if waste is poorly managed it becomes a danger to health, a nuisance, and possibly a major social problem. In addition, waste management occupies a vital place in the economies of both developed and developing countries (Abagale, et.al 2012).

2.2 Elements/ Practices of Solid Waste Management System.

According to Wikipedia (2013).the municipal solid waste industry has four components: recycling, composting, land filling, and waste-to-energy via incineration. The primary steps are generation, collection, sorting and separation, transfer, and disposal. Asase et. al, (2009) also mentioned waste generation, waste composition, waste collection and transportation, and waste treatment and disposal as the main elements of solid waste management system. Labspace website, (2013) also gave four main components of waste management system. However, each stage with the exception of the last stage seems to have more than one activity. The stages/ components are: onsite handling, collection and processing; collection, transfer and transport of solid waste; resource recovery and processing; and disposal of solid waste. For the purpose of this paper, we consider the following main components.

2.2.1. Waste generation.

Waste generation encompasses activities in which materials are identified as no longer being of value (in their present form) and are either thrown away or gathered together for disposal. Waste generation is, at present, an activity that is not very controllable (Vergas and Techobanoglous, 2002). In the future, however, more control is likely to be exercised over the generation of wastes. Reduction of waste at source, although not controlled by solid waste managers, is now included in system evaluations as a method of limiting the quantity of waste generated (Vergara and Techobanoglous, 2012).MSW generation rates are influenced by economic development, the degree of industrialization, public habits, and local climate. Generally, the higher the economic development and rate of urbanization, the greater the amount of solid waste produced. Income level and urbanization are highly correlated. Waste generation varies as a function of affluence, however, regional and country variations can be significant, as can generation rates within the same city. Waste generation in sub-Saharan Africa is approximately 62 million tonnes per year (Stanford, 2000). Asaase et al, (2009) added that on the average, 1.2 kg per capita of household solid waste is generated in the city of London per day. The estimated daily municipal waste generation rate in Kumasi is 0.6 kg per capita. In the year 2006, a total of 267,000 tonnes of both residential (58%) and non-residential (42%) waste was managed in the city of London as against 365,000 tonnes generated in Kumasi. It is estimated that households generate the highest amount of waste in Kumasi, followed by Markets, then industries with the least from institutions although the exact proportions could not be provided. The waste generation rate in the municipality is expected to increase by 15% by the year 2010 (KMA Website, 2013). Although the per capita waste generation in Kumasi is lower than that of the city of London the large population in Kumasi makes the overall waste generated in Kumasi higher than that of London (Asaae, et.al, 2009).

2.2.2 Waste Handling, Sorting, Storage, and Processing at the Source

The second of the six functional elements in the solid waste management system is waste handling, sorting, storage, and processing at the source. Waste handling and sorting involves the activities associated with management of wastes until they are placed in storage containers for collection (Stanford, 2000). Handling also encompasses the movement of loaded containers to the point of collection. Sorting of waste components is an important step in the handling and storage of solid waste at the source. For example, the best place to separate waste materials for reuse and recycling is at the source of generation. Households are becoming more aware of the importance of separating newspaper and cardboard, bottles/glass, kitchen wastes and ferrous and non-ferrous materials (Steblin and Stanfor, 2008). Labspace, (2013) agreed that onsite means solid waste at the place where the waste is generated and residential waste means waste at home within the household. But the onsite handling is the very first step in waste management. It involves individual family members, households and communities, all of whom need to know how to handle waste properly at this level. 'Handling' means the separation of wastes into their different types so they can be dealt with in the most appropriate way. The benefits of appropriate onsite handling include reducing the volume of waste for final disposal and recovering usable materials (Labspace, 2013).Onsite storage means the temporary collection of waste at the household level. It is important that waste is stored in proper containers. These could be baskets, preferably made from locally available materials, plastic buckets or metal containers. Larger containers or dustbins, especially those used for food waste, should be leakproof, have tight lids and be long-lasting. The size of the container should be sufficient to hold at least the amount

of solid waste that is generated per day at household level. Institutions and businesses should consider having onsite storage facilities with greater capacity (Labspace, 2013).The cost of providing storage for solid wastes at the source is normally borne by the household in the case of individuals, or by the management of commercial and industrial properties. Processing at the source involves activities such as backyard waste composting (McDougall, et.al, 2001).

2.2.3. Collection

The functional element of collection includes not only the gathering of solid wastes and recyclable materials, but also the transport of these materials, after collection, to the location where the collection vehicle is emptied. This location may be a material processing facility, a transfer station, or a landfill disposal site (McDougall and Hruska, 2000). Labspace (2013) indicated that in urban centres, collection is a function that has its own process and services. Waste is collected and held at central transfer stations where waste is stored before it is transported to a final disposal site.

2.2.4. Sorting, Processing and Transformation of Solid Waste

The sorting, processing and transformation of solid waste materials is the fourth of the functional elements. The recovery of sorted materials, processing of solid waste and transformation of solid waste that occurs primarily in locations away from the source of waste generation are encompassed by this functional element. Sorting of commingled (mixed) wastes usually occurs at a materials recovery facility, transfer stations, combustion facilities, and disposal sites. Sorting often includes the separation of bulky items, separation of waste components by size using screens, manual separation of waste components, and separation of ferrous and non-ferrous metals (Steblin and Stanford, 2008). Waste processing is undertaken to recover conversion products and energy. Waste transformation is undertaken to reduce the volume, weight, size or toxicity of waste without resource recovery. Transformation may be done by a variety of mechanical (e.g. shredding) thermal (e.g. incineration without energy recovery) or chemical (e.g. encapsulation) techniques (Stanford, 2000). Labspace (2013) added that Resource recovery means finding a way to use the waste so it becomes a valuable resource, rather than just a disposal problem. This is a very important part of waste management. Resource recovery includes a range of processes for recycling materials or recovering resources from the waste, including composting and energy recovery.

2.2.5. Transfer and Transport

The functional element of transfer and transport involves two steps: (i) the transfer of wastes from the smaller collection vehicle to the larger transport equipment and (ii) the subsequent transport of the wastes, usually over long distances, to a processing or disposal site. The transfer usually takes place at a transfer station (Vergara and Techobanoglous, 2012).

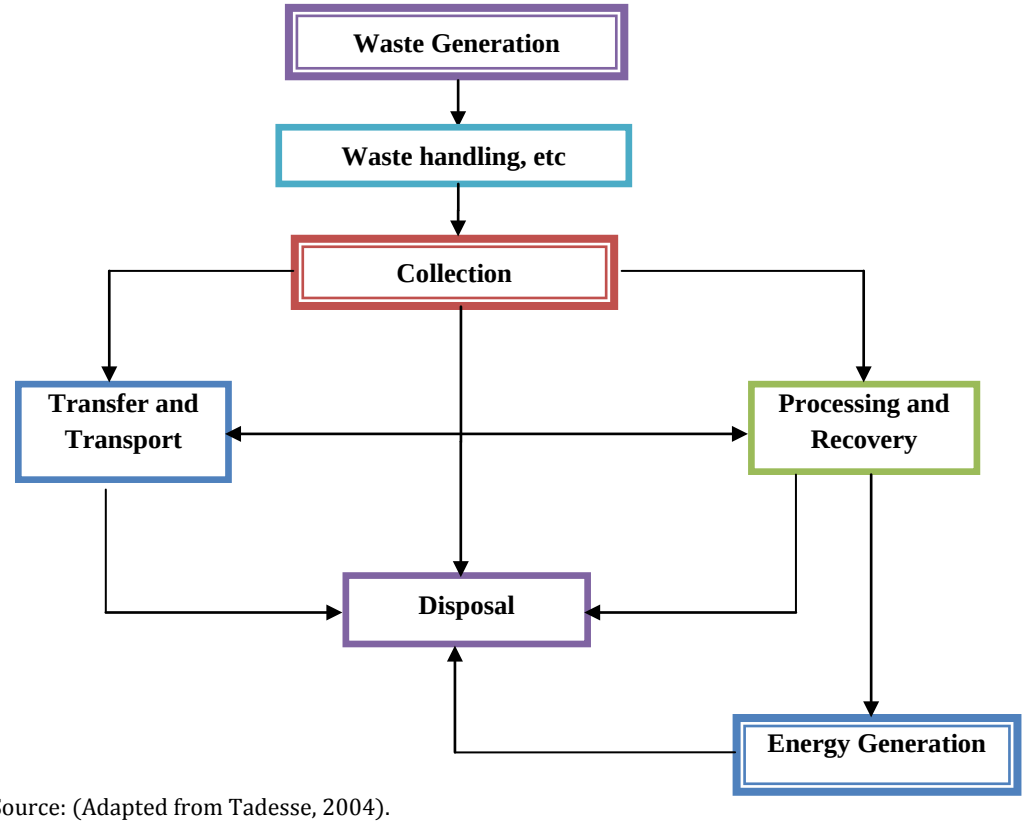
2.2.6. Disposal

The final functional element in the solid waste management system is disposal. Today the disposal of wastes by land filling or uncontrolled dumping is the ultimate fate of all solid wastes, whether they are residential wastes collected and transported directly to a landfill site, residual materials from Materials Recovery Facilities (MRFs) residue from the combustion of solid waste, rejects of composting, or other substances from various solid waste-processing facilities (McDougall, et.al 2001). A municipal solid waste landfill plant is an engineered facility used for disposing of solid wastes on land or within the earth's mantle without creating nuisance or hazard to public health or safety, such as breeding of rodents and insects and contamination of groundwater (Vergara and Tchobanoglous, 2012).

2.2.7. Energy generation

Municipal solid waste can be used to generate energy. Several technologies have been developed that make the processing of MSW for energy generation cleaner and more economical than ever before, including landfill gas capture, combustion, pyrolysis, gasification, and plasma arc gasification (Vergara and Techobanoglous, 2012). While older waste incineration plants emitted high levels of pollutants, recent regulatory changes and new technologies have significantly reduced this concern. United States Environmental Protection Agency (EPA) regulations in 1995 and 2000 under the Clean Air Act have succeeded in reducing emissions of dioxins from waste-to-energy facilities by more than 99 percent below 1990 levels, while mercury emissions have been by over 90 percent. The EPA noted these improvements in 2003, citing waste-to-energy as a power source "with less environmental impact than almost any other source of electricity" (Wikipedia, 2013).

Figure 2.1 Solid Waste Management System Model



Source: (Adapted from Tadesse, 2004).

2.10. Challenges to Urban Solid Waste Management

Researchers have identified several factors that militate against solid waste management efforts in poor country cities. Linden *et al.* (1997) identified ten common constraints/ challenges that militate against solid waste management efforts in Asian countries. These were: Inappropriate technologies/processes; Enforcement inefficiencies/non-existent; illegal dumping; Lack of financing; Lack of training/human resource; Lack of political support; Lack of legislation; Policy conflict among levels of government /overlapping responsibilities; Rapid increase in waste generation/limited data; Lack of awareness among public; and Limited land areas and land tenure issues. These factors, according to the report, frustrated the waste management efforts of municipal authorities in Asia and made it difficult for them to keep their city environments clean and safe for the populations. After studying the solid waste problem in Tanzania, Kironde (1999) has also attributed the abysmal performance of the waste sector to resource constraints including the scarcity of financial, physical, human and technical resources for the organization of waste management operations. In a study of the solid waste problem confronting the city of Kampala, Uganda, researchers from the Namilyango College (2001) identified several causes of the waste problem including the lack of dumping sites, ignorance of the masses about the need for proper waste disposal, inefficient collection methods, poor government attitude towards waste management, poverty of the people, corruption among public officials and lack of trained personnel for waste management. These have posed serious constraints to the waste sector and dampened efforts towards waste management in the city. Many other writers have elaborated on how the factors cited above (plus others) interact to aggravate the solid waste problem in poor country cities. What follows from here is a detailed examination of the factors responsible for the abysmal waste situation in poor country cities (Baabereyir, 2009).

2.9. The Effects of Solid Waste Mismanagement

Solid waste management is an important facet of environmental hygiene and needs to be integrated with total environmental planning. Its storage, collection, treatment and disposal can lead to short risks, in the long term there may be dangers arising particularly from the chemical pollution of water supplies. The

problems connected with refuse and storage in buildings were insects, rats, fire, odour, atmospheric pollution and water pollution (Anonymous, undated).

3.0 Methodology and Organisational Profile

This research was both exploratory and causal. The strategies used were survey and single case embedded studies. The case study was waste management department of KMA; the choice was made because of strategic location of Kumasi as a commercial center of the country and easy access to information. The case was important because, it is the department responsible for ensuring that Kumasi is kept clean. The population of the study was made up of the workers of waste management department at KMA. The total population was 350 comprise management staff, supervisors, and conservative workers (including sweepers, refuse truck drivers, and drain desilters). The sample size used was 200 because, according to Saunders et.al (2007) cited in Otchere et al, (2014). for a population of 400 a minimum sample size of 196 should be used to achieve a 5% margin of error. This was rounded up to 200 for both easy calculation and in anticipation of positive response. Convenience sampling method (a non-probability sampling method) was use to obtain data from the employees. This technique involves selecting samples of convenient elements by the interviewer which means that respondents were selected because they were coincidently in the right place at the right time for the questionnaire (Saunders et.al, 2007). The researchers stopped administering the questionnaires after achieving the desired sampling size. However, purposive sampling method was used for Management Staff and Supervisors. The breakdown is as follows:

Table 3.1Sample Size and Sampling Method table

Unit of Analysis (Population Groups)	Population Size	Sample Size	Sampling Method
Management Staff	15	15	Purposive
Supervisors	40	40	Purposive
Conservative Workers	295	145	Convenience
TOTAL	**350**	**200**	

(Source: Author's Fieldwork, 2013)

The sources of data were both primary and secondary. The Secondary data were sourced from the KMA web sites and diary. On the other hand, the primary source which is firsthand information from the employees directly was collected, using Self-administered questionnaire instrument. The questionnaire was prepared to elicit information on waste management variables within KMA waste management department and was conveniently distributed among the employees of that department. The researchers administered the questionnaire personally and it was easy getting access to the employees and administering the questionnaire to them. The questionnaire was developed using a Likert scale technique and it comprised twenty (20) questions dealt with the solid waste management elements or practices. For the purpose of this study, only permanent employees were given the questionnaires to fill. In order to ensure that respondents had a fair idea on the waste management practices at KMA.

All data were coded and analysis were carried out using the Statistical Package for Social Sciences (SPSS) version 16.0 and Microsoft Excel 2007 Software to measure the means of all the factors of waste management, standard deviation, correlation coefficient, frequency, and percentages. For objective 2, a cross tabulation was drawn for solid waste management practices and challenges to solid waste management practices. The challenges were considered as the independent variable with solid waste management practices treated as dependant variable. All the two hundred (200) questionnaires administered were received representing 100% response rate, since the respondents answered the questionnaires instantly because it had a very simple structure. To ensure validity and reliability, the questionnaire was pilot tested to 10 employees of KMA. This helped the researcher to correct any ambiguity. Notwithstanding, some challenges faced during the research, it did not in any way affected the reliability, validity, credibility, and accuracy of the result.

4.0 Data Presentation, Analysis, and Discussions

4.1 Challenges affecting Waste Management System of KMA

One of the reasons for the conduct of this research is to identify the challenges that confront solid waste management system in Kumasi. In order to identify these challenges 20 questions were asked under 7 categories. Each of the categories with the exception of the political factors had 3 statements/ constructs testing them. Respondents were to assess the statements using a five-point likert scale of strongly agree to strongly disagree. Strongly agree carries the highest weight of 5 score, and strongly disagree carries the least weight of 1 score as follows:

Table 4.3 Frequency Results of Factors Affecting Waste Management Survey, N= 200

Variables	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Financial Factor					
There is sufficient funds from budget to finance solid waste management (SWM)	0	0	88	40	72
Most cost of SWM is recovered	20	22	67	43	48
Adequate fees are charged for waste collection.	25	80	20	40	35
Average	**15**	**34**	**58**	**41**	**52**
Personnel Issues					
There are adequate qualified personnel in the waste sector	21	95	9	70	5
Working conditions of waste personnel are among the best	0	25	0	25	150
Waste personnel are regularly trained	0	0	29	114	57
Average	**7**	**40**	**12**	**70**	**71**
Technical Issues					
KMA has adequate sophisticated waste management equipment	15	7	66	68	44
Most equipment are in working order	0	33	89	67	11
The city is well planned with appropriate infrastructure	0	31	67	89	13
Average	**5**	**24**	**74**	**75**	**22**
Institutional Arrangements					
Several institutions or agencies are not involved in waste management	22	67	66	24	21
There is a single agency designated to coordinate the activities of waste and sanitation agencies	65	68	43	15	9
Waste management agencies have enough capacity to manage waste	10	101	22	60	7
Average	**32**	**79**	**44**	**33**	**12**
Legislation and Enforcement					
Adequate solid waste management law exist	25	175	0	0	0
The laws are not outdated	25	100	75	0	0
The laws are enforced (the law bites)	0	25	50	100	25
Average	**17**	**100**	**42**	**33**	**8**
Good Governance and Civil Society					
The citizens adequately participate in waste management decisions	0	80	41	67	12
Poverty is not high among the citizenry	0	0	22	110	68
Civil societies exert adequate influence on SWM issues	9	66	40	42	43
Average	**3**	**49**	**34**	**73**	**41**
Political Factors					
Government accord high priority to SMW	25	74	20	70	11
Waste management is among the top 5 priorities of government and KMA	75	50	25	31	19
Average	**50**	**62**	**23**	**50**	**15**

(Source: Author's Fieldwork 2013).

Table 4.4 Result of mean standard deviation, etc of Factors Affecting Waste Management Survey, of Kumasi Metropolis

Variables	N	Mean	SD	SD error of the mean	Coefficient of variation	Confidence level @ 95%	
						Lower	Upper
Financial Factors constructs							
There is sufficient funds from budget to finance solid waste management (SWM)	200	2.08	0.54	0.04	25.97%	2.01	**2.15**
Most cost of SWM is recovered	200	2.62	0.29	0.02	10.96%	2.58	**2.65**
Adequate fees are charged for waste collection.	200	3.10	0.57	0.04	18.46%	3.02	**3.18**
Average		**2.60**	**0.47**	**0.03**	**18.46%**	**2.54**	**2.66**
Personnel Issues constructs							
There are adequate qualified personnel in the waste sector	200	3.29	0.75	0.05	22.76%	3.18	**3.39**
Working conditions of waste personnel are among the best	200	1.50	0.33	0.02	21.73%	1.45	**1.55**
Waste personnel are regularly trained	200	1.86	0.47	0.03	25.19%	1.80	**1.92**
Average		**2.22**	**0.51**	**0.04**	**23.23%**	**2.14**	2.29
Technical Issues constructs							
KMA has adequate sophisticated waste management equipment	200	2.41	0.35	0.02	14.62%	2.36	**2.45**
Most equipment are in working order	200	2.72	0.55	0.04	20.05%	2.64	**2.80**
The city is well planned with appropriate infrastructure	200	2.58	0.46	0.03	17.97%	2.52	**2.64**
Average		**2.57**	**0.45**	**0.03**	**17.55%**	**2.51**	**2.63**
Institutional Arrangement constructs							
Several institutions or agencies are not involved in waste management	200	3.23	0.52	0.04	16.01%	3.15	**3.30**
There is a single agency designated to coordinate the activities of waste and sanitation agencies	200	3.83	0.71	0.05	18.51%	3.73	**3.92**
Waste management agencies have enough capacity to manage waste	200	3.24	0.79	0.06	24.54%	3.12	**3.35**
Average		**3.43**	**0.67**	**0.05**	**19.69%**	**3.33**	**3.52**
Legislation and Enforcement constructs							
Adequate solid waste management law exist	200	4.13	1.52	0.11	36.84%	3.91	**4.34**
The laws are not outdated	200	3.75	0.84	0.06	22.48%	3.63	**3.87**
The laws are enforced (the law bites)	200	2.38	0.42	0.03	17.61%	2.32	**2.43**
Average		**3.42**	**0.93**	**0.07**	**25.64%**	**3.29**	**3.55**

Good Governance and Civil Society constructs							
The citizens adequately participate in waste management decisions	200	2.95	0.64	0.05	21.85%	2.86	**3.03**
Poverty is not high among the citizenry	200	1.77	0.45	0.03	25.39%	1.71	**1.83**
Civil societies exert adequate influence on SWM issues	200	2.78	0.46	0.03	16.39%	2.72	**2.84**
Average		**2.50**	**0.52**	**0.04**	**21.21%**	**2.43**	**2.57**
Political constructs							
Government accord high priority to SMW	200	3.16	0.54	0.04	17.09%	3.09	**3.23**
Waste management is among the top 5 priorities of government and KMA	200	3.66	0.72	0.05	19.77%	3.55	**3.76**
Average		**3.41**	**0.63**	**0.03**	**18.43%**	**3.32**	**3.50**

Source: Author's Fieldwork 2013.
NB: The mean for a five point likert scale is 3.00 with a standard deviation (SD of 1.58). and a coefficient of variation of 52.67%.

4.2. Discussion of result

4.2.1 Financial Factors

From table 4.4, the construct, 'there are sufficient funds from the budget' recorded the lowest mean figure of 2.08 below the mean figure 3. This means the respondents generally disagree that KMA makes sufficient funds in its annual budget to finance solid wastes management. Most cost recovered recorded a mean figure of 2.62 also below 3. The managerial implication is that management of solid waste in Kumasi invests funds in wastes management but do not get all the investment back let alone profit. This may be consistent with the observations made during our previous work (Otchere et al, 2014) where we analyze waste management practices, it was discovered that most wastes are disposed but not converted to generate energy and other important waste recycle products which can then be sold at a profit. The Authors believe that this is the only way of recovering huge investment in waste management. On the other hand, a mean figure of 3.10 was recorded for the constructs 'adequate fees are charge', this may cover only administrative and collection costs but not capital investments. The entire construct recorded an average mean figure of 2.60 which is below 3, and a standard deviation of 0.47, standard error of mean of 0.03, and coefficient of variation of 18.46%. There is a 95% confidence level that the mean figure for the entire constructs falls within 2.54 to 2.66. The findings suggest that financial factor is a major challenge of waste management in Kumasi Metropolis. Table 4.1 confirms the assertion that KMA lacks sufficient funds to finance solid wastes management. While 93 respondents 'Agree', 49 'Disagree' and 58 remain 'Neutral'.

4.2.2. Personnel Issues.

From table 4.2, the highest mean of 3.29 was recorded on the construct 'there are adequate qualified personnel in the waste sector' with a standard deviation of 0.75. The lowest mean figure of 1.50 was recorded on the 'personnel working conditions'. The construct 'waste personnel are properly trained' recorded the mean figure of 1.86. The entire construct recorded an average mean figure of 2.22 with standard deviation of 0.51, and a standard error of the mean of 0.04. The coefficient of variation for the construct is 23.23%. There is a 95% confidence level that the mean figure for the entire construct falls between 2.14 and 2.29. The managerial implication is that personnel issues are a major challenge to solid waste management practices. It is discerning from Table 4.3 as well that personnel issues at KMA are not effective as 47 respondents 'Agree' that they are good, only 12 remain 'Neutral' and majority141 'Disagree' thatpersonnel issues are the best.

4.2.3. Technical Issues

From table 4.2, all the 3 constructs tested for technical issues had a mean figure below 3. The highest mean was recorded on the construct 'most equipment is in working order' even that, the mean figure recorded is 2.72 which is below 3. The entire construct had a mean figure of 2.57 with a standard deviation of 0.45, and a standard error of the mean of 0.03. The coefficient of variation recorded is 17.55%. There is a 95% confidence level that the mean figure for technical issue falls between 2.51 and 2.63. This implies that technical issue is a major challenge to solid waste management system in KMA. It is clear from Table 4.1

that, only 29 respondents 'Agree' that technical issue it is not a challenge, 74 remain 'Neutral' and 97'Disagree' that technical issue it is not a challenge. This confirms the assertion from Table 4.2 that technical issues are major challenge to solid waste management system in KMA.

4.2. 4. Institutional Arrangements

From table 4.2, all the constructs tested recorded mean figures above 3, with the lowest being 3.23 representing 'several institutions are not involved' to the highest being 3.83 representing 'single agencies coordinating the activities of waste management agencies'. The entire construct recorded an average mean figure of 3.43 which is above 3 with a standard deviation of 0.67. The standard error of mean recorded for the entire construct is 0.05 with the confidence level ranging from the lower mean figure of 3.33 to the highest mean figure of 3.52. The managerial implication is that institutional arrangement is not a major challenge or obstacle to solid waste management system in Kumasi. However, it must be noted that the mean figure for this factor is 3.43 which is still below 4, this clearly shows that even though on the basis of the figures recorded, institutional arrangement is not a major challenge, it cannot be totally ignored. It can be seen from Table 4 as well that Institutional arrangement was not seen to be a major challenge to solid waste management. Majority 111 of the respondents 'Agree' with the statement, 44 remain 'Neutral' and minority 45 'Disagree' with the statement. This is consistent with table 4.2 that there is moderate Institutional arrangement in place at KMA to deal with solid waste management.

4.2.5. Legislation and Enforcement

From table 4.2, the construct 'adequate solid waste management law exists' recorded the highest mean figure of 4.13 with a standard deviation of 1.52. The standard error of the mean is 0.11. The coefficient of variation is 36.84% and 95% confidence level that the mean figure for this constructs falls between 3.91 and 4.34. The managerial implication here is that KMA has adequate legal framework for regulating waste in the metropolis. On the constructs 'the laws are not outdated', a mean of 3.75 was recorded. This is above 3 with the upper confidence level being 3.87. The implication is that the laws are moderately current; however, with a construct like this, the authors were expecting a mean figure above 4 which correspond with the agreed response, this clearly shows that the laws are not all that current. On the construct 'the laws are enforced', a mean of 2.84 which is below 3 was recorded. This clearly shows that the waste management laws of KMA do not "bite" (that is are not enforced) even though, laws are adequate and not too outdated. From the above it is clear that whiles legislation is not a major challenge, enforcement is. It is evident from Table 4.1 that majority 117 'Agree' that KMA seems to have adequate solid waste management laws that are not outdated, but, these laws are not properly enforced. 42 remain 'Neutral' and 41 of them 'Disagree' with those statements. This confirms the assertion from Table 4.2 that, the KMA solid waste management laws are toothless bulldog which do not bite.

4.2.6. Good Governance and Civil society

From the above table 4.2, the construct 'the citizens adequately participate in waste management decisions' recorded a mean figure of 2.95 which is 0.05 mean figures below 3. This indicates that the citizens do not adequately participate in waste management decisions leaving management to takes decision without considering the point of view of the citizenly. A mean figure of 1.77 was recorded on the construct 'poverty is not high among the citizenly'; this is an indication that the people are generally and do not have the financial empowerment to manage their own waste generation as evidenced when testing the waste generation constructs. The mean figure of 2.78 recorded for the construct 'civil society exert adequate influence on waste issues' also indicates the lack of civil society interest in propagating the need for adequate waste management in Kumasi Metropolis. The entire construct tested had average mean figure of 2.50. This means that lack of good governance and seemingly inactivity of the civil society on environmental issues is a major challenge to waste management in KMA. Table 4.1 contradicts the assertion from Table 4.2 that KMA Lack the appropriate good governance structures to deal with environmental issues. While 51respondents 'Agree', 73 and 41 (=114) 'Disagree' and 'Strongly Disagree' respectively but 34 remain 'Neutral'. This seems there is a relatively appropriate good governance structures and involvement of civil societies to manage environmental issues of waste management practices in KMA.

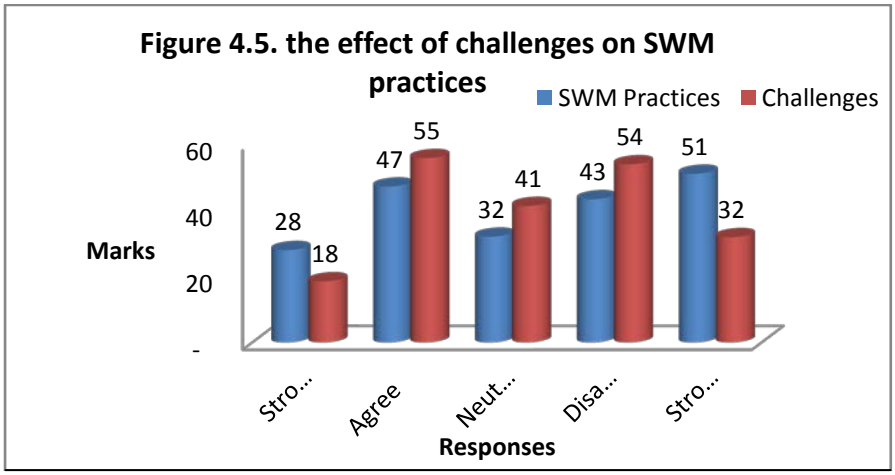
4.2.7 Political Factors

From the above table 4.2the construct 'government accord high priority to solid waste management' recorded a mean figure of 3.16 which is a little above the mean figure of 3 clearly indicates that government moderately accord high priority to waste management. On the construct 'waste management is among the top 5 priorities of government and KMA', a mean of 3.66 was recorded. This mean figure is also above 3 but

below 4. This may not be surprising because the first construct is somewhat linked with the second one. This is because if government places much priority to waste management then it must be among the top 5 priorities. The entire constructs recorded a mean figure of 3.41. This suggests that a political consideration is not a major challenge to waste management. However, going by their recorded means, it may not be far-fetched to list political will as one of the challenges confronting waste management. From Table 4.1 it is clear that majority 112 respondents 'Agree' that, Political factors were not a major challenge to waste management. However, a significant number 65 respondents 'Disagree' with the statement and 23 remain neutral. The result is a confirmation of what is seen in Table 4.1 that, both government and KMA accord high priority to solid waste management. Notwithstanding, what may be lacking is the political will.

4.3 Effect of the Challenges on Solid Waste management Practices

For this part, the effect of the challenges on the waste management practices are presented and analysed. In doing so, a cross tabulation was drawn. The results are presented below:



(Source: Author's Fieldwork, 2013)

From figure 4.5, there seems to be a relationship between solid waste management practices (SWM) and the challenges to the waste management practices. That is the challenges to the waste management practices seem to have links the inefficiency in the solid waste management practices. The correlation coefficient of solid waste management practices and challenges is 0.51. This shows that there is a positive relationship between solid waste management practices and challenges. That is the higher the challenges, the higher the inefficiency in the waste management system. However, this relationship seems moderate since it is only 0.51 out of 1. The correlation of determination between the two variables is 0.26 0r 26%. That is the challenges identified in section 4.2 influences solid waste management practices by only 26%. This means that the challenges identified in this study do not so much account for the inefficiencies in the solid waste management system of KMA. This indicates the inefficiencies in the solid waste management systems of KMA is 74% accounted by other factors other than the challenges identified in section

5.0 Summary of Key Findings, Conclusions, and Recommendations

5.1 Summary of Key Findings

The following are the summary of key findings with respect to the analysis of empirical data:

5.1.1 Challenges to solid waste management system of KMA

Stated below are the key findings with respect to solid waste management challenges: One, financial factors recorded a mean figure of 2.60. This implies that financing waste management is a major headache for solid waste managers of KMA. Two, personnel issues recorded a mean figure of 2.22. Also this shows that issues confronting waste management personnel like working condition, training, among others are not properly handled at KMA. These are both intrinsic and extrinsic factors that motivate these workforces to give out their best. Three, technical issues were also found to be a major challenge to waste management system of KMA. With a mean figure of 2.57 it indicates KMA is currently not breasting itself with modern technical and

logistical requirements needed for efficient solid waste management service delivery. Four, institutional arrangement however was also not seen to be a major challenge to solid waste management, with a recorded mean of 3.43, KMA has moderately put in place the right institutions needed to deal with the menace of solid waste.

Furthermore, KMA seems to have adequate solid waste management laws and that these laws are not outdated. This means that the laws can be applied to modern practices; however, these laws are shown to be a toothless bulldog. They do not bite. In addition, lack of appropriate good governance structures coupled with the insensitivity of civil societies to environmental issues was also detected as a major challenge to waste management practices in KMA. Finally, political factors were also detected not to be a major challenge to waste management. The result in chapter 4 shows that government and KMA accord high priority to solid waste management. However, what may be lacking is the political will.

5.1.2 The effect of the Challenges on the Solid waste management Practices of KMA

There is a positive relationship between the challenges identified in this study and the solid waste management practices of KMA. This means that the inefficiencies in the solid waste management system of KMA are partly due to the challenges identified in this study. However, the impact is moderate as itis accounted for only 26% of the inefficiencies in the solid waste management practices. This indicate that 74% of the inefficiencies in KMA solid waste management practices are due to other factors other than the challenges identified in this study.

5.2 Conclusions

From the above it can be concluded that on the challenges confronting solid waste management practices, only institutional arrangement, legislation, and political factors were found not to be a hindrance. The rest: financial factors, personnel issues, technical issues, legislation enforcement, and good governance as well as civil society inactivity were detected to be a major hindrance to solid waste management system of KMA.

5.3 Recommendations

In view of the findings above the following managerial recommendations are made:

1. KMA should put in place adequate measures to ensure that waste are properly and adequately collected as well as handled appropriately at the onsite stage.
2. KMA should put in place measures to generate energy from the solid waste generated in the metropolis.
3. KMA should look for adequate funding especially for capital projects like energy generation facilities.
4. Waste management workers issues must be appropriately handled.
5. Technical issues like sophisticated waste equipment and city infrastructure must be looked into.
6. Waste laws must be enforced; that is it should bite.
7. KMA must find ways to educate the public on how to sort (segregate) the generated at various areas in to components.
8. Government should involve the citizenly in waste management decisions and must work hard to improve the livelihood of it citizens.
9. The civil society should actively involve themselves in waste management issues.

Finally, it is also recommended that further studies needs to be conducted to identify all other factors such as behavioral attitudes and poor education other than the challenges identified in this study that leads to inefficiencies in KMA solid waste management practices.

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