Avoiding the Urban Waste Management Mess, Lessons for Emerging Cities: The Case of Ho Municipality, Volta Region, Ghana

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Abstract

This paper investigates the driving forces of waste management lapses in the Ho municipality of Ghana, and proposes solutions that would help the municipality avoid future waste management crisis. Methods used for the study include analysis of questionnaire data and field observations. Results of the study show demographic factors, logistical challenges, and human resource management weaknesses as the prime causes of unmanaged waste problems in the municipality.

Keywords: Waste types, management, health risks, municipality, drivers

Introduction

Anthropogenic activities result in the generation of waste which has health consequences and implications for ecosystems and natural resources (Vergara and Tchobanoglous, 2012). Waste management challenges in developing countries are increasingly becoming very difficult to solve due to high population growth, affluent life styles, and low level of waste management technology (Cheremisinoff, 2003).

These waste management challenges are further compounded by rural to urban migration leading to increased human waste generation and pilling up of waste on the streets, drains and domestic compounds that leach and exude bad smells (Kuma, 2004; Ogbonna, Ekweozor and Igwe, 2002; De Foe et al, 2013).

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In Ghana, evidence of waste management challenges abounds in towns and cities including the obvious accumulation of garbage in gutters and streams around neighbourhoods such as Nima in Accra (Freduah, 2005). waste may be defined as something which owners no longer want at a given time, and has no market value (WHO, 2014).. The definition of waste is however shifting towards a new perspective that regards waste products as resources that could support societies to be economically and environmentally sustainable (Graedel, et. al., 2012). This new thinking is informed by the fact that, waste products can be recycled to produce new products. In Ghana, water sachets and used plastic water bottles for example, are very much sought after by scavengers who sell them to recycling companies to make a living.

The nuisance associated with the waste generated compelled residents in Palestine to resist deposition of waste in their neighbourhoods (Al-Khatib, et al, 2014). To address neighbourhood resistances, most waste management reports suggest that garbage produced and collected should not just be deposited but, treated, recycled, buried, or transported outside communities (Denison 1996; Manfredi et al., 2010 and Cheremisinoff, 2003). This option can best be implemented when waste is sorted into component parts for recycling such as separating kitchen waste from metal, plastic, glass and garments as in Shanghai, China (An, et al., 2014).

Even though African countries are desirous of managing their waste sustainably, their desires are often not achieved due to challenges. In view of the challenges, municipal and metropolitan authorities had to educate citizens on how to handle waste by sorting before dumping, but such efforts have not yielded the desired results. Waste continues to accumulate where they ought not to be (de Araúújo and Costa, 2006). As a result, heavy budgetary allocations made to clear waste are often exceeded annually without the problem being fully addressed (Guerrero, Mass and Hogland, 2013).

Problem statement

Waste management is a major challenge confronting Ghana's municipal and metropolitan authorities such as the Accra, Tema and Kumasi metropolitan areas where other competing needs make it difficult to raise adequate financial resources to manage waste (Oten-Ababio, 2010b).

The Local Government Act 462, makes it mandatory to decentralize waste management for the sake of efficiency in waste management among citizens, communities, private sector enterprises, NGOs and Government institutions (Ministry of Local Government and Rural Development, 2010). In spite of the Act, cities are still grappling with waste management problems. In Accra, for example, 2000 metric tons of waste is generated daily, but, only 1,200 – 1,300 tons are properly collected (AMA, 2009a) and in Kumasi an estimated 600 tons of solid waste is produced daily (Post, 1999).

Tamale, a fast growing city in the Northern Region which was adjudged in 2005 and 2008 as the cleanest city in Ghana is becoming a slum associated with waste problems especially in communities such as Changli, Aboabo, Dabokpa and Zogbeli (Gyebi, 2012). A fundamental reason for the failure in managing waste is the lack of accurate data on the quantity and composition of waste in cities (Earth Institute Columbia University, www.earth.columbia.edu). In Kumasi for example, improper planning, inability to forecast and quantify future solid waste generation is identified as a major reason for the waste management challenges (Owusu-Sekyere, Harris and Bonyah, 2013). In the Ho Municipality, residential and commercial areas generate 65 tons of waste daily, but only 42 tons are disposed off. The remaining waste are found in drainage channels and water ways that are over grown with weeds (UN-Habitat, 2009).

The 65 tons of waste produced in Ho compared to 2000 and 600 tons produced in Accra and Kumasi respectively show waste generation in Ho is low and can be managed better. This development rises the question to what extent can the Municipality learn from the case of Tamale to prevent future waste management problems given that the services sector is expanding and attracting more migrants to the Municipality.

Attempts to manage waste in the Municipality involved providing garbage collection service points termed block collection of waste. Though a good initiative, smaller volume receptacles used for waste collection make it impossible to clear all the waste resulting in persistent pilling of garbage in front of houses. Furthermore, waste collection schedules, and logistics needed to evacuate waste are far below what is required, hence the consistent backlogs of waste in the municipality.

Residential areas located at outskirts of the municipality operate community open pit landfills managed through burning of garbage to reduce accumulated waste. This practice comes along with air pollution that spreads hazardous combustion products such as carbon monoxide, sulphur dioxide, oxides of nitrogen, halogenated carbons, polyaromatic hydrocarbons, and particulate matter into the atmosphere due to the mixture of different waste materials. Other effects of poor waste management in cities include breeding and spread of insects and diseases Manfredi et al., (2010).

Materials and Method

Research instruments used were informal interviews and questionnaires comprising 53 households and waste management companies in communities such as Ahoe, Bankoe, Dome, Zongo, and Klefe Achatime, Mawuli Estate, Ho Polytechnic, SSNIT Flats, Maryland, Dziedzorm, Voradep Village, Medical Village, Awudome, Areas 51, 52 and 53. Questions were based on causes of waste management problems, public suggested solutions, administrative issues, logistical challenges and personnel management issues in the Municipality. Simple random sampling method was used to select respondents. Relationship analysis was based on comparison of changes in one or more independent variable resulting in changes in another dependent variable which is termed causes and effect analysis (Saunders et al., 1997).

To identify the factors that affect the probability of garbage spill over in a given community, and attitude towards proper waste disposal issues, the Linear Probability Model (LPM) was used. The LPM allows for the estimation of a linear regression model to determine variables that have statistically significant impacts on observance of garbage spill overs, and inappropriate waste disposal (littering).

The estimated LPM for spillage is specified as,

$$Spillage = \beta_0 + \beta_1 \text{mod} \, erate \; growth + \beta_2 high \; growth + \beta_3 pay \; for$$
$$disposal + \beta_4 visitors + \beta_5 neighbourhood \; category + \beta_6 privatized$$
$$collection + \beta_7 recyclable \; trade + \varepsilon \quad \ldots\ldots \quad (1)$$

In equation 1, spillage is defined to be equal to 0 if there is hardly any waste spillage from receptacles in respondent's community and equal to 1 if there is frequent waste spillage. Where ε is the error term and the betas ($\beta_1 - \beta_7$) measure the marginal impact of the explanatory variables on probability of observing spillage.

The moderate growth variable *moderate growth* is defined to be equal to 0, if no growth has been observed in the settlement size in the past three years and equal to 1 for moderate growth. *High growth* is defined to be equal to 0, if no growth in settlement size has been observed and equal to 1 for high growth. Payment for waste pickup and disposal from homes *pay disposal* is defined to be equal 0 if respondent does not pay for home pick-up and equal to 1, if respondent pays for home pick-up of waste. *Visitors* is defined to be equal to 0, if respondents do not often receive visitors that stay for more than two days and equal to 1, if respondents receive visitors often.

Neighbourhood category refers to non residential, which equals 0 and residential is defined to be equal to 1. The privatized collection variable *privatized collection* is defined to be equal to 0, if no improvement in waste collection has been observed, and equal to 1, if improvements have been observed. *Recyclable trade* is defined to be equal to 0, if respondents have never traded in recyclables and equal to 1, if respondents have traded in recyclables.
The estimated LPM for the waste disposal model is specified as,

$$
\begin{aligned}
disposal = \alpha_0 + \alpha_1 \bmod erate\ growth + \alpha_2 high\ growth + \alpha_3 pay\ for\\
disposal + \alpha_4 waste\ management\ education + \alpha_5 neighbourhood\\
category + \alpha_6 privatized\ collection + \alpha_7 recyclable\ trades + \alpha_8 waste\ management\\
education + \varepsilon
\end{aligned}
$$ …………... (2)

Where ε is the error term and the alphas ($\alpha_1 - \alpha_8$) measure the marginal impact of the explanatory variables on probability of inappropriate waste disposal (littering). Disposal is defined to be equal to 0, if respondent admits to littering and equal to 1, if respondents report practicing proper waste disposal.

Results

Analysis of survey results focus on thematic areas such as, sources of waste, logistic challenges, inconsistencies in waste collection schedules and the effects of waste accumulation on the people and the environment.

Sources of solid waste identified in the Ho Municipality are households (3.8%), restaurants (1.9%), schools (1.9%), hotels (26.4%) and hospitals. Of all the waste sources, households are the biggest generators of waste, followed by schools and hotels respectively. The least source is the health sector comprising hospitals and clinics as there are only two hospitals in the Municipality and few clinics producing solid, liquid and chemical wastes. In attempt to determine which of these waste categories pollute the environment most, solid waste came first, (77%), sewerage second with (19%) and chemical waste as the least pollution source (4%).

Disposal of waste in the Ho municipality is by the open method as trucks haul solid waste from collection points and spread the waste on open sites using bulldozers and compacters. To improve upon waste management, the municipal authority decided to register individuals and organizations to provide waste collection services, but only few households, (37.7%) registered for their waste to be collected while majority of them (62.3%) prefer to manage their own waste as they reside at newly developing sites with vast undeveloped plots surrounding them on which they damp their waste. In other instances, waste is damped on house compounds and covered daily with fresh layer of dirt. This disposal mode is deemed by residents as cost effective since they do not pay for waste collection.

Analysis of seven variables to determine the causes of waste spillage problems using the Linear Probability Model has provided statistical reasons to explain the problem. Out of seven variables in equation 1 of the Linear Probability Model two have statistically significant effects on the probability of spillage and equation 2 regression model indicate that community expansion, payment for waste pick-up and disposal, and education programs on proper waste disposal are statistically significant in explaining improper waste disposal. However, high growth in community size and the other significant relationships reduced the probability of improper waste disposal by 43% because of the self-managed waste system that is being practiced in the Municipality.

Table 1: Regression model results of waste spillage.

Spillage	Coef.	Robust Standard Error	t	P>|t|
High growth	-0.164	0.207	-0.79	0.433
Moderate growth	-0.019	0.213	-0.09	0.930
Pay for waste	0.388	0.114	3.41	0.001
Visitors	0.100	0.130	0.77	0.443
Neighbourhoods	0.182	0.148	1.23	0.224
Privatised waste collection	-0.011	0.123	-0.09	0.928
Recycling	0.260	0.124	2.10	0.041
Constants	0.520	0.210	2.47	0.017

Further statistical analysis reveal that (Figure 1), (24.5%) of the respondents rated refuse spillage in
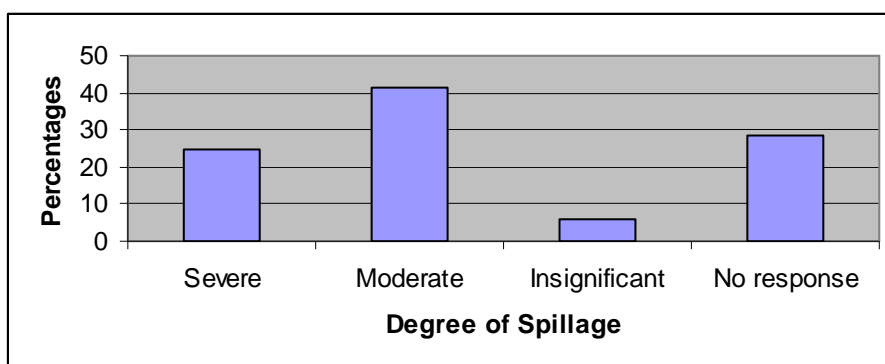
Figure 1: Rate of refuse spillage in the Municipality.

The Municipality as severe; 41.5% as moderate; and 5.7% as insignificant, while 28.3% did not respond to the questions. A test of hypothesis on causes of spillage produced a mean of 0.4634696 showing most respondents view waste spillage as a major cause of littering. The diverse opinions expressed on waste littering was enforced by 45% of respondents who admitted littering streets at least once, but, justified such actions by lack of litter bins provided along streets and 55% never dropped any litter on the streets. The fact that 55% of respondents never littered the streets show a high level of awareness on avoided waste spillage among the sampled population.

This level of awareness suggests that refuse found on the streets may not necessarily be generated by pedestrians, but from other sources such plastic bags carried by wind.

Population growth and waste management companies

Population growths coupled with infrastructural development were identified as key drivers of waste generation in the Ho Municipality given the increases in waste over the decades. The population increase and density of the Ho District from 30 persons per square kilometre in 1970 to 79.5 per square km in 2000 show clearly the extent to which population density may have contributed to waste generation given the increase in population from 235,331 in 2000 to 271,881 in 2010 (Ghana Statistical Service, 2012).

Client satisfaction with services provided by private waste management companies was rated as excellent by only 5% of respondents, 33% rated service quality as good, 38% as reasonable and 24% as poor. As far as the waste collection services of Ho Municipal Assembly are concerned, 76% of the clients were satisfied with the quality of service delivery, while 24% were not satisfied (Figure 2).
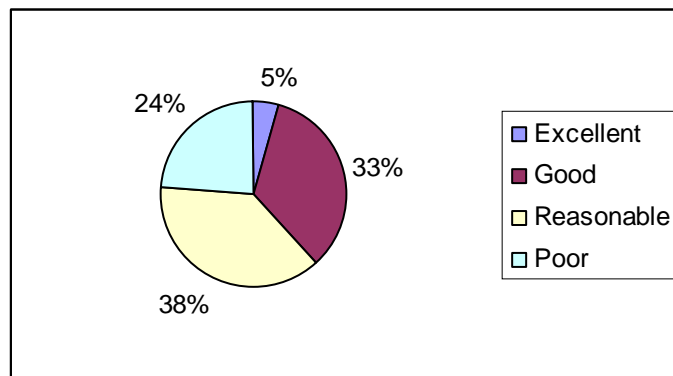

Figure 2: Service quality response of HMA clients

The positive rating for waste collection suggests the Ho Municipal Assembly is performing better than private companies. It is likely however, that when the quantity of waste increases in the future, it may be difficult to handle when better management measures are not put in place now.

Waste types

The kinds of waste disposed off comprise food waste (35%), plastics, (27%, glass (14%) and paper (21%). In neighbourhoods where animals are kept, there are no traces of left over foods and peels of food items as they get consumed by the animals. Leather items such as old bags and shoes contribute less to waste generation in the Municipality because such products have long life spans, hence are used for longer periods before they are disposed off. About half of plastic wastes in the Municipality are burnt in the open while the remaining are either recycled or buried in pits. The practice of waste separation in the Ho municipality is non-existent as residents do not separate their waste before dumping in bins as such; all kinds of waste including plastics, glass, wood, kitchen waste, leather and paper are all put into the same container (Figure 3).

Wastes in dustbin	Plastics	Glass	Wood	Kitchen	Leather	Paper
■ Series1	27	14	7	35	5	21

Figure 3 Categories of waste produced.
Source: Adanu, 2012

Recycling of waste is low as only 30.2% of respondents ever sold waste materials for recycling compared to 69.8% who never sold waste for recycling such as the sale of scrap metals (Table 2).

Table 2: Trading in recyclable waste materials.

Responses	Frequency	Percentages
Yes	16	30.2
No	37	69.8
Total	53	100.0

Source: Adanu, 2012.

Work conditions

The conditions of service for workers in the waste management sector can either serve as motivation or disincentive to work depending on whether workers get paid based on their qualification and are promoted promptly when due for promotion. Out of ten workers assessed by questionnaires two got promoted for more than three times (13.3%), during their working life, one person got promoted twice (6.7%), four workers were promoted once (26.7%) and three had no promotion as they had worked for only a year (53.3%). The four who were promoted have Higher National Diploma qualifications while the three who got no promotion have Junior High School (JHS) and Senior High School (SHS) certificates.
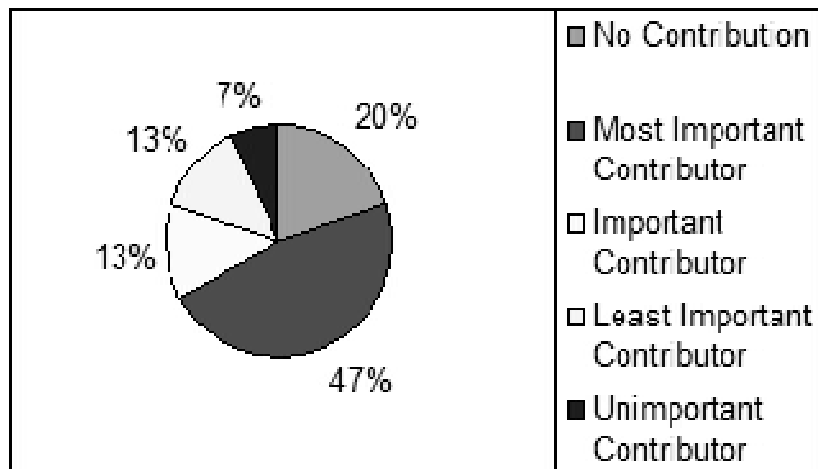

Figure 4: Relationship between salary and waste accumulation.
(Source: Adanu, 2012).

Further analysis based on opinions of residents to questions regarding poor salary as a cause of bad waste management practice reveals that majority of respondents 47% believe low salary contributes to waste accumulation while the minority (20%) are of the opinion that low salary does not influence service delivery and pilling up of waste in the municipality. The problems get compounded when waste collectors do not have the capacity to take administrative decisions in case they have to take quick decisions, as they are mandated to consult their superiors which sometimes delay waste collection in times of emergency when managers are not available to give orders for work to be done.

Transport and Logistics

It is also evident that waste management equipment's such as roll-roll, skip and compactors have maximum capacities that cannot be exceeded such as $8m^3$ or 2160 kgs that can't be extended for carting waste. The cost of logistics is consistently high as such containers are being placed closer to road networks instead of residential buildings to cut cost. To boost waste collection, three (3) new trucks were purchased by the Municipal Authority as a show of commitment to managing accumulated waste but more is expected from the Municipal Assembly.

Effects of Waste Accumulation

Waste accumulation and spillage due to delays in waste collection results in breeding of insects such as houseflies and rodents that disturb residents and contribute to the spread of preventable diseases. Littering of residential areas with black plastic bags blown by the wind, due to late collection of garbage and spillage of waste containers degrade the physical beauty of the environment.

Discussion

Multiple waste types generated in the Ho Municipality from residential, and commercial sources show solid waste is of utmost concern as piles of waste produced are not collected on time due to the sheer waste volumes and logistical constraints. To resolve this efficiently better waste disposal options other than using open sites are required to avoid spillage of waste into drains and around neighbourhoods.

None collection of waste contributes extensively to piles of garbage in cities that have health risks (Gutberlet, 2013). Persistent increases in the Municipal population may contribute to land scarcity for waste disposal in the future when much of the land is used for infrastructural development. This scarcity may compel people to dump refuse in gutters and open spaces such as in other parts of the world, for example, Laogang in Shanghai, China (Hoornweg, Bhada-Tata, and Kennedy, 2013).

Efficiency in waste management requires education of the public to separate waste into organic, plastic, glass, and textile and leather categories for easy recycling. Separated waste then becomes industrial raw material for production such as sachet rubber processing, and the processing of kitchen waste to manure for farming and horticulture. Waste separation at source in households was suggested for the Kumasi Metropolitan area (Asase), 2011 a suggestion that is equally useful for the Ho Municipality.

Waste generation in the Ho Municipality is not out of control as is the case of Kumasi and Accra in terms of meeting waste collection schedules. There is the likelihood however; that any further increases in waste generation without the corresponding capacity to collect the waste could create filth in the municipality. To effectively manage the waste, there is the need for partnership between government agencies and private companies to deal with the problem.

This collaboration will require long and short term management strategies for the next decade such as acquiring land fill sites at strategic locations before the present land fill site gets full. The World Bank recommends formulation of long-term goals that are based on local urban needs developed as medium- and short-term action plans. Such action plans should have activities tied to specific people for execution (World Bank, 2011). Further recommendations of the World Bank are capacity building of staff and providing the financial resources needed for work delivery. In doing so, city authorities should be mindful of the poor and consider their ability to pay waste collection fees before charging them (World Bank, 2011).

Poor salary earnings among workers of waste management companies de-motive workers in developing countries (Kuma, 2004). The lukewarm attitude to waste collection due to poor salary may continue to negatively affect waste collection in Ho if this is not addressed in time.

Conclusion

The study result show population growth, transport, logistical challenges, and human resource issues are the key drivers of waste management challenges in the municipality. These challenges make it difficult for waste collectors to meet their waste collection schedules and targets even though the tonnage of waste generated is not as huge as in Acrra, especially when newly developing areas in the Municipality dispose of waste in their backyards. Effects of waste disposal challenges include littering of the environment, breeding of insects and pests that contribute to preventable diseases in the municipality.

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