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Determinants of Poor Waste Management in Ghana; Challenges and Health Implications

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Abstract

The purpose of the study was to analyze the underlying factors affecting effective solid waste management in the Ghana using the Tamale metropolis as a case. Solid waste management has become a major development challenge in Tamale Metropolitan Assembly (TAMA) in recent times. This deserves not only the attention of the Metropolitan Assembly and the waste management institutions but also concerns of corporate organizations and individuals to find a lasting solution to the problem. Therefore, with the aid of concurrent mixed method design, three main techniques employed in gathering the primary data were: preliminary field investigation, questionnaire survey and face-to-face interview. Findings of the study established that factors affecting effective solid waste management in the Metropolis included inadequate skip supply for storing waste, lack of routine collection of waste and poor methods of waste management. The study also concluded that there were inadequate resources for waste management institutions to effectively collect the waste generated. In the light of these problems enumerated above, the research recommended the adequate supply of skips, regular collection of waste, use of Integrated Solid Waste Management Model (ISWM), proper management of the landfill and adequate resourcing of the waste management institutions.

Keywords: *Ghana, Environment, Waste management, Solid waste.*

Introduction

As a consequence of modernization and economic development, events of the 20th and early into the 21st century indicate that waste in whatever form or classification- solid, liquid or toxic have become a major environmental issue (Tsiboe and Marbell, 2004). In the early days, waste disposal did not pose difficulty as habitations were sparse and land was plentiful. Waste disposal became problematic with the rise of towns and cities where large numbers of people started to congregate in relatively small areas in pursuit of livelihoods (Shafiul and Mansoor, 2003). While the population densities in urbanised areas and per capita waste generation increased, the available land for waste disposal decreased proportionately. Solid waste management thus emerged as an essential, specialised sector for keeping cities healthy and liveable (Ogawa, 2005).

Solid waste management refers to source separation, storage, collection, transportation and final disposal of waste in an environmentally sustainable manner (Momoh, and Oladebeye, 2010). In the light of this, solid waste management is an important environmental health service, and an integral part of basic urban services. This is because, the health implications of poor waste management can be very damaging to the people exposed to these unsanitary conditions. Diseases such as cholera, typhoid, dysentery and malaria are all related to the practice of poor waste management. This can result in the loss of human resources needed in the development of the country (Kumah, 2007).

The collection, transfer and disposal of waste have been generally assumed by metropolitan governments in both developed and developing world. This constitutes a basic and expected government function. The format varies in most urban areas where solid waste is collected either by a government agency or private contractor. Despite the fact that developing countries do spend about 20 to 40 per cent of metropolitan revenues on waste management, they are unable to keep pace with the scope of the problem (Zerbock, 2003). In fact, when the governments of African countries were required by the World Health Organization (WHO) to prioritize their environmental health concerns, the results revealed that solid waste was identified as the second most important problem after water quality (Senkoro, 2003 cited by Zerbock, 2003).

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In this case, Ghana is not an exception and for that matter Tamale Metropolitan Area (TAMA). Over the years, solid waste disposal has become a major problem in the Tamale Metropolitan Area (TAMA). Therefore, indiscriminate dumping, irregular collection of waste generated and inadequate resources are the key problems facing solid waste management in the Metropolis. In the Metropolis, it is estimated that 810 tonnes of waste is generated a day and out of this, 216 tonnes are hauled daily. This leaves a backlog of 594 tonnes uncollected a day (Boadi and Kuitunen, 2004). This has resulted in littering, heaping of waste and overflowing of skips with waste in the Metropolis most especially in the low class residential and peri-urban areas. The recent proliferation of polythene bags for packaging has seriously aggravated the situation in the study area. This makes the above-mentioned residential areas filthy and unattractive for living. Therefore, if the situation is left unchecked it can result in the outbreak of communicable diseases such as cholera, typhoid and this will affect people exposed to this unsanitary condition. This study therefore analyses the underlying factors affecting effective solid waste management in the metropolis.

Methods

In this study, a concurrent mixed methods approach was adopted. In this, approach, a researcher collects both quantitative and qualitative data, analyzes them separately, and then compares the results to see if the findings confirm or disconfirm each other. The key assumption of this approach is that both qualitative and quantitative data provide different types of information often detailed views of participants qualitatively and scores on instruments quantitatively and together they yield results that should be the same (Creswell, 2014).

Data were collected through preliminary field investigation, questionnaires survey and face- to-face interviews. The field observation involved scouting through the study area to assess the following; communal waste collection skips, dustbins in the selected areas of study in the metropolis, dump sites, landfill site, informal contacts with Tamale Metropolitan Assembly (Waste Management Department) and ZoomLion Ghana Ltd. Household data through questionnaires focused on variables such as types of solid waste, place of disposal, availability of skips and bins for storing waste, mode of collection and payment for collection and distances covered to dispose of waste in skips. Face-to-face interviews were used to collect data from key stakeholders as far as solid waste management is concerned in the study area. With the aid of purposive sampling technique, stakeholders such as assemblymen in the selected areas, Tamale Metropolitan Assembly (Metropolitan Budget Officer), Waste Management Department (Landfill Manager) and Zoomlion Company Limited (Assistant Regional Operations Supervisor) were interviewed.

Target population for the questionnaire survey were women between the ages 20 years and above. They were selected because they were mostly in charge of sweeping and gathering of all sorts of domestic solid waste in homes and disposing of them. Men were excluded because they were not culturally bound to perform such duties at home. The sample frame of the questionnaire survey included a total number of eighty thousand, five hundred and ninety-nine (80,599) female population between the age group of 15 and 64 for the TAMA (GSS, 2012). Furthermore, from the sampling frame, the estimated sample of the study was deduced as follows;

n= N/1+N (α); Where **n**= sample size, **N**= population, **α** = alpha level (Babbie and Benaquisto, 2009).

n= 80599/1+80599 (0.08)

n= 156

Therefore, the sample size for the survey was one hundred and fifty-six (156). This was to ensure that the sampled mean was closer to the population mean and minimise errors.

The following sampling techniques were employed to select the respondents for the study. These were: cluster, purposive, stratified, systematic and accidental sampling. Firstly, the study area was zoned into three clusters namely: Central Sub-Metro, North Sub-Metro and South Sub-Metro. Secondly, purposive sampling was used to select twelve (12) areas from the three sub-metros for the survey as shown in Table 3. Table 1 below gives the selected areas under each of the sub-metros.

Table 1. Sub-Metros and Selected Areas of Study (Cluster Sampling)

Sub-Metro	Selected Areas	Total
Central	Moshi Zongo, Aboabo, Choggu	**3**
North	Education Ridge, Kalpohin Etates, SSNIT Flates, Sakasaka	**5**
South	Vitting Estates, Nyohini, Lamashegu, Ghanasco	**4**
Total		**12**

Source: Author's Construct

The selected areas were further stratified into low class, middle class and high-class residential areas in the metropolis. Table 2 below shows the stratification of selected areas.

Table 2. Stratification of Selected Areas of Study

NO.	Low Class	Middle Class	High Class
1	Aboabo	Education Ridge	Kalpohin Estates
2	Choggu	Ghanasco	SSNIT Flats
3	Lamashegu	Russian Bungalows	Vitting Etates
4	Moshi Zongo		
5	Nyohini		
6	Sakasaka		
Total	**6**	**3**	**3**

Source: Author's construct

Due to lack of census data for the female population of each listed area, the sample size of 156 was divided equally among the 12 selected areas. This gave a sample size of thirteen (13) for each selected area. This means that 13 women were interviewed in each selected area in the metropolis. Furthermore, systematic sampling technique was used to select houses in each selected area. Table 3.3 below illustrates the systematic sampling procedure.

Table 3. Systematic sampling procedure

Selected Area	No. of Houses (Sample frame)	Total women to be surveyed (Sample size)	Sample fraction (K^{th} house)
Aboabo	165	13	Every 13^{th} house
Choggu	243	13	Every 19^{th} house
Lamashegu	235	13	Every 18^{th} house
Moshi Zongo	160	13	Every 12^{th} house
Nyohini	198	13	Every 15^{th} house
Sakasaka	166	13	Every13^{th} house
Education Ridge	120	13	Every 9^{th} house
Ghanasco	50	13	Every 4^{th} house
Russian Bungalows	48	13	Every 4^{th} house
Kalpohin Estates	98	13	Every 8^{th} house
SSNIT Flats	61	13	Every 5^{th} house
Vitting Estates	43	13	Every 3^{rd} house

Source: Author's Construct

Because most of the houses in selected areas were not well planned with serial numbers, a serpentine movement was used to select every K^{th} house starting from the direction of the first point of contact with any house in the selected area. With this approach a respondent was interviewed in each K^{th} house until the required sample of 13 women was obtained in each area. Finally, accidental sampling method

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was used to select the respondents for interview. That is, the first woman to be contacted in each selected house was interviewed. If the first woman contacted was not ready, the next available woman was interviewed. Since some of respondents did not understand English language people who understood both the English and the local dialect were trained and employed to administer the questionnaires. The questionnaires were pre-tested in the study area before the full survey was carried out.

Finally, administered questionnaires were examined to check completeness, accuracy and consistency of responses in order to detect and eliminate errors. The Statistical Package for Social Sciences (SPSS) was used to process the quantitative data. The data were processed into statistical tables and charts for interpretation and discussion. Processed data were therefore analysed both quantitatively and qualitatively.

Results

Background information

From table 4, 36.5% majority of respondents were between the ages of 20-29 years. However, 9% of respondents were between 50 years and above and were under-represented in the study. The study therefore had a youthful population. Concerning educational level, most respondents had no education background. On the other hand, a significant number of respondents had secondary level of education (21%), followed by tertiary education (17.3%) and training college education (13.5%). It is interesting to note that though most respondents had no educational background, majority of them were employed as public servants. It is possible that these public servants had vocational training college and tertiary level of education. There is also the likelihood that respondents who had no educational background were petty traders (28.2%) and farmers (7.1%).

Table 4. Demographic characteristics

	Frequency	**Percent**
Age Group		
20-29 years	57	36.5
30-39 years	49	31.4
40–49 years	36	23.1
50 years and above	14	9.0
Level of education		
None	36	23.1
Primary	10	6.4
Middle/JHS	18	11.5
Secondary/Technical	34	21.8
Vocational	10	6.4
Training college	21	13.5
Tertiary	27	17.3
Occupation		
Farming	11	7.1
Petty trading	44	28.2
Business	28	17.9
Public servant	51	32.7
Other	22	14.1

Source: Author's Construct

Methods of disposal of household solid waste

The disposal of household solid waste is one of the functional elements in the management of waste. Figure 1 below illustrates the methods of disposal sites of solid waste by respondents in TAMA.

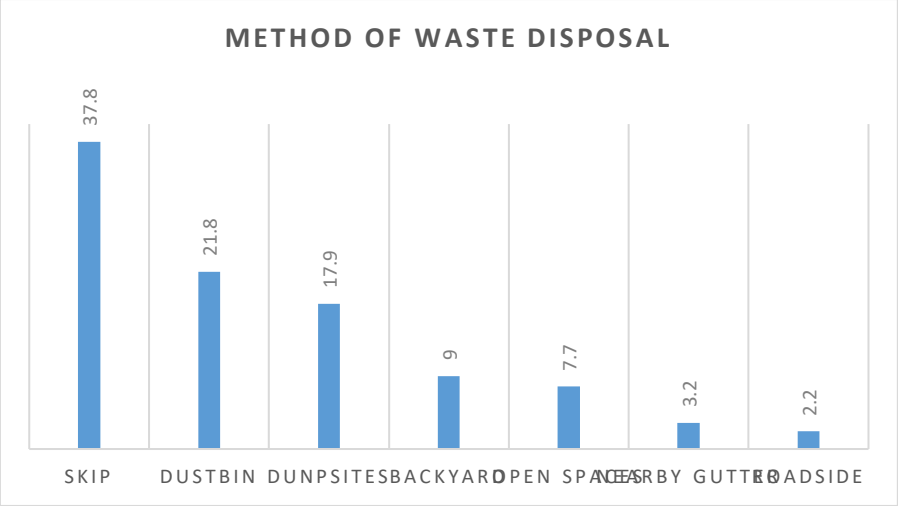

Figure 1

Author's construct

From figure 1 above, the commonest place of waste disposal was the skip (37.8%). This method was used in the low-class residential areas in the metropolis. These areas include: Sakasaka, Choggu, Moshi Zongo, Lamashegu and Aboabo. This is followed by storing waste in dustbins (21.8 per cent) mostly in the high-class residential areas and some middle-class residential areas in the Metropolis. These areas were: Vitting Estates, Russian Bungalows, SSNIT flats and Kalpohin Estates. The rest of respondents (40.5 per cent) resorted to dumping waste in either the roadside, dump, open spaces, nearby gutter or backyard. These methods of waste disposal also happened in the low-class residential areas as mentioned above. This resulted in littering and heaping of waste thereby making the environment filthy. Therefore, the possibility of outbreak of cholera and other environmental related diseases is high if such practice continues.

Table 5 below, suggests that, the average number of times that waste was collected in low class residential areas was thrice a week as opposed to the minimum of four times a week. It is also important to add that waste was collected six (6) times a week in Aboabo because there was a market located in the heart of the settlement. Therefore, a lot of waste was generated in this area. This explains why an extra 14 skips were demanded as indicated in table 5.2. In the middle-class residential areas, waste was collected once a week. This is because these areas were supposed to demand door-to-door collection in the Metropolis which they did not do. As a result, ZoomLion did not find it prudent to communally collect waste from these areas like the low-class residential areas. This is because ZoomLion felt the people in the middle class were capable of paying for the door-to-door collection. But respondents also gave a contrary view. According to them, door-to-door services were expensive.

Additionally, though indicated by ZoomLion waste was collected at least once in the middle-class residential areas, the survey revealed a different view. In some areas like Education Ridge and Russian bungalows, collection did not take place at all. This resulted in respondents dumping their waste at unapproved sites and in some cases burning the waste. The interview with ZoomLion showed that 216 tonnes were hauled every day out of the 810 tonnes generated daily. This means that a backlog of 594 tonnes was left uncollected in the entire Metropolis. During the field investigation it was observed that a lot of skips were overflowing with waste uncollected for days in the low-class residential areas. This has the tendency of breeding diseases such as typhoid, cholera, chicken pox which are sanitation related diseases.

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Table 5. Mode and number of times of waste collection per week

Residential/area/Section	Mode of Collection	Number of times in a week
Low Class Residential areas		
Aboabo	Communal	6
Choggu	Communal	3
Lamashegu	Communal	4
Moshi Zongo	Communal	4
Nyohini	Communal	3
Sakasaka	Communal	3
Middle Class Residential areas		
Education Ridge	Communal	**1**
Ghanasco	Communal	**1**
Russian Bungalows	Communal/door to door	**1**
High Class Residential Areas		
Kalpohin Estates	Door to door	**2**
SSNIT Flats	Door to door	**2**
Vitting Estates	Door to door	**2**

Source: Author's Construct

Final disposal of waste

The final disposal site of solid waste in the Metropolis was landfill site at Gbalahi, about 13 kilometres away from the city centre. A visit to the site showed that, it was in a bad shape. Ideally, a sanitary landfill should have the following functional elements: Weighbridge; Internal access Treatment plant; leachate collection system; Gas recovery and Location should be far away from human settlement and existing water body. This was not the case with the landfill in Tamale. Though there was presence of the facilities mentioned above they were not functional. Additionally, the landfill has no internal access and the site was closed to a community called Wovuguma. This community was about one kilometer (1km) away from the site. Almost all the cells at the site were filled to capacity. Waste dumped in the cells was not leveled and compacted as required of a sanitary landfill. This left a mountain of waste at the site. Worst of it all burning of waste occurred at the site. Therefore, the description of the landfill site in Tamale Metropolis was similar to the one described by Anamanyo (2004) in Accra Metropolis.

According to the WMD and ZoomLion, waste separation which is one of the initial steps to reduce the volume and/or toxicity of waste was not carried out before final disposal. This is because plastic waste takes approximately two-hundred (200) years to decompose. In addition, other components of waste such as metals may not decompose at all. In this case if waste is not segregated before dumping in landfill, the intention of decomposition of waste in the landfill for reclamation of land for use will fail since about 57.5 per cent of the waste in the Metropolis is plastic. Similarly, through waste disaggregating, reusable products and packaging such as returnable bottles will be diverted from the landfill. That notwithstanding, waste management involving collection, transportation and disposal at the landfill site has huge financial implications. In the light of this the next section analyses the cost of managing solid waste in TAMA.

Cost of managing waste

An amount of GH¢ 15,000 was spent on solid waste by the WMD. This amounted to GH¢ 60,000 in a month. Out of this 60 per cent went into fuel for collection, 25 per cent for maintenance of vehicles and equipment and 15 per cent for other administrative duties. However, this amount was given to the WMD by the Metropolitan Assembly monthly. Also, ZoomLion spent approximately GH¢ 2,700 a week on waste collection and maintenance (GH¢ 108,000 a month). An interview with the Metropolitan Assembly showed that an amount of GH¢ 1,711,984.2 was spent on waste management out of the total revenue of GH¢ 4,003,158.64 received in 2009. That is, both IGF and DACF. This represents 42.8 per

cent of the Metropolitan revenue spent on solid waste management. Table 6 below summarises the revenue and expenditure on waste management for 2009.

Table 6. Revenue and Expenditure on Waste Management-2009

Source of Revenue	Amount Received (GH¢)	Amount Spent (GH¢)
IGF	266,140.8	1,444,087.2
DACF	3,737,017.84	267,897
Total	**4,003,158.64**	**1711,984.2**

Source: Author's Construct

From table 6 above, Internal Generated Fund (IGF) by the Assembly per month was GH¢ 22,178.40. However, an amount of GH¢ 120,340.61 was spent on waste management per month by the Metropolitan Assembly which was far greater than the revenue earned. Because the IGF alone could not be used to finance waste management, an amount of GH¢ 1,177,946.52 was taken from the Common Fund to finance the deficit. This implies that 31.5 per cent of the District Assembly Common Fund (DACF) went to support waste management in 2009. In effect waste management is taking a chunk of the Metropolitan Assembly revenue which could have been used for other infrastructural development. Having analysed the cost involved in managing solid waste by the Metropolitan Assembly; the next section assesses the capacity of the waste management institutions in the Metropolis.

Capacity of waste management institutions

An understanding of the capacities of WMD and the ZoomLion Ghana Ltd. will enable conclusions to be drawn regarding their effectiveness. This section assesses the capacities of the WMD and ZoomLion Ghana Ltd. in terms of equipment and technical staffing. An interview with the WMD and ZoomLion Ghana Ltd. revealed the equipment base of the two waste management institutions in the Metropolis. Table 7 below displays the equipment used for storing and collecting waste by the two institutions.

Table 7. Equipment base of waste management institutions (WMD and ZoomLion)

Equipment	WMD (Number available)	Number required	ZoomLion (Number available)	Number required	Total available	Total required
Dustbins	550	1000	1047	3000	1597	4000
Skips	118	200	68	30	186	230
Oboafo tricycle	-	-	100	200	100	200
Motorist	-	-	8	50	8	50
Graders	1	2	-	2	1	4
Skip loaders	3	4	3	3	6	7
Compaction trucks	1	2	1	2	2	4
Roll on/Roll off trucks	3	4	2	4	5	8

Source: Author's Construct

Analyses of the equipment base from table 7 are grouped into their respective uses namely storage, collection and transportation. In terms of waste storage two-hundred and thirty (230) skips were required by ZoomLion Ghana Ltd. and WMD to be supplied in both the middle- and low-class residential areas. However, one hundred and eighty-six (186) were available and supplied for storing waste in the Metropolis. In effect, if this extra skip were not supplied this could result in people dumping waste at unapproved sites. Also, about four thousand (4000) dustbins were needed for storing waste in the high-class residential areas for effective service in the Metropolis particularly those living in the high-class residential areas. This is because dustbins are the main equipment for storing waste in order to prevent dumping of waste at unapproved sites. In terms of waste collection and transportation in the Metropolis Oboafo tricycle, motorist skip loaders, roll on/roll off and compaction trucks were mainly

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used. The Oboafo tricycle and motorist were used for primary collection and transferring of waste collected into a compaction truck for final disposal at the landfill.

However, these were not enough to ensure regular collection and transportation of waste to the landfill. For instance, about two-hundred (200) Oboafo tricycles were needed by the waste management institutions for the door-todoor collection. Also, the compaction trucks which were used for the door-to-door collection were only two (2) for the entire Metropolis. In effect if the few existing core waste equipment for collection and transportation like skip loaders, compaction trucks and roll on/roll off trucks are broken down for just a day or two it will result in heaping of waste. This can lead to outbreak of communicable diseases such as cholera, typhoid and chicken pox. On staffing situation of the two institutions the Metropolis have high calibre of personnel at the top management position.

Table 8. Technical staff of waste management institutions in TAMA

Institution	Personnel	Number	Qualifications
WMD	Directors	2	MSc. Civil Engineering
	Engineer	1	BSc. Civil Engineering
	Technical supervisors	8	Dip. Environmental Health
	Supervisors	3	Certificate
ZoomLion Ghana Ltd	Regional Operations Supervisor	1	B.A Social Sciences
	Assit. Regional Operations Supervisor	1	M.A Environmental Management
	Technical Supervisor	1	Advance Certificate in Engineering

Source: Author's Construct

From table 8 above, the waste management department (WMD) had more technical staff than the ZoomLion Ghana Ltd. Once the ZoomLion are into solid waste management technical staff like engineers were required especially at the landfill site to ensure effective waste disposal. Even if the operation supervisors were engineers that would have still been inadequate for a Metropolis not even to talk of the whole Northern Region. Additionally, the technical supervisors were woefully inadequate as compared to the WMD which had eight (8). This is because one (1) person cannot supervise waste collection in the whole Metropolis with over thirty (30) communities.

Discussion

From the study, inadequate skip supply was a major factor affecting waste disposal in TAMA especially among the low-class residential areas. The survey established that about 66 per cent of respondents have no access to skips for disposing their waste particularly those living in the low-class residential area. This implies that respondents resorted to dumping waste in nearby gutters, by roadside, opened spaces and other unapproved ways of managing their domestic waste. Additionally, the skip ratio to population was very high. That was 1: 9378 compared to the maximum number of seven hundred people to a skip (1:700). These include high populated areas like Moshi Zongo, Aboabo, Lamashegu and Sakasaka. This goes to reaffirm the inadequacy of skip supply in the Metropolis. Also, the time spent by residents to dispose of waste at the few existing skip sites was a latent factor influencing dumping of solid waste at unapproved sites. Indeed, there was irregular or lack of routine collection of waste by ZoomLion Ghana Ltd. especially in the low-class residential areas in the Metropolis. Waste collection was mostly carried out twice a week and in some areas like middle class residential areas no collection took place. Even in the high-class residential areas collection was done once a week.

This resulted in people dumping their waste in opened spaces and in most cases burning was the alternative to final disposal at the landfill. Unlike the door-to-door collection which attracted a monthly charge of GH¢ 7.00 in the high-class residential areas, the communal collection was carried out at no cost to the residents in all the low-class residential areas. This is because respondents in these areas

were not requested to pay for waste collection though their monthly average monthly income (GH¢ 260) earned could support the payment.

The landfill did not meet the requirement of a sanitary landfill as in the case of KMA and therefore could be described as an open dump. Though the landfill had a weighbridge, gas recovery system, leachate collection system they were not functioning. The landfill too had no internal access and sited near a settlement. Additionally, waste was not usually separated into their various components before final disposal. This led to burying of some valuable resources in the landfill which could have been otherwise re-used. More so, burning of waste occurred in the landfill. The waste management institutions were unable to deliver efficient services as they were under resourced. Skips for storing waste generated were woefully inadequate. In the whole Metropolis one hundred and eighty-six (186) skips were supplied particularly in the low-class residential areas.

However, about 230 extra skips were required by WMD and ZoomLion Ghana Ltd. to be supplied to the low-class residential areas. Also, about four thousand (4000) dustbins extra were required to be supplied in the middle- and high-class residential areas in the Metropolis as against about one thousand, five-hundred and ninety-seven (1,597) dustbins distributed. Equipment for waste transportation were also inadequate. These include: "oboafo" tricycle, compaction trucks, roll on/roll off trucks and skip loaders. For instance, two hundred (200) "oboafo" tricycles were needed by the waste management institutions for the door-to-door collection. However, about one hundred (100) tricycles were available. Furthermore, the compaction trucks which were used for the door-to-door collection were only two (2) for the entire Metropolis. Therefore, four (4) were required to ensure regular collection.

Conclusion

The study concludes that the key factors affecting effective waste management in the Tamale Metropolis inadequate skip supply for storing waste; high population to skip ratio; lack of routine collection of waste, poor methods of waste management and inadequate resources for waste management institutions to effectively collect the waste generated. To effectively tackle the problems enumerated, the following measures are recommended; provision of adequate skips and dustbins, regular collection of waste, use of Integrated Solid Waste Management Model, proper Management of Landfill, adequate resourcing of Waste Management Institutions. If the above recommendations given are well taken and implemented, it will bring about effective solid waste management; ensure a clean environment and curb any possible outbreak in TAMA.

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