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SOLID WASTE DISPOSAL IN EAST MAMPRUSI MUNICIPALITY: ASSESSMENT OF REASONS FOR DISPOSAL METHODS

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ABSTRACT

Purpose: The study determined the methods of solid waste disposal in the municipality, in relation with awareness and compliance with dumping on approved locations.

Methodology: The study adopted simple and purposive sampling techniques to select households and respondents. The target respondents for the study were, planning and Environmental offices, chiefs and opinion leaders, and heads of households. Data were analyzed using a regression model to determine the influencing factors of the disposal options, whiles also evaluating compliance with the disposal on approved lands.

Findings: The research found out that; open dumping in the neighborhood, (83.33%), was the main disposal option of the municipality, also, there was a significant relationship between; awareness of approved dumping sites and compliance with dumping on approved sites, distance to the waste disposal sites affected the disposal on approved sites, and lack of knowledge on by-laws on waste management also affected the choice of disposal option. The research concluded that open dumping of waste is mainly driven by low awareness of approved disposal sites and the absence of recycling alternatives.

The unique contribution to theory, practice and policy: The study recommended the need for the provision of more communal containers and waste bins by government and sector players on waste management in the district; intensive education on bye-laws, emphasizing on the significance of dumping waste on approved sites is a welcoming intervention.

Key words: *waste, waste disposal method, open dumping, awareness, compliance, approved sites, purposive sampling, simple random sampling*

1. INTRODUCTION

Human consumption and activities lead to the generation of unwanted remains, and the management process determines whether it will produce waste or not. If proper handling is not made, it poses risk to the environment and human health (Zhu et al., 2008). Key sources of waste generation are usually after consumption (Li, 2019). Waste generation also stems from sources such as households, markets, commercial establishments and, recreational places (Sexena et al., 2010). The inability of several cities to source-separate their wastes leads to loss of valuables, hence difficulty in adding value to the wastes (Moh, 2014). Lack of value for waste has led to littering of solid waste in major parts of human settlements, creating health and environmental threats (Miezah et al., 2015). Similarly, technological issues are also major bottlenecks to waste management challenges (Ayotamuno & Gobo, 2004). Ayotamuno and Gobo (2004), added that, institutional capacities on waste management strategies are weak in technology, hence, degenerating into weak approaches to waste management. The increased generation of wastes marked by poor infrastructure development for its disposal has been identified as the cause of some of the unsafe disposal of wastes (Hoornweg & Bhad-Tata, 2012).

Waste disposal methods are the different approaches advanced to get rid of solid waste in the environment, be it approved or unapproved (Hamer, 2013). However, most common form of solid waste disposal is the open dumping (Narayana, 2009). Sam Jnr (2009), argued that engineering of open disposal sites is often less practicable in Ghana. These sites are often described as crude dumpsites. Disposal of solid waste in most parts of Ghana is either on approved locations or unapproved locations. The popular methods employed for solid waste dumping in Ghana include uncontrolled dumping of refuse, controlled dumping, sanitary landfills, composting and, incineration (Oteng-Ababio, 2011).

Solid waste assimilation has often been observed to be inversely related to its accumulation in the northern environment of Ghana (Oduro-Kwarteng, 2013). This inverse array of disposal and assimilation has led to the accumulation of solid waste in almost every part of the country. As a result, uncontrolled dumping in East Mamprusi Municipal is affected by this widespread practice.

In the light of this imbalance magnitude of accumulation and assimilation of waste, solid waste management has risen to be one of the most crucial health and environmental problems facing governments in developing countries (Zurbrugg et al., 2012). It has been local government's responsibility to provide this service for decades. As opined by Verma and Antahal (2013), waste management service is non-exclusive; meaning that, upon the provision, it benefits the community as overall public welfare. The service is also non-rivaled, meaning that, any resident can enjoy the benefit of the service without diminishing the benefit to anyone else. They further argued that, waste management services by waste management administrators have often not met the demand of the general public, although the service is an important public affair. Research on waste management expenditure is often observed to be on the higher site. As opined by Achankeng (2003), expenditure on waste management has often ranged twenty to twenty-five percent (20%-50%) of the income of most governments in developing nations. The major opposing challenges for this failure in managing solid waste are due to driving factors such as; rapid population growth, expansion of cities, diminishing resources regarding finance and poor urban planning (Achankeng, 2003). In effect, waste management budgets have often not met the demand of the population in developing countries even though the generation rate is high in developing nations compared to developed countries (Omar & Gavrilescu, 2008).

Solid waste collection accounts for most of the expenditure on solid waste management, and solid waste management is often the largest item of expenditure in municipal budgets (Fu, Li & Wang, 2015). The shortage of funds and the difficult procedures involved in accessing funds are often cited as the reasons why important steps cannot be taken (Shafuil & Sayed, 2006). Added to that, one of the main causes of difficulties in the field of solid waste collection is the failure to take account of the important differences between geographical regions, between nations, between cities, and even within a city. International consultants, engineers who have studied overseas, and decision-makers who have been impressed by solid waste management systems in other countries, often recommend systems that they have seen work well in an industrialized country and assume the same systems will work equally well in a completely different context (Marshall and Farahbakhsh, 2013). This is a serious misconception. Decision-makers and engineers may believe that the only significant component in a waste collection system is the technology and ignore other vital aspects (Sharma, et al., 2019). International consultants may prefer systems with which they are familiar or which are manufactured in their own countries (Khana and Faisal, 2009). Too often, the result of these influences is extravagant expenditure of foreign exchange, vehicles lying idle awaiting imported spare parts, and waste collection services that are unable to cope with the amounts of waste that are being generated (Aziale and Asafo-Adjei, 2013). The list of differences between one location and another can be quite long. These include social, economic, climate, spatial and urban development methods, and finally technical aspects (Chester and Allenby, 2019). All these differences account for the difficulty in adaptations of foreign methods of waste collection in developing countries.

Accordingly, solid waste management policy direction started taking shape within the 20th century in Ghana. The 2004 sanitation profile indicates that, solid waste management in Ghana is the responsibility of the Ministry of Local Government, and Rural Development, which supervises the decentralized Metropolitan, Municipal and District Assemblies (MMDAs). However, the regulatory authority is vested in the Environmental Protection Agency (EPA) under the auspices of the Ministry of Environment and Science. The Metropolitan, Municipal and District Assemblies are responsible for the collection of solid waste and its final disposal through their Waste Management Departments (WMDs) and their Environmental Health and Sanitation Departments (Sanitation report on Ghana, 2004). However, research has observed a challenge in the waste management processes of these legit bodies (Guerrero, 2013). Also, studies on solid waste management reveal very interesting patterns. Most of these studies highlight on the health effects of uncontrolled dumping without emphasis on land appropriation, education, and awareness level (e.g. Norsa'adah, 2020).

Control on land use for waste management in the East Mamprusi Municipality has often hung so much on the balance. District Assembly is not able to enforce their sanitation related by-laws. Land designation for waste disposal has often not been included in the planning system of the District (Nnaji, 2015). Lack of education on the health implications is perceived as the cause of this act (Olli & Wollebaek, 2001) However, the cause may be beyond education and just knowledge on the health effects. It is important to note that, exploring the disposal methods, the use of land for waste management and evaluation of awareness and compliance with dumping waste on approve locations will to a great extent unfold the problem.

This paper is framed in to four major sections. Of these sections, the materials and methods being the section two; defining the rout to acquiring and analyzing information obtained from the field, follows the section one-the introduction of the study, which also defines the general motivation for the study. The conclusion of the study being the final section highlighting the study findings and

conclusions, follows the results of the study being the third section- unleashing the fundamental information obtained from the field.

2. MATERIALS AND METHODS

The study employed different approaches to collect data from the field for further analysis. The study is based on waste disposal options and reasons for adopting the various disposal options within the East Mamprusi Municipality. The keywords employed were waste, waste disposal method, open dumping, awareness, compliance, approved sites, purposive sampling, simple random sampling. Some further studies were identified through the reference list of these articles and Google was used to find special reports or conference proceedings. Purposive sampling was employed in the selection of zonal council capital towns such as Langbinsi, Gambaga, Nalerigu, Sakogu, Nagbo, and Gbintiri. Random sampling was employed in selecting households from these selected sub-urban areas in the Municipality. The total number of household respondents was determined using the statistical formula:

$Z * Z\ [P * P)\ /D * D$..... Eqn 2.1

Where n= number of household respondents

Z=value at accepted confidence level, P= estimate of standard deviation in the population and D=margin of error.

A total of 340 respondents were selected for the study. The various components included households 300, chiefs and opinion leaders 33, and four (4) were administered to the Municipal Assembly and three (3) to a waste management service provider, Zoomlion Ghana Limited staff.

Information was collected from key informants with in-depth knowledge of waste accumulation and waste management as well as major party players on waste management challenges within the municipality using key informant interviews. These include four staff from the municipal assembly planning unit and the environmental unit. Private sector waste management bodies such as Zoomlion Ghana Limited had three staff contacted for information. Opinion leaders who are powered to talk, and influence the people on waste disposal as well as releasing land for dumping waste were also interacted with- through a semi-structured questionnaire.

Moreover, a questionnaire was administered to households to ascertain their methods of dumping waste and the reasons that result in the adoption of a particular method of choice. The primary data were collected from 300 households and 33 chiefs and opinion leaders of the municipality. Before data collection the questionnaire was pre-tested for content validity and easy understanding.

A group of stakeholders from the municipality were tasked to criticize the content of the questionnaire in relation to ambiguity, clarity, and appropriateness of the items used to operationalize each construct. They included; two from the municipal assembly, one from private sector waste management actors, two from the sampled households and one opinion leader, giving a total sum of six stakeholders. The respondents were also task to assess the extent to which the content sufficiently addressed the topic investigated. Based on the feedback received, the instrument was modified accordingly and used to collect information about the state of waste disposal practices in the municipal.

The results of the regression model (ordinance) were presented by using APA style tables, whiles categorical result such as the waste disposal options was presented by the use of a bar graph. The

tools that were used for analyzing the data were Microsoft excel, and Statistical Package for Social Sciences (SPSS)

3. RESULTS AND DISCUSSION

3.1 Solid Waste disposal options in East Mamprusi Municipal

The study identified three main disposal options of solid waste in the Municipality. These included: Open dumping (250/300), dumping in communal containers (27/300), and collection by a waste service provider which is Zoomlion Ghana Limited (23/300). Open disposal practice is the crude dumping of solid waste in nearby compounds, close to residence. It includes dumping in created pits from gravel extracted for construction works. Open dumping also occurs along the roads in storm drains as well as any other form that is considered illegal and unacceptable.

Another method of solid waste disposal was dumping in communal containers. This method of solid waste disposal explains the act of dumping at located central points in the community where communal containers are placed close to the residence so that they can be carried away by the Municipal Assembly for final disposal. These communal container points serve as adopted transfer stations for solid waste collection. From observation and interviews conducted, Communal container points are relatively scarce and seldom lifted for disposal by Municipal Assembly and service providers. This subsequently led to a complex process of handling. As a result, some communal containers have invariably turned to improvised open dumping sites aside from the known open dumping.

The third method involves waste management contractors who are charged by the Municipal Assembly per contract agreement to collect solid waste from individual residence, market centers, offices and dispose them at approved locations. In the East Mamprusi Municipality, Zoomlion Ghana Limited is the sole service provider. The company provides waste collection services to households, market stores, and other clients. A service fee of two dollars ($ 2) is charged per weekly lifting of the waste. This method agrees with the polluter pays principle; where individuals who generates waste pays for the environmental effect or the management of the waste generated.

Based on the volume of the waste bin, the individual has to meet the standard of payment for waste bins of either 120 liters or 240 liters. The survey revealed that Zoomlion Ghana has a total of 70 waste bins which they are contracted to manage in the Municipality. However, 40 out of the 70 are currently active for the service provider whilst the remaining 30 are dormant and are not used in any service due to the inability of the household to pay for the services.

East Mamprusi municipality constitutes five zonal councils which include: Gambaga, Nalerigu, Langbinsi, Sakogu, and Gbintiri Zonal Councils. From the survey, it was realized from the Municipal assembly that, the five zonal councils are served with 11 communal containers for waste collection. It is however important to note that, differences exist between what is said about what people do and what they do (Russell, 2006). Despite earlier accessions by the Municipal assembly that zonal councils were served with communal containers, further research on direct observation carried out in the zonal councils unpacked the evidence that, the new reality in the district is that; three of the zonal councils do not receive service from Zoomlion Ghana or the Municipal Assembly on communal containers provision.

An analysis of the various disposal options using an ordinal regression model to determine the significance of the three methods of disposals practices which include; open dumping, dumping in

communal containers, and collection by service providers revealed that open dumping was significant at 0.00, the goodness of fit for the model revealed a significance of 0.001 and a chi-square value of 70.195. This indicates that, of all the various disposal options assessed by the research coverage, open dumping is the predominant practice

Figure1 shows the various methods of solid waste disposal adopted by households from the communities selected for the survey. The survey revealed that open dumping is the most adopted waste disposal option in the District. Out of the 300 household respondents interviewed, 250 representing 83.3% households practiced open dumping, 27 households' respondents dumped in communal containers, representing 9.0% of the respondents and 23 representing 7.7% of the respondents said they subscribe to the services of Zoomlion Ghana Limited.

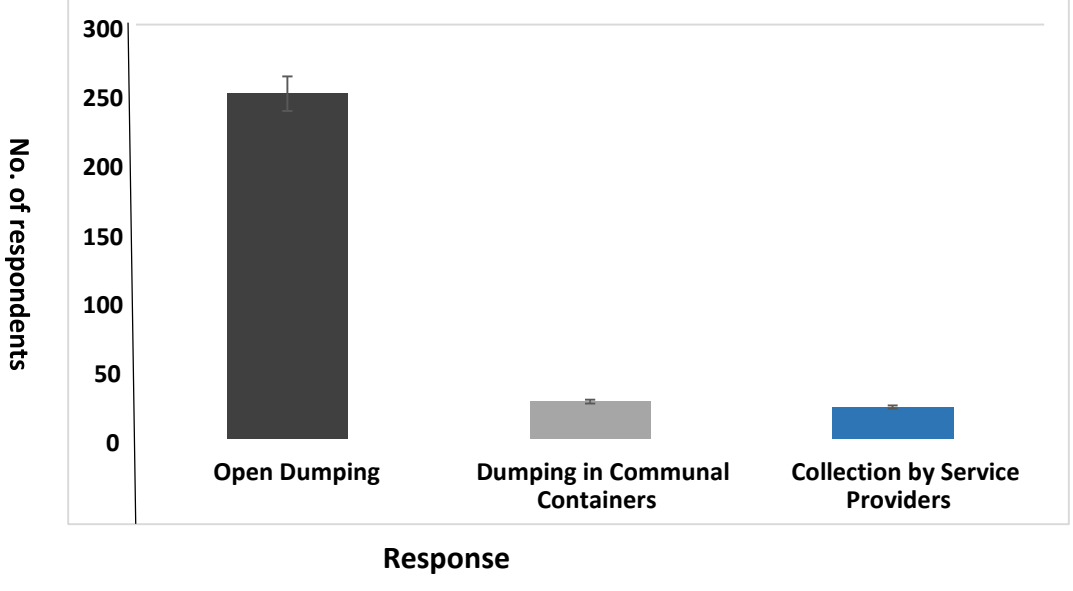

Fig 1: Waste disposal options of households in East Mamprusi District

Source: Author's construct

3.2 Factors that affect open dumping in East Mamprusi District

The ordinal regression model was further employed to test the significant factors that influence open dumping in the district to obtain realities of the interconnectivity of open dumping for possible interventions. Several factors (independent variables) were tested for significance against the dependent variables, which is open dumping. From the list of factors tested, two factors significantly affect the act of open dumping in the district. These include; lack of efforts of awareness of approved dumping sites, which was significant at 0.000, and poor effort to recycle waste, which was significant at 0.006.

3.2.1 Reasons for the preferred disposal options

The survey further assessed the reasons for predominantly practicing open dumping. Interviews on Opinion leaders and some households cited reasons such as *Lack of Communal Containers or Waste bins for disposal; long distances to dumping sites and individual ownership and control over land*

use. There was a challenge regarding the availability of communal containers and waste bins in the District. The number of the communal containers, as well as waste bins provided, were not enough to meet the individual household demand. Also, many households were not able to afford the monthly payment charged by the service providers. Crude dumping being a predominant practice became the preference of most, even though they have the knowledge and were aware of the negative effects of the crude dumping of solid waste close to their residence. This is in line with the findings of Kirama and Mayo (2016), who cited reasons for poor patronage of private sector waste management bodies as; inferior and unavailable waste collection and transportation material, inefficient system of waste collection fees, inaccessible roads, and inefficient municipal policies and by-laws.

The study also revealed that 60% of the residents interviewed complained of a lack of communal containers in their neighborhood for disposal of waste. Another reason that was observed from the field survey was the distance to sites where the communal containers were positioned against individual homes was far-flung. This in reality prevented people from carrying solid waste over such a distance for disposal. Most (16%) of households explained the distance to be 1-2 km, thus believed this hindered them from disposing of waste in the few available communal containers. Interviewing key informants from the district further revealed tha*t land ownership by individuals has its effect, as land owners has control over its use. This has led to the abuse of land by individuals without any retribution, since the land belongs to them. Individuals decide on how to use their land without any hindrance*. This is in line with the findings of Di Bella and Vaccari (2014) who stated issues of land ownership and availability as a constraint for solid waste management in Somalia.

Table 1. Disposal options and reasons for indiscriminate dumping

Response	No communal container or bins	Long distance to dumping site	Because I am the land owner	No appli cable reason	Total
Open dumping	179	47	24	0	250
Dumping in communal	0	0	0	27	27
Collection by service providers	0	0	0	23	23
Total	**179**	**47**	**24**	**50**	**300**

Source: Author's construct, 2021

3.3 Awareness of approved lands demarcated for solid waste disposal and compliance

3.3.1 Awareness of approved lands demarcated for solid waste disposal

On the awareness of approved lands for solid waste disposal, the study revealed corresponding outcomes of the divergent views of respondents which was further analyzed statistically. The percentage of respondents affirming their awareness of approved lands demarcated for solid waste management were 82 in number, representing 27% of the total respondents. Those who responded in the negative were 218, representing 73% of the total households interviewed.

Table 2 Factors influencing awareness of approve dump site for solid waste

Variables		Estimate	Sig (P).
Threshold Awareness of approve dumping site = yes		-3.433	0.001
Location	[Awareness of Negative effects of open dumping]=yes	-.804	0.258
	No	0[a]	
	i) Disposal option=1. open dumping	1.154	0.072
	2.dumping in communal containers	-2.645	0.009
	3. Collection by service providers	0[a]	
	ii) Awareness of land use bylaws= yes	-1.785	0.000 *
	No	0[a]	
	iii) Educational status= 1. No formal education	-0.604	0.277

2. Basic education	0 .561	0.393
3. Secondary education	0 .566	0.344
4. Tertiary	-0.162	0.825
5. others	0[a]	.
Knowledge on bylaws for waste disposal= Yes	-2.645	0.000 *
No	0[a]	.

Ordinal regression model test, statistically significant (P) at < 0.05

Source: Author's construct, 2021

3.3.2 Compliance with dumping on approved lands demarcated for solid waste disposal

The research determined whether individual awareness will positively correlate their level of compliance on dumping waste on approves points or lands for waste disposal. The study revealed that 47.56% households agreed that they are complying with dumping waste on the approved venue, whiles 52.42% responded that they still dump waste openly without sending it to the approved site.

Table 3 shows the relationship between awareness of approved sites for dumping and compliance with dumping at the site. The results show that there was a significant relation between awareness and compliance. Thus, compliance level increases with awareness. The test which is a two-sided test of both observed and expected are both significant with a chi square value of (3.0000E2a) and a likelihood ratio of 351.928.

Table 3. Ordinance regression model Pearson Chi-square relationship between awareness and compliance with dumping solid waste on approved sites

	Value	Df	Asymp. Sig. (2sided)
Pearson Chi-Square	3.000E2[a]	2	.000*
Likelihood Ratio	351.928	2	.000*
N of Valid Cases	300		

Ordinance regression model significant at P<0.05

Source: Author's construct, 2021

3.3.3. Factors influencing awareness of approved land demarcated for solid waste disposal

The awareness of approved dumping sites was statistically tested by factors such as the educational status (63.7% formal education), the awareness of the negative effects of open dumping (73% awareness), the knowledge on the land-use bylaws (30% awareness), the open disposal option (83%) and knowledge on approved lands demarcated (30%) for waste management to determine the significant influencing factors on awareness. A statistical analysis using the ordinance regression model revealed that knowledge on by-laws for waste disposal significantly (P=0.00) leads to awareness of approved lands for disposal. This means that once a person is aware of the by-laws, s/he would be aware of the approved site. Thus, many people will practice open dumping if they do not know about the approved site for dumping. This had a positive correlation with the number of people who practice open dumping which was 250 as earlier illustrated in Figure 1.

Also, awareness of by-laws on waste management significantly (P=0.00) contributed to the awareness of individuals on approved lands for waste disposal. In simple, those who were conversant with the by-laws of the Assembly on waste management and waste disposal knew about demarcated areas for dumping and this also contributed to proper disposal practices in the District. Since the number remained very few, policies regarding enforcement of by-laws need to be put in place to ensure controlled dumping in the area.

On the contrary, educational status and awareness of the negative effects of open dumping did not significantly affect the awareness of approved dumping site. People might choose to dump openly or uncontrollably irrespective of the status of their education or their knowledge on the negative effects on the environment and their health. Thus, relaxed enforcement of by-laws could be the cause of open dumping in the area, though reasons such as distance to dumping sites and lack of disposal facilities were given.

4. CONCLUSIONS AND RECOMMENDATION

Waste disposal options in East Mamprusi District is a community menace and a challenge. Majority of the households in the District practice open dumping disposal. The practice is mainly driven by low awareness of approved disposal sites and the absence of recycling alternatives. This practice was influenced by factors such as lack of awareness of approved sites for disposal and no recycling efforts. These two major factors were lacking in the District per the outcome of the research. However, reasons such as lack of disposal facilities, long distances to dumping areas, individual control, and ownership of lands also influenced most people to dispose-off waste openly.

Awareness creation is about Education and this would bring about compliance with dumping on approved land and also strengthening the recycling efforts of households of the District. Since the awareness level was low, compliance was a challenge because people were not aware that lead to inability to comply. The factors that determined whether individuals were aware of approved dumping site were: the disposal options adopted, the knowledge of the by-laws on waste management, and by-laws on land ownership and usage.

The study recommended that; there should be strong government intervention that would deal with the challenge of open dumping. They include; a) District assembly in collaboration with central government should provide more waste bins and communal containers to serve the need of households so people can act positively towards dumping in approved locations. b) The number of officers in charge of education and ensuring compliance with environmental regulation concerning waste disposal should be increased with serious capacity building and working tools to allow them to operate effectively. By so doing, the government can recruit volunteers at the community level to identify waste management challenges so that it is reported for necessary address at the District level. Such officers shall be responsible for quality education and compliance on waste management strategies that are anthropogenic or tested and scientific.

By-laws on approved locations for waste disposal should be strengthened with the carrot approach employed as a motivational factor to ensure compliance by individuals in the District as far as issues of waste disposal on approved locations is concerned. Local stakeholders such as; chiefs, community elders, religious leaders, traditional leaders, assembly persons, as well as community members, should be charged with the responsibility of developing positive sub-cultural practices that can enhance proper waste management in the District. The District Assembly should correlate effectively with local NGO's who are into the area of Health and Sanitation so that the message can be carried across all communities to ensure that higher compliance level is achieved on by-laws for waste management

Further research should be conducted on the health risk of open dumping in the District to acquire realities on the disease prevalence rate from the available hospitals in the District. Further research on land use by-laws, stakeholders, or sector players' coordination in ensuring safe disposal of waste is a potential area of investigation.

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