

An Effective Solid Waste Management and Environmental sanitation Diseases Reduction Module of Ghana- A Case of Thetechiman Municipal Area, Brong Ahafo Region, Ghana

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Abstract

Urbanization the world over and in Ghana has resulted in many poor environmental consequences. Urban solid waste disposal in Ghana has become a heavy task for the central government; the municipal authorities and other stakeholdersto manage. The solid waste disposal problem is increasingly becoming unbearable for the stakeholders in the waste disposal sectors. This paper investigates the nature of the urban solid waste disposal challenge and its environmental sanitation related issues in Ghana and more especially in the Techiman municipality. Major issues concerning the management of solid waste problem in the country that were considered include: the inadequacy of logistics for managing the menace, human resources, funds and public education. Apart from discussing the waste situation in the study area the study also identifies the causes of the menace from the perspective of the various stakeholders. The waste collection and disposal facilities and services provided by the key stakeholders in the waste sector were examined in relation to the concepts of environmental sustainability and sanitation diseases respectively. Methods used in this study include observations; questionnaires and interviews from stakeholders, households, business units and the public health departments as well as pictures and documentaries. It was realized that the study area had an increased solid waste generation capacity which resulted in various kinds of epidemic diseases in humans and animals alike. The situation also tends to degrade the environment and even pollute the TanoRiver which inhabits the sacred fishes and serves as a site for tourist attraction to the municipal area. Some causes of the crisis can be identified as lack of political will to managing the solid waste situation in the country. Though the country has environmental laws, these laws are too flexibility and relaxed that most offenders go unpunished.

Keywords: Solid waste; Management; Environmental sanitation; Diseases; Reduction module

Introduction

Good sanitation practices and improved hygienic behaviour has been a topic for discussion the world over, sanitation issues remain a major problem in the world and more particularly in Africa. Though this has been included in the Millennium Development Goals much seems not to be happening to the sector.

In many urban areas in Ghana, there has been the issue of solid waste disposal and management challenges. This canker is growing at an alarming rate such that its generation, collection and disposal seriously drain the nation's resources. Urban solid waste management is not only an economic issue but includes all activities that seek to minimize the health and environmental impact of both plants and animals. When the

waste generated is not properly handled its results will pose a serious threat to humans and their environment resulting in the prevalence of sanitation related diseases.

The generally poor waste collection in cities of developing countries remain a crucial challenge and will deviate from achieving the objectives and targets of the Sustainable Development Goals (SDGs)2 (OECD, 2008). Furthermore, the achievements of the targets of many of the Sustainable Development Goals depend mainly on maintaining clean and healthy environment for humans. For example, reducing child mortality, improving maternal health, reducing malaria and other environment-related diseases and ensuring environmental sustainability are directly affected by the quality waste and environmental management practices put in place.

Across the globe the amount of residue waste products that are not or cannot be reintegrated is on the increase. Rapid uncontrolled urbanization in Ghana has saddled the country's cities with problems of physical, socio-economic and environmental nature [1], underscores that "the livelihood of more than half of the economically active population in the developing world directly depends on the environment through agriculture, as well as animal husbandry, hunting, fishing, forestry, and foraging".

Urban areas generate heaps of waste daily, causing a lot of environmental and health hazards. Diseases of these areas can be traced to how waste is disposed of and managed. A solid waste, or a combination of solid wastes which, because of its quantity, concentration or physical and infectious characteristics, is injurious to environmental and human health, especially when it is not properly collected, managed or transported and disposed of. The management of solid waste has been an intractable problem in the country for so long a time. This is due to the expansion of towns and cities because of increase in population, resulting in the generation of large quantities of solid waste daily by households, commercial activities, institutions among others. Based on an estimated population of 18 million and an average daily waste generation per capita of 0.45 kg, Ghana generates annually, about 3.0 million tonnes of solid waste [2].

However, waste generated are not always disposed of properly especially in the cities and other urban areas. It is estimated that throughout the country only about 10% of solid wastes generated are properly disposed of. Records indicate that out of the 1800 tonnes of waste generated daily in Accra, only 1200 tonnes is collected and out of the percentage that is collected only a fraction receives proper disposal [3]. Also, in the Techiman Municipal Assembly, Refuse Generation Rate (RGR) is about 150 tonnes per day (TMA medium term report, 2014).

The problem under investigation in this paper is the overview of the solid waste and environmental sanitation management to curbing sanitation related diseases in the Techiman

Municipality and an educational module of waste management in Ghana. Urban settlements in Ghana are grappling with the seemingly worsening solid waste situation. Accra, the capital city of Ghana, still struggles with environmental issues including the seemingly insurmountable problem of handling an ever-growing amount of trash and other waste [4]. It is estimated that Accra's population of more than 4 million people accounts for an average daily waste generation of 3,000 tons (ibid, 2011).

Observation within the study area shows visible solid waste, including garbage accumulation, street littering, clogged drains and gutters. Despite the concerns frequently raised by institutions, individuals and among the populace, the solid waste situation in the municipality continues to deteriorate, posing serious health and environmental threat. Despite decades of preaching cleanliness, Techiman is suffering from the problem of waste and the whole environment is surrounded with waste materials not collected (Figure 1). Various campaigns encouraging inhabitants to keep the municipality clean seem to go unheeded.

Even though the National Sanitation Policy was enacted by an Act of parliament and implemented in 1999 to clear solid waste in the country by the year 2020, the waste problem remains the same. Consequently, if solid waste is not properly managed in the area, it has the potential of outbreak of communicable diseases such as cholera, typhoid, chicken pox and other environmental related diseases. This is because the health implications of poor waste management can be very damaging to the people exposed to these unsanitary conditions.

Besides, the environmental burden associated with the worsening solid waste situation in the Techiman Municipality appears to fall heavily on the poor even though waste removal and disposal are public funded and regulated. This paper is therefore undertaken to give an understanding of the challenges and issues involved in solid waste management in Techiman to pave the way towards finding a lasting solution to the waste problem in Ghana and the Techiman Municipality in particular.

As a result, littering, indiscriminate dumping in opened spaces, gutters among others is the order of the day. It is also observed that most skip containers (Figure 2) are often seen



Figure 1: Heap of Solid Waste at Takofiano a Suburb of the TMA



Figure 2: Mountain of waste producing smoke at Manyanka a suburb of Techiman

overflowing with garbage uncollected in the municipality. The recent proliferation of polythene bags for packaging has seriously aggravated the situation in the country making the environment filthy and poses a health hazard for living things and their environment.

Over the years, urban solid waste disposal has become a major problem to the Techiman Municipal Assembly and ineffective solid waste collection, transportation, sanitation related diseases and inadequate resources to help curb the waste menace in a more sustainable manner in Ghana and the urban areas especially the study area. These challenges cause dumping of waste in drains, heaping of waste and skips overflows with waste in the many urban areas in Ghana.

This paper discusses the various definitions of solid waste management by different institutions and countries. It also reiterates the importance of environmental sanitation management and the health delivery implications. There is a major section on the overview of solid waste management in West Africa and in Ghanaian cities which highlighted several issues including institutional arrangements and approaches, challenges in the waste management sector and its consequences. Many issues are also elaborated in the section on the way forward.

The paper concludes with some key issues such as conflicting definitions, waste management and sanitation planning, waste management and sanitation education and waste management, waste management ownership and sanitation financing which need to be critically looked at by central government and the various stakeholders in the waste and environmental management sectors in Ghana.

Definitions

Solid waste and sanitation management: an overview

Basically, urban solid waste management refers to source separation, storage, collection, transportation and disposal of waste in an environmentally sustainable manner. Solid waste management is an important environmental health policy, an integral part of basic urban and city services. Diseases such as cholera, malaria, dysentery and typhoid will emerge from the practice of poor waste management. The action

programs adopted by both developed and developing world in the collection, transfer and disposal of waste constitutes a government function. The format varies in most urban areas where solid waste is either collected by the government or a private agency. Even though developing countries do spend about 20 to 40 percent of revenue on waste management, they are unable to keep pace with the problem [5]. For instance, when the governments of African countries were required by the World Health Organisation (WHO) to prioritize their environmental concerns, the results were that, solid waste was identified as the second most essential problem after water quality [5]. In this case Ghana is not an exception and for that matter Techiman Municipal Assembly.

In recent times, urban solid waste management has become a major development challenge in the Techiman Municipality. The problem cannot be handled solely by the Municipal Assembly but also need the collaboration of private waste institutions, corporate organisations, individuals and civil society organisations to find a lasting solution to the problem.

Solid waste management is a major challenge in urban areas throughout the world. Without an effective and efficient solid waste management program, the waste generated from various human activities, both industrial and domestic, can result in serious health hazards and have a negative impact on the environment. There are several concepts about solid waste management which vary in their usage between countries or regions. Some of the most general, widely used concepts in solid waste management include: collection, transportation, processing, recycling, disposal, managing and monitoring of waste materials. Solid waste management is also carried out to recover resources that could be useful to man and the environment. Solid waste management can involve solid, liquid, gaseous or radioactive substances, with different methods in the management for each.

The concept solid waste management has varied definitions from various scholars. Some look at it as the act of keeping our environment free from the contaminating effects of waste materials. For instance, Gilpin [6] 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.”

According to UNDP [7], solid waste management is a complex task which must go beyond purely technical considerations to political, institutional, social, financial, and economic aspects.

Solid waste management may be defined as the discipline associated with controlling the generation, storage, collection, transfer and transport, processing, and disposal of solid waste in a manner that is in accordance with the best principles of health, economics, engineering, conservation, aesthetics, and other environmental considerations, and that is also responsive to public attitudes [8].

Additionally, Tchobanoglous et al. [9], provide a more comprehensive definition of the concept. Accordingly, they defined solid waste management as:

“That discipline associated with the control of generation, storage, collection, transfer and transport, processing and disposal of solid wastes in a manner that is in accordance with the best principles of public health, economics, engineering, conservation, aesthetics and other environmental considerations and that is also responsive to public attitudes.”

However, what these definitions fail to look at is the education as to negative implications of the solid waste generated. It appears to assume that all the improved solid waste management technologies include landfill site management and recycling as well. However, when the waste is often removed and dumped into the environment not treated. The solid waste problem in the Sub region would be a thing of the past if education becomes the starting point to managing all kinds of waste in the country. If solid waste management situation is to be achieved in a more efficient and effective manner in the urban cities, aspects that are crucial such as the inclusion of waste management and sanitation practices in our educational curriculum from the basic educational level to the tertiary level would stand tall to the management of the waste menace as identified in the first place and incorporated with other key elements to enable the cities address the solid waste management situation. In this development, for solid waste management to achieve its desire objective successfully it should incorporate the following key elements: education, source separation of the waste generated for easy handling of the waste, waste storage, waste collection, waste transportation, waste disposal, waste processing and landfill management in a more sustainable manner.

The scholarly definition of sanitation centers on excreta from humans and wastewater collection, treatment and disposal. Sanitation according to the World Health Organisation [10] is defined as group of methods used to collect human excreta and urine as well as community waste waters in a hygienic way. This definition is not all embracing for it fails to capture solid waste management practices that are domestic, industrial and clinical whose management has been poor in the developing world especially in the Sub Saharan Africa. Solid waste menace noticeably is the most visible sanitary canker which poses health and environmental challenges in the continent.

The EPA [11] in the ‘Environmental Sanitation Policy’ document opined that solid wastes comprise all solid waste material generated by households, institutions, commercial establishments and industries, and discharged from their premises for collection; all litter and clandestine piles of such wastes; street sweepings, drain cleaning, construction/demolition waste, dead animals and other waste materials. The EPA added toxic, flammable, corrosive, radioactive, explosive and other dangerous materials as hazardous waste. Because of their potential pollution danger, hazardous waste materials require rigorous and cautions means of disposal [12]. Waste

refers to any unwanted item or substances that result from a human activity or process. According to Tchobanoglous et al. [9], solid waste is any material that arises from human and animal activities that are normally discarded as useless or unwanted. Zerbock [5], define solid waste to include domestic waste, industrial waste, non- hazardous waste, household institutional garbage, hospital waste and constructional waste. Drawing from the scholarly expressions above, the definition of solid waste to be used in this paper is any substance (solid, liquid, gaseous and radioactive) thrown into the environment because it is no longer of use and impact negatively on the environment.

According to Awuah [13], the definition of sanitation by the WHO fails to look at the end of pipe treatment. Accordingly, when the sludge from liquid waste is finally removed it is dumped into the environment untreated and so therefore the final handling of the sludge should be included in the definition.

Overview of the Sanitation Situation in Ghana

The Environmental Sanitation Policy of Ghana also defines Environmental Sanitation using the following parameters as the major components:

- Collection and sanitary disposal of wastes, including solid wastes, liquid wastes, industrial wastes, health-care wastes, excreta and other hazardous toxic wastes;
- Storm water drainage;
- Cleansing of thoroughfares, parks, market centres, lorry stations and other public spaces;
- Food hygiene;
- Control of pest and vector diseases;
- Inspection and enforcement of sanitary bye-laws;
- Disposal of the dead;
- Control of rearing and straying of animals;
- Monitoring and observing of environmental standards;
- Environmental sanitation education.

There is a conflict resulting from the definitions of the two authorities, the WHO and that of the Environmental Sanitation Policy definition of Ghana. In this case the definition of sanitation and sanitation management could result in confusion among the stakeholders and actors in the sanitation management sector. So, for this paper, environmental sanitation management is defined as the provision of education on sanitation management to individuals from the basic to the tertiary levels for safe management of human waste and human activities from solid, liquid, gas and any other material in the environment that can harm and affect negatively human beings and other animals from the sanitation related diseases.

It is therefore impossible to talk about environmental sanitation management without discussing education, and this

would help for the promotion sanitary practices; and this will deal with an aspect concerned with the prevention of illness and maintenance of health.

Juxtaposing the definition of the Environment Sanitation Policy definition of Ghana, environmental sanitation education features and this is the type of education given to market women, street hawkers on how to keep the environment free from felt and diseases. It fails to suggest the fact that, environmental sanitation management should start from the basic school level to the senior high level to the tertiary level and be made compulsory to help bring up a new generation in ten (10) years to come who would be environmentally cautious to reduce the impact on the environment and the from the various kinds of wastes generated.

Methodology

The research employed varied methods and techniques by gathering both secondary and primary data for the study. The essence of this paper was to study and come out with a more concise module on managing urban solid waste and its environmental management implications to reducing sanitation related diseases in Ghana.

Sample size determination of households

Determining sample size is a very important issue because samples that are too large may waste time, resources and money, while samples that are too small may lead to inaccurate results. In many cases, we can easily determine the minimum sample size needed to estimate a process parameter, such as the critical value z_{α} . When sample data is collected and the sample size (ss) is calculated from the infinite population as the population is large enough, with the aid of percentage of population picking a choice and the confidence interval also known as error margin: The sample size (New SS) will be drawn by the aid of the below formula.

Sample Size - Infinite Population (where the population is large).

$$SS = \frac{z\alpha^2 * (p) * (1 - p)}{c^2} \quad (1)$$

Whereas;

SS = Sample Size

Z = Z-value (i.e. critical value of 1.96 for a 95% confidence level)

P = Percentage of population picking a choice expressed as decimal (i.e. 0.5 meaning equal chance of been selected)

C = Confidence interval also known the error margin, expressed as decimal (i.e. 5%)

$$\text{Therefore, } SS = \frac{1.96^2 * (0.5) * (1 - 0.5)}{0.05^2}$$

= 384.16

= 384

New sample size (New SS) is then calculated from the above sample size using the finite population (i.e. population of 147,788) (Table 1).

$$New SS = \frac{ss}{[1 + \frac{(ss - 1)}{POP}]} \quad (2)$$

$$New SS = \frac{384}{[1 + \frac{(384 - 1)}{34,137}]}$$

= 379.7

= 380

From J.D, Sarantankos table in Appendix 1, if a population of about 50,000 a sample size of 380 is appropriate at 5% error margin.

Per the above table, Sarantankos postulated that at a confidence interval of 95% and 5% error margin a total population of 34,137 will have a sample size of 380. Meaning the above formula and calculations are accurate for the determination of the sample size of the study area.

Determination of sample households

For the entire sample size, 380 households were selected to represent the entire study area, since the study area is faced with a serious waste disposal problem. Proportional stratified sampling is a kind of stratified sampling in which size (number of observations) of each stratum is proportional to that of the

Table 1: Sampled Districts and the total Number of Households

District	Total Number of Households
Techiman Municipality	34,137
Total	34,137

Appendix 1

Population Size	Required Sample Size [†]							
	Confidence = 95%			Confidence = 99%				
	Margin of Error			Margin of Error				
	5.0%	3.5%	2.5%	1.0%	5.0%	3.5%	2.5%	1.0%
10	10	10	10	10	10	10	10	10
20	19	20	20	20	19	20	20	20
30	28	29	29	30	29	29	30	30
50	44	47	48	50	47	48	49	50
75	63	69	72	74	67	71	73	75
100	80	89	94	99	87	93	96	99
150	108	126	137	148	122	135	142	149
200	132	160	177	196	154	174	186	198
250	152	190	215	244	182	211	229	246
300	169	217	251	291	207	246	270	295
400	196	265	318	384	250	309	348	391
500	217	306	377	475	285	365	421	485
600	234	340	432	565	315	416	490	579
700	248	370	481	653	341	462	554	672
800	260	396	526	739	363	503	615	763
1,000	278	440	606	906	399	575	727	943
1,200	291	474	674	1067	427	636	827	1119
1,500	306	515	759	1297	460	712	959	1376
2,000	322	563	869	1655	498	808	1141	1785
2,500	333	597	952	1984	524	879	1288	2173
3,500	346	641	1068	2565	558	977	1510	2890
5,000	357	678	1176	3288	586	1066	1734	3842
7,500	365	710	1275	4211	610	1147	1960	5165
10,000	370	727	1332	4899	622	1193	2098	6239
25,000	378	760	1448	9539	646	1285	2399	9972
50,000	381	772	1491	8056	655	1318	2520	12455
75,000	382	776	1506	8514	658	1330	2563	13583
100,000	383	778	1513	8762	659	1336	2585	14227
250,000	384	782	1527	9248	662	1347	2626	15555
500,000	384	783	1532	9423	663	1350	2640	16055
1,000,000	384	783	1534	9512	663	1352	2647	16317
2,500,000	384	784	1536	9567	663	1353	2651	16478
10,000,000	384	784	1536	9594	663	1354	2653	16580
100,000,000	384	784	1537	9603	663	1354	2654	16584
300,000,000	384	784	1537	9603	663	1354	2654	16586

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population. It means that sampling fraction of each stratum is the same. It is also termed as proportionate stratified sampling.

The results obtained by stratified sampling are highly accurate and usually unbiased.

This method of sampling provides a greater precision in comparison with simple random sampling. Stratified sampling often requires small stratum size which leads to saving of time as well as capital. Stratified sampling is a technique that is applicable to various geographical entries and thus, is very flexible. This type of sampling generates more representative results for the entire population. Based on this comprehensive sampling procedure, the sample can be highly representative of the overall population in the study area (Table 2).

$$f = \frac{n}{N} * 100\% \quad (3)$$

Where;

f is the sample fraction

n is the sample size

N is the population

Therefore, $n = 34,137$

$N = 147,788$

$$f = \frac{34,137}{147,788} * 100\% = 23\%$$

23% of 380 is $23/100 * 380 = 88$ households

Focus Group Discussions

At the community level, focus group discussions (FGD) with community groups would be used to provide additional insights about the waste collection and disposal challenge in the study area. The focus groups to be selected for the survey will be composed of 5 to 15 people who are knowledgeable about their community and had experience in waste and sanitation problems. Chiefs, stakeholders, and opinion leaders (assembly persons) will be involved in the focus group discussions. A total of 10 focus group discussion sessions were held in all the selected communities for the study.

In-depth Interviews

In-depth interviews were conducted. The researcher interviewed the assembly persons, chiefs and other stakeholders in the waste and sanitation related sectors of the study area. An interview guide was used to solicit information from the experts in the waste management sector of the study area.

Table 2: Number of Households Sampled

District	Total Number of Households	Total Number of Households Sampled
Techiman Municipality	34,137	88

Direct Observation

Direct observation was employed to identify communities that were hard hit with the waste problem in the study area. Some sanitation related diseases were identified as communities show signs of waste infected diseases in the areas that have heaps of waste.

Research Findings

Devas and Korboe [14] that the waste collection service provided by the authorities is skewed to favour planned residential areas in the municipality. Nonetheless, poor neighborhoods in the same area however, only has access to an erratic communal skip service while many peripheral communities have no service compelling households in such areas to dump their waste in any space available to them. The picture in Figure 1 shows a heap of waste at Takofiano a suburb of the Techiman municipal area. In Figure 1 the waste dump is close to residence and the stench, smoke, flies and other disease-causing agents have negative health implications to members of the community.

Methods of Disposal of Household Solid Waste

The disposal of household solid waste is an important component in the management of waste. Figure 1 above illustrates the methods of disposal sites of solid waste by respondents in the Techiman municipal area. Majority of the respondents complained about the nuisance arising from the waste containers which were usually not attended to for a long period of time. These range from bad odour, smoke, cholera epidemics, flies, communicable diseases, environmental pollution, and respiratory diseases to skin infections. Figure 1 is a heap of solid waste burnt to produce smoke which causes respiratory infections through the smoke in a suburb of the municipality called Manyanka.

Waste disposal methods

Waste disposal methods ranges from burning, dumping into a nearby drain and others. This was carried out in Table 3 below as shown.

Contrary to Table 3 above which indicates that majority of the respondents disposed of their waste through the waste dump, the views of respondents in Table 3 depicts that burning was the most preferred means of household waste disposal. The conflicting opinion can be reconciled because of the different types of household waste generated. While the plastic and paper waste can easily be burnt the food, waste were disposed of at the waste dump.

Waste collection frequency

The survey revealed that, the frequency of waste collection in the Techiman municipality was mostly weekly showing 44 per cent. Monthly collection of waste depicts 28 per cent while every day and regular collection services by service providers shows 14 per cent respectively. Depending on the kind of

businesses the waste generation may be daily, weekly or monthly which confirms the varying opinion of the frequency of waste collection. From observation at the close of business especially in the CBD (Figure 3), owners of shops sweep whatever waste they have generated onto the street for onward collection by the authorities responsible.

(Figure 4) above shows a skip container overflowing with waste from the central business district of the Techiman municipality which was evidential that the frequency of waste collection does not tally with the rate at which waste was generated. According to the respondents representing 28 per cent waste was mostly stored in dustbins. The frequency of waste collection and the size of the dustbins do not correspond. This makes the dustbins full within a short time which was then disposed of into the skip container resulting into its overflow and creating nuisance in the Central Business District of the municipality.

Waste problems and the causes

The causes of the solid waste and environmental sanitation situation in the Techiman municipal area ranges from indiscriminate dumping of waste, lack of education, indiscipline and inadequate logistics. These were looked at in Table 4.

The causes of waste problems could be attributed to the unwillingness of respondents to pay for waste collection services in the Techiman municipal area. As a result of the situation described above the following set backs were encountered, indiscriminate dumping of waste (16 per cent), inadequate machinery (14 per cent), indiscipline (14 per cent), indiscriminate disposal of waste (14 per cent), lack of education (14 per cent), no vehicles to lift skip containers (14 per cent) and regular breakdown of available vehicles (14 per cent).

Another observation was that, the activities of those who sweep the grounds and remove solid waste from gutters who were either employed by the waste management department of the Assembly or by Zoomlion were still not enough to keep

Table 3: Method of Waste Disposal

Method	Frequency	Percentage
Burning	78	39.0
In the bush/roadside/drain	33	16.5
Burying	30	15.0
Other methods	59	29.5
Total	200	100.0

Table 4: Causes of Waste Problems

Causes of Waste Problems	Frequency	Percentage
Inadequate machinery	7	14.0
Indiscipline	7	14.0
Indiscriminate disposal of waste	7	14.0
Indiscriminate dumping of waste	8	16.0
Lack of education	7	14.0
No vehicle	7	14.0
Regular breakdown of vehicle	7	14.0
Total	50	100.0



Figure 3: Skip Container Overflow with waste at the CBD premises in Techiman



Figure 4: Skip Container overflowing with Waste at the Techiman orange market

public grounds in the municipality clean and environmental conditions in the markets, streets and lorry stations still leave much to be desired as these grounds have heaps of garbage left uncollected.

The state of equipment at the waste management departments

Waste collection and transportation services is a public private partnership, the Techiman municipal waste management department do not only supervise the activities of Zoomlion but also carry out street, markets and drain cleaning. Both the municipal waste department and the Zoomlion Company limited are responsible for the maintenance of the final dump sites.

However, information gathered for this study showed that, neither the municipal waste management departments nor the Zoomlion Company has adequate logistics for their operations.

Interview with the municipal waste management department indicates several broken down equipments including waste trucks, tricycles, tipper trucks, skip containers among others. They added that the department was under financed which

was a challenge to managing the solid waste menace in the municipality. The World Bank, UNESCO and Abu Katakayie Company limited, a private waste company from 2002 to 2006, supported TMWM department in the evacuation of some heaps of waste in the municipal area and in the management of the landfill site. He lamented that the inability of the waste department to play its role of providing waste management services was because of the inadequate logistical challenge.

Waste components

The major waste components generated in the Techiman municipal area ranges from food waste, plastics, metals, wood waste, paper, glass and other types of waste. These are shown in percentages in Figure 5 illustrated below.

The major components of solid waste generated in the municipality includes food waste 71 per cent, plastic waste 13.3 per cent, metals 2 per cent, wood waste 3.6 per cent, paper waste 3 per cent, glass waste 1.9 per cent and others 4.5 per cent. The assessments of the major waste generated by the Assembly persons in their electoral areas were mainly food waste which conforms to that of the household assessment.

Municipal environmental health division of the Ghana health service

The Environmental health directorate of the Ghana Health Service is responsible for public health management in the Techiman municipal area of the Brong Ahafo Region [15]. The functions of the division include the following:

- (i) Provision of guidance to MLGRD on environmental sanitation sector planning, policy and legislation;
- (ii) Planning and assisting in the areas of human resources development;
- (iii) Provision of technical assistance and training to District Assemblies and service providers;
- (iv) Coordinating and disseminating the results of research in the field of environmental sanitation.

Good sanitation and environmental management is a very important aspect for human health. Poor environmental sanitation has dire consequences on the health of the people.

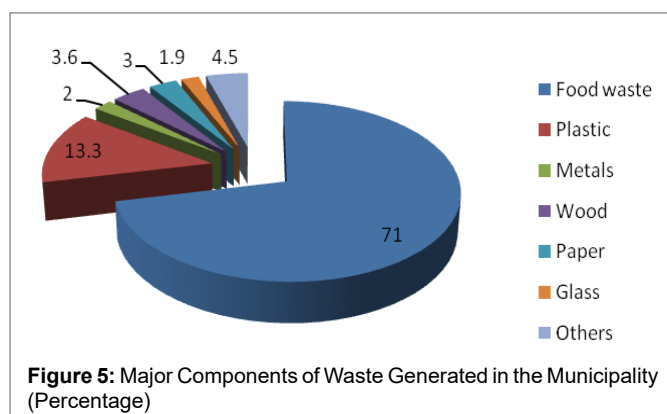


Figure 5: Major Components of Waste Generated in the Municipality (Percentage)

Data gathered from the Municipal Health Directorate revealed that, in 2010, 86.93 per cent of the top ten causes of admissions to hospitals in the Techiman municipality were environmental or sanitation related, with malaria topping the list [16]. The remaining 13.7 per cent of admissions were caused by all other diseases and complications combined. The situation was no different in the year 2011 and 2012 respectively [17].

One major finding of the study was the lack of coordination between other allied agencies, such as the Waste Management Department, Town and Country Planning Department, the Municipal Health Directorate and Ghana Water Company Ltd. These departments and agencies do not see themselves as working together towards a common goal, that is, improving public health but rather see their activities as independent of the other. For example, the Ghana Health Service sees itself as health service provider and has nothing to do with the Waste Management Department. This was demonstrated clearly by the Disease Control Officer of the Techiman Municipal Health Directorate as she refused to answer questions the Researcher posed to her and said it was the responsibility of the Environmental Health Unit to answer those questions. It rather spends huge sums of money annually on curative measures rather than partnering with the MWMD to provide preventive measures which could eventually reduce environmental and sanitation related diseases in the municipality.

Summary and Discussions of the Research Findings

The solid waste situation in the techiman municipal area

The study found that Techiman municipality had very poor solid waste and environmental sanitation situation. This was evidence from the heaps of the waste accumulation and overflowing waste containers in many residential and commercial areas around the central business district, heavy litter on the streets and open drains, garbage-choked gutters.

The analysis has shown that waste generations in the Techiman municipality greatly outstrip the capacity of the authorities responsible for the collection of waste. In Techiman, the municipal waste department claims that 60% of the daily waste output was collected for disposal. Meanwhile the validity of these analysis put out by the TMWMD could not be ascertained, it was clear to any observer that higher quantities of solid waste remain uncollected each day and waste accumulation was a growing problem, making the municipality and its environs prone to environmental and sanitation epidemics. Apart from the low rates of waste collection in the municipality, the study also found that the stakeholders (Zoomlion) and other authorities sometimes concentrate their waste collection activities in areas that inhabit the rich.

Out of the 200 households interviewed, 60 per cent dump their waste at the waste dump while 35 per cent had access to dustbins for the disposal of solid waste. Takofiano, Mamprusi

line, Mayanka and parts of the yam market recorded low access to containers for solid waste collection services in the Municipality.

Community Environmental Sanitation

The study revealed differences in sanitation behaviour among the various housing sectors in the municipality. Residents from the traditional housing sector (Takofiano and Sabon Zongo) described the environmental sanitation condition in their suburb as bad. This implies that more attention must be given to suburbs in the traditional housing sector in any sanitation improvement projects, since they have poor environmental sanitation conditions.

Even though the Municipal Assembly has made great effort in improving the environmental sanitation situation in the Techiman Municipality, the sanitation conditions are still worsening. In the overall assessment of the environmental sanitation condition in Techiman, 80.8 per cent of the respondents described the environmental sanitation condition in the area as from bad to worst.

Solid Waste Disposal

The research revealed that, some households from the high-income housing sector dispose of their waste using unapproved means such as burning of paper and other combustible materials. Respondents from the traditional housing sector expressed desire for the house-to-house waste collection services. However, the respondents from the tenement sector who have had the house-to-house waste collection service before and were now using the communal waste disposal (Skip container), indicated that they do not want the house-to-house service because the service providers fail to empty the waste bins on time, which causes the waste bins to overflow. If these inefficiencies in service provision remain unchecked, it will negatively impact on efforts to promoting the house-to-house waste collection services in the Techiman municipal area.

Enforcement of Environmental Sanitation Bye-laws

Poor environmental sanitation practices have largely been attributed to poor attitude of the people towards sanitation. To ensure good environmental sanitation practices in the Techiman municipality, majority of the respondents proposed that the Techiman Municipal Assembly enforce the existing Environmental Sanitation Bye-laws to make the inhabitants responsible and accountable for environmental sanitation in their immediate environment. The people also called for the re-introduction of a past concept call the “Samasama” and the empowerment of chiefs and their elders to help summon persons who litter the environment for the traditional rulers to carry out the appropriate punishment. At Takofiano, the Federation of Muslim Women Association of Ghana (FOMWAG) suggested the institution of an award scheme that would award communities that had observed and maintained a clean environment over time as a motivation for others to copy.

Punishment for Breaking Sanitation Bye-laws

To ensure enforcement of the sanitation bye-laws, very strong punishment should be introduced to serve as a deterrent to others from engaging in bad environmental sanitation practices. From those interviewed, 66.7 per cent suggested that, environmental sanitation offenders be made to pay a heavy fine after they have been apprehended. Also, 20.5 per cent suggested that, offenders be made to do community service such as sweeping public places or dredging gutters for specific number of days. This would allow for spectators to see people who break the environmental sanitation laws work in public and they would eventually learn a lesson from that. The remaining 12.8 per cent of the respondents suggested that, offenders be prosecuted and put in prison for specific number of days/months to serve as a deterrent for others to learn.

According to the Senior Environmental officer in the Techiman Municipality, five (5) offenders were apprehended for breaking various sanitation offences in 2012, but due to political interference the Assembly was unable to prosecute a single person.

Techiman Municipal Waste Management Department

Departments in the Assembly, such as The Environmental Health Department lack the necessary logistics such as tools, vehicles and bulldozers to enable them to monitor environmental sanitation activities in the Techiman Municipality. The Department also lacks adequate data to help them to identify priority areas for effective planning purposes to reduce the waste menace in the Municipal area.

There was also the lack of coordination between the WMD, Environmental Health Department, the Town and Country Planning Department and the Building Inspectorate division and other line agencies in the study area. For instance, developers get the permit to construct stores and offices without making adequate provision for sanitation which invariably puts pressure on public facilities and compound the sanitation problems in the city.

Enforcement of Environmental Sanitation Bye-Laws

The study revealed that the principal cause of the poor sanitation conditions in the Techiman Municipality should be attributed to the poor attitude of the people towards environmental sanitation. People know what constitutes good sanitation practices, but they would pretend and do what is wrong thereby engaging in bad sanitation practices. TMA must make conscious effort to implement and enforce the environmental sanitation regulations and bye-laws to punish offenders and to serve as a deterrent to others in the municipality area. The “Samasama”⁴ concept should be reinstated and empowered to arrest sanitation offenders. The Techiman Municipal Assembly can effectively do their work in collaboration from the Ghana Police Service, the Ministry of Local Government

and Rural Development and the Judicial Service by establishing sanitation Courts in all the Metropolitan, Municipal and District Assemblies in the country to expeditiously give speedy trails to sanitation cases before them. Enforcing the bye-laws would result in compliance and cost savings for the Municipal Assembly. A classic example of a country that has transformed its urban environment with strict sanitation regulations to turn its cities into economic fortunes is Singapore. The Accra Metropolitan Assembly (AMA) has also established sanitation courts to prosecute sanitation offenders in its effort to improve upon the sanitation situation in Accra.

Political Support in the Management of Waste (Waste governance)

The study found that both the national and municipal governments in Ghana lack the political will of enforcing solid waste management bye laws. The political neglect of the waste situation was shown in a few ways including the lack of a waste policy to give direction on the waste management situation in the Techiman municipal area. The study also revealed that the low political will in the waste management and sanitation sector was because of the lack of public education and the need to inculcate sanitation education in the educational curriculum. If political support or waste governance is introduced into the local government structure and decentralized to all the MMDAs it would help to curb the waste situation and thereby reducing sanitation related diseases which are prevalent in the Techiman Municipal area.

Provision of Sanitation Facilities in the Municipality

The study revealed that pedestrians litter anywhere due to the unavailability of waste bins on streets and public places. Adequate investment should be made in the provision of waste bins on all streets and public places. Business owners should be encouraged to place waste bins in front of their businesses, and the Techiman Waste Municipal Department (TWMD) must ensure that the waste management company (Zoomlion) empties the waste bins regularly. This would reduce the amount of waste disposed of on streets, in the centre of compounds, in front of shops and walkways. The Techiman Municipal Waste Management Department (TMWMD) alone cannot provide the needed sanitation infrastructure, the private sector should be encouraged through incentives to provide such infrastructure, especially making communities to own their waste containers and contribute towards the collection of the waste they generate while the TMWMD and the private waste companies concentrate on the collection of waste in the public sector.

Hygiene Behaviour and Hygiene Promotion

Adequate hygiene behaviour is crucial in preventing diseases. Improving infrastructure without improving behaviour will rarely result in effective disease control and good environmental sanitation practices. The largest improvements

in environmental sanitation and the health implications would occur with hygiene improvement because of behavioural change of the residents. Hygiene education is integral to environmental sanitation. An Akan way to pronounce those who inspect the sanitation conditions in the households in the past. These people used to summon people and the Akan could not mention the word summon but called it Samasama.

Hygiene education seeks to support sustainable behaviour improvements through increased awareness and knowledge. It greatly influences the extent of people's adaptation to environmental sanitation regulations, policy issues, new technologies and participation in environmental awareness. Hygiene education should therefore be included in the Ghana Education Service School's curriculum from the Basic Education level to the tertiary level to enable us start with the young ones on the need to keep their surroundings clean and this would trickle down to their parents and the society at large. This would ensure that school children understand the concept of sanitation and the consequences of indiscriminate waste disposal, the health and economic benefit that can be accrued from engaging in good environmental sanitation practices. They can then become ambassadors for environmental sanitation in their homes and on the street. Changing people behaviour is difficult and often requires prolonged education. As the saying goes "catch them young." The media operating in the municipality must also be involved in campaigning for good environmental sanitation.

Zoomlion and Municipal Waste Management Department

Zoomlion Ghana Company limited was the only waste management company in the municipality collaborating with the municipal waste management department to solving the environmental sanitation problems in the municipal area.

Institutional capacity for improved service delivery

The private waste management company has an important role to play in improving sanitation in the Techiman municipality. The company may need assistance in acquiring the needed equipment to provide effective sanitation services to households. The banking sector could also play an important role in providing low interest loans for sanitation improvements to these companies to help them secure the necessary tools, adequate staff and equipment to be effective in their activities.

Adequate urban planning in techiman municipal area

Urban planning has an important role to play in assisting governments to meet the challenges of the twenty-first century, such as rapid population growth, slum development; deteriorating environment coupled with the increasing sanitation related diseases. It is against this background that, the Global Report on solid waste management argued that, in most parts of the world current approaches to planning must change and that a new role for sustainable urban development must

be found. This would ensure that developers and house owners make adequate provision for solid waste collection services. This would reduce the pressure on public sanitation facilities. There is also the need for collaboration between The Town and Country Planning Department, The Environmental Health Directorate, Ghana Health Service and the Waste Management Department of the Techiman Municipal Assembly to ensure development control by ensuring that developers comply with environment and sanitation requirements laid down by the Assembly before putting structures at the sites that they acquire.

Capacity Building for the Municipal Waste Department

Sanitation programmes need planners and other sector professionals who are trained in evaluating different approaches to providing, operating and maintaining good environmental sanitation. One of the challenges of the TMWD pointed to a severe shortage of qualified field workers and engineers to providing the needed technical knowhow to help develop sanitation programmes that will clear the municipality of filth. The TMA needs to pay attention to the Environmental Health Department by equipping it with the needed logistics such as vehicles, public address systems and computers to ensure efficient operations in the Department.

Discussions of Results

Means of households waste disposal by residents

The research reveals that majority of the household size is 10 people which is far beyond the 2010 population and housing census average household size of 4.3. This contradiction goes long way to affect environmental management planning. The methods of waste collection services are mainly waste dump and home collection where waste dump is the most preferred choice because it is virtually free couple with small dustbins and the inability of service providers to collect home waste at the agreed time schedule. The method of waste disposal from the households indicates that food waste is disposed of at the waste dump and skip containers while plastics and paper waste generated at the household level is burnt. Other waste generated is dump into drains, gutters and by the roadside. Overflowing skip container with waste at the central business district such situation poses health hazards to the people.

Resources available in collecting the waste generated

The frequency of waste collection is mostly weekly but due to the wrong estimation from the 2010 Population and Housing Census report which estimated the household size to be 4.3 and containers located at communities to collect their waste gets full within a short period of time which overflow creating health hazards to the residents and the environment. Collection of waste is a major challenge to the Techiman municipal Assembly and this was due to the inadequate logistics and funds to enable the Municipal Assembly and the private waste management institution, Zoomlion to handle the situation. This has left to the uncollected wastes forming heaps in and around the Techiman municipal area.

The Role of the Municipal Environmental Health Division of the Ghana Health Service

The Environmental health directorate of the Ghana Health Service is responsible for public health management in all the urban areas in the country including the Techiman municipal area of the Brong Ahafo Region. The functions of the division include the following:

- (V) Provision of guidance to MLGRD on environmental sanitation sector planning, policy and legislation;
- (vi) Planning and assisting in the areas of human resources development;
- (vii) Provision of technical assistance and training to District Assemblies and service providers;
- (viii) Coordinating and disseminating the results of research in the field of environmental sanitation.

Good sanitation and environmental management is a very important aspect for the health of humans and their environment. Poor environmental sanitation has dire consequences on the health of the people. Data gathered from the Municipal Health Directorate revealed that, in 2010, 86.93 per cent of the top ten causes of admissions to hospitals in the Techiman municipality were environmental or sanitation related, with malaria topping the list. The remaining 13.7 per cent of admissions were caused by all other diseases and complications combined. The situation was no different in the year 2011 and 2012 respectively.

One major finding of the paper was the lack of coordination between other allied agencies, such as the Waste Management Department, Town and Country Planning Department, the Regional Health Directorate and Ghana Water Company Ltd. These departments and agencies do not see themselves as working together towards a common goal, that is, improving public health, but rather see their activities as independent of the other. For example, the Ghana Health Service sees itself as health service provider and has nothing to do with the Waste Management Department. This was demonstrated clearly by the Disease Control Officer of the Techiman Municipal Health Directorate as she refused to answer questions the Researcher posed to her and said it was the responsibility of the Environmental Health Unit to answer those questions. It rather spends huge sums of money annually on curative measures rather than partnering with the MWMD to provide preventive measures which could eventually reduce environmental and sanitation related diseases in the municipality.

Urbanisation and rapid increase in population

Population growth in many of the towns and cities is rapid and this is usually because of rural drift to urban centres for commercial activities and also to find a place where one can be assured of all the social amenities including proper education. This drift had increased the urban population putting pressure on existing sanitation and environmental management

facilities. This has therefore made the central government and its decentralized agencies difficult to provide quality services to towns and cities which have overgrown their bounds and now become very busy and crowded commercial central business districts.

Because of rapid urban population growth, the development of informal settlements and growing urban poverty, African governments will need to provide sanitation to 211 million urban residents to attain the Millennium Development Goal seven (7) targets 10, [18]. This is therefore a big task given to the Sub-region and African governments in the day of high population momentum and increase in the rural urban drift to congest the few towns and cities making them a hub of all kinds of waste creating health, sanitation and environmental nuisance.

Poor motivation and lack of Incentives

The way in manner environmental bye-laws are enforced and adhere to in the waste and environmental management sector can partly be attributed to the poor motivation to those who are to enforce the law. In the Techiman municipality of the Brong Ahafo Region of Ghana the necessary equipment and logistics to aid in the proper waste and sanitation management strategies is woefully inadequate. These personnel when the law catches up with a person anything the person gives in a form of a bribe is accepted instead of allowing the law to deal with persons who break the sanitation related offence. Central government in its wisdom through the MMDAs and other stakeholders in the sector must resource adequately these personnel by providing them with waste and environmental sanitation equipment, vehicles, motorcycles, rollers, compactors, the needed fuel and other incentives packages and daily remunerations to curb the incidence of bribery in the sector.

To highlight this point, the table below shows the logistics situation as far as waste and environmental sanitation management is concerned in the Techiman Municipality of the Brong Ahafo Region of Ghana.

The government of Ghana [19] through Waste care and Carl Bro both non-governmental organizations in the management of environmental sanitation provided training on waste management restructuring for the environmental and sanitation officers, the District and Municipal Chief Executives, Assembly persons, Zoomlion officials and heads of the decentralized departments of the municipal Assembly. Food handlers in the municipality were also trained by the disease control unit on how to hygienically handle food to prevent food contamination.

There has also been a gradual increase to the number of employees from 2006 to 2012 in the sector that manages waste in the municipality. The increased in the number of employees alone cannot solve the environmental problems but the effectiveness of these employees in terms of their operations couple with the availability of equipments, waste management policies and other interventions will effectively address the waste problems in the Techiman municipality

The provision of waste management equipment's to the Techiman Municipal Assembly is erratic because of poor maintenance culture. It is expected that the rate of provision of these equipments should commensurate the population growth rate of the Municipal area.

In the light of the above observations, these concluding questions need some answers in this section:

- Who should fund the waste and environmental sanitation in Ghana? The sub region must be up and doing in the sector of waste education to solving the waste and environmental sanitation menace than to rely on donor funds.
- How can we speed up the implementation of waste education to achieve 50-100 per cent coverage? Since most countries in the sub region cannot achieve the MDGs targets by 2015 which are waste diseases related.
- What waste and environmental sanitation module is required to solving the waste menace in Ghana? The module will help sustain the waste challenges and a long way to achieving the MDGs targets by 2015 which are waste diseases related.

The Way Forward

In this section, the paper will outline a brief statement of key issues, for discussion, on the main topics in moving forward on the waste and environmental sanitation in the country and especially in the Techiman municipality.

Building the capacity of stakeholders in the waste sector and research

In many countries capacity building and development on the waste and environmental sanitation focus on improving the enabling environment and human resources rather than strengthening structurally the sector and adding to the educational curriculum in the waste and environmental sanitation sector. The essence of the involvement of the sector in the educational sector is to build a long-term management and operating capacity. Governments need to develop and implement very effective National Sanitation Policies and Action Plans towards a new era of sanitation education implementable from the basic level to the tertiary level. This will lead to the strengthening and promotion of the concept of behavioural change through the building of capacity for waste, environmental health and sanitation unit. The required logistics such as transport, qualified staff to reach out to all communities with education, enforcement of laws and regulations shall be the road map to the new era of modeling a comparative system to eradicating the waste menace in the country.

Development programmes such as research in waste and environmental sanitation carried out by institutions of credibility must not be left in the shelves but the recommendations must be implemented. Questions as far as

waste and environment sanitation is concerned are; what are the gaps and recommendations made by research institutions? What are the current educational institutions working on sanitation and what programs are they offering?

Public involvement in decision making processes

The impact of waste and environmental sanitation is detrimental to the health of the people. Stakeholders in the decision-making process, planning and implementers in the towns and cities should try and be part of all respective decisions. Various stakeholders including traditional rulers, religious leaders and the public must collaborate and participate in the sanitation related issues and enforcing regulations and by-laws at the community levels and beyond. This approach will ensure a scope of including the children in the education of waste and environmental sanitation.

Planning and the Strategies

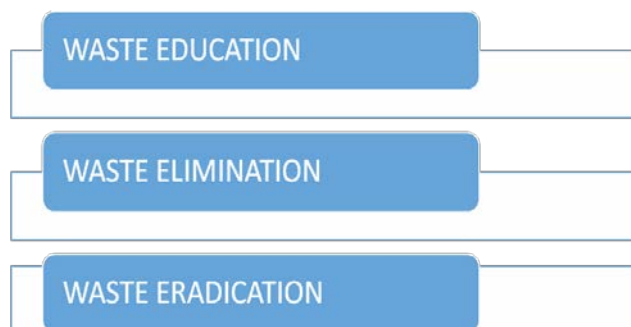
The Central government must consider, short, medium and long-term action-oriented plans to mitigate the waste and environmental sanitation challenges that the country is engulf in.

To make this sustainable, it is vital to draw policy guidelines which are action driven for implementation. Ghana has the National Environmental Sanitation Policy document which is long term action plan from which all other sanitation related policies are based on.

Additionally, the Ghana government [20] has prepared a National Environmental Sanitation Strategy and Action Plan (NESSAP) and the District-level Environmental Sanitation Strategies and Action Plans (DESSAPs) to speed up the quality of waste and environmental sanitation delivery.

But the question one need to ask is; are these policies not drawn only on the paper as paper works?

This paper has an antidote to the waste and environmental management challenges to this country. The module is the three E's; Education, Elimination and Eradication of waste. A school set up in the Sunyani Municipality, the Sacred Heart Basic School uses the module. Right from Day Nursery to the Junior High School levels the children are trained on how to handle waste, how to minimize waste generation, how to be disposed of waste among. The suggested module is elaborated below.



Conclusions

In concluding, the paper an overview assessment of the solid waste and environmental sanitation management situation, challenges and solutions to addressing these challenges has been addressed. Overall the major problem identified is the lack of solid waste and environmental sanitation management education in our school curricula from the basic level to the tertiary level to instill the culture of environmental management in the young who will grow to be environmentally sensitive and manage the environment to eradicate sanitation related diseases from the Ghanaian cities. Other challenge identified includes; review of the legislation and by laws, punishment for breaking sanitation by laws, waste ownership and waste financing.

Review of the Legislation and Law Enforcement

The driving element when it comes to an enabling environment free from filth and sanitary related diseases is the existence of sanitation laws and regulations. Government and the various stakeholders shall formulate by laws which should be reviewed in line from the national policies from time to time to address the current situations at hand. There should also be a clear-cut direction on the roles and responsibilities of all key partners in the waste and environmental sanitation management sector to realistically implement the general regulations and policies to enhance the enforcement of the sanitation by laws.

Enforcement of environmental sanitation bye-laws

Poor environmental sanitation practices have largely been attributed to poor attitude of the people towards waste and environmental sanitation management. To ensure good environmental sanitation practices in Ghana and the Techiman municipality, the paper proposed that the MMDAs must in a matter of agency enforce the existing Environmental Sanitation Bye-laws to make the inhabitants responsible and accountable for environmental sanitation in their immediate environment and beyond. The people also called for the re-introduction of a past concept call the "Samasama" and the empowerment of chiefs and their elders to help summon persons who litter the environment for the traditional rulers to carry out the appropriate punishment.

Punishment for breaking sanitation bye-laws

To ensure enforcement of the sanitation bye-laws, very strong punishment should be introduced to serve as a deterrent to others from engaging in bad environmental sanitation practices. It is however, important to choose a cost effective but efficient punishment that would help balance punishment and cooperation. Cooperative methods alone will not ensure voluntary compliance. Punishment should be structured so that penalties increase in severity for repeat violators. From those interviewed, 66.7 per cent suggested that, environmental

sanitation offenders be made to pay a heavy fine after they have been apprehended. Also, 20.5 per cent suggested that, offenders be made to do community service such as sweeping public places or dredging gutters for specific number of days. This would allow for spectators to see people who break the environmental sanitation laws work in public and they would eventually learn a lesson from that. The remaining 12.8 per cent of the respondents suggested that, offenders be prosecuted and put in prison for specific number of days as deterrent for others to learn. A classic example of a country that has transformed its urban environment with strict sanitation regulations to turn its cities into economic fortunes is Singapore.

The Accra Metropolitan Assembly (AMA) has also established sanitation court to prosecute sanitation offenders in its effort to improve sanitation in the capital city. According to the Senior Environmental officer in the Techiman Municipality, five (5) offenders were apprehended for breaking various sanitation offences in 2012, but due to political interferences the Municipal Assembly was unable to prosecute one of the five culprits.

Waste Ownership

Since sanitation and solid waste management affects the whole populace, stakeholders, service providers and the MMDAs must be involve in all decision-making, planning, education and implementation process. There must be an increased collaboration and a very active involvement of the waste generators who should own the waste they generate. Other actors such as the traditional and religious leaders should effectively communicate the impacts of environmental sanitation related situation and enforcing regulations and bye-laws at the community levels. This is the beginning to addressing the environmental challenge in the country for this approach would ensure a wider scope of all-inclusiveness to help achieve a realistic and much sustainable way because the waste must be owned by the people who generate the waste.

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