

Waste Management and Environmental Sustainability in Ghana: Challenges and Strategies of the Ketu North Assembly in Managing Waste

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Abstract

Solid waste management has become a huge burden to most developing countries. The hard and harsh reality is that most developing countries are overwhelmed by the volume of waste they generate. Consequently, waste management is increasingly getting policy attention in most emerging countries. These countries have neither the technical expertise nor the financial resources or facilities for confronting this challenge. Academics seeking to bemoan the fate of waste management in intellectual discourse draw an emblematic parallel between waste as a resource in the developed countries and waste as a burden in developing countries. This article examines the challenges confronting Ketu District Assembly in managing waste and assesses the strategies used in doing so. The major objective of the study was to analyse the degree of sustainability of waste management practices in Ketu North District. Information was gathered from the field through face-to-face interviews and through the administering of questionnaire among waste management practitioners and producers of waste. The research revealed that the major challenges militating against sustainable waste management in Ketu North District are; inability of the Ketu South Assembly to re-cycle waste, rising cost of haulage and difficulties in acquiring land for final disposal sites, environmental pollution and its attendant health hazards, inadequate communal waste containers in the communities, inadequate litter bins for commuters at vantage points and poor waste management attitudes. In this 21st century where waste is considered a resource, Ketu District should be in the position to make gains from the management of solid waste rather than allowing it to become a burden that would continuously drain the District's meagre resources. The study recommends the provision of more communal waste containers and litter bins to promote waste separation and harnessing it as a resource for development and periodic education of the people to help address poor attitude to waste management. The article further recommends re-cycling of waste with undiminished intensity until poor attitudes are righted and waste becomes a resource for generating employment, rather than a drain on the meagre resources of the District Assembly.

Key words: waste management, environmental sustainability, solid waste pollution, health hazards.

Introduction

Chapter one sets the overview of the study which includes background of the study, statement of the problem, research objectives of the study, research questions and significance of the study. The chapter also talked about research methodology, scope of the study, limitations of the study and organization of the work.

The wanderings of waste-bearing vessels like the *Karin B*, the *Deep Sea Carrier*, the *Zanoobia* and the *Khain Sea*, which travelled the globe looking for places to dispose of their waste and found that the world was no longer large enough, or willing to accommodate them was perhaps one of the prevailing images of the 1980's. Crises like these come and go but the core issues remain – how can the wastes generated by the world be dealt with in an environmentally sound manner? (Gray, 1993)

With approximately 1.3 billion tons of municipal waste generated each year, and volumes expected to increase to 2.2 billion tons by 2025 according to World Bank figures, urgent action is needed to head off the threat to the environment and human health posed by this global waste crisis (UNEP GPWM, News Conference, 2012)

A United Nations Environmental Programme (UNEP) report indicates that the ever-faster population growth, urbanization and economic development are producing increasing quantities of waste that are overburdening existing waste-management systems.

According to the report, there is no end in sight to this trend: by 2030, the global middle-class would have grown from 2 billion to 4.9 billion, each of these new affluent consumers longing for greater quantities of more sophisticated and resource-intensive goods. Public waste systems in cities cannot keep pace with urban expansion; rapid industrialization is happening in countries that have not yet developed the appropriate systems to deal with hazardous and special wastes; and the growing trade in waste poses significant challenges (UNEP

GPWM, News Conference, 2012).

The concept of waste has two very distinct dimensions, the human/economic dimension (wastefulness and pollution) and the ecological dimension (which has a human factor). The human/economic dimension relates to using more than we need; the by-products of production; by-products in use; the disposal of by-products and what to do with the by-products when humans have stopped using them. The ecological dimension relates to the effect of this process on the capacity of the biosphere to continue functioning – a challenge facing society today (Miller, 2011)

Developed countries of the late 20th century are increasingly discovering that their material wealth and technological advancements are submerging them in a volume and variety of wastes that threaten both their environments and established ways of life. The United States of America may serve as an example of situations all too common worldwide (Miller, 2011) Looking at the human/economic dimension of waste, it can be deduced that the issue of waste is associated with development. As populations grow, incomes rise, and consumption patterns change, the volume of disposal materials continues to expand. Relatively, little waste is created in subsistence societies that move food from garden to table, and waste from table to farm animals or compost heaps.

Aside the ever increasing population coupled with unplanned urbanization and industrialization, another issue as far as waste management is concern is its rising cost. A report from the biennium conference of the UNEP-hosted Global Partnership on Waste Management (GPWM), held on November 5 and 6, 2012 in Osaka, Japan indicated that Waste management is one of the most complex and cost-intensive public services, absorbing large chunks of municipal budgets even when organized and operated properly (UNEP GPWM, News Conference, 2012).

Another issue regarding waste management is the threat posed by poor waste management which is particularly prominent in low-income countries where waste-collection rates are often below 50 per cent. Piles of garbage along river banks; thick smoke from open burning of mixed, and partly toxic, waste; pungent odors; flies and rodents are an all too familiar scene. Besides, basic human needs such as clean water, clean air and safe food are jeopardized by improper waste management practices, with severe consequences for public health. Poor waste collection can lead to the spread of disease and improper waste disposal – for example, hazardous waste mixed with household waste – can be extremely harmful for workers in the waste sector, adjacent communities, and the environment (UNEP GPWM, News Conference, 2012).

Another important issue that is associated with waste management is emission of greenhouse gases. In a global era where climate change is one of the most important topics of discourse, every year an estimated 11.2 billion tons of solid waste is collected worldwide and decay of the organic proportions of solid waste is contributing about 5 per cent of total greenhouse gases (UNEP GPWM, News Conference, 2012).

The issues regarding waste management are more of a threat to the environment and human survival, according to Matthew Gubb, the director of the UNEP's International Environment Technology Centre (IETC) he recognizes both risks and opportunities inherent in the waste sector and highlights it as "a model area for greening the economy". Indeed, if handled properly, waste management has huge potential to turn problems into solutions and to "lead the way towards sustainable development" through the recovery and reuse of valuable resources; the creation of new business and employment opportunities, including for the informal sector; reduced emissions of greenhouse gases from waste management operations, such as landfills; and conversion of waste to energy (UNEP GPWM, News Conference, 2012).

The benefits are huge, for both climate and business. A 2010 UNEP report showed that, in Northern Europe, recycling one ton of paper or aluminium saves more than 600kg and 10,000kg of CO₂ equivalent respectively. If you consider that a 2009 UNEP report revealed there is 65 times more gold in one ton of old mobile phones than the five grammes in a ton of ore, the business case for "urban mining" is clear. Those who work in the UD\$410 billion waste sector already understand the great potential of sound waste management. So, let's consider waste not as a problem, but as an opportunity to recover and convert resources, a paradigm shift that is gaining increasing currency. Whatever perspective one takes, the message is clear: waste matters (UNEP GPWM, News Conference, 2012).

The issues of waste management in Africa are somewhat a complex one as there are different issues contributing to the present state of play. These issues include the disconnect between Federal and State government and the local government authorities whose role it has inherently been to manage waste generated; the issues of funding for waste management projects; an understanding of global and newer models of sustainable waste management to mention but a few. Waste and its management is arguably the most crucial environmental challenge facing all African states and therefore the need for sustainable waste management approaches cannot be overemphasized. This has arisen out of the realization that wastefulness of our industrial society is compromising the ability of nature to sustain our needs and the needs of future generations.

Given recent advances in waste management practices, whether it is municipal waste, commercial and industrial, clinical, construction or food waste, there are a number of robust scalable technologies that can be

deployed to turn waste into a resource. Such technologies span waste sorting and commodity recovery facilities right through to highly efficient energy from waste plants whereby mixed waste streams can be used to generate renewable heat and power for local communities.

The successful management of waste continues to be elusive enterprise for many nations. In Ghana, waste management constitutes a monumental challenge that is not likely to be surmounted if consistent and focused actions are not taken. Due to increasing urban population and its concomitant urbanization, the changing pattern of production and consumption, and modernization of lifestyles and the economy, tons of waste are generated in our cities on daily basis. Apart from the technical and financial issues, successful waste management efforts should be substantially human-focused. The efforts of educating the citizenry on waste minimization and reuse, and reversing negative environmental attitudes should be intensified (WasteWise Ghana, 2012)

Philemon Kwesi Koomson (2013) stated “as a citizen of the Republic, I wish to express my concern about how managing waste in Ghana has become a problem over the years, reaching a stage where waste is engulfing us while promises are being made by government after government, and yet the waste problem seems unresolved” (Daily Graphic 9th February, 2013).

As an unavoidable by-product of economic growth, the issue of wastes management should be factored in the developmental programmes of the Ketu North District Assembly to find lasting solution to the seemingly intractable problem. This can only be achieved when issues and strategies in managing waste sustainably are adhered to.

Statement of the Problem

Solid waste management (a discipline associated with the control, generation, source separation, storage, collection, transfer and transport, processing and disposal of solid waste in a manner that is in accordance with the best principles of public health, engineering, economics, conservation and other environmental consideration and which is also responsive to public attitude) has not been of its best since independence of Ghana. As far back as the 1960’s to the late 1980’s, there was no properly constituted organization to manage solid waste generated in the country. Residents therefore generated and deposited their solid waste on nearby low-value lands, frequently wetlands, creating a waste dump. These dumps were the feeding places for most livestock’s with residents having less to no knowledge of the effect of such practices (Kwaku, 2010).

Today, the decentralized metropolitan, municipal and district assemblies supervised by the Ministry of Local Government and Rural Development (MLGRD) bear the ultimate responsibility for sanitation and waste management in the country through their Waste Management Departments (Sanitation Country Profile Ghana, 2004)

In most low income but densely-populated communities such as Dzodze, the District capital of the Ketu North District, central waste depositories (communal containers) are positioned at vantage points for the daily collection of waste from households at no cost to beneficiaries. Residents send all sorts of waste ranging from biodegradable to non-biodegradable. From the central collection points, communal containers are picked to final disposal sites.

But the million dollar question that comes to mind is as a District, is Ketu North really managing its waste well? The reality on the ground is more of waste disposal rather than on management practices such as waste prevention, reuse, material recycling, composting, energy recovery and final disposal.

Figure 1: A snapshot of a communal waste container overflowing with waste.



Figure 2: A snapshot of the final disposal site of waste in the Ketu North District at distant community called Deme.



Due to the growing urban population, migration, the changing patterns of production and consumption and modernization of lifestyles and the economy tons of wastes are generated in our cities on a daily basis. In the Ketu North District, the situation is not different as the issue of waste management becomes more noticeable as one move from the peripheral communities of the District where population size and consumption patterns are different from what pertains in the District capital which is more urbanized.

With our “throw-away” attitude of disposing of waste, the rising cost of waste management, its consequences on public health and the environment at large, Members of Parliament called for a national policy on waste disposal and enactment of a National solid waste law to deal with the problem (Daily Graphic, Friday, February 22, 2013). Amidst the aforementioned issues in waste management coupled with problems such as inadequate planning capacity, lack of unsound waste management options, increasing solid waste quantities in the Ketu North District and the fact that in this modern era where waste is becoming a resource, there is the urgent need for the Assembly and other stakeholders to put into their development plans issues and strategies to manage waste sustainably.

Research Objectives of the Study

The general objective of study is to examine sustainable waste management practices and sustainability of the methods that are employed in the management of waste in Dzodze.

Specifically, the study would look at the following:

1. To examine the structures and measures put in place by the Ketu North District Assembly to deal with waste management.
2. To analyze the current issues in managing waste (i.e. its drain on the Assembly’s budget, effects on public life and the environment)
3. To assess behavioral change especially among commuters on waste generation and management.
4. To recommend sustainable waste management practices through: (a) backyard composting, (b) waste separation in schools and homes, (c) reuse of materials.

Research Questions

The following are the research questions for the study:

1. What are the structures and measures put in by the District Assembly to deal with waste management?
2. What are the current issues surrounding waste management in the District?
3. Do commuters understand the implication of their throw away attitudes of disposing of waste the environment?
4. What measures or strategies can be used to promote sustainable waste management?

Significance of the Study

In the wake of the rising cost associated with waste management, its effects on public health and the environment at large, recommendations from the study would help reduce cost and effects on public health and the environment if put into practice. Good waste management practices also come with some employment

opportunities if adhered to, some idle hands would be gainfully employed. In addition, the study would contribute to knowledge since it would be a reference point for students who may want to carry out related research study. Further, the study would let people appreciate the need to be responsible for managing the waste they generate.

Literature Review

Chapter two deals with a review of literature related to the study. The review looks at what constitutes solid waste, the classification and categories of solid waste. The review also examines the concepts of sustainability and waste management. It defines sustainability and environmental sustainability which are relevant to the research topic. The relationship between the concepts of environmental sustainability and sustainable waste management will also be examined. Lastly, the review looks at the issues in waste management, the strategies for sustainable waste management which the Ketu North District Assembly needs to reduce cost in waste management.

This is the outline of the review of literature:

- 1.Solid Waste, Classification and Categories.
- 2.Concepts of Sustainability, Environmental Sustainability and Sustainable Waste Management.
- 3.Issues in Waste Management
- 4.Strategies for Sustainable Waste Management

Solid Waste Classification and Categories

According to Miller (2011), solid waste is any unwanted or discarded material that is not liquid or a gas. He stated that in nature, there is essentially no solid waste because the waste of one organism becomes nutrients for the organism. Further, he pointed out that humans will always produce some solid waste directly or indirectly in almost everything we do. Miller (2011) outlined two reasons for being concerned about the solid waste we produce directly or indirectly. One is that much of it represents an unnecessary waste of the earth's precious resources and the other being the solid products we use and often discard, is responsible for the huge amounts of air pollution, water pollution and land degradation.

A simple but thoughtful definition of solid waste given by Kwaku (2010) is all materials arising from human and animal activities that are normally solid and discarded as useless or unwanted. It includes all solid and semi-solid materials that the processor no longer considers of sufficient value to retain. In his examples, he said solid waste generally includes house sweepings, kitchen waste, garden waste, cattle dung and waste from cattle sheds, agro waste, broken glass, metal, waste paper, plastic, cloths, rubber, waste from markets and shopping areas and hotels.

Both Miller (2011) and Kwaku (2010), with regards to solid waste, emphasized discarded or unwanted materials, however in the modern Ghanaian context, there is a new trend of waste emerging that is un-discarded materials or items that are kept by households not for the want of it but for keeping sake. Examples of such items include old electronic gadgets-televisions, fridges and old brand of automobiles. Perhaps people who keep such items might not be aware they are surrounded by waste.

As per biodegradable, Kwaku (2010) classified solid waste as biodegradable and non-biodegradable. Biodegradable waste refers to material that is capable of being broken down, usually by bacteria, into basic elements. Most organic waste such as kitchen waste, animal dung, agricultural waste and paper are biodegradable. Non-biodegradable waste is waste which cannot be decomposed by biological processes and they are of two types-recyclable and non-recyclable. Recyclable waste refers waste having economic value but destined for disposal. Such a waste can be recovered and reused along with their energy value. Examples include paper, plastic, old cloths etc. Non-biodegradable waste consists of waste which does not have economic value. Examples include tetra packs and carbon paper.

With respect to categories of waste, Kwaku, (2010) identified five main categories of solid wastes. These are municipal, hazardous, agricultural and industrial wastes. Municipal Solid Waste (MSW) is mainly household waste including commercial waste and institutional waste. Municipal solid is highly heterogeneous and its composition depends on factors like living standards, types of housing, seasons, country and cultural habits of individuals. It is sometimes defined to mean all solid wastes that a city authority accepts responsibility for managing in some way. Hazardous waste is a special group of wastes defined by certain criteria fixed by an individual region or country and containing substances that can cause hazard to humans. Examples of hazardous waste include used dry cell batteries, paints, and fluorescent tubes Agricultural waste includes both plant and animal waste. Food processing waste is also considered agricultural waste although it may also come under industrial waste in some cases. Some agricultural wastes such as pesticides and fungicides are also hazardous waste. Industrial waste comprises waste from industrial and manufacturing processes and some of these could also be hazardous waste. Sewage sludge, which is mainly organic waste, from domestic and industrial waste water treatment plants is also an industrial waste. Such waste may include but not limited to the following

manufacturing processes: electric power generation; fertilizer/agriculture chemicals; organic chemicals; iron and steel manufacturing; leather and leather products; non-ferrous metals; explosives; organic chemicals; plastic and resins manufacturing; rubber and miscellaneous plastic products etc. Electronic waste (e-waste) is a waste type consisting of any broken or unwanted electrical or electronic appliance. It is a point of concern considering that many components of such equipments are considered toxic and are non-biodegradable. Examples include broken cell phones, old computers, refrigerators, TV sets, iPods, small appliances, and other obsolete gadgets that no longer serve a purpose and are thus discarded.

Arvid (2012) based his categorization of waste according to the origins of the waste streams. He identified two main groups' heterogeneous and homogeneous wastes. Heterogeneous wastes are solid wastes-mix generated and collected in urban areas often referred as Municipal Solid Waste (MSW). The MSW include waste from houses but sometimes also include waste from industries and small scale businesses in the urban area. Homogeneous waste on the other hand is solid waste generated from industries, farms, mines etc in both rural and urban areas. According to him homogeneous waste is easier to collect and process because such waste is concentrated to certain large producers. Further, Arvid (2012) categorized waste depending on the character and content where he identified two main groups as organic and inorganic waste. The inorganic waste for example can be divided into sublevels based on the material content as plastic, paper, metal and glass. To complete his classification Arvid (2012) touched on hazardous waste which he said deserves some extra attention. Hazardous waste he said consist of two subcategories namely medical waste and chemical waste and may be found in both heterogeneous and homogeneous waste streams.

Taiwo (2009) indicated that in the traditional scheme of classification, residential (domestic) solid waste consists of household garbage and rubbish, or refuse. The garbage fraction is mostly in the form of wastes derived from the preparation and consumption of food (for example meat and vegetable scraps). An alternate term commonly used to describe the garbage fraction is "putrescibles".

Classification of solid waste based on the origin hence being heterogeneous or homogeneous is relevant to the types of solid waste identified in the study area. The heterogeneous or the mixed solid waste which is more evident are generated from most households whilst the homogeneous waste are associated with small scale businesses such as metal fabrications, carpentry and hazardous waste from the hospital.

Concepts of Sustainability, Environmental Sustainability and Sustainable Waste Management Sustainability:

Rochlin (cited in Elliot 2012) pointed out that in 1984; the Worldwatch Institute published the first edition of State of the world, a report identifying the current state of the Earth and the problems it faces in its transition to a "sustainable" society. Among other things, this report documented how human consumption of Earth's resources is currently unsustainable (Brown et al, 1984). In order to cope with and manage this unsustainable reality, a new social movement is required. Called a "Sustainability Revolution" it demands participants to adopt a new value system, consciousness and worldview, the adoption of a new approach to development is needed. If not sustainable, development within the built environment, encompassing food, clothing, shelter and jobs will leave the world "prone to ecological and other crises" (United Nations, cited in Elliot, 2012)

Sustainability according to Miller (2011) is the ability of a specified system to survive and function over a specified time. He identified several types of sustainability which included a sustainable society. To him a sustainable society manages its economy and population size without exceeding all or part of the planet of the planet's ability to absorb environmental insults, replenish its sources and sustain human and other forms of life over a specified period usually hundreds to thousands of years. Further, Miller (2011) emphasized that a sustainable society learns how to live within the carrying capacity: the maximum number of organisms that a local, regional or a global environment can support over a specified period. This capacity depends on the available resource supplied and the ability of the environment to absorb, detoxify or recycle wastes produced by resource use.

According to Attah (2010), there are several definitions of the term "sustainability". While some have defined sustainability in relation to the ability of man to preserve the available natural resources and not over use the resources in a way that it will be deficient in the future; others have defined it in relation to policy making. But the definition given by the United Nation Commission on Economic Development in its 1987 Brundtland report seems to be generally acceptable. In its report titled Our Common Future, sustainability is defined as that which "meets the needs of the present without compromising the ability of the future generations to meet their own goals" (United Nations, cited in Atta 2010).

Taylor (2002), in his critique of the UN definition; argued that it is often difficult to determine the future needs of the next generation which may be different from the needs of people today. He further added that the developed countries view the concept of needs is completely different from the views of that of the developing countries. However, even though the UN definition of sustainability may have raised some controversies, it still covers the two fundamental issues; the pressing problem of environmental degradation that

results from economic growth and the need for such growth to lighten poverty in the society (Taylor cited in Attah, 2010).

Further, Attah (2010) stated that despite all these critiques, there is a general consensus that the rate of environmental degradation is increasing very fast. The rate of transformation of the earth is very rapid especially in the developing countries that are currently undergoing industrialization. Consumption of living resources as raw material and sinks for waste materials is high and growing (Wackernagel & Rees, cited in Attah 2010). To maintain a balance between the environment, economy and man has become the pressing goal that is facing the communities, enterprise organizations, government and the world at large, to Attah (2010), the way forward is for both developing and developed nations to work towards a sustainable environment.

Environmental Sustainability:

According to BusinessDictionary.com, Environmental Sustainability is defined as maintaining the factors and practices that contribute to the quality of environment on a long-term basis (www.businessdictionary.com)

In his Millennium Report of the United Nations in 2001, the then UN Secretary-General Kofi Annan stated that “Environmental sustainability is everybody’s challenge..... Our goal must be to meet the economic needs of the present without compromising the ability of the planet to provide for the needs of future generations” (UN Millennium Report, 2001: p17).

Another definition of Environmental Sustainability has been given by Daly (1973, 1974, 1992 & 1999) and Daly & Cobb (1989):

1. Output rule: Waste emissions from a project or action being considered should be kept within the assimilative capacity of the local environment, without unacceptable degradation of its future waste absorptive capacity or other important services.
2. Input rule:
 - Renewal resources: Harvest rates of renewal resources inputs must be kept within regenerative capacities of natural system that generates them
 - Non-renewable resources: Depletion rates of non-renewable resource inputs should be set below the historical rate at which renewable substitutes were developed by human intervention and investment according to Serafian quasi-sustainability rule. An easily calculable portion of the proceeds from liquidating non-renewable resources should be allocated to the attainment of sustainable substitutes (Daly & Cobb cited in Attah, 2010).

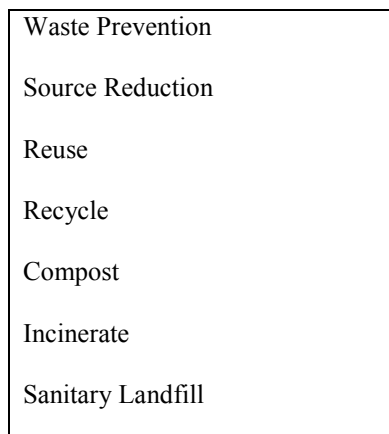
Sustainable Waste Management:

The conventional approach of solid waste management has been to manage the removal of solid discards from the immediate vicinity of human settlements. This resulted in the mechanized systems of collection and transportation of waste in the industrialized countries and landfills to bury waste. In the later part of the twentieth century, it was realized that societies will not be able to master the waste avalanche. The waste management has to change its focus from “efficient removal” to waste avoidance, minimization and recycling options with higher priority. Municipal solid waste contains organic waste, plastics, papers, glass, metal and inert substance. Carbon and nitrogen-based organic waste from kitchen, market and abattoir is a source of rich organic manure or energy. Plastics, papers, glass and metals are recycled into new products. Debris can be recycled and earth and inert waste used as landfill cover. This helps in conserving natural resources and also generates employment. Promotion of waste recycling sector and providing that with an institutional support can therefore be in tune with the goals of sustainable development (http://isebindia.com/05_08/07-01-1.html).

The key sustainability principles that need to be applied to waste management can be taken from Natural Capitalism that is radical resource productivity and Biomimicry. Biomimicry refers to lessons learnt from nature, in this case the fact that in nature nothing is wasted. The waste from one process becomes raw material for another in continuous closed cycles. In human terms this can be achieved through recycling and composting (John & Helen, 2003).

According to John & Helen (2003), the literature on sustainability supports the continuing relevance of the waste hierarchy as a guiding principle. Kwaku (2010) indicated that the hierarchy ranks waste management operations according to their environmental or energy benefits hence the purpose of the hierarchy is to make waste management practices as environmentally sound as possible. John & Helen (2003) mentioned that any interpretation of the waste hierarchy must also take into consideration broader environmental, social and economic impacts. According to Kwaku (2010) virtually in all countries, the hierarchy is similar to the figure 3.

Figure 3: Definition Sketch for Solid Waste Management, Hierarchical.



Source: Kwaku, 2010.

According to Kwaku (2010), source reduction tops the hierarchy because of its potential to reduce system costs, prevent pollution, consume resources and increases efficiency. Basic activities that can be adopted to encourage reuse practices include: reuse of bottles and glasses other disposable ones, rent, borrow and share items that are needed only on occasions, repair and maintain durable products. Recycling (including composting) involves collecting materials, reprocessing, and or remanufacturing into new materials or products and using them.

From a sustainability view, Arvid (2012) emphasized that an integrated solid waste management approach can only be seen as positive. Establishing a waste management plan deeply rooted and accepted at the local authorities and among the inhabitants is seen as the most critical step in Integrated Solid Waste Management. The waste management plan should also consider non-technical aspects such social and environmental effects of waste management and also set the road for how the waste management should be improved in the future (Arvid 2012). An integrated approach to Sustainable Waste Management can deliver both environmental and economic sustainability. Integrated Solid Waste Management (ISWM) is a comprehensive waste prevention, recycling, composting and disposal programme. An effective ISWM system considers how to prevent, recycle and manage solid waste in ways that most effectively protect human health and the environment. ISWM involves evaluating local needs and conditions, and then selecting and combining the most appropriate waste management activities for those conditions (Kwaku, 2010).

Environmental sustainability and sustainable waste management share some common features. Both concepts focus on the judicious usage of the earth's resources by human beings taking into consideration the future generation and the sink role the environment plays by absorbing generated waste. However, the reality on the ground is that rapid population growth, technological advancement and modern ways of production and distribution are not in tune with the concepts of environmental sustainability of which sustainable waste management is a part. Developed countries of the 20th century are increasingly discovering that their material wealth and technological advancements are submerging them in a volume of wastes that threaten both their environments and their established way of life (Fellmann et al, 1988).

Issues in Waste Management

A United Nations Environmental Programme (UNEP) report indicates that the ever-faster population growth, urbanization and economic development are producing increasing quantities of waste that are overburdening existing waste-management systems. According to the report, there is no end in sight to this trend: by 2030, the global middle-class would have grown from 2 billion to 4.9 billion, each of these new affluent consumers longing for greater quantities of more sophisticated and resource-intensive goods. Public waste systems in cities cannot keep pace with urban expansion; rapid industrialization is happening in countries that have not yet developed the appropriate systems to deal with hazardous and special wastes; and the growing trade in waste poses significant challenges (UNEP GPWM, News Conference, 2012).

According to Tsiboe (2004), the problem of waste in urban cities of Africa and can better be understood in the light of recent rapid urbanization worldwide and political pressures from outside Africa to deal with the governance and management problems related to waste (urbanization creates the waste and market forces serves as the panacea to the waste problem). For the first time in the history of mankind, we are witnessing an unprecedented phenomenon in the development of places of habitat: the balance of human settlement patterns have shifted from more people inhabiting rural areas to more people living in cities (Rabinovitch; UNFPA, cited in Tsiboe, 2004). This is especially so in developing countries such as Ghana, Lagos, Nairobi and Mauritania.

Urbanization introduces society to a new way of life: cars, pre-packed foods; it allows for economies of scale in the production of goods and services, and in the transportation of the finished products for human consumption (UNFPA, cited in Tsiboe, 2004). This new wave of urbanization as Rabinovitch (cited in Tsiboe, 2004) concludes has led to “a radical transformation in the structure of cities in many parts of the world accompanied by complex social, economic and environmental changes”.

Aside the ever increasing population coupled with unplanned urbanization and industrialization, another issue as far as waste management is concern is its rising cost. A report from the biennium conference of the UNEP-hosted Global Partnership on Waste Management (GPWM), held on November 5 and 6, 2012 in Osaka, Japan indicated that Waste management is one of the most complex and cost-intensive public services, absorbing large chunks of municipal budgets even when organized and operated properly (UNEP GPWM, News Conference, 2012).

Another issue regarding waste management is the threat posed by poor waste management is particularly prominent in low-income countries where waste-collection rates are often below 50 per cent. Piles of garbage along river banks; thick smoke from open burning of mixed, and partly toxic, waste; pungent odors; flies and rodents are an all too familiar scene. Besides, basic human needs such as clean water, clean air and safe food are jeopardized by improper waste management practices, with severe consequences for public health. Poor waste collection can lead to the spread of disease and improper waste disposal – for example, hazardous waste mixed with household waste – can be extremely harmful for workers in the waste sector, adjacent communities, and the environment (UNEP GPWM, News Conference, 2012).

On environmental issues, Cointreau-Levine (1994) stated that the decomposition of waste into constituent chemicals is a common source of local environmental pollution. This problem is especially acute in developing nations where very few existing landfills would meet acceptable environmental standards, due to limited budgets. The problem is again compounded by the issues associated with rapid urbanization. As land becomes scarce, human settlements encroach upon landfill space, and local governments in some areas encourage new development directly on top of operating or recently closed landfills. A major environmental concern is gas release by decomposing garbage. Methane is a by-product of the anaerobic respiration of bacteria, and these bacteria thrive in landfills with high amount of moisture. Methane concentrations can reach up to 50% of the composition of landfill gas at maximum anaerobic decomposition (Cointreau-Levine, 1994). Another important environmental issue that is associated with waste management is emission of greenhouse gases. In a global era where climate change is one of the most important topics of discourse, every year an estimated 11.2 billion tons of solid waste is collected worldwide and decay of the organic proportions of solid waste is contributing about 5 per cent of total greenhouse gases (UNEP GPWM, News Conference, 2012).

Francis and William (www.nurru.or.ug) identified operational inefficiencies as an issue in waste management. Operational inefficiencies are due to inefficient institutional structures, inefficient organizational procedures or deficient management capacity of institutions involved as well as the use of inappropriate technologies. With regard to technical system often, the “conventional” collection approach, as developed and used in the industrialized countries is applied in developing countries. The used vehicles are sophisticated, expensive and difficult to operate and maintain, thereby not meeting conditions in developing countries. Transport of waste also relies on operational vehicles and frequent breakdowns coupled with parts shortages can immobilize collection vehicles for extended periods of time. For example, UNEP (1996) estimated that in cities in West Africa, up to 70% of collection/transfer vehicles may be out of action at any one time (www.nurru.or.ug). Besides having serious economic, environmental and health implications, unsound waste management has a social dimension. Like most environmental hazards, deficiencies in waste management disproportionately affect poorer communities as waste is often dumped on land adjacent to slums. Left with the choice between going hungry and waste picking, one per cent of the urban population in developing countries choose to sift through the detritus on dumps and dirty streets. Millions of these waste pickers are being exposed to hazardous substances as they try to secure their survival and that of their families. Lead, mercury and infectious agents from healthcare facilities – as well as dioxins and other harmful emissions released during the recovery of valuable materials from e-waste – not only affect the health of waste pickers, but further contribute to air, land and water contamination (UNEP GPWM, News Conference, 2012).

As the crisis unfolds, there are significant opportunities for organizing the waste sector, with all its complexities, in a way that is more economically, environmentally and socially sustainable. Matthew Gubb, Director of the United Nations Environment Programme’s International Environmental Technology Centre (IETC), recognizes both risks and opportunities inherent in the waste sector and highlights it as “a model area for greening the economy”. Indeed, if handled properly, waste management has huge potential to turn problems into solutions and to “lead the way towards sustainable development” through the recovery and reuse of valuable resources; the creation of new business and employment opportunities, including for the informal sector; reduced emissions of greenhouse gases from waste management operations, such as landfills; and conversion of waste to energy (UNEP GPWM, News Conference, 2012).

The benefits are huge, for both climate and business. A 2010 UNEP report showed that, in Northern Europe, recycling one tonne of paper or aluminium saves more than 600kg and 10,000kg of CO₂ equivalent respectively. If you consider that a 2009 UNEP report revealed there is 65 times more gold in one ton of old mobile phones than the five grammes in a ton of ore, the business case for “urban mining” is clear. Those who work in the US\$410 billion waste sector already understand the great potential of sound waste management. So, let’s consider waste not as a problem, but as an opportunity to recover and convert resources, a paradigm shift that is gaining increasing currency. Whatever perspective one takes, the message is clear: waste matters. This concept of “Waste matters” was the message of the keynote address given by Richard Samans, Director General of the Global Green Growth Institute (GGGI) at the GPWM conference. Mr. Samans made an urgent call for “decoupling social and economic development from environmental degradation and resource use.” The GPWM, an initiative hosted at UNEP’s International Environmental Technology Centre (IETC), is already set up to answer this call, enhancing cooperation among various international stakeholders to promote better waste management practices and resource conservation and efficiency.

The issues regarding waste management are more of a threat to the environment and human survival, according to Matthew Gubb, the director of the UNEP’s International Environment Technology Centre (IETC) he recognizes both risks and opportunities inherent in the waste sector and highlights it as “a model area for greening the economy”. Indeed, if handled properly, waste management has huge potential to turn problems into solutions and to “lead the way towards sustainable development” through the recovery and reuse of valuable resources; the creation of new business and employment opportunities, including for the informal sector; reduced emissions of greenhouse gases from waste management operations, such as landfills; and conversion of waste to energy.

The benefits are huge, for both climate and business. A 2010 UNEP report showed that, in Northern Europe, recycling one ton of paper or aluminium saves more than 600kg and 10,000kg of CO₂ equivalent respectively. And that is not all. If you consider that a 2009 UNEP report revealed there is 65 times more gold in one ton of old mobile phones than the five grammes in a ton of ore, the business case for “urban mining” is clear. Those who work in the United State waste sector already understand the great potential of sound waste management. So, let’s consider waste not as a problem, but as an opportunity to recover and convert resources, a paradigm shift that is gaining increasing currency. Whatever perspective one takes, the message is clear: waste matters (UNEP GPWM, News Conference, 2012).

From the reviewed literature, issues in waste management present both threats and opportunities to humans as well as the environment. Comparing the practice on the ground with reviewed literature (theory), there is a gap that must be bridged. To bridge the gap and get to where others are in terms of opportunities regarding waste management, there is the urgent need for a massive education on waste management. Without sensitization it will be very difficult for the District to tap fully the opportunities that comes with waste management.

Strategies for Sustainable Waste Management

According to (JIP UI 2008), based on the definition by the Brundtland Commission, sustainable waste management aims at the improvement of human life by providing healthy living condition and providing economic advantages for human while at the same time keeping the effect of waste from damaging the ecosystems. It is safe to say that sustainable waste management means:

1. Environmentally sustainable waste management:

Environmentally sustainable waste management means a waste management that produces no damage to the biosphere and to any particular ecosystems. The focus should not only be on the immediate environment concerned but also on the implication for future generations. Starting from the source point, waste should be handled to avoid pollution, including the odor. There is a limit that defines if odors become a disturbance for human beings or not. Where and how waste should be discarded is the utmost crucial aspect in environmentally sustainable waste management for its effects are immediate.

2. Socially sustainable waste management:

Socially sustainable waste management implies meeting the needs for human’s health and well being, maintain the cohesion of a society, including the involvement of the society in its process, help society’s members to work together to achieve common goals and promote the society’s members to work together for long term goal.

3. Economically sustainable waste management:

Economically sustainable waste management emphasizes efficiency in the long run. Sustainability means the incorporation of externalities (external cost) into the total cost of for the management of waste. Including in the externalities are pollution prevention cost and social cost and the open opportunity for vulnerable group to be involved in the process.

Gertsakis and Lewis (cited in JIP UI, 2008) suggested that “other writers suggested in recent years have highlighted the fact that “true” sustainability will require significant increases in the efficiency of resource use (often called ‘eco-efficiency’). This is implying that the concept of waste management hierarchy of popularly 3R

is the basic requirement for sustainable waste management. Schall (cited in JIP UI, 2008) indicated that one way to achieve a sustainable waste management is by employing waste management hierarchy which is the basis for ISWM (van de Kludert & Anschutz, cited in JIP UI, 2008). Waste management hierarchy is a protocol for minimizing waste and maximizing recycling (Smith & Scott, CIWMB, cited in JIP UI, 2008). Gertsakis & Lewis (cited in JIP UI, 2008) stated that “the waste management hierarchy is a concept that promotes waste avoidance ahead of recycling and disposal.” The following are the steps in the hierarchy:

- The first aim of waste management policy should be waste minimization and reduction, that is reduce sources of waste. This is to say that individuals and businesses should look for opportunities to reduce the waste they generate before they practice any other option.
- Secondly, waste re-use should be examined. After all attempts to reduce or eliminate the generation of waste have been exhausted the next preferred option is to look for opportunities to reuse items or substances which could become waste.
- Thirdly, waste recovery by recycling and composting should be maximized. If all waste reduction and reuse options are exhausted, individuals and businesses should try to recycle waste items or substances.
- Fourthly, waste recovery by energy recovery should be maximized, as in waste to energy plants.
- Finally, the option is disposal to landfill, including recovery of energy from methane capture from landfill.

The concept of sustainable waste management defined further in the concept of Integrated Sustainable Waste Management. Integrated Sustainable Waste Management (ISWM) refers to a waste management system that best suits the society, economy and environment in a given location. ISWM recognizes three important dimensions in waste management: (1) stakeholders (2) waste system elements and (3) sustainability aspects. Schall (cited in JIP UI, 2008) indicated that one way to achieve a sustainable waste management is by employing waste management hierarchy, which is the basis for ISWM.

Kwaku (2010) indicated that an effective ISWM system considers how to prevent, recycle and manage solid waste in ways that most effectively protect human health and the environment. The major ISWM activities are waste prevention, recycling and composting, and combustion and disposal in properly designed, constructed and managed landfills. Each of these activities requires careful planning, financing, collection and transport. Kwaku (2010) outlined the following as the requirements for ISWM in Ghana:

- Development of a solid waste management plan which is needed to set up short-to-long term plans on management of solid waste in the country.
- Collection of data on waste composition-this is needed for planning, collection, transportation, treatment and disposal of solid. Good data is the foundation to effective ISWM systems.
- Separation of biodegradable waste from Municipal Solid Waste which can then be composted.
- Progress from uncontrolled dumping to the use of sanitary landfills.
- Formal involvement of scavengers in the collection of recyclable materials.
- Continuous education of the masses on good solid waste handling practices.
- Involving the public and private sectors in the management plan.
- Continuous provision of training for managers on the state-of-art management systems.
- Formal promulgation of laws to allow beneficiaries of solid waste management pay for the waste generation and collection. Prosecution, where necessary of offenders and monitoring of managers as they strive to meet targets.
- Sourcing for funds to manage solid waste.
- Adopting fee-based solid waste management systems.
- Incorporating cost recovery mechanisms into management strategies.
- Ensuring the autonomy and or independence of the Waste Management Departments to enable them implement sustainable programmes.
- Monitoring the systems to ensure higher efficiency.

According to Miller (2000), reducing consumption and redesigning the products we produce are the best ways to cut waste production and promote sustainability. He outlined six ways to reduce resource use which he called the sustainability six as follows:

- Consume less than is before buying anything, ask questions such as do I need this or just want it?
- Redesign manufacturing processes and products to use less material and energy.
- Reduce manufacturing processes to produce less waste and pollution.
- Develop products that are easy to repair, reuse, remanufacture, compost or recycle.
- Design products to last longer
- Eliminate or reduce unnecessary packaging

Methodology and Scope of the Study

Research design provides the framework the research project. With this particular research, the case study design was used to structure the research, to show how the major parts of the research that is the samples or groups, measures and methods work together to address the central research questions. From the population of the study area, sampling was made to derive the sample size of the study. The simple random and judgmental/purposive sampling methods were employed to select respondents who answered questionnaire of the research. Primary data was collected from the field through the face-to-face interview method and the use of open and close ended questionnaire. Secondary sources of data were from books and the internet. Quantitatively, Excel was used to analyze questionnaire whilst feedback from interviews were analyzed qualitatively.

The study area is the Ketu North District Assembly in the Volta Region of Ghana. The District Assembly which is the highest political and administrative authority in the District has a total of 55 members made up of eight female and 47 male members of which 38 are elected and 17 are appointed members. There is also the District Chief Executive and one Member of Parliament (DCPU- KNDA, 2012). The District has four sub-district structures; these are Dzodze Urban Council, Penyi Town Council, Weta Area Council and Afife Area Council. The district also has 38 Unit Committees dotted all over the various Urban, Town and Area Councils. There are 38 Electoral Areas in the District (DCPU- KNDA, 2012). A recent survey carried out by the District Assembly put the population of Dzodze at 23,760 (KNDA Survey 2012). This figure however, comprises of children who may not have a fair idea about the research topic hence the population was limited to the responsible adult population of 10,063 (2010 projection, KNDA).

Table 3.1: Categories and Composition of Respondents

Selected members of household	Frequency	Selected staff of Zoomlion & Environmental Health	Frequency
Farmers	13	Environmental Health Officer	1
Traders	12	Supervisor, Zoomlion	1
Salary workers	131		
Drivers	8		
Others	34		
Total	198		2

Source: Field Data, June 2011

Data Collection

There are two main types of data namely the primary and secondary. Primary data are those collected for the first time and thus happened to be original in character. Secondary data consist of information already collected and processed by other agencies. The research used both primary and secondary data. The principal primary data method used to get information from respondents was the questionnaire method. The close-ended questionnaires were used to facilitate the research process however; a few open-ended questionnaires were also administered to give respondents chance to freely express their views on some issues relating to the research topic. The researchers also used face to face interviews to gather information from some respondents. To provide an understanding of how people behave with regards to the study and also to get an insight into the problem being investigated, the researchers used the non-participant observation method to gather information from the field.

Analysis of Data and Discussion of Findings

The focus of this chapter is presentation and analysis of data collected from the field. Further, it seeks to address the questions raised in the statement of the problem enumerated below:

- (i) What are the structures and measures put in by the Ketu North District Assembly to deal with solid waste management?
- (ii) What are the current issues surrounding waste management in the District?
- (iii) Do commuters understand the implication of their throw-away attitudes of disposing of waste on the environment?
- (iv) What measures or strategies can be used to promote sustainable waste management?

Personal Data of Respondents

The sample size of the study was 200 respondents comprising two (2) waste management officials from Zoomlion Ghana Limited and the District Environmental Health Officer. The remaining 198 respondents were picked randomly. On the classification of age group, it was realized that 48% of the respondents were between the age brackets of 20-29, 33.5% were between 30-39 years, 7% were between 40-49 years and 4.5% were sixty years and above as indicated in Table 4.1.

Table 4.1: Age Group of Respondents.

Age Group	Frequency	Percentage
20-29	96	48
30-39	67	33.5
40-49	14	7
50-59	14	7
60 & above	9	4.5
	200	100

Source: Field Data June, 2013.

With respect to gender, out of the total of 200 respondents, 59.5% were males and the remaining 40.5% were females as indicated in Table 4.2.

Table 4.2: Gender of Respondents

Gender	Frequency	Percentage
Male	119	59.5
Female	81	40.5
	200	100

Source: Field Data June, 2013

Table 4.3: Marital Status of Respondents

Marital Status	Frequency	Percentage
Married	73	36.5
Single	112	56
Divorced	5	2.5
Separated	5	2.5
Widowed	5	2.5
	200	100

Source: Field Data June, 2013

From Table 4.3, 36.5% of the respondents were married, 56% were single whilst those who were divorced, separated and widowed recorded 2.5% each.

In relation to highest level of education attained, 52 respondents which constituted 26% of the total had varied forms of tertiary education- teacher training colleges, nursing training, IPMC, School of Hygiene and Agricultural College. Table 4.4 summarized the details on education.

Table 4.4: Educational Level of Respondents

Level of Education	Frequency	Percentage
None	8	4
J.S.S	15	7.5
S.H.S	40	20
Polytechnic	36	18
University	49	24.5
Others	52	26
	200	100

Source: Field Data, June 2013

University education constituted 24.5% of the respondents the second to “Others” (26%), Senior High Secondary (S.H.S) constituted 20% of the respondents followed by Polytechnic and J.S.S which had 18% and 7.5% respectively. The last category of respondents that was in the minority (no education) constituted 4% of the respondents.

Table 4.5: Occupation of Respondents

Occupation	Frequency	Percentage
Farmer	13	6.5
Trader	12	6
Salary Worker	133	66.5
Driver	8	4
Others	34	7
	200	100

Source: Field Data June, 2013

From table 4.5, 66.5% of the respondents were salary workers (teachers, nurses, public/civil servants and bankers), “Others” constituted 7% of the respondents whilst farmer, trader and driver constituted 6.5%, 6% and 4% respectively.

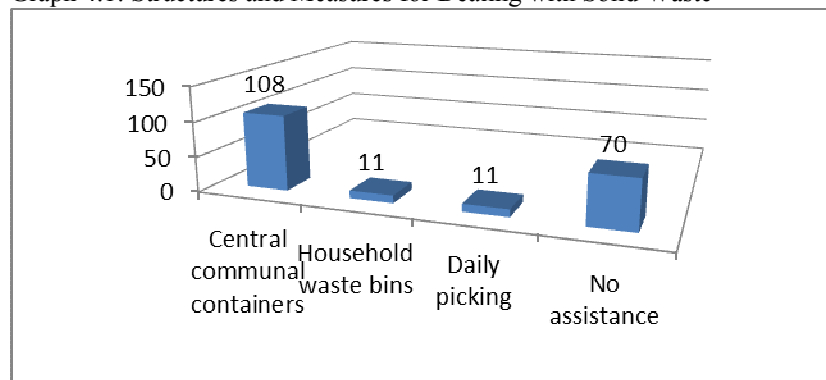
Structures and Measures put in place to deal with Solid Waste Management by the Ketu North District Assembly.

As earlier mentioned in the statement of the problem, solid waste management is discipline associated with the control, generation, source separation, storage, collection, transfer and transport, processing and disposal of solid waste in a manner that is in accordance with the best principles of public health, engineering, economics, conservation and other environmental consideration and which is also responsive to public attitude. Solid waste management has not been of its best since independence of Ghana. As far back as the 1960’s to the late 1980’s, there was no properly constituted organization to manage solid waste generated in the country. Residents therefore generated and deposited their solid waste on nearby low-value lands, frequently wetlands, creating a waste dump. These dumps were the feeding places for most livestock’s with residents having less to no knowledge of the effect of such practices (Kwaku, 2010).

Today, the decentralized Metropolitan, Municipal and District Assemblies supervised by the Ministry of Local Government and Rural Development (MLGRD) bear the ultimate responsibility for sanitation and waste management in the country through their Waste Management Departments (WMD). It is in the light of this that the research seeks to examine the structures and measures put in place to deal with solid waste management in the Ketu North District (Sanitation Country Profile Ghana, 2004)

Graph 4.1 shows the response given by respondents in relation to structures and measures put in place by the Assembly to deal with solid waste.

Graph 4.1: Structures and Measures for Dealing with Solid Waste



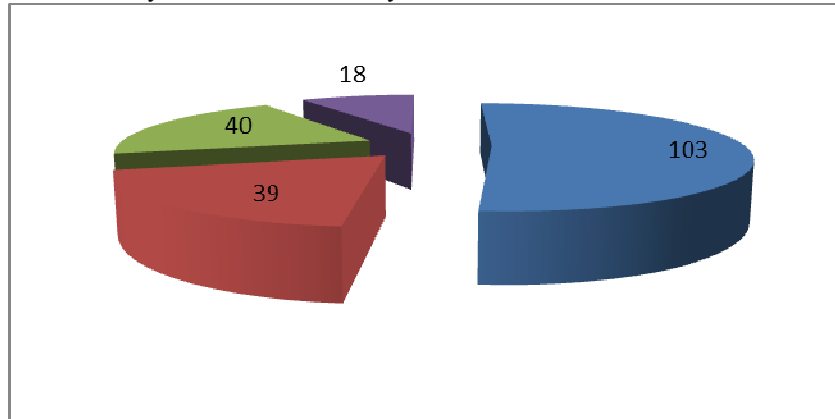
Source: Field Data, June 2013

From the graph above, 108 respondents which constituted 54% of the total respondents indicated the District Assembly provided central communal waste containers as a form of assistance in dealing with solid waste management. Seventy (70) respondents which represented 35% of the total respondents indicated they received

no assistance from the District Assembly. Eleven (11) respondents which represent 5.5% of the total respondents indicated the District Assembly provided waste bins in their houses whilst the remaining eleven (11) respondents indicated daily picking of waste was the assistance they received from the Assembly.

Aside household waste, respondents indicated how the District Assembly catered for commercial waste generated in town. Pie chart 4.1 shows responds from the field.

Pie chart 4.1: Measures used by the District Assembly to cater for commercial waste

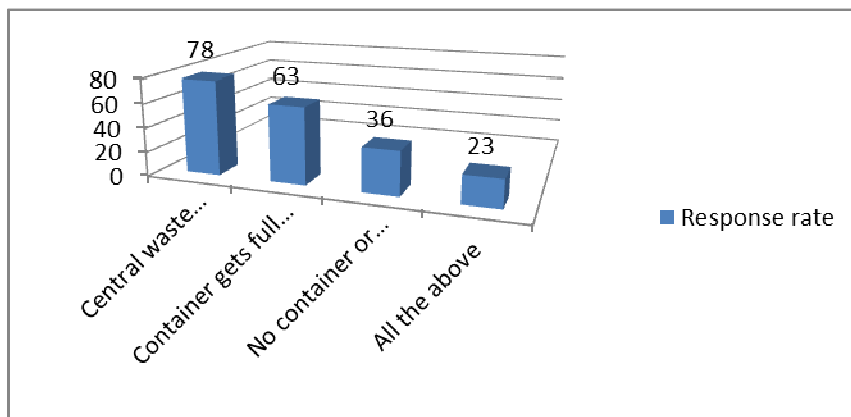


Source: Field Data, June 2013.

From Pie chart 4.1, 103 respondents which represent 51.5% of the total respondents did indicate that in catering for commercial waste, the District Assembly provides litter bins at vantage points in town, 39 respondents which represent 19.5% of the total pointed out that no litter bins were provided but Assembly does daily collection. Forty (40) respondents which represent 20% of the total indicated that the Assembly does not cater for commercial waste whilst eighteen (18) respondents which represent 9% of the total also indicated people volunteer to manage commercial waste.

In managing household waste, respondents pointed out some problems they faced with the measures the District Assembly employed. Graph 4.3 shows how the response rate.

Graph 4.2: Problems associated with measures used by the Ketu North District Assembly in managing household Solid Waste.

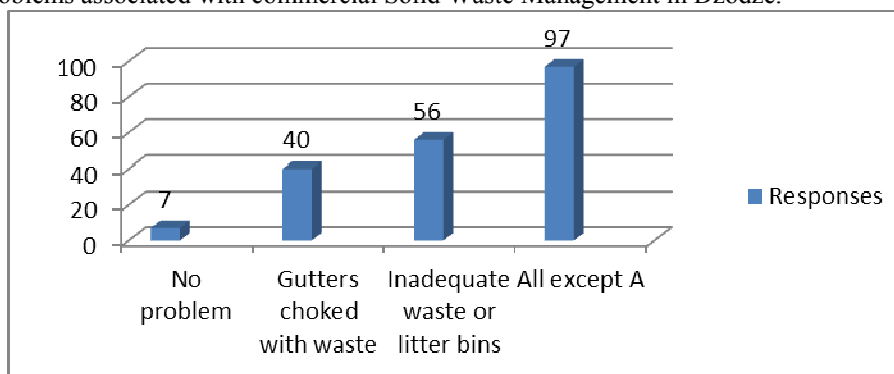


Source: Field Data, 2013

From Graph 4.2 seventy-eight (78) respondents which represent 39% of the total respondents indicated that the central waste container was far from their houses and sixty-three (63) respondents which represent 31.5% of the total were of the view that waste containers got full for days unattended by the Ketu North District Assembly. Thirty-six (36) respondents (18%) indicated that no containers or bins were provided and twenty-three (23) respondents (11.5%) indicated that they all the outlined problems affected them.

In dealing with commercial waste, respondents indicated they had problems with how the Ketu North District Assembly handled it. Illustrated below Graph 4.3 are the responses from the field.

Graph 4.3: Problems associated with commercial Solid Waste Management in Dzodze.

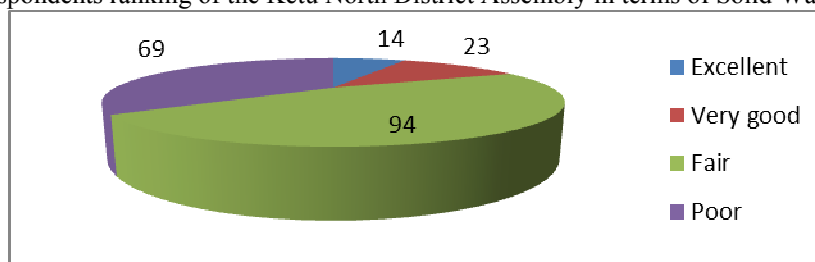


Source: Field Data, June 2013.

With reference Graph 4.3, ninety-seven (97) respondents which represent 48.5% of the total respondents indicated that with respect to commercial waste, their problems were gutters choked with waste as well as inadequacy of waste or litter bins in the town. Fifty-six (56) respondents which constitute 28% of the total respondents admitted that in relation to commercial waste management by the District Assembly they, identified inadequacy of waste bins as a problem. Forty (40) respondents (20% of the total) claimed gutters in town were always choked with waste whilst seven (7) respondents (3.5% of the total) indicated they had no problem with the measures used by the Assembly to manage commercial waste.

In ranking the District Assembly in terms of its performance in waste management, respondents indicated their views as contained in Pie chart 4.2.

Pie Chart 4.2: Respondents ranking of the Ketu North District Assembly in terms of Solid Waste Management



Source: Field Data, 2013.

As indicated in Pie chart 4.2, with respect to ranking the District Assembly in waste management, ninety-four (94) respondents which represented 47% of the total admitted that the District Assembly's performance was fair whilst fourteen (14) the least number of respondents representing 7% of the total respondents picked excellent as their option. Twenty-three (23) and sixty-nine (69) respondents respectively ticked very good and poor as their ranking.

From the management level, two officers one each from the District Assembly (District Environmental Health Officer) and Zoomlion Ghana Limited- a leading private waste management organization (District Operations Supervisor) were interviewed on the structures and measures used to manage solid waste. The District Operations Supervisor of Zoomlion Ghana Limited indicated that his outfit collaborated with the Ketu North District Assembly to manage waste. He said Zoomlion currently used the landfill method to manage waste generated in the Ketu North District. With commercial waste they use the tricycle on daily basis to convey collected garbage to communal central waste containers. On the other hand commercial wastes collection was in two categories. The first category included households that paid some amount of money monthly for waste collection and the second comprises households that sent their wastes directly to the central waste containers designated at vantage points in town. At the final disposal site which was an abandoned gravel pit, the District Operations Supervisor indicated that the site has been compartmented into four blocks. A block is in use for now and subsequent blocks may be used when the first get full. He indicated that because of the degradable nature of solid waste, there was the possibility of decay to give way to the first block after the four year rotation (Agbenyaga, 2013).

The District Operations Supervisor mentioned some of the challenges faced by his outfit as follows:

- Rising cost in terms of haulage (long distances, spare parts and fuel)
- Problems with acquisition of final disposal sites (land disputes)

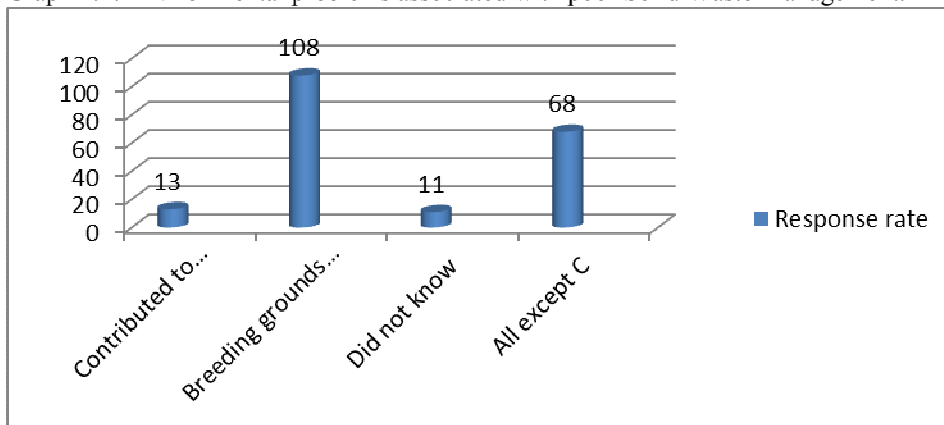
- Separation of wastes or waste sorting before final disposal
- Ascendency in waste generation due to change in lifestyle and population growth
- Institutional bottlenecks (Agbenyaga, 2013).

From the District Environmental Health Officer indicated that in terms of structures, the District has two (2) haulage trucks, eight (8) communal waste containers and thirteen (13) tricycles for waste management in the District which was carried in collaboration with Zoomlion Ghana Limited. He stated that his outfit did not have the staff strength to do effective supervision and monitoring (Richard, 2013)

Current Issues Surrounding Waste Management in the Ketu North District

As indicated earlier, waste management is surrounded by a whole lot of issues and according to Matthew Gubb the Director of the UNEP’s International Environment Technology Centre (IETC) issues regarding waste management are more of a threat to the environment and human survival. In the Ketu North District, respondents gave different views on the issue as contained in Graph 4.4.

Graph 4.4: Environmental problems associated with poor Solid Waste Management.

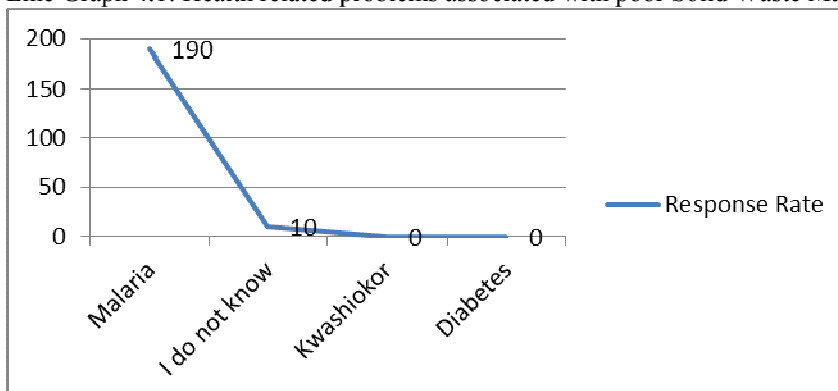


Source: Field Data, 2013.

With reference to the above table and graph, aside eleven (11) respondents that constitute 6.5% of the total respondents who indicated they did not know the environment problems associated with poor waste management, (89) respondents indicated different views on the issue as follows. Fifty-four (54) percent of the total population indicated that poor waste management accelerated the breeding of mosquitoes and rodents which are disease vectors. Flooding was also mentioned as one of the problems associated with poor management of waste in the Dzodze by thirteen (13) respondents that represented 13% of the total respondents. Sixty-eight (68) respondents were of the view that poor waste management in Dzodze contributed to both flooding and breeding of mosquitoes and rodents.

Line Graph 4.1 shows the response from the field on health related problems associated with poor management practices.

Line Graph 4.1: Health related problems associated with poor Solid Waste Management



Source: Field Data, 2013.

With reference to Line Graph 4.1, aside the ten (10) respondents who indicated they did not know the

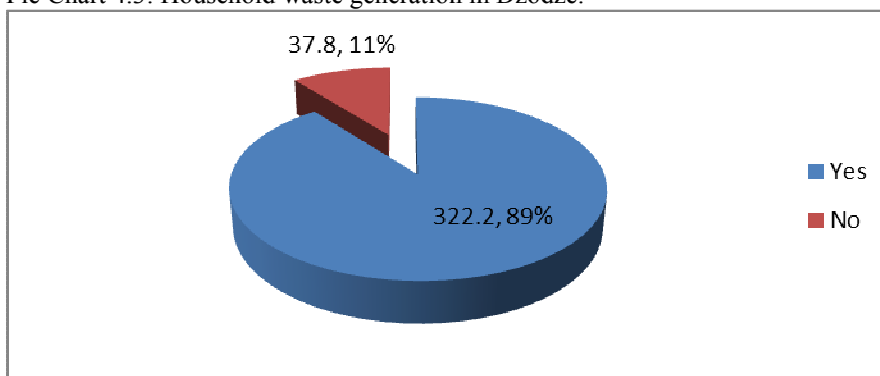
health related problems associated with poor waste management practices, ninety-five percent admitted that malaria and cholera were the associated health problems with poor waste management practices in Dzodze.

An interview with the District Operations Supervisor of Zoomlion and District Environmental Health Officer revealed that the District Assembly was handicapped in terms of staff, logistics and technical know how to manage waste sustainably in the District. He gave an instance at the St. Anthony’s Hospital where waste separation was practiced but because structures and measures on the ground did not support the practice, the sorted waste got back to the pool of unsorted wastes in communal waste containers. On the environment, he mentioned that aside the unsightly littering, foul-smell from choked gutters, uncontrolled solid waste blocked drains and caused flooding whilst vermin and rodents on mounds of refuse dumps contributes to malaria, cholera, diarrhea and typhoid.

The Implication of the Public Throw-away Attitudes on the Environment

To ascertain the implications of the public throw-away attitudes on the environment, respondents admitted that waste cannot be done away with in any human institution. From Pie chart 4.3, 89% which represents 179 respondents agreed that they generate waste in their homes whilst 11% answered no.

Pie Chart 4.3: Household waste generation in Dzodze.



Source: Field Data, 2013.

On ways of disposing of generated waste, Table 4.6 shows the details of the response from the field.

Table 4.6: Ways of Disposing Solid Waste in Dzodze

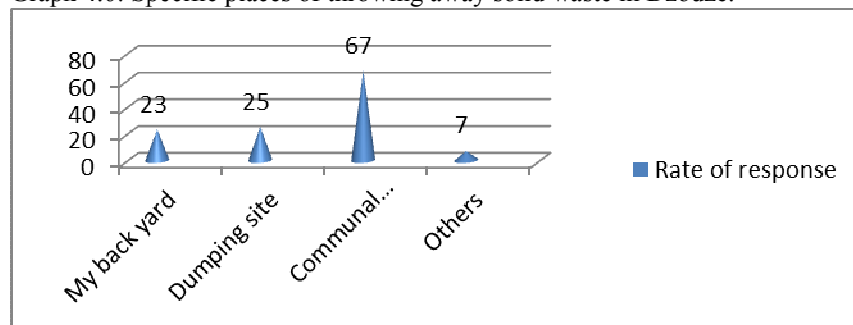
How do you usually dispose of your waste?	Frequency	Percentage
Bury it	10	5
Burn it	79	39.5
Throw it away	101	50.5
Others	10	5
	200	100

Source: Field Data, 2013

As indicated in Table 4.6, most respondents (50.5%) used the throw-away method to dispose of their waste. Seventy-nine (79) respondents which represent 39.5% burnt their waste whilst the rest either buried or adopted other methods.

Respondents who used the “throw-away” method to dispose of their waste specifically indicated the following as indicated in Graph 4.6: My back yard (11.5%), dumping site (12.5%), communal waste container (33.5) and others (3.5). Aside those who sent their waste to the communal waste container, the rest remain within the immediate environs.

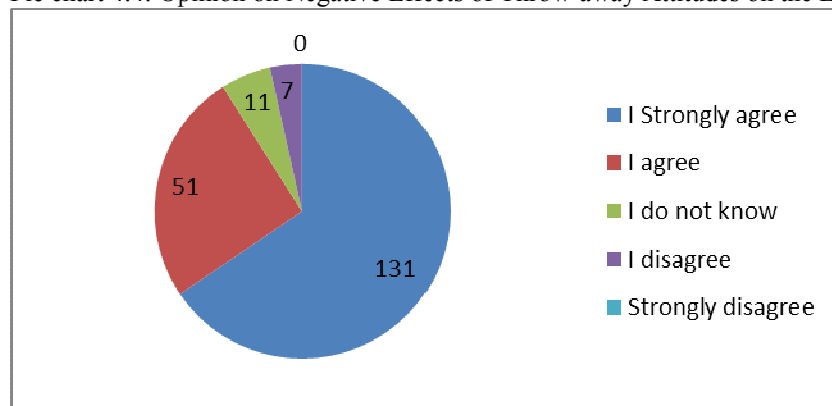
Graph 4.6: Specific places of throwing away solid waste in Dzodze.



Source: Field Data, 2013

Views of respondents on the negative effects of throw-away attitudes on the environment in Dzodze indicated in Pie chart 4.4.

Pie chart 4.4: Opinion on Negative Effects of Throw-away Attitudes on the Environment



Source: Field Data, 2013.

Apart from eleven (11) respondents which represented 5.5% of the total respondents that indicated they did not know the negative effects of their throw-away attitudes on the environment, 94.5% agreed though on varying levels that their throw-away attitudes have negative effects on the environment.

Table 4.7 contained responses received from respondents on their throw-away attitudes on the environment. As indicated in the table, 126 respondents (63%) said the consequences of their throw-away attitudes included the following: made their environment dirty, choked gutters and contributed to flooding. Twenty-two percent (22%) indicated that their throw-away attitudes made the environment dirty whilst 10.5% admitted that it choked their gutters and contributed to flooding. The remaining 4.5% indicated they did not know.

Table 4.7: Consequences of Throw-away Attitudes on the Environment

Consequences of throw-away attitude on the environment	Frequency	Percentage
Makes our environment dirty	44	22
Choke our gutters and contributes to flooding	21	10.5
I do not know	9	4.5
All except C	126	63
	200	100

Source: Field Data, June 2013

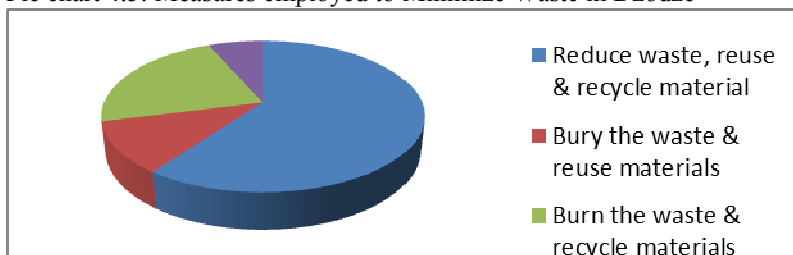
Measures and Strategies Used to Promote Sustainable Waste Management in the Ketu North District.

According to the 2010 National Environmental Sanitation Strategy and Action Plan, poor solid wastes management with its immediate and visible impact remains one of the major challenges to the MLGRD and many a Chief Executive of MMDAs. From the 2000 Housing and Population Census, 4.8% of households have

their waste collected directly from their dwellings, 7.9% burn their household waste, and 57.6% use various household receptacles for storage and send it to designated public dumps including communal-container stations or sanitary sites. In total, close to 85% of all refuse generated is currently not collected and disposed of in a proper manner. To liberate the Ketu North District from this monumental environmental problem, there is the urgent need for the Assembly to promote sustainable waste management practices.

Pie Chart 4.5 shows the response rates of various respondents on household waste minimization as an option to promote sustainable waste management.

Pie chart 4.5: Measures employed to Minimize Waste in Dzodze

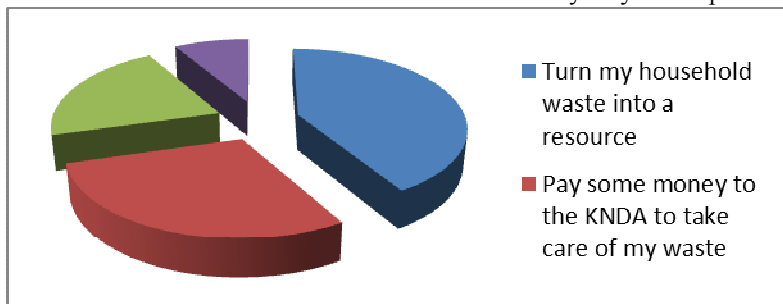


Source: Field Data June, 2013

Pie chart 4.5 indicated that 120 respondents which constitute 60% of the total population admitted that for household waste minimization, they must reduce waste, reuse and recycle materials. Twenty-two (22) respondents admitted that waste should be buried and reuse materials. Forty-five (45) respondents went for burning and recycling whilst 6.5% indicated they do not know.

On sustainable and environmental-friendly ways of disposing waste in Dzodze, respondents indicated their views as contained in Pie chart 4.6. From the Pie chart, eighty-three (83) respondents which constitute 41.5% indicated that they will turn their household waste into a resource like manure, 29% of the total respondents opted for paying some amount of money to the District Assembly to cater for their waste and 21% and 17% opted to bury their waste in their backyard and burn it in the open respectively.

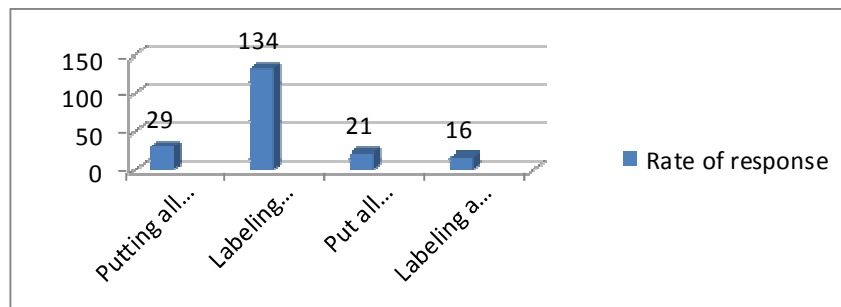
Pie Chart 4.6: Sustainable and environmental-friendly ways to dispose of waste in Dzodze.



Source: Field Data, June 2013

Graph 4.7 shows the various options respondents made available to respondents in relation to waste separation a pre-requisite for sustainable waste management. Labeling different containers for different waste categories was rated high with 134 respondents representing 67% of the total respondents. Twenty-nine (29) respondents indicated that they would put all waste into one big container. Twenty-one (21) respondents said they would put all waste into one container and later separate. The remaining sixteen (16) opted for labeling a container for all kinds of waste.

Graph 4.7: Waste separation as means to promote Sustainable Waste Management.



Source: Field Data, 2013

A face-to-face interview conducted with the District Operations Supervisor of Zoomlion Ghana Limited revealed that current measures such as daily collection with tricycles to central waste depositories and the use of communal waste containers which are transported later to final deposit ground which is not an engineered landfill site is not sustainable. He said with the current high cost in haulage and socio-economic effects of poor waste management, sustainable options such as recycling, composting and biogas will be considered in future. Another face-to-face interview granted to the District Environmental Officer revealed that for the District Assembly to adopt sustainable measures there is the urgent need for waste sorting a pre-requisite for sustainable waste management to be in place but which comes with a cost.

Discussion of Findings

The main objective of the research is, to promote sustainable waste management practices amidst current practices that are not sustainable. The following objectives will guide the discussions of the study.

1. To examine the structures and measures put in place by the Ketu North District Assembly to deal with waste management.
2. To analyze the current challenges in managing waste (that is its drain on the Assembly's budget, effects on public life and the environment).
3. To assess behavioral change especially among commuters on waste generation and management.
4. To recommend sustainable waste management practices through: (a) backyard composting, (b) waste separation in homes and schools, (c) re-use of materials.

On structures and measures put in by the District Assembly to deal with solid waste, it was found that aside 35% of the total respondents that indicated that they did not receive any assistance from the District Assembly; the remaining 65% received varied forms of assistance which included provision of communal waste containers, household waste bins and daily picking of waste from some houses. However, respondents indicated varied problems with measures the District Assembly employed to manage household solid wastes. The problems included communal waste containers being far from some households (39%), the communal waste containers got full unattended to (31%), no container or bins were provided (18%) and 22% admitting that all the mentioned problems affected them.

On the issue of how the District Assembly catered for commercial waste, 51.5% of the respondents indicated that the District Assembly provided litter bins at vantage points and 19.5% were of the view that the District Assembly did daily collection but did not provide litter bins in Dzodze. The remaining 29% admitted that the District Assembly did not cater for commercial waste in Dzodze. From Graph 4.3 which outlined problems respondents had with commercial waste management, it could be deduced that only 3.5% of the total respondents did not have any problem. Majority of the respondents (48.5%) indicated that gutters in Dzodze town were always choked with wastes and also waste or litter bins were inadequate. With 20% and 28%, respondents respectively indicated gutters were choked with wastes and inadequacy of litter bins.

Respondents' rating in the District Assembly's performance in waste management was not too good reference to Pie chart 4.2. A major finding of the research is that the District Assembly needs to be up and doing when it comes to measures and structures used to manage waste. With a current population of 23,760 (KNDA Survey 2012), Dzodze town needs more than eight (8) communal waste containers for the various communities or suburbs as indicated by the District Environmental Health Officer in an interview. There is the need also to beef up the skeletal staff strength of the District Environmental Health Office to do effective supervision and monitoring. Aside the structures that are inadequate, the measures employed are not sustainable. The era of wholesale-dumping (putting all waste together) and finally disposing it is past and gone. In this 21st century, waste is seen as a resource and not just something unwanted there should be waste sorting or separation at source, reuse, recycle and composting of materials to benefit society.

Another issue of concern identified with regards to the disposal method used that is un-engineered landfill site can contaminate ground and surface water. The community of Deme where the final disposal site is located is a deprived one that can boast of pipe borne water. Solid waste streams can bleed toxic materials and pathogenic organisms into the leachate of dumps and landfills (Leachate is the liquid discharge of dumps and landfills; it is composed of rotten organic waste, infiltrated rainwater and extracts of soluble material.) If the landfill is unlined as in the case of the study area, depending on the drainage system and the composition of the underlying soils, this runoff can contaminate ground or surface (USAID, 2013).

The creation of greenhouse gas emissions and other air pollutants is another problem identified with landfill method being used. When organic wastes are disposed of in deep dumps or landfills, they undergo anaerobic degradation and become significant sources of methane, a gas with 21 times the effect of carbon dioxide in trapping heat in the atmosphere (USAID, 2013).

From the data collected on current issues surrounding waste management in the Dzodze, the analysis showed that, 94.5% of them had a fair idea about the environmental problems associated with poor waste management as contained in Graph 4.4. Apart from the 11% that indicated they did not know, the majority responded as follows: contributed to flooding, breeding grounds for mosquitoes and rodents or both. On health related problems associated with poor waste management, 95% indicated that their awareness that it leads to malaria and cholera as contained in Line Graph 4.1. The major finding is that people are aware of both the environmental and health problems associated with poor waste management. If the right measures and structures are employed, these problems if not eradicated in the communities may be minimized. Two major issues were also identified during the face-to-face interview with the District Operations Supervisor of Zoomlion. He mentioned rising cost of haulage of waste due to the long distance covered on daily basis by the trucks and rising cost of spare parts. Further, he mentioned that acquisition of land for final disposal site usually came with litigations from families.

On the implication of the public throw-away attitudes on the environment, data collected indicated that 96.5% agreed that the attitude of throw-away regardless of where it occurred had negative effects on the environment as indicated in Pie chart 4.4. It was revealed that other methods such as burying and burning which some households used also have adverse effects on the environment. Garbage burning creates thick smoke that contains carbon monoxide, soot and nitrogen oxides all of which are hazardous to human health and degrade air quality (USAID, 2013).

As indicated earlier, from an interview conducted it came to light that the measures and strategies used to manage waste in the Ketu North District were not sustainable but respondents indicated their readiness to embrace the concept of sustainable waste management. This was revealed in their responses to questions relating to sustainable waste management. As indicated in Pie chart 4.5, on household waste minimization, 60% of the respondents indicated that they would prefer to reduce waste, reuse and recycle materials to other options such as burying, burning or paying some amount of money to the District Assembly to cater for their wastes. Again on the issue of sustainable and environmental-friendly ways of disposing waste, 41.5% of the total respondents indicated that they would turn their household wastes into a resource such as manure to other options such as burying the waste, burning the waste in the open or paying for their waste to be handled by the District Assembly. From all indications, respondents are in ready to embrace sustainable waste management measures should the District Assembly implement it.

Summary of Findings

Response from the field indicated that the Ketu North District Assembly had some structures and measures in place to manage domestic and commercial waste in Dzodze. Respondents mentioned provision of communal waste containers, household waste bins, litter bins at vantage points and daily collection as some forms of assistance received. However, there were some challenges that must be addressed. Respondents indicated that the following as some the challenges: communal waste containers were far from their homes, containers got full for days unattended, inadequate litter bins and gutters choked with wastes. The skeletal staff of District Environmental Health Unit for supervision and monitoring and the disposal method used (un-engineered landfill site) with its attendant problems such as contamination of ground and surface water and emission of greenhouse gases were some of the challenges identified by the Officer in-charge of the unit.

In analyzing current issues in managing waste, the major finding was that on both environmental and health, respondents were aware of the associated problems that came with poor waste management. Malaria and cholera were the health problems whilst on the environment respondents indicated that it contributed to flooding and becomes breeding ground for mosquitoes and rodents. Rising cost of haulage of waste due to long distances covered and problems in acquiring land for final site such as land litigations from families were some of the issues raised by the District Supervisor of Zoomlion.

On behavioral change, it was realized that most respondents were involved in throwing-away their daily refuse any where regardless of the negative effects on the environment. Other methods of disposing of waste

such as burning and burying which some respondents adopted also had some environmental and health effects such as degrading air quality and the release of carbon monoxide and nitrogen oxides into the atmosphere. From all indications, respondents were ready to embrace sustainable waste management practices. Most respondents opted to turn their household waste into a resource such as manure (composting). Source separation of waste was also rated high among other options such as putting all waste into one big container and labeling a container for all kinds of waste.

Conclusion

Questions raised in the statement of the problem were answered by respondents and from that it can be concluded that the Ketu North District Assembly was not using sustainable measures to manage its solid waste. With the current practice where for the whole Dzodze town with a population of over 20,000 have only five communal waste containers with no separation or sorting of waste and finally depositing the waste into an un-engineered landfill site is a serious matter of concern. In this 21st century where waste is considered a resource, the Assembly should be in the position to make gains from the management of solid waste rather than a burden that will continuously drain the Assembly's meager resources.

Recommendations

Based on the findings made, the following recommendations are being made:

The Ketu North District Assembly in collaboration with Zoomlion Ghana Limited should provide more labeled communal waste containers to cater for the growing population of Dzodze and promote waste separation among the people. Waste separation is a pre-requisite for sustainable waste management hence it should be adhered to. Likewise more labeled litter bins should be placed at vantage points such as the lorry parks, market square and along major streets in the town. On the issue of the skeletal staff of the District Environmental Health Unit of the Assembly, the Assembly should make use of employees of the Sanitation Module of the National Youth Employment Programme and recruit some volunteers as well to assist in daily supervision and monitoring. Zoomlion Ghana Limited should collaborate with the District Assembly to establish a modern engineered landfill site to cater for waste that cannot be used as a resource.

The Ketu North District should collaborate with Zoomlion Ghana Limited, Ghana Education and other organized groups to carry out periodic and sustained environmental education with more emphasis on sustainable measures to help reduce the rising cost of waste haulage. A clean environment will reduce flooding caused by choked gutters and reduced the breeding of mosquitoes and rodents which impact negatively on human lives. Sustained and periodic education will also change people's attitude of throwing away waste indiscriminately to promote good environmental ethics.

Research has shown that developing countries have a greater percentage of their solid waste coming from organic substances such as leftover food and farm produce that easily decompose. With the most of the people being farmers composting could be encouraged from the household level to commercial level. Composting can be used as manure for backyard gardening or sell to farmers in larger quantities.

If the larger percentage of the waste component (organic) is used for compost, the other stream of waste could easily be separated. With scrap metal there are some few hands into the business, the Assembly should liaise with Zoomlion or other private waste organizations to come and buy collected plastic waste from Dzodze to the nearest recycling plant. Plastic waste would become a very scarce commodity should a market be created for it. Materials such as used gallons, bottles and other containers could be used by local manufacturers to package their finished products of drinks, oils, powder, soap and pomade.

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