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WASTE MANAGEMENT FOR SUSTAINABLE ENVIRONMENTAL DEVELOPMENT: THEORETICAL PERSPECTIVE

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ABSTRACT: Waste management refers to the activities and actions that handle waste materials. It includes collection, transportation, processing, and disposal of waste. Waste prevention, recycling, reuse, and recovery are important waste management strategies that eases the burden on landfills, conserves natural resources, and saves energy. This helps utilize resources more effectively and sustainably. Humans generate a lot of waste, much of which now affects the air we breathe, the water we drink, and land on which we live. According to the United Nations, about 11.2 billion tonnes of solid waste is collected worldwide, almost all of which comes from humans alone. We therefore not only need to manage this waste but also come up with strategies that will manage such waste sustainably. This article will talk about sustainable waste management, its importance and said strategies for sustainable waste management.

Keywords: Energy Recovery, Healthy Environment, Recycling, Toxic Waste And Waste Management

INTRODUCTION

Waste management has become one of the burning issues for discussion in recent times due to its devastating effect on the ecosystem. In this era when ozone layer has been depleted due to carbon emissions, fossil and other harmful toxics being emitted into the atmosphere, it has become imperative that we adopt sustainable ways of waste management so as to preserve our environment and make it more habitable. In this write up, we are going to examine the concept of waste management and sustainable environmental development. The aim of the paper is to x-ray practical ways for efficient and sustainable waste management, promote a healthy environment by ensuring sanitary waste management, minimize waste generation and promote sorting at source, reuse, recycling and energy recovery, ensure safe and nuisance-free disposal of (urban and rural) domestic, medical, and industrial wastes in order to adequately protect public health during and after collection and disposal of waste. It includes both transportation, treatment and promote effective Stakeholders participation in waste management. Further it will help to generate employment opportunities, improve the standard of living and thus reduce poverty, optimize labour and equipment in waste management to

enhance increased productivity, build an institutional framework capable of ensuring an efficient waste management system, evolve and maintain an indigenous waste management system based on the physical and socio-cultural characteristics of communities. Finally, it will maintain adequate and regular waste management services at affordable cost; improve and safeguard public health and welfare through efficient sanitary and hygiene management methods that will economically, sustainably guarantee sound environmental quality.

Concept of Waste

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 into volume and variety of wastes that threaten both their environments and established ways of life. Miller (2011) stated that 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.

Adewole (2009) defined waste as any solid, liquid or gaseous substances or materials which being a scrap or being super flows, refuse or reject, is disposed of, or required to be disposed as unwanted, this is Environmental law, the term assumes it's ordinary literal meaning unlike in the real property Law, When" waste" is used as a term of art, having meaning completely different from its ordinary meaning. One of the few states in Nigeria, which attempts to define waste is the Lagos State Environmental Edicts 1985, there in Section 32, waste is define as follows:

i. Waste of all description.
ii. Any substance, which constitutes scrap materials or an effluent or other unwanted surplus substance arising from the application of any process.

One thing to notice is that none of the above definitions of waste give "value" to the elements considered. There is no suggestion that the items, which constitute a waste, do not have value or is intrinsically useless. The word "unwanted" appears in the definition although it introduces its own problem. This does not necessarily import a value element for a substance or material that may be unwanted notwithstanding that it has some value.

Waste Management

Beside 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 government budgets even when organized and operated properly (UNEP GPWM, News Conference, 2012). Wan, Shen and Choi (2019) stated that waste management refers to the activities and actions that handle waste materials. It includes collection, transportation, processing, and disposal of waste. Waste prevention, recycling, reuse, and recovery are important waste management strategies that eases the burden on landfills, conserves natural resources, and saves energy. This helps utilize resources more effectively and sustainably. Among the human activities, waste management is one of the areas that needs close attention in pursuit of sustainable development. Waste causes enormous negative impacts on economic development and human health.

To buttress further, Adekunle et al. (2011) posit that waste management is a globally challenging issue especially in developing countries, due to its adverse environmental effects. Mankind naturally depends on the environment to sustain their lives, but solid waste is one of the three major environmental problems in Nigeria. Many other developing and even the developed countries are threatened by this. It plays a significant role in the ability of nature to sustain life within its capacity. Domestic waste management, collection and disposal have always been a universal issue. This is because efficient and appropriate collection and disposal of solid waste has been recognized as essential to the hygiene and health of urban societies-since the nineteenth century. Over the course of the first half of the twentieth century, sanitary engineers and the broader public also came to understand that the inappropriate treatment of waste could cause major environmental degradation, while recycling could contribute significantly to environmental sustainability (Jalil, 2010). Waste management is imperative because improperly stored refuse can cause health, safety and economic problems. All living organisms create waste, but humans create far more waste than other species. To prevent damaging the Earth's ecosystems and maintain a high quality of life for the planet's inhabitants, humans must manage and store their waste efficiently and safely. Ndubuisi-Okolo, Anekwe & Attah (2016) opined that waste management is to prevent waste from causing harm to human health and the environment and promote resource use optimization.

Waste management according to Adewole (2009) is the collection, keeping, treatment and disposal of wastes in such a way as to render it harmless to human and animal life, the ecology and the environment generally (Ndubuisi-Okolo, Anekwe & Attah, 2016). This definition is very crucial because the essence of waste management is to protect human lives in particular and the environment in general. Udocha & Uchegbu (2002) define waste as those materials which are generated as a result of normal operations over which we have control in terms of their production, disposal or discharge. Waste could be seen as any substance or object which the producer or holder discards or intends or is required to discard. Wright (2005) holds the view that, waste is the total of all the materials thrown away from homes and commercial

establishments and collected by local governments. It encompasses food wastes, household waste, containers and product packaging, dirt, demolition and construction wastes and other kinds of organic and inorganic wastes from residential, commercial and institutional sources, the collection and disposal of which are performed by local authorities and which may be in either solid or semi-solid form. Examples of this kind of waste are electronic appliances, newspapers, clothing, food scrapes, boxes, disposable table wares, office and classroom papers, furniture, wood pallets, rubber tyres and restaurant wastes.

Solid Waste Management

Adegoke, 1989 opined in Nwaokobia, Ogboru and Okoli (2018) solid waste management remains one of the most daunting Environmental Sanitation challenges facing the country today and it has continually remained at its lowest ebb despite huge investments in the sector. 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. The growth of human population coupled with increased economic activities in towns and cities result in high rate of solid waste generation. A fundamental attribute of solid waste is that it is inevitable as almost every human activity involves the generation of waste in solid, liquid and gaseous forms.

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. In a nutshell, both Nwaokobia, Ogboru & Okoli (2018), Miller (2011) & Kwaku (2010) in the definitions with regards to solid waste, emphasized waste as discarded or unwanted materials, however in the modern 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. This calls for careful planning and adequate resource allocation to forestall a mismatch between the rates of waste generation, rate of collection and disposal. The management of solid waste is far from being satisfactory in Nigeria.

Many parts of our cities and towns do not benefit from any organized waste management service and therefore wastes are unattended to, buried, burnt or disposed haphazardly. In areas where the authorities do the collection, it is often irregular and sporadic. Recycling of waste is negligible while the methods used for collection, transportation and final disposal are very unsatisfactory (Uwaegbulam 2004). Waste when left unattended to for a long time constitutes serious health hazard, causes offensive odour, pollutes underground water sources and decreases environmental aesthetics and quality. Effective and efficient Solid Waste

Management is based on a hierarchy of management options: the reduction of waste, its reuse wherever possible, recycling, composting and energy recovery, and final disposal.

Types of Solid Waste

Solid waste according to Kwaku (2010) can be classified into five different types depending on their source, which include:

a) Household waste, generally classified as municipal waste. They are mainly household wastes 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.

b) Agricultural waste: 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. However, some agricultural wastes such as pesticides and fungicides are also regarded as hazardous waste.

c) Industrial waste, as hazardous waste: 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.

d) 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.

e) Electronic waste (e-waste): 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 equipment 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. Agunwamba (2008) observed that the number of electronic devices used per capita at the global scale is growing at a rate of about 4% and will continue to increase as it is becoming the fastest waste stream worldwide.

There are other classifications of waste according to various environmental and health experts. For instance; 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 (Amegashie-Viglo & Nuertey, 2014).

Factors Affecting Waste Management

Poor Funding: This is one of the major problems constraining the waste management sector (Ogu, 2000). Incapability of purchasing new waste collection trucks, limited staffs, poor vehicle maintenance, unsubsidized waste storage containers, inability to purchase equipment among others are all attributed to shortage of capital. To a large extent, inadequate funding has been identified by several researchers as one of the most predominant factors affecting solid waste management in Nigeria, (Agunwamba, 2008; Ezeah and Roberts, 2012). It has been suggested that the financial strength of environmental agencies in the country has not been able to parallel the rate at which solid waste is being generated. Ogwueleka (2009) argues that environmental agencies do not have the capacity to perform their duties effectively due to limited budgets. He suggests that the low morale among waste management agencies personnel resulting from poor remuneration, affect solid waste management.

Poor Legislation and Implementation of Policy: The constitutional strength of municipal waste management policy is weak and ineffective. Also, implementation of this policy is not monitored. The policy is not well structured and definitely tends to be weak. There are instances in which due process is obstructed and sanctioned penalty are not expended on certain municipalities and individuals. Policies are yet to be aimed at the 3R's of waste

management – reduce, reuse and recycle. Government policy on waste are not revisited, reaffirmed, restructured and upgraded in a comprehensive tune and form. Agunwamba (2008) points out that there is a loop hole in the government policies on solid waste management. He observed that, although the public are urged to partake in the monthly exercise to clean up the city, the efforts of the residents have not been complemented through the provision of disposal sites. This problem persists throughout the country. Ezeah and Robert (2012) noted that the legal framework on waste management is weak. Their view is that the waste policies in place do not have strategies for realisation. Hence, they suggested a review of the legislative aspects of solid waste management in other to work towards achieving the objectives of waste hierarchy. In addition, they suggested a management approach which should incorporate re-use and recycling, composting and energy generation and waste prevention.

Limited Infrastructures and Professionals: Limited waste infrastructures are one of the major contributing indexes of poor waste management system in Nigeria. Nonetheless, experts to man these machineries are also not on ground. The environmental protection agencies and waste management personnel are not experts and exposed to workshops and trainings that meet international standards on technology use, information management and knowledge management. Most of the state environmental protection agencies lack adequately trained personals (Agumwaba, 2008).

Level of Awareness: In Nigeria, populace awareness on sustainable waste management is still very poor and effort by the agencies to increase awareness is still very low. Municipal members are not well informed on the adverse effects of indiscriminate and improper disposal of waste and also the benefits of such act.

Recovering and Recycling: Access to possible recyclable material possesses great difficulty due to poorly limited recycling programs. The informal recycling programs involve scavengers' effort search of recyclable items. Presently, the informal sector renders the service of retrieving and recycling of materials in Nigeria (Oguntoyinbo, 2012). The introduction of an advance formal recycling program presents positive and accelerating outcomes for solid waste management sector.

Disposal: The landfill disposal technique of waste materials with dearth of treatment processes and open dumping possess increasing public health hazards to human lives, animals and plants. However, the evolutions of poisonous gases such as methane and carbon-dioxide causes alteration of weather, leading to climate change.

Unplanned developments and population increase: This is perhaps one of the greatest challenges facing solid waste management in the country. Ogbazi (2013) concluded that urban planning has failed in Nigeria due to several factors such as weak policies and laws, designs.

Inappropriate Technology and Inadequate Facilities: From the literature it is clear that, in Nigeria, local conditions are not taken into consideration before the adoption of a waste management strategy. Ogwueleka (2009) revealed that irrespective of the local conditions

most cities in Nigeria adopt open dumping or uncontrolled landfills as their disposal route. This may be attributed to the fact that in most cases state environmental bodies are headed by politicians and their associates. The management system in place is usually haphazard since the people in charge have very little or no training on solid waste management.

Waste to Wealth Management Strategies

Government plays an important role in developing and enforcing waste management standards, providing funding, and day-today management. Planning is the first step in designing or improving a waste to wealth management system. Waste management planners should, for example, take into consideration institutional, social, financial, economic, technical, and environmental factors. These factors vary from place to place.

Waste prevention: Waste prevention, also called "source reduction", seeks to prevent waste from being generated. Waste prevention strategies include using less packaging, designing products to last longer, and reusing products and materials. Waste prevention helps reduce handling, treatment, and disposal costs and ultimately reduces the generation of methane. It is highlighted as a top prioritized strategy for sustainable development. It is the first step that avoids a substance become waste. The strategy reduces the total amount of waste generated as well as the adverse impact associated with waste and optimizes efficiency use of resources. The success of the strategy requires a change of both consumption and production patterns.

Amutenya, Shackleton, and Whittington-Jones (2009) suggested that developing policies and regulations would transform waste prevention to a norm and campus-wide practice. Take paper products as an example. Double-spaced and single-sided hard copies of assignments and enormous printed documents for administration make paper products as the single largest component of waste stream in campus. Setting up guidelines would facilitate reduction of generating paper waste, for example, providing guidelines to academic departments that students are no longer required to submit assignments printed in double-spaced and single-sided paper or developing policies which require duplex printing for every administrative document; use electronic form to replace printed version of memo for circulation, or centralize all procurements to reduce printing paper (Zhang et al. 2011). Formulating policies also provide clear instructions for preventing the generation of waste.

Reuse: This is a key component of waste prevention; it is also the second prioritized strategy for achieving sustainable development according to the waste hierarchy. Reuse of products can extend products' life span and reduce the amount of waste directed to landfills or incineration. Procurement policy which includes the requirement of selecting long life span products would be structurally important (Zhang et al., 2011). Besides, establishing exchange center in campus that offers support for reuse practices to students and staff (e.g., allocating products to new users) is suggested. It is expected that reuse of materials or products may not be accepted by every individual. In light of this, changing individuals' perceptions of reuse may be more important than improving the surrounding environments for facilitating behavior change. Other than popular promotional programs, setting up quality-assurance scheme which

provides information about the quality of reused materials and products would be more effective for promoting reuse behavior.

Recycling and Composting: Recycling is a process that involves collecting, reprocessing, and/or recovering certain waste materials (e.g., glass, metal, plastics, paper) to make new materials or products. Some recycled organic materials are rich in nutrients and can be used to improve soils. The conversion of waste materials soil additive is called composting. Recycling and composting generate many environmental and economic benefits. For example, they create jobs and income, supply valuable raw materials to industry, produce soil-enhancing compost, and reduce greenhouse gas emissions and the number of landfills and combustion facilities.

Recycling is one of the most popular strategies adopted by universities for making campuses more sustainable. Recyclables provide economic value and further enhance the efficiency use of materials. The practice also reduces the volume of waste being dumped into landfill sites or incinerated and thus causes less harmful effects on the environment. It involves processes that separate collected waste and convert recyclables into useable materials or new products. A large proportion of waste is recoverable (Armijo de Vega et al.2008). Common examples of recyclables in this context are paper and paper products, pet bottles, plastics, nylons, disposable beverage containers, and food packaging materials etc. (Anacio, 2017).

Recovery: This refers to the processes of extracting energy or materials from the waste. For example, waste can turn into energy through thermal treatment; recovery of organic waste can be converted into energy and compost; materials recovered through recycling are of economic value. Although recovery is prioritized in a relatively low position in the waste hierarchy, the strategy contributes to sustainable development by reducing the demand of using resources as well as the amount of waste being buried in landfill sites.

Disposal (land filling and combustion): These activities are used to manage waste that cannot be prevented or recycled. One way to dispose of waste is to place it in properly designed, constructed, and managed landfills, where it is safely contained. Another way to handle this waste is through combustion. Combustion is the controlled burning of waste, which helps reduce its volume. If the technology is available, properly designed, constructed, and managed landfills can be used to generate energy by recovering methane. Similarly, combustion facilities produce steam and water as a byproduct that can be used to generate energy.

Disposal is perceived to be contradictory to sustainable development because it is inefficient in making use of potential resources, making energy consumption during waste collection and transportation, causing harmful effects to the environment and public health. However, not all waste can be prevented, reused, recycled, or recovered. With appropriate informational and structural inventions, disposal can also be a strategy that complies with the principle of sustainable development.

Government and private sector roles for efficient and effective waste management

According to Nwaokobia, Ogboru and Okolie (2018), government at all levels, civil societies and the public all have a role to play to ensure adequate waste to wealth management of waste.

The Federal Government shall:

i. Develop, periodically review and update the Policy Guidelines on Solid Waste Management.

ii. Develop and circulate set standards for equipment procurement and maintenance in Solid Waste Management.

iii. Develop and circulate set standards on private sector participation in Solid Waste Management services.

iv. Prepare a Solid Waste Master Plan as a national blue print for effective Solid Waste Management and ensure its implementation at the appropriate levels of Government.

v. Enact appropriate legislation that will foster successful implementation of the Policy Guidelines and Master Plan.

vi. Source for funds for programme development, specialized studies and capacity building on Solid Waste Management.

vii. Provide technical assistance to States and LGAs in Solid Waste Management.

viii. Initiate relevant programmes for improved Solid Waste Management practices.

ix. Establish a national data bank on Solid Waste Management for planning and development.

x. Provide environmental education and awareness on sound Solid Waste Management.

xi. Collaborate with relevant Stakeholders on Solid Waste Management.

xii. Register Solid Waste Management facilities that require Environmental Impact Assessment (EIA) certification.

The State Government shall:

a. Support and ensure the implementation of the Policy Guidelines on Solid Waste Management.

b. Facilitate the implementation of the National Solid Waste Master Plan.

c. Enact relevant State Legislation.

d. Provide technical support to the LGAs through training and manpower development programs for capacity building and institutional strengthening.

e. Support the provision of logistics including financial instruments to facilitate private sector participation in Solid Waste Management.

f. Conduct public education and enlightenment on sound Solid Waste Management.

g. Conduct research into local options for Solid Waste Management to guide LGAs.

h. Establish data bank on Solid Waste Management.

i. Provide land for siting waste management facilities.

The Local Government shall:

a. Implement the Policy Guidelines on Solid Waste Management as a statutory obligation.

b. Implement the National Solid Waste Master Plan.

c. Enact appropriate legislative instruments and establish necessary sanctions and enforcement mechanisms for efficient service delivery.

d. Enlist the services of the private sector and other Stakeholders in Solid Waste Management.

e. Register and license all operators of waste management facilities and services.

f. Make adequate annual budgetary provisions for Solid Waste Management.

g. Recruit, train and retrain staff for efficient service delivery.

h. Establish a consultative forum with members of the public to build consensus on appropriate strategies for waste management.

i. Develop materials on solid waste handling techniques at household level.

j. Promote private sector participation in the delivery of waste management options.

The Private Sector shall:

a. Comply with the provisions of the National Policy Guidelines and Master Plan on Solid Waste Management.

b. Participate in Solid Waste Management on cost recovery basis.

c. Undertake waste recycling activities in an environmentally sound manner.

d. Engage in partnership with Local Governments for better service delivery.

e. Undertake research, specialized studies and product development in Solid Waste Management.

f. Promote public enlightenment campaigns.

Civil Society Organizations shall:

a. Undertake grassroots mobilization to support appropriate waste management options.

b. Promote the adoption of waste separation and resource recovery at household level.

c. Promote public enlightenment campaigns on appropriate strategies for waste storage, collection and disposal.

The Public shall:

a. Adopt environment friendly habits and practices.

b. Comply with existing Legislation on Solid Waste Management.

c. Comply with the provisions of the Policy Guidelines

d. Cooperate with other Stakeholders to ensure sustainable Solid Waste Management systems.

e. Patronize recycled goods and biodegradable packages.

f. Undertake sorting of recyclable components at source and dispose residue at designated sites.

g. Segregate hazardous wastes and ensure hygienic and safe disposal.

h. Maintain sanitary dustbins in homes

i. Adopt the technology of converting local waste into energy generation including biogas.

j. Adopt the use of compost as soil conditioner.

k. Pay for Solid Waste Management services to ensure its sustainability.

l. Effective solid waste collection and management service delivery at Local Government level.

Sustainable Development

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.

Sustainability development as defined in the Brundtland Report, the concept refers to "development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs". It is a holistic approach for human development which foregrounds a state of equilibrium between environmental protection and economic and social progression for improving the quality of life; economic, social, and environmental needs for both the present and future generations could be balanced by incorporating the concept into concrete practices (Filho 2011; Lozano, 2006).Daily activities of humans can contribute to pollution and environmental degradation; and common waste management strategies such as landfills and incineration are not sustainable practices.

According to the World Bank (2005), sustainable development is a strategy designed to improve the economic and social conditions of a specific group of the people, the rural poor. It involves extending the benefits of development to the poorest among those who seek a livelihood in the rural area. Apeh (2006) perceive sustainable development as a strategy designed to improve the social, economic, cultural and political conditions of rural dwellers and to make the process of their development self-sustaining through individual and collective participation. The implication of this definition is that sustainable development is not only concerned with improvement in the quality of rural living through increased and improved community services but also in the provision of environmental and waste management best practices, portable water that will promote good sanitation and hygiene to rural people. However, sustainable development activities can be undertaken by governments or an international agency which may be private or public. Sustainable development constitutes a process of planned change for which one approach or the other is adopted for improvement and/or transformation of the lot of the rural populace.

United Nation's (UN) (2008) defines sustainable development as 'development that meets the needs of the present without compromising the ability of future generations to meet their own need. The principle of sustainable development seeks to achieve societal and environmental equity while in pursuit of economic gain. From the point of view of sustainable development, waste can be interpreted broadly or narrowly. Broadly it might be construed as including various forms of pollution, ranging from discharges of toxins into the commons, or of emissions into the atmosphere. A narrow interpretation on the other hand, can be characterized as those by-products of production and consumption that are the subject of specific waste control programs. Sustainable development is an implied development without destruction. It is the judicious use of non-renewable resources for the present and future generations, which are non-renewable resources, which must be used at a judicious rate, neither too fast nor too slow and to ensure that the natural wealth that they represent is converted into long-term wealth as they are used (Adewole2009).

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) Another definition of Environmental Sustainability has been given by Daly & Cobb (1989) using output and input rule as:

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.

Input rule: These refers to renewal resources and 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).

In Nigeria, we succinctly put it as sustainable development without jeopardizing future development, meaning that in our efforts to explore and exploit the natural resources to serve us, there is an obvious paradox evident in the need to ensure economic development, while protecting the environment. It is important to note that there must be a balance between levels of development and the stock of natural resources, that is, development must be at a level that can be sustained without prejudice to the natural environment or to future generations.

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. Waste management has to change focus from "efficient removal" to waste avoidance, minimization and recycling options with higher priority. Municipal solid waste contains organic waste, plastics, papers, glass, mental 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), 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 re-manufacturing 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 21th century is 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.

Strategies for Sustainable Environmental Management

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 providing better and sustainable ways of evacuating waste without

jeopardizing the future. Thus, we can look at the strategies for sustainable waste management from three ways namely:

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 odour. There is a limit that defines if odours 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.

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