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**IMPROVISING MUNICIPAL WASTE DISPOSAL THROUGH INTEGRATED WASTE MANAGEMENT: THE SOUTHERN NIGERIAN EXPERIENCE**

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**INTRODUCTION**

The World Health Organization (2008) refers to waste as "something, which the owner no longer wants at a given time and space and which has no current or perceived market value". The line of thought in this definition presented a broad based approach towards the classification of what constitutes waste. However, what one regards as waste may not be totally useless as much can be recycled to produce new products. Wastes may be gaseous, liquid or solid. Solid wastes are not free flowing. Solid wastes have remained man most intractable problems. Waste generation and disposal is a growing problem worldwide and is directly connected to industrial development and population growth. Solid waste management remains one of the most daunting environmental sanitation challenges facing the most developing countries today and it has continually remained at its lowest ebb despite huge investments in the sector (Federal Ministry of Environment, 2005). Waste is generated by activities in all economic sectors and is generally regarded as an unavoidable by-product of economic activity (Stren *et al.*, 2005). Since early modern times, disposing of waste has been an important concern for individuals and community officials (UNEP, 2002). The generation and disposal of waste is an intrinsic part of any developing or industrialized nation. Waste, both from domestic and commercial sources has grown significantly in Nigeria over the past decade. Currently, as a result of industrialization and rapid population growth in many cities and towns, wastes are generated faster than they are collected, transported and disposed. Every time a householder shops at the store and open market, he contributes to the mountain of waste. It is difficult to quantify the volume of waste generated from each house hold in Nigeria, but merely from observation, it shows that the generation of waste amounts to millions of tons. The percent of Nigeria's population living in rural-urban, semi-urban and urban areas has more than doubled in the last 15 years.

The cities and urban areas experience continuous growth which contributes to enormous generation of solid waste. In Nigeria, it has been observed that about 75% of the total wastes generated each month are mainly from the urban centres (Nnamani, 2000). Several researchers have studied the volume of waste generated in Nigerian cities, for example, Maclaren International Ltd (1993) estimated this volume at 182.900 tones. The latest study, concluded by Haskoning and Konsadem Associates (2002) estimated the per capita rate at 0.6kg/day, with a density of 300kg/m<sup>3</sup>. The projections are based on an annual growth rate of population per year. The waste composition in major south-west rural-urban centres comprises of leaves, polythene bags, paper, food waste, tins, metal, glass and rags (Maclaren International Ltd, 1993). This is because these areas are located in the heart of a rice commercial land and has a large old and unplanned section. The management of waste is a matter of national and international concern. The volume

of waste does not actually constitute the problem but the ability of governments, individuals and waste disposal firms to keep up with the task of managing waste and the environment becomes the problem. There is no doubt that a dirty environment affects the standard of living, aesthetic sensibilities, health of the people and thus the quality of their lives (World Bank, 1992, Koehn, 1992; Kumuyi, 2005; Stren *et al.*, 2005; Swilling *et al.*, 2006). The corollary is that improper disposal or storage of these wastes can constitute hazards to the environment through the pollution of air, land and water. The indiscriminate disposal and dumping of waste has become a common practice in Nigeria urban centres (Bodija and Oluyole, 2004). Most of the waste dumps are located close to residential areas, markets, farms, roadsides and creeks. The composition of waste dumps varies widely, with many human activities located close to dump sites (World Bank, 1992, Onibokun and Famran, 1995; Olowu and Akinola, 2008). Significant percentage of what refuse/garbage resident communities generates, are picked up from house or establishment by the sweeper and dumped at near by community bin (Hyden, 2004). The community bins and dumping sites become eye sore, cause foul smell, become breeding places for harmful bacteria and attracts disease carrying vectors such as flies, mosquitoes, birds, rats, dogs etc. the situation gets bad-to-worse when this waste enters into water bodies during wet season (NISER, 1981; Koehn, 1992; Stren *et al.*, 2005). The prime concern arising out of indiscriminate waste disposal system is its impact on community health and environment. No matter who owns the responsibility of waste disposal, reality is that resident communities are the victim of their own apathy towards sustainable solution to the problem (Hyden, 2004). The opportunity cost of using modern waste disposal system in Nigerian urban cities for disposing waste is very high. Apart from land being costly and finite resources, judicial activism on use of land near water bodies is compelling municipal administrators to move towards enforcement of waste segregation and encourage community initiative towards waste generation (Barrett and Lawler, 2009). The disposal of wastes in the world is a problem that continues to grow with the development of industrialized nations and the growth of population (Ahmed, 2004).

The growth of human population coupled with increased economic activities in towns and cities result in high rate of solid waste generation (Federal Ministry of Environment, 2005). A fundamental attribute of solid waste is that it is inevitable as almost every human activity involves the generation of waste in solid, liquid or gaseous form. Social dynamics such as modernisation and economic development also influences waste generation. The management of solid waste is far from being satisfactory in Nigeria. Many parts of our cities and towns do not benefit from any organised waste management services 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. Inadequate environmental sanitation in many urban centres is a major cause of disease and a drain on the economy by way of lost workdays cost on treatment and cleanup activities. The disposal of wastes in or on the land without careful planning and management can present a danger to health and management can present a danger to health and the environment (Smith, 2005). In Nigeria especially in major urban centres waste disposal is a critical problem. In fact, Nigeria government has taken different steps in the past and even present to combat the problem without success. You don't need to look far before you see mountain of waste in most of our urban centres.

Earlier on, the step taken was based on waste disposal on some designated landfills (that were not sanitary because they were not constructed with underline to prevent leachate problem). Then, when the municipal government could not cope with waste collection and disposal successfully, the people resorted dumping their waste into storm water during rainfall, open dumping sites, stream dumping, burning, landfill e.t.c. Also, wastes generated in the country were characterized by a high percentage (60-80%) of domestic and commercial waste. This gives the wastes high density and makes them very attractive to flies, cockroaches, rats and other vermin (Areme *et al.*, 2007). The term waste disposal and management, in all its ramifications encompasses all steps taken in controlling the generation, storage, collection, transportation, processing and disposal or utilization of waste, in a sanitary manner (Isaac and Olanike, 2007). Therefore, waste management can be defined as the collection, transportation, processing, recycling or disposal of waste materials produced by human activities (Papper *et al.*, 2008). It is undertaken to reduce their effect on health, the environment or aesthetics. Sustainable waste disposal system provides a comprehensive inter-disciplinary framework for addressing the problems of managing urban solid waste, often with no effective means of recovering them (Sangodoyin, 2003). Upgrading the coverage of modern waste disposal system and services and increasing their efficiency is a precondition for improving the environmental quality of the urban centres. It is against this background that this paper anchored on improvising municipal waste disposal system through integrated waste management approach.

### **DESCRIPTION OF STUDY AREA**

Warri metropolis is an important urban centre in southern Nigeria that comprises of many communities. It lies between latitude 5<sup>0</sup> 31'N and longitude 5<sup>0</sup> 45'E of the equator. Warri metropolis has a boundary town with Uvwie, Udu and Okpe. Warri is a commercial and highly industrialized urban centre that is, all types of industries (major and minor industries) are located in the city. It is an important economic area, mostly because of it having a seaport. The main products transported by ship from Warri port consists of rubber, palm products, cocoa, groundnut, hides and skin, cargo and fairly used foreign materials. The centre is surrounded by tropical rainforest and swamp. It experience high rainfall and high humidity for most part of the year. The centre is connected to Benin city by a chief highway. Warri is highly populated, with an estimated population between 507,255 to 1,000,000 and it is necessary that over populated area can enhance the rate of waste generation because the people use all types of materials that results to waste. In attempt to develop technologically; increase in population and industrialization however has led to waste generation which in turn contributes to environmental pollution the price of modernisation.

### **MATERIALS AND METHODS**

The study area was divided into eight (8) zones from which field investigation were conducted. The process of data collection was both on direct personal observations and oral interview. Also, secondary source of data collected was employed; this includes published and unpublished materials. This study was based on the examination of the problems posed on the existing municipal waste disposal methods, environmental and health effects on the individuals in the study area, so as to improvise the waste disposal methods by defining an integrated management approach as a solution to arrest the issue

for sustainable development. Therefore the variables determined were the types of waste generated, methods of disposal, their effects on the environment and human health, and the effectiveness of the prevailing methods of control. Methods of disposal and their effectiveness were determined by direct inspection of the dump sites; and also, photographs were taken to give visual impression of the effects of waste on the environment. Table was used to present the different types of waste generated and disposed off in the study area.

## **RESULTS AND DISCUSSION**

**Types and composition of solid waste generated:** Solid waste that are generated in the study area are mainly from market places, homesteads, factories, workshops, hospitals, seaport, primary, post-primary and tertiary institutions. Pedestrians and hawkers generate a lot of waste on the roadside and streets. Each commercial place in the study area like the seaport, oil refinery, market, the university community and household generates a specific amount of commercial/domestic waste on daily basis. The quantity of such waste depends mainly on location, activity and number of people in the household. The rate of solid waste generated per capita increases as the standard of living improvises. Average per capita waste generated from city was at 0.29kg/day (Egunjobi, 2004; Ndakara, 2011).

### **Methods of waste disposal/control in the study area**

Solid wastes are disposed in the study area in three major ways as: kerbside collection, burning and dunghill disposal.