

**The Case of Sustainable Management of Solid Waste in the Country State of Bremen,
Germany: Practical Lessons for Nigeria**
Reuben Adeolu Alabi¹ and Karl Wohlmuth²
**Institute for World Economics and International Management (IWIM), University of
Bremen, Bremen, Germany**
1.bayobimb@yahoo.com, 2. wohlmuth@uni-bremen.de

1 Introduction

The problems of waste management are increasing because of changing consumption patterns, industrial development and urbanization, but also because internet shopping and new transport logistics play a role. In Nigeria, however, the waste management systems which are in use are still inadequate, unsustainable and unable to cope with the increasing volume of waste being generated day by day. With the increase in population, urbanization and industrialization, including globalization effects on Nigeria, the challenge of solid waste management (SWM) in Nigeria has increased and even is becoming now more complex. Nigeria has over 35% of her population living in cities, with a growing urbanization rate of about 7% per annum; and less than 10% of the city population enjoys “marginal waste management services” (Ossai, 2006). The rate of waste generation in Nigeria is on the increase, while the current volume is estimated at 0.4 to 0.8 tons /capita /annum. Iriyuga (2012) indicated that in Lagos State, for instance, waste generation is estimated at 9,000 tons per day, while in Kano it is estimated at 3,849 tons per day. Therefore, it is common practice to dispose of rubbish in unsafe landfills and illegal dumps, or directly in rivers and sewers. Local authorities are often unable to introduce integrated waste management systems due to the associated high costs. Very few models in Nigeria are capable of financing themselves while operating effectively.

2 Waste Management Problems in Nigeria

The problem of solid waste management is a universal and major one as waste exists in every society. Waste management problems only appear more serious in developing countries because of the poor management framework (Ukpong and Udofia, 2011). The quantity and type of waste generated depends upon the function which a city performs, its economic status and the level of technological and industrial development. Initially, solid waste management efforts were directed merely at the removal of waste from the urban and peri-urban centres and the subsequent destruction of such waste. Later attention shifted to waste utilization, waste reduction, re-use and re-cycling, management of hazardous substances, and the prevention of pollution emanating from waste disposal. In Nigeria, a major feature of the urban and semi-urban environment, particularly from the beginning of the oil boom in the 1970's onwards, was the rapid takeover of cities by all kinds of solid waste. Most state capitals and other large cities are littered with solid waste despite the presence of state and local government-owned waste management agencies, including private waste collectors. No town in Nigeria, especially the urban and semi-urban centres of high population density, can boast of having found a lasting solution to the problem of filth and huge piles of solid waste; rather the problem continues to assume dangerous dimensions (Mba, 2003). According to the Federal Environmental Protection Agency (FEPA, 1991), domestic waste generated per capita per year is increasing rapidly in Nigeria, and this increase has to be seen in the context of a population figure of 160 million, so that the volume of waste to be managed is huge.

The Nigerian Environmental Study/Action Team (NEST, 1991) has reported that Nigeria had generated over 60% of her waste as leaves and food waste in the 1960's. With the growth of industries in recent years, polythene and paper of various types have replaced leaves for using as wrapping and packing materials. The fact remains that the rate of collection and evacuation perpetually lags behind the rate of generation which makes solid waste accumulation a major source of environmental nuisance in Nigerian cities (Uwadiogwu and Chukwu, 2013). For example, Sada (1984) had reported that in 1980, on the average, a balance of 100 metric tons of solid waste is piled up daily in Benin City, Nigeria. This is so because, while about 350 metric tons of solid wastes are generated daily, the maximum rate of evacuation achievable was only 250 metric tons daily. Atuegbu (2007) observed that between 500 and 850 metric tons of wastes are generated daily in Enugu city. Big cities, like Abuja, Lagos, Port Harcourt and Kano, in Nigeria produced on the average 0.66kg, 0.63kg, 0.60kg and 0.56kg of solid waste per person per day respectively. Taking the population into account, this translates to about 105 tons, 5058 tons, 632 tons, and 1819 tons of solid waste per capita per day in Abuja, Lagos, Port Harcourt and Kano respectively. As living standards rise, people consume more and generate more waste. A rise of the Nigerian middle class as expected may contribute to this effect.

A major disadvantage of improper disposal of bio waste is that the organic carbon in bio wastes is converted to carbon dioxide and methane. Methane is a potent greenhouse gas with 20 times the global warming potential of carbon dioxide (EPA, 2014). The more this gas is released into the atmosphere, the higher the rate of global warming. Also, climate change has adverse effects on the natural resources of the country. This is particularly disturbing because a large part of the economy depends on the natural resources as sources of living. Climate change mitigation and adaptation and waste management have therefore to be considered in context.

An examination of municipal solid waste management in many developing cities, including Nigeria, shows that the present strategies are deficient and need to be re-addressed. Rapid urbanization in the developing world, if ignored, can be a threat to health, to the environment and to urban productivity. Cities are known to be engines of economic growth, but the environmental challenges of such a growth need a proper assessment. Schioppa et al. (2007) and Schwarz-Herion et al. (2005) agree that there is the need to develop, to master and to implement a simple and reliable tool which will help the government to tackle the ever-increasing volumes of waste. This is the more so necessary in a developing country such as Nigeria with its associated high population and population growth rate. Although the government of Nigeria is aware of the environmental impacts of improperly managed wastes, it appears that it is overwhelmed by the problem of waste mismanagement. The Nigerian government needs implementable strategies on waste management which are related to disposal, collection, storage, and recycling of wastes. For Nigeria the use of waste may become important as the base for a new industry; remanufacturing is already developing in the informal sectors of Nigeria and green industries may be an option for starting a new industrialization path even in the formal sector!

3 The Case of Germany and of the Country State of Bremen in Germany

Germany has developed a very robust waste management system which ensures efficient waste collection, storage, transportation, and disposal while minimizing the impacts of disposal

on the environment. In addition, there is emphasis and focus on waste-sorting, re-cycling, and re-using, including other practices which help to save waste management costs. Also, the German waste management system is developing further, and there is a European Union-wide comparison and competition between member countries for best practices. Sustainable waste management and recycling systems in Germany aim at reducing the quantity of natural resources consumed by ensuring that any resources already taken from nature are reused many times and that the amount of residual waste produced is kept to a minimum and treated in an environmentally safe way (GIZ, 2014). The Country State of Bremen is a particular case, as it is the smallest country state in Germany, but has developed innovative strategies and policies. Although affected by European Union (EU) regulations and Federal Government laws, the country state of Bremen has developed specific solutions to increase the recycling rate and to reduce the volume of waste. The paper addresses these innovative solutions. Nigeria and other developing countries can learn from the experiences of this country state in Germany. This paper therefore examines the factors that are responsible for a sustainable waste management system in Germany, and evidence is taken from the country state of Bremen. Although the conditions differ, some lessons can be drawn from the case of Bremen, and some experiences can be transferred to improve the waste management system in cities of Nigeria.

The ranking of EU countries based on the efficiency of their waste management systems shows that Germany is ranked third after Denmark (BiPRO, 2012). The report by the European Commission graded the 27 EU member states (at that time) against 18 waste management criteria, and ranked them by score. Categories of criteria in assessing waste management performance in EU countries include total waste recycled, pricing of waste disposal, and infringements of European legislation. In almost all the criteria used, Germany scored higher than the average score for European Union countries.

Waste management in Germany can be said to be efficient and sustainable. In fact the EEA/European Environmental Agency (2009) indicated that landfilling of (untreated) municipal waste has almost ceased in Germany, with only 1% (of the waste) landfilled in 2006. Many factors can be attributed to the success of efficient waste management in Germany. In the mid-1960s the national government and the federal states in Germany started to analyse waste disposal and disseminated the findings to municipalities, which were responsible for disposing of municipal waste. Due to a substantial increase in industrial production and private consumption, as a result of economic growth, waste generation grew rapidly at the beginning of the 1970s. At that time, waste was primarily disposed of in 50, 000 small dumpsites, and interest concentrated on them and the need to build appropriate waste management facilities. In the 1990s, Germany was among the first European countries to introduce policies to limit landfilling. Measures applied included schemes for collecting plastics, packaging waste, bio-waste, and waste paper separately. As a result, by 1995 Germany already recycled a relatively large proportion of municipal waste and landfilled approximately 40 % (treated or untreated waste) (EEA/European Environmental Agency, 2009). True federalism helped in designing appropriate mechanisms and basic laws that are relevant and binding to each state. In Germany, responsibility for waste management and environmental protection is shared between the federal government, the country states, and the local authorities. The federal Ministry of Environment sets priorities, participates in the enactment of laws and oversees strategic planning, information and public relations, and defines requirements for waste facilities. Each country state adopts its own Waste

Management Act containing supplementary regulations to the federal law, e.g. concerning regional waste management concepts and rules on requirements for disposal. There is no federal waste management planning system in Germany. Instead, each country state develops a waste management plan for its area (EEA/European Environmental Agency, 2009). Germany's waste management policy follows the EU's waste order, with prevention as the first priority, followed by material recovery and energy recovery, depending on which is better for the environment. Objectives for managing municipal waste also focus on avoiding contamination of waste and ensuring treatment and landfilling of waste that is not recovered. Recycling aids in diverting waste from landfills by limiting the organic content of the waste. A landfill ban was introduced to achieve this goal; it was introduced in two steps and using three pieces of legislation because the initial statute contained severe loopholes. The first step was an administrative regulation (TASi/Technische Anleitung Siedlungsabfall) in 1993, which limited the organic content in waste going to landfills to less than 3 % of total organic carbon (TOC). Achieving such a low organic content necessitated thermal treatment of the waste. Separate collection of bio-waste and paper is also regulated mainly through legislative measures. In 1983 the Country State of Hessen initiated separate collection of bio-waste to divert waste from landfill. Between 1985 and 1993, the number of inhabitants with a collection system for bio-waste increased from 400, 000 to 7.6 million (EEA/European Environmental Agency, 2009). Packaging waste is regulated by the Packaging Ordinance (1991), which introduced producer responsibility. This implies that producers and retailers are obliged to take back used packages and to contribute to their further management. The implementation of this Ordinance led to the 'Green dot' system. In Germany, waste collection charges on households have to cover the full cost of collection and management of waste. Such tariffs vary between municipalities, depending on the waste management situation and the service offered to the citizens. The system of fees used in the country state of Bremen will be taken as an example. It works in a specific way through the category of "residual waste" (waste not separated out as paper, plastic, and bio-waste).

4 Conclusions

Nigeria can learn from Germany's federal system and the states and cities in Nigeria can learn from the country state of Bremen. Nigeria can learn from Germany about the need for effective waste management policy formulation and implementation, at national and state level. True federalism (with shared commitments of the federal states, the country states and municipalities) is an important anchor on which waste management is made effective in Germany, and this is definitely also important for Nigeria. The producer responsibility system is equally important so that the fees being paid by the producers of the waste will be sufficient to manage the waste.

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