

An Overview of Solid Waste in Nigeria: Challenges and Management

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Abstract

Waste can be seen as material originating from animal and human activities, and when discarded as useless and unwanted, it attracts pathogens. The ineffective management of solid waste by individuals, homes, consumers, and waste management companies in Nigeria can be attributed to inadequate information on the benefits of waste management and poor implementation of government policies. This study is a descriptive research based on observation and secondary data gathered from news print and journals. The review sheds light on the concept of solid waste and management in Nigeria, recent studies in solid-waste management in Nigeria, solid-waste menace in Nigeria, methods for the control of land pollution in Nigeria due to improper waste disposal and challenges of municipal solid-waste management. Public and private partnership and public awareness should be encouraged to enhance solid-waste management. Thus, the sustenance of a healthy environment requires a careful attention to the environment which includes proper management of solid waste whose rate of generation in Nigeria has been put at an average value of 0.49 kg/capita/day.

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1. Introduction

The environment is very crucial for the existence of every creature. In addition to serving as a place of abode to any creature, it also contributes, to a large extent, to the quality of life of creatures (Oreyomi, 2005). The environment can be seen as the total factors that surround and influence an organism at a given time and place. The failure of the numerous efforts to address the problem of environmental health hazards in developing nations has been attributed to various factors including unhealthy socio-cultural practices, poor environmental sanitation education and awareness, low literacy level, bad governance, disregard to the rule of law and other forms of indiscipline (Omotosho, 2005). Solid wastes are abandoned materials and could be garbage, sludge from a waste-treatment plant, discarded materials resulting from industrial, commercial, mining, agricultural operations, and those resulting from community activities such as waste tires, scrap metal, latex paints, furniture toys, appliances and vehicles, empty aerosol cans, paint cans and compressed gas cylinders, and construction and demolition debris. (Bamgbose et al., 2000). However, most of the waste commonly known as garbage, which consists of everyday items being discarded by the public, is generally regarded as municipal solid waste. It covers all thrown-away materials including products of packaging, grass clippings, furniture, clothing, bottles, food scraps, newspapers, appliances and batteries (Afon, 2006; Basse et al., 2006). The quantity and rate of solid waste generation in a place is largely dependent on the population, level of industrialization, socio-economic status and the kinds of commercial activities (Dauda and Osita, 2003).

Humans have suffered in no small way from diseases associated with solid wastes and the contamination of the subsurface water by the leachate from solid wastes heavily laden with toxic chemicals and pathogenic organisms which contaminate the water and make it unfit for human consumption (Adedibu, 2008).

Solid-waste management entails the collection, storage, transportation, treatment, recycling, recovery, and disposal of waste in such a way as to render them innocuous to human and animal life, ecology, and the environment as a whole (Fafioye and John-Dewole, 2013). The problem of waste management is a primordial and poses threats in developing countries in Africa, particularly Nigeria. Municipal waste-management problems in Nigeria cut across concerns for human health, air, water, and land pollution among others. The analysis of the key problem affecting the efficient management of municipal waste is critical for developing a workable solution in an emerging economy like Nigeria's (Abila and Kantola, 2013). Waste management is not properly done in most towns in Nigeria. Most parts of urban areas do not benefit from public waste disposal services, which makes residents sort for other options such as burying or burning their waste therefore disposing it haphazardly.

Given the fact that waste management in developing countries is an ongoing challenge due to weak institutions and policies including the environmental laws, a chronic under-funding, the rapid urbanization and industrialization, the situation in the urban areas of Nigeria may not be different from other towns in the developing world. These challenges

along with the lack of understanding by different factors that contribute to the hierarchy of waste management may affect the treatment of wastes. It is imperative therefore, to examine the menace of solid waste generated in urban areas in Nigeria and the ways they can be curbed.

2. Concept of Solid Waste and Management in Nigeria

Waste could be any material which has been used and is no longer wanted as the valuable or useful part of it has been taken out (Oyeniyi, 2011). Solid waste can be defined as non-liquid and non-gaseous products of human activities, regarded as useless. It could take the form of garbage and sludge (Leton and Omotosho, 2004). Waste generated by human activities since time immemorial has continued to be a threatening problem and a growing one that is of major concern to every nation around the world (Oyelola and Babatunde, 2008). The rapid increase in the volume and types of solid and hazardous waste, due to the continuous economic development, urbanization and industrialization is becoming a burgeoning problem for most governments in ensuring an effective and a sustainable management of wastes (Ogu, 2000; Igoni et al., 2007). Waste generation encompasses those activities in which materials are identified as being no longer of value and are either thrown away or gathered together for disposal. When living standards rise, people consume more, so waste increases. The best place to sort waste materials for recovery is at the source of generation (Ezigbo, 2012).

According to Areme et al. (2007) cited in Ikemike (2015), waste generated in the country is characterized by a high percentage (60-80%) of domestic and commercial waste in relation to others. This gives waste a high density and makes it very attractive to flies, cockroaches, rats, and other vermin. Also, Mshelia (2015) opined that solid wastes are generally very diverse and are usually made up of complex mixtures of biodegradable and non-biodegradable matters. The biodegradable nature that characterizes solid waste in Nigeria is similar to what is obtainable in countries with similar economic and demographic characteristics including India, Bangladesh and Ghana (Akinwonmi et al., 2012). In Nigeria today, among the pressing environmental and public health issues are the problems of solid waste generation, control, and disposal (Okwesili et al, 2016). Although the problem of solid waste disposal is as old as man's existence that is inextricably linked to the generation of waste, the truth is that in many cities, it has become so intractable that even the government is overwhelmed (Momodu et al., 2011). The volume of solid waste generated continues to increase at a faster rate than the ability of the agencies to improve the financial and technical resources needed to balance this growth (Olukanni and Mnenga, 2015). The rate of solid waste generation in Nigeria has been put at an average value of 0.49 kg/capita/day (Nnaji, 2015). The average rate of waste generation in some Nigerian cities is shown in the Table 1 below:

Table 1. Quantity of municipal solid waste generated in some cities across Nigeria.

Cities	Population Estimation	Estimated kg/capita/day	Tonne/day	Tonne/year
Minna	346,524	0.68	235	86007
Enugu	817,757	0.74	605	220876
Birnin kebbi	128,403	0.65	83	30463
Lagos	21,000,000	0.92	119320	7051800
PortHarcort	1,363,596	0.85	1159	423055
Bauchi	493, 730	0.68	336	122543
Abuja	1,857,298	0.95	1764	644018
Ibadan	3,565,108	0.72	2566	936910
Kaduna	1,582,102	0.70	1107	404227
Onitsha	561,066	0.69	387	141304
Sokoto	563,861	0.68	383	139950
Jos	816,824	0.73	596	217642
Benin City	1,125,058	0.78	877	320304

Source: Ike et al. (2018)

Table 1 above shows that Lagos with an estimated population of 21 million and generation rate of 0.92 kg/capita/day, generates about seven million tons of waste annually. When compared with generation rates around the world, Nigeria, similar to other third world countries generate tons of waste, but is unable to deal with it effectively due to poor management practices. Moreover, the amount of waste generated is very necessary in determining and planning waste-treatment facilities and management (Ike et al., 2018). Wastes contain a lot of valuable resources in the form of nitrogen, phosphorus, potassium etc which are useful (Hammed et al., 2011). Almost all substances that are designated as waste possess potential resource utilization in that within the waste stream, there exists some degree of residual value for alternative uses. Waste represents valuable resources as ground covers to reduce erosion, and as fertilizers to nourish the crops and can also be a source of energy (Adekunle et al., 2011).

Different types of vehicles are used for solid-waste collection in Nigeria. The compactor trucks, side loaders, rear loaders, mini trucks, tippers, skip trucks and open back trucks are the commonly used collection trucks. It was observed that 60% of the available trucks are always out of service. The few available trucks breakdown frequently due to overuse (Agunwamba et al., 2003). Cities in Nigeria, being among the fast growing cities in the world, are all faced with the problem of solid waste generation (Onibokun and Kumuyi, 1996). The need for proper collection, adequate treatment and sanitary disposal of solid waste by man has risen as populations migrated from disperse geographical areas into communal living areas. Waste generation, both domestic and industrial, continues to increase globally in tandem with the growth in population and consumption patterns of towns and cities (Emelumadu et al., 2016). Based on the available literature, it has been confirmed that if current trends continue, the world may see a five-fold increase in waste generation by the year 2025 (Okalebo et al., 2014).

One of the consequences of population growth is waste. It therefore becomes a serious problem that needs attention from the government or agencies responsible for this (Olu-Olu and Omotosho, 2007; Schwarz-Herion et al, 2008; Adejobi and Olorunnimbe, 2012).

Waste management comprises the collection, transport, segregation, recycling, and disposal of wastes in an environmentally acceptable manner (Ekanem et al., 2013; Elenwo, 2015).

A sustainable environment and improved waste management offer opportunities for income generation, health improvements and reduced vulnerability (Adetunji et al., 2015). This could hardly be attained in some of the developing countries, most especially in Nigeria because of non-readiness, uncoordinated and laissez faire attitudes toward better ways of solid-waste disposal methods in spite of the high rate of urbanization and growth in commercial and industrial activities (Afangideh et al., 2012).

3. Recent Studies on Solid Waste Management in Nigeria

The unprecedented increase in world population growth rate particularly in developing countries coupled with the technological advancements, waste disposal and management constitute serious problems for societies. In cities going through rapid urbanization, the problems and issues of solid-waste management are of immediate importance (Momoh and Oladebeye, 2010). Nigerian cities and towns are currently facing serious environmental challenge due to poor solid-waste management. Solid waste is generated at a rate beyond the capacity of authorities to handle for the sake of maintaining a sustainable urban environment. This has resulted in a poor solid-waste management system that portends serious environmental crises in most Nigerian towns and cities (Abel and Afolabi, 2007).

Babayemi and Dauda (2009) reported high waste-generation rates in Abeokuta without a corresponding efficient technology to manage the wastes. Out of 201 sampled respondents in Abeokuta Ogun State, (35.8%) used waste collection services, (64.2%) used other waste disposal options, (16.4%) used both, (68.7%) and (58.7%) were aware of waste-collection services and waste-management regulations, respectively.

Okeniyi and Anwan (2012) reported that amongst the average wastes generated per day in Covenant University Ota, food waste exhibited the highest percentage of (26.2%), followed by polythene bags (19.3%); plastic bottles (13.6%), metal cans (11.5%), paper (10.5%), plastic food packages (7.2%), other combustible wastes (5.6%) and polystyrene food pack (5.6%).

Ogu (2000) interviewed 591 households in Benin-City, Nigeria and found out that three-fifth of the respondents had no solid-waste collection service. This is attributed to inadequate resources, and the privatization scheme set up in 1995 to address the environmental issues. The current study stresses the need for private partnership with government in providing adequate delivery services to the public.

Onwughara et al., (2010) examined the disposal habits,

and the environmental impact of solid-waste management in Umuahia, Abia State, Nigeria. They gave an overview of the various management practices and the necessary rules for achieving a sound management with a population of about 1.2 million people who produced 250 metric tons of waste in 2005 and 350 metric tons of waste in 2007 daily. The study revealed that (80.0 %) of the solid wastes was generated from market traders consisting of mixed wastes containing hazardous and non-hazardous components which are separated, treated, or recycled before disposal by the municipality.

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The solid-waste generation scenario in Nigeria has been of great concern to the government and waste generations have been known to pose hydra-headed problem beyond the scope of the local and city councils (Awomuti, 2008). The reason is centered on the fact that major streets experience a continual presence of solid waste from varying sources. Although studies have been conducted on various aspects of the phenomena in Nigeria; however, most of the studies are confined to the much larger and older cities, while the situation in smaller and newer cities, which may be experiencing faster urbanization, is being neglected.

4. Solid-Waste Menace in Nigeria

It was observed that residents in many urban areas of Nigeria do not carry out efficient solid-waste management practices. They dispose their waste in burrow pits, road sides, and drainages. This finding is consistent with the work of Ogwueleka (2003) in Nsukka Nigeria, who reported that people dump waste at any vacant plot, public space, and river or burn them in their backyard, thereby polluting the air. Babayemi and Dauda (2009) reported a high waste generation rate in Abeokuta without a corresponding efficient technology to manage the wastes. Nkwocha et al., (2011) assessed the efficiency of solid-waste collection services in Owerri's municipality and found out that the level of efficiency in waste collection was only about 61%; a situation they attributed to a wide range of socio-economic and technical factors. Ogwueleka (2009) also investigated solid-waste management involving nine cities in Nigeria and discovered that a great majority of the total solid wastes generated in the cities are organic in nature and there is gross inefficiency in the solid waste management practically in all the cities. The poor performance was attributed to the inadequate funding, personnel, equipment, and technological constraints. Motorists are frequently seen throwing their refuse on the road as they pass by. The wastes disposed

by residents in these manners were not only domestic but include other types such as medical waste which is more hazardous to man. Usually, the sites of disposal were close to the houses and markets where food items were sold. This can increase the risk of contamination of these food items. It could be observed that some residents in Nigeria dump their waste into nearby drainages; around their surroundings which are mostly unattended or throw their garbage on the roadside. This finding agrees with the study of Puopie and Owusu-Ansah (2014); Nabegu (2010). Anyanwu and Adefilia (2014) reported in their work that people have the habit of dumping their refuse within a close range to their residence or where they carry out their daily activities and it accounts for huge heaps of accumulated refuse found along the roadsides, streets, and gutters. This also agrees with the report of Ogbonna et al. (2002); Samuel et al. (2013); Naphtali and Vimtim (2016); Opara et al. (2016); Opara and Uwakwe (2016) that most people dispose their solid waste in any open space which contribute to the improper management of waste. This further explains why people tend to disregard the use of designated official dump-sites and create alternative points. Strict laws against indiscriminate disposal of waste should therefore be enacted and enforced so as to discourage people from such practices

These attitudes lead to the degradation of the environment and create a breeding ground for pathogens which could cause serious health problem. It has been reported that the exposure to poorly disposed food wastes leads to health hazards due to the decaying matter which provides suitable material for harmful insects, rats and other creatures to thrive and rapidly aid the cause and spread of diseases including cholera, diarrhea, dysentery, guinea worm and typhoid fever (Komolafe, 2011). This finding was similar to the documentation by Fafioye and John-Dewole (2013) in their study on the 'Effect of Solid Waste Management on the People of Iseyin Community in Oyo State, Nigeria'. In Nigeria, poorly-disposed waste creates a lot of problems on the roads especially during rainy seasons when drains are blocked thereby hindering the free flow of water which results in waterlogging or the flooding of the roads. This corresponds with the report of Manton et al. (2016).

5. Control of Land Pollution due to Improper Solid-Waste Disposal

According to Egunjobi (2004), in the early times (pre-colonial days) up until the 1970s, the disposal of refuse and other waste did not pose any significant problems. The population was small and enough land was available for the assimilation of waste. Solid waste has started to constitute a problem with the urban growth. Also, it has resulted partly from the national increase in population and more importantly from immigration. In view of the problems associated with control of land pollution in Nigeria; the following aspects can be determined:

1. Public enlightenment: In Nigeria, public awareness on sustainable waste management is still very poor and the efforts by the agencies to raise the awareness are still very low. Municipal members are not well informed on the adverse effects of the indiscriminate and improper

disposal of waste and also the benefits of such act (Abila and Kantola 2013). Fafioye and John-Dewole (2013) reported that the knowledge community occupants have about the environment, waste management and control is inadequate, and accounts for the poor environmental management. Akpala (2006) also reported that the poor attitude towards the keeping and maintenance of hygienic environment stems from the inadequate knowledge of the inhabitants on safe and hygienic waste handling and management. Therefore, in order to curb land pollution due to improper disposal of waste, people should be adequately enlightened.

2. Solid-waste management method: It includes waste minimization, reuse, and recycling before thinking of disposal. Sridhar and Hammed (2014) observed that a school in Abeokuta collected worn out tires and used them as a fence around their playground. Individuals in urban areas should sort items that can be reused before disposing them as waste thereby reducing the volume of solid waste in the environment. Solid wastes that cannot be reused should be sorted and taken to industries for recycling. These recyclable wastes can find their way to big industries. Aluminum can be recycled into cooking pots. Plastic can be transformed into plates, spoons, chairs, and other household materials. Broken bottles can be transformed into usable bottles for industries. Scavengers in the various operating fields can recover both ferrous and non-ferrous metals. Blacksmiths, welders and artisans can recycle these metals for the construction of metal gates and hand-held tools such as cutlasses, hoes, spades and piercing instruments (Nzeadibe and Eziuzor, 2006). In this era of a massive waste generation and diminishing raw materials, reuse and recycling should be encouraged. Recyclable materials can be obtained by local residents or by cart pushers thereby creating jobs for themselves. The activities of the cart pushers are popular among the residents of unserved areas although formal waste-management authorities regard them as illegal (Afon, 2007). However, the public attitude towards informal waste workers is usually negative and is characterized by repression, particularly of the cart pushers and, sometimes, the landfill scavengers (Medina, 2000). These scavengers are primarily waste workers who collect and dispose of household refuse for a fee, from places not served by the formal refuse collection system (Medina, 2005; Afon, 2007). Solid waste that can be recycled is, however, thrown away indiscriminately in most towns. This agrees with the findings of Otitoju (2014) that the solid wastes collected from the streets of Nigerian urban centers are dumped in open dumps without the due recourse of sorting them at sources of waste generation and disposal. Modebe et al. (2009) in their study in Awka Nigeria, showed that most of the households did not recycle their solid waste. Also, Ogwueleka (2003) reported that less than 60% of (MSW) generated is collected in developing countries. However, 60% of waste generated in the households can be recycled, if a proper waste-recycling system is put into place (Nkwocha and Okeoma, 2009; Adogu et al., 2015).

3. **Composting:** It is a method through which solid waste in Nigeria can be curbed. It is the biological process of breaking up organic waste such as food waste, manure, leaves, grass trimmings, paper worms and general household wastes into an extremely useful humus-like substance by various micro-organisms including bacteria and fungi in the presence of oxygen (Bellamy, 2007). The waste materials generated in Nigeria can be classified as municipal solid waste (MSW) which is a heterogeneous mixture of various kinds of solid wastes including biodegradable food waste and non-biodegradable solid waste such as polythene bags, glass, rags, metal items etc. Most of the wastes are from residential houses that generate majorly all waste food articles, vegetable peelings, fruit peelings etc. These wastes are organic in nature and therefore decompose quickly as such they are good for composting. Manure obtained from the compost is more beneficial to the soil than the inorganic fertilizer. It produces a good yield, lasts longer, softens the soil, and adds vital humus and a natural pesticide for the soil (Ladan, 2014). It is reported in the work of Ladan (2014) that in Katsina metropolis, composting can be a sustainable method of waste management.
4. **Management Improvement:** Waste management agencies should be headed and administered by professional environmental managers who are well-trained environmental practitioners rather than being politicians who are not adequately knowledgeable about environmental matters. This will facilitate the making of right decisions on waste management (Uwadiogwu and Chukwu, 2013).
5. **Strengthening Waste Management Agencies:** Strengthening a public waste-management agency requires that the government should be committed to the cleanliness of the town by beefing up the personnel strength of the agency, improving the circulation infrastructure and logistics. These will enable the agency to operate at a high level of efficiency (Uwadiogwu and Chukwu 2013).

6. Challenges of Municipal Solid-Waste Management in Nigeria

The problems affecting municipal solid-waste management in Nigeria are diverse and numerous, and are related to economical, technological, psychological and political aspects in the country. In view of the challenges of municipal solid waste management in Nigeria; the following challenges can be determined:

1. **Poor Funding:** This is one of the major problems constraining the waste-management sector (Ogu, 2000). The incapability of purchasing new waste-collection trucks, the limited staff, poor vehicle maintenance, unsubsidized waste-storage containers, and the inability to purchase equipment among others are all attributed to the shortage of capital. Actualizing waste-management projects requires a consistent funding to achieve answers to the strategies yet to be implemented (Abila and Kantola 2013). More importantly, economic or financial constraints may result in the populace

- patronizing cart pushers who are not able to get to the approved designated dump sites where the solid waste are expected to be managed properly (Igbinomwanhia and Ohwovoriole, 2012).
2. **Poor Legislation and Implementation of Policy:** The constitutional strength of solid-waste management policy is weak and ineffective. Also the implementation of this policy is not monitored adequately. The efforts by state and local environmental protection agencies in Nigeria to completely rid streets and neighborhoods of indiscriminate wastes have not yet achieved the much desired success (Kofoworola, 2007).
3. **Cultural Belief:** Wastes are viewed as an invaluable and unwanted materials rather than wealth. Wastes are not seen as valuable materials that can be recycled for actual use, material recovery and energy recovery. The value of waste to people enhances the actualization of the process involved in the management of waste (Abila and Kantola, 2013).
4. **Urbanization:** As a result of urbanization and the rapid population growth in the country, wastes are generated faster than they are collected, transported, and disposed. This problem of urbanization has also complicated the problem of waste management as land becomes scarce, human settlements encroach upon landfill spaces, and government in some cases encourage new development directly on top of operating on recently closed landfills (Ikemike, 2015).
5. **Poor management strategies:** Waste management in the country is hindered by exhausted waste collection services, and by inadequately managed and uncontrolled dumpsites and the problems are worsening day by day. The effectiveness of waste collection initiated by both the public and private sectors is largely controlled by location, the ability and willingness of the owner of the waste to pay the amount charge (Olukanni and Mnenga, 2015). Most of the times, people are not willing to pay. Most waste in Africa is not collected by municipal collection systems because of poor management, fiscal irresponsibility, equipment failure, or inadequate waste-management budgets (Bartone, 1991; Opara et al., 2016).
6. **Population growth:** The ever increasing challenges of rapid population growth rate and poor planning, has not only affected solid-waste volume but they also made solid-waste management strategies incapable of keeping pace with the rate of generation. Education, income and socio-economic status are other important factors influencing per-capita solid-waste generation (Abel, 2009).

7. Conclusions

A healthy environment in most places in Nigeria has been compromised by an indiscriminate disposal of solid waste as such, it requires efficient management since solid-waste generation occurs as a result of human activities. The need for an adequate waste-management strategy in any community cannot be overemphasized, because inadequate waste management creates a negative impact on the environment and human health. Solid-waste management

in Nigeria can be achieved through public enlightenment, composting, management improvement and strengthening and supporting waste- management agencies. Efficient solid-waste management can, however, be affected by poor funding, poor management strategies, population growth, Poor legislation and implementation of policies. Thus, the goal of the sustenance of a healthy environment requires paying a careful attention to the environment which entails a proper management of solid waste.

8. Recommendations

In view of the problems associated with poor solid-waste management in Nigeria; the following recommendations are made:

1. Public awareness campaigns via electronic and print media, by the chiefs and community leaders, etc. should be launched so as to enlighten the general public regarding the effects of poor waste disposal and the need for effective waste management.
2. The public and private partnership should be highly encouraged to participate in effective solid-waste management for the sustenance of a healthy environment.
3. The government should encourage more research projects in the area of waste management.
4. There should be comprehensive environmental legislation that relates to environmental sanitation offences.
5. There should be adequate and proper town planning for effective solid-waste management for example, there is a big need to provide a good access to roads to ease the evacuation of solid waste from all the nooks and crannies of the town.
6. Solid Waste Management in Nigeria should be the concern of everybody not one agency by itself.
7. There should be provision for sanitary landfill facilities for a proper deposition of solid waste. This will help minimize pests, disease, air pollution, ground and surface water pollution and also improve aesthetic values.

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