



Environmental Hazards of Continued Solid Waste Generation and Poor Disposal in Municipal Areas of Nigeria

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Authors' contributions

This work was carried out in collaboration between all authors. Author SMM designed the study and wrote the first draft of the manuscript. Author DDD handled the literature aspect. Author JDD managed the section of municipal solid waste treatment in Nigeria, while author RAN drafted the recommendation and typed the work. All authors read, edited and approved the final manuscript.

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ABSTRACT

Municipal waste generation and management is a global phenomenon. This paper has critically examined the trends in waste generation and management in Nigerian urban areas. Drawing largely from related works reviewed, the paper has discovered that the rate of waste generation is 25 million tonnes per year, at a daily rate of 0.44-0.66 kg/capita/day while the density of the country ranges from 280-370 kg/m³. Further findings indicated that increased municipal waste management problem stemmed from such unethical practices of dumping wastes in streams, runways, drainages, open spaces and burning of combustible materials that release smoke and particulate matter in the environment to threaten flora, fauna and human beings. These approaches to wastes

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management have adverse consequences on human beings as the wastes readily become breeding ground for disease-causing organisms like rodents and insects. The paper concluded by recommending the need for public enlightenment on the menace of filthy environment, provision of waste management facilities, establishment of waste -recycling plants and encouraging more research activities into ways of recycling wastes in order to make the urban environment habitable.

Keywords: Environment; hazard; solid waste; generation; disposal; Nigeria.

1. INTRODUCTION

Nigeria is located in West Africa and apart from Atlantic Ocean found in the South, the country is bounded to the North, East and West by the Republics of Niger, Cameroun and Benin respectively [1]. Nigeria is located between latitudes 3°15' and 13°30'N of the Equator; and between longitudes 2°59' and 15°00'E of the Prime Meridian. It has a total area of 923,768 km²: where land comprises 910, 768 km²; water 13,000 km², land boundaries 4,047 km and a coastline of about 853 km [2].

The country has a kaleidoscopic pattern of landforms and landscapes: Soil, vegetation and climatic types, extending from Mangrove Swamps and Rainforest of the Guinea coastal lowlands to the Savanna Woodlands of the High Plains of Hausa land and the Semi-arid Sahelian lands in the far Northeast [3]. The country experiences wet and dry seasons which alternate with each other within a space of roughly 6 months in most parts of the country. The country is occupied by about 50% Highland areas in the North central, Southwest, Southeast and Northeast while the remaining 50% comprises lowlands, depressions, basins and troughs. The highest point in the country is Chappal Waddi Hills, being 2,419 m in the Northeast while the lowest points which are mostly made up of recent deposits of sand and clay are in the Islands of Niger Delta with average height of 20 m [1].

Nigeria has one of the fastest growing populations of 3.3% in the world where census results of 1991 and 2006 showed that the population were 88.5 million and 140 million respectively [2]. There is high inequality in the distribution of urban centres either on regional, geo-political or on state basis. Nigeria is arguably the most urbanized country in Africa where in 1991 there were 359 urban centres, rising to 680 in 2002, as against 14 in the southwestern region, 5 in the northern region and 4 in southeastern region in pre-colonial period [2]. There is also high inequality in the

level of development and distribution of social and economic infrastructure between rural and urban areas in the country leading to the high rate of rural-urban migration being experienced in the country [2]. Less than 40% of the population lives in urban areas but the rate is increasing rapidly with consequent acute problem of waste disposal, pollution and general land degradation [4].

It is not simply the quantity of waste generated that has raised concern but the environmental impacts which such waste cause to the quality of our environment. Indeed, in almost all the major cities of the country, from Lagos to Sokoto and from Calabar to Maiduguri, the situation is the same where refuse heaps are often seen dotting the urban centres [3]. Drainages are blocked, sewage systems clogged, surface and underground water bodies are polluted while agricultural lands become breeding grounds for rodents, pests, and diseases [5]. The operations of the waste management authorities, where they exist, are inefficient and ineffective. Only about 30-50% of waste is collected in most cities, the remainder is often burned or dumped haphazardly on open plots of land particularly along main roads and on the streets where it creates health hazards, blocks drains, contributes to urban flooding and makes the cities less aesthetically pleasant [4].

The rapid changes and growth in industrial technology, the rapid increase in the country's population, the ever increasing rural-urban migration, the dramatic change in consumption patterns in favour of imported packaged can foods and other luxurious goods are substantially yielding high quantities of both degradable and non-degradable materials like metals, bottles, plastic materials, glasses, electrical and electronic equipment and other solids which transverse Nigerian cities today; hence complicating the problem of maintaining urban environment at a healthy level for human beings. Thus the intention of this study is to examine the problems of municipal wastes in Nigerian cities and suggest ways of contending them.

The paper provides an in-depth overview of the state of solid waste generation and management in Nigeria; it describes the trends and hazards posed to the environment and recommends appropriate approaches to waste management that would enhance an effective disposal of waste in order to make Nigeria an environmentally safe and clean nation for sustainable development. The paper is organized into nine parts. It begins with introduction, then study methodology, clarification of waste and classification, theoretical framework, trends in waste generation and management, environmental hazards of poor disposal of waste, assessment of the economic viability of municipal solid waste treatment in Nigeria, recommended approaches to effective waste management and lastly the paper is concluded, in that order.

2. STUDY METHODOLOGY

Although some inferences were drawn from different parts of the world, the study was done with special emphasis on Nigerian cities. The data for the work were obtained mainly from secondary sources: Though personal observation of the situation in some Nigerian cities gave some insight into the problem being discussed in this paper. Many articles on solid waste management practices and problems published in highly reputable academic journals were read by the authors. As a result, a lot of information and ideas derived were noted and later expanded to meet the desire of this paper. The authors are very grateful to all the sources of information obtained. Consequently, the writers whose materials were cited have been properly acknowledged in the bibliography accordingly.

3. WASTE AND CLASSIFICATION

Any material, solid, liquid or gas that is no longer required by the organism or system that has been using it or producing it is termed waste. Waste is an integral part of the environment and the environment has developed a series of very efficient waste disposal systems which involves recycling of the product [6]. Kemp, further explained that organic waste such as that produced by animals is reduced by insects and bacteria into its constituent chemicals which are reabsorbed into the environment. Leaves discarded by deciduous trees in the autumn are for instance, treated in a similar fashion and the process of photosynthesis prevents a build-up of the carbon dioxide given off as a waste gas by animals. However, problems arise when waste is

produced in such quantity that the normal disposal system cannot cope or when the waste takes such a form that existing systems cannot dispose of it immediately or only slowly or in some cases not at all [6]. This implies that any substance can become a waste provided that the accumulated quantity exceeds the carrying capacity of the environment and poses health risk to human beings, animals, plants and of course, human activities. However, most of the municipal solid wastes being generated in Nigerian urban centres are harmful to the society and components of the physical environment as some of them are toxic, biologically active, flammable, corrosive, and radioactive or a combination of the factors. In Nigeria, there is no gainsaying the fact that sheets of polythene wrappers, human faeces, leaves, tins, bottles, waste papers, waste food, old tyres, disposed electronic parts discarded into the environment are hazardous.

There are many ways of classifying waste. There are some common groupings however. According to Kemp [6], waste can be classified on the basis of: origin as clinical waste, domestic refuse, agricultural waste, industrial waste and nuclear waste; form as solid, liquid and gas; properties as inert, toxic and carcinogenic wastes. It should be noted that most of the waste will fit into a number of groupings and for the sake of this paper we are more concerned about solid wastes which are useless, unwanted or discarded materials including agricultural wastes, commercial, industrial and household wastes found in garbage dumps. The waste comprises: newspapers, paper products, glass, bottles, aluminum cans, rubber, plastics, discarded food and yard wastes which surround our cities and are not only offensive to the eyes but affect human health, their activities and the physical environment negatively [7].

4. THEORETICAL FRAMEWORK

Considerable volumes of wastes are being generated in Nigerian cities with adverse effects on human beings and the physical environment. The reasons for the continued generation and poor disposal can be understood better within the concept of ecosystem. May and Soger [8] viewed this man-environment interaction as an ecosystem which is a relatively stable community of organisms that have established interlocking relationship and exchange with one another in the natural habitat such materials and substances for their continued survival. The doctrine is based on the idea that *natural and*

human phenomenon exist in a delicate balance in any given geographical areas and are closely interrelated and interact beneficially with each other in order to survive. Thus, in trying to meet up with necessities of life, human beings exercise some great influence over the environment and the environment in turn sets some limitations. Therefore, waste is an unavoidable consequence of the need for survival. In order to live, we eat, drink and provide other necessities of life from the environment: hence can create systems that enhance efficiency and generate comfort on the one hand and degrade the environment with filthy wastes on the other. We deliberately create waste to such an extent that the amount generated has relationship with per capita consumption [3]. Degradation of the environment through waste generation and poor disposal is an evidence of man's interference with this delicate balance of the ecosystem hence; human beings have to bear the brunt. Waste is a function of prosperous high technology and disposable economic where many products that have the potential to be repaired, reused or recycled are simply thrown away due to high level of affluence [3].

Indeed, the rate at which wastes are building up in Nigerian urban centres is alarmingly greater than the natural process of converting them into harmless substance. This is posing health hazards to human beings and the components of the environment. The causative factors for the continued generation and poor disposal of municipal wastes have been identified by Gandy [9] to include: rising levels of affluence, cheaper consumer products, the advent of built-in obsolescence, the proliferation of packaging, changing pattern of taste and consumption as well as the need for convenient products. The bad habit of use and throw away of some affluent Nigerians in cities after a product has lost its primary utility should be stopped. This is because in the context of ecosystem whatever affects the urban areas will certainly affect the rural areas hence; the problem of municipal waste should be viewed as a problem of the whole Nigerian society in particular and the world system in general.

5. TRENDS IN WASTE GENERATION AND MANAGEMENT

The waste generation scenario has been of great concern both globally and locally and of different categories. Waste is everybody's business

because everyone: man, woman or child produces waste in nearly every activity. Sheets of polythene wrappers, human faeces, leaves, tins, bottles, waste papers, waste food, old tyres, disposed cartons, scrap metals, automobile parts, and electronic gadgets, plastic and clothing materials are ubiquitous in Nigeria's municipal areas. They are posing problems beyond the control of various waste management systems, not only in Nigeria but also in various countries of the world.

The Awake Magazine [10] has reported in its August 22 edition that approximately 9 million 'autos' are being scrapped annually in the European Union and an Italian Environmental Association estimated that cigarette butts can pollute the sea for up to 5 years. More so, most of the things that constitute waste are either not degradable at all or take very long time to decompose. For example plastic bags take 10-20 years to decompose; nylon articles take 30- 40 years; cans take 500 years while polystyrene 1,000 years [11].

Oyediran et al. [3] gave the per capita waste generation per person per day for Nigerians as 0.5kg while in United States of America is 1.6 kg. Although, the rate of waste generation in USA and UK are higher, being 11 billion tonnes and 700 million tonnes per annum in the late 1980s respectively [7] however, their solid waste management systems are highly efficient, hence Nigeria needs to emulate them. Indeed, the quantity of solid waste generation is steadily increasing at an alarming rate over the years in Nigeria. It is lack of efficient modern technology for the management of wastes in the country that is compounding the problem; hence this has grave consequences not only to people living in urban areas alone but the entire Nigerian society. One can imagine the rate at which wastes will be generated as the population, urbanization and modern standard of living continue to rise. Table 1 shows the estimated and projected volumes of solid waste produced in 15 selected urban areas in Nigeria.

Several works of scholars who have assessed the volumes and rate of waste generation in some urban areas in Nigeria has been cited in the literature [5] and their findings were that;

- ❖ Lagos with population of 10.3 million in 1990 generated 3.7 million tonnes of solid waste.
- ❖ Kano with population of 1.4 million in 1994 generated 450 tonnes per day.

- ❖ Port Harcourt and Warri in 2002 generated 164,029 tonnes and 66,721 tonnes per year of solid wastes respectively.
- ❖ Maiduguri in 2002 generated 8.5 million tonnes of solid wastes.
- ❖ Makurdi generated an average of 0.54 kg per capita per day of solid wastes.
- ❖ Abuja generated between 0.55 kg and 0.58 kg per capita per day of solid wastes.
- ❖ Kaduna, Onitsha, Aba, New Bussa and Uyo generated as much as 4,313,124 tonnes; 386,593 tonnes; 236,703 tonnes; 9,518 tonnes; and 20,923 tonnes of solid wastes per year respectively.
- ❖ Oyo generated about 55,200 kg per day of solid wastes.
- ❖ Uyo collected 4,079,000 kg of municipal wastes for disposal monthly.
- ❖ The projected per capita solid wastes generation in Ilorin by the year 2020 has been predicted to be about 0.43 kg per person per day.

The problem of wastes in Nigeria is not the amount generated but the inability to have a planned system of effectively controlling the production, storage, collection, transportation, processing and disposal or effective utilization of wastes in a sanitary aesthetically acceptable and economic manner. Hence, mounds of garbage in solid waste dumps surround many Nigerian cities which are very offensive to the eyes and nose. Table 2 shows waste generation in 9 selected urban cities in Nigeria and the waste management agencies; where it clearly

indicates that the rate of waste generation is 25 million tonnes per year, at a daily rate of 0.44-0.66 kg/capita/day while the density of the country ranges from 280- 370 kg/m³. This implies that one day some Nigerian cities may invariably be engulfed by immeasurable quantities of solid wastes. Even at the household level, the usual practice by many Nigerians is to dump refuse in streams, runways, drainages or any open space within the cities. This action, coupled with urbanization and industrialization often release load of waste materials into water bodies to pollute the resources, apart from clogging the drainages with filth to cause urban flooding.

In order to deal with the problem of solid wastes, many municipal authorities have now resorted to burning combustible materials in incinerators, digging open holes to dump the wastes, operating of sanitary landfills while what most authorities of coastal cities do is to tow the solid wastes offshore and dump into the ocean which often result in washed-up debris on beaches causing land pollution [7]. Even the sanitary landfills that are supposed to be among the safest methods of waste disposal system still pose some problems. According to Olanike [12], the usual method of waste management in Nigeria are land filling, open dumping, land spread, illegal disposal into water bodies, burning or incineration. Igoni et al. [13] further stressed that open dump is more practiced among Nigerians where some people employ the service of streams to transport their solid wastes out of their sight while others directly dump them by the roadsides.

Table 1. Estimated and projected volumes of solid waste generation in some Nigerian cities (In tonnes per year)

S/No	Urban area	1982	1985	1990	2000
1.	Lagos	625,399	681,394	786,079	998,081
2.	Ibadan	350,823	382,224	440,956	559,882
3.	Kano	319,935	348,580	402,133	535,186
4.	Kaduna	257,839	280,925	324,084	431,314
5.	Onitsha	242,240	263,929	304,477	386,593
6.	Port Harcourt	210,934	229,821	265,129	352,853
7.	Oshogbo	131,903	143,712	173,720	253,841
8.	Aba	131,903	143,712	169,719	236,703
9.	Jos	99,871	111,905	135,272	197,660
10.	Warri	67,477	75,607	91,396	133,531
11.	Gusau	44,488	48,471	57,243	79,835
12.	Potiskum	15,434	16,816	19,399	28,347
13.	Uyo	12,508	13,628	15,721	20,923
14.	Suleja	9,383	10,514	13,311	21,336
15.	New Bussa	5,690	6,200	7,152	9,518

Source: NEST 1991 (Osuntokun, 1999:140)

Table 2. Waste generation in some urban cities in Nigeria and the waste management agencies

City	Population	Agency	Tonnage /Month	Density (kg/m ³)	Kg/Capita /Day
Lagos	8,029,200	Lagos State management authority	255,556	294	0.63
Kano	3,348,700	Kano State environmental protection agency	156,676	290	0.56
Ibadan	307,840	Oyo State environmental protection commission	135,391	330	0.51
Kaduna	1,458,900	Kaduna State environmental protection agency	114,443	320	0.58
Port Harcourt	1,053,900	Rivers State environmental agency	117,825	340	0.60
Makurdi	249,000	Urban development board	24,242	300	0.48
Onitsha	509,500	Anambra environmental protection agency	84,137	310	0.53
Nsukka	100,700	Enugu State environmental protection agency	12,000	370	0.44
Abuja	159,900	FCT environmental protection agency	14,785	280	0.66

Source: All Sites Engineering Ltd. [17]

Even though sanitary landfills appeared to be one of the major strategies employed in handling solid wastes in some Nigerian cities, the actual disposal method principally involves the use of crude form of sanitary landfill technology where open pits and abandoned mine ponds are filled with these unsorted wastes without compaction, leveling or covering [14]. Despite the fact that once the sanitary fills are filled to capacity, they can be landscaped and use as parks, golf courses and other recreational facilities however; wastes can ooze out of landfills and pollute the surrounding areas. This can occur because some household wastes often include pesticides, cleaning materials, paints, paint thinners and other toxic chemicals which when the compacted garbage begins to decompose, methane gas is produced and can easily explode [7].

Another problem with sanitary landfills is that at present, they cannot handle more than a fraction of the solid wastes produced in this country because of lack of sufficient space. Besides, the siting of the facility far away is associated with high cost of implementation and operation, hence can promote such unethical disposal methods of throwing away wastes indiscriminately in any available space. It has been reported that municipal refuse dumping sites are even being located near river banks and drainage channels as observed in Kaduna, Kano, Sokoto, Minna and Ibadan, which can pollute water bodies and promote degradation of the environment [15].

The position of this paper is that there is an urgent need for effective municipal solid waste management approach that would promote

source waste prevention and minimization where waste recycling and re-use have to be emphasized much more rather than immediate waste disposal at the point of generation.

6. ENVIRONMENTAL HAZARDS OF POOR WASTE DISPOSAL

Improper disposal of solid waste in urban areas of Nigeria has a lot of health hazards and other deleterious consequences on the environment. Some of the prominent hazards are discussed as follows:

6.1 Environmental Degradation

Mounds of wastes brought about through indiscriminate disposal by people in urban areas have become eyesores to members of the general public. It destroys the scenery of the environment which is a source of psychological disorder in urban areas [16]. Solid wastes also tend to block drainages resulting in floods. This can occur because once the rate at which refuse accumulates exceeds its removal; the wastes will not be pushed to flow along with the moving water. Hence, uncleared wastes lower the aesthetic quality of the locality and valuable property in the affected neighborhood. If tourism has been an important revenue base of the economy of such degraded environment, the economic gains of the area could certainly be reduced.

6.2 Enhances Insect Proliferation

Waste dumps serve as feeding stations for various insects that spread diseases, which

easily debilitate human beings. The transmission route of filth-induced diseases such as malaria, cough, cholera, dysentery, diarrhea, vomiting and a host of others are usually brought about by flies and mosquitoes that use the waste dumps as their breeding grounds. These diseases are very common in almost every urban centre of Nigeria.

6.3 Rodent Infestation

Solid waste dumps have become the main source of food supply to rats, rabbits, squirrels and beavers where they quickly proliferate and spread to neighborhood like dwelling units, market stores, bookshops, garages and farmlands. Rodents have been confirmed by health professionals to be the sources of diseases such as plague, typhus, leptospirosis, histoplasmosis, rat bites, fever and many others [16]. Rats in particular are known to be the causative agents of Lassa fever, a deadly disease that has been reported by the National Dailies to be responsible for the death of over 100 people across the country just between January and February 2016.

6.4 Production of Offensive Odour

Wastes constitute one of the major sources of stench and offensive odour arising as a result of combination of rotten vegetal matter and other refuse that are indiscriminately discarded. When this noxious odour continues day and night, it can constitute a major environmental nuisance. Passers-by and indeed, people living around such environment find this offensive odour uncomfortable and unattractive hence, lowers the social status of the 'urbanites' in those areas.

6.5 Pollution

The indiscriminate dumping of wastes in sites located near river banks and drainages as observed in many cities of this country can pollute water bodies for domestic and industrial uses. Besides, some of the toxic wastes can easily kill aquatic animals and reduce fish population in their habitat and people's table. When combustible waste materials are burnt in open space, a pool of dense black smoke is often released into the atmosphere and exacerbates such respiratory problems like asthma. Apart from the particulate matter that constitutes smoke, land pollution also occurs due to accumulation of non-biodegradable refuse like metal scraps, bottles, nuts, bolts, plastic

materials and broken blocks. These may injure people accidentally.

6.6 Fire Disaster

Some solid wastes may harm people directly while others may not. A common hazard associated with refuse disposal during hauling and transportation is fire outbreak in refuse collection tanks. This easily happens when there is emission of methane gas in refuse dumps during hot sunny windy days in the dry nearby bush causing serious fire disasters of unknown origin. Fire can also be ignited by flickering embers in the waste containers to cause fire disaster that does not only release smoke into the environment but can even destroy lives and property.

7. ASSESSMENT OF THE ECONOMIC VIABILITY OF MUNICIPAL SOLID WASTE TREATMENT IN NIGERIA

The preceding section has shown a startling revelation of how one day some Nigerian cities may invariably be engulfed by immeasurable quantities of solid wastes (see Tables 1 and 2). No responsible government would like to see its citizens wallowing in such hazardous environment. It was in realization of this fact that governments at federal and state levels of this country embarked on the formulation of several environmental laws and policies to ensure wastes are properly managed. In spite of the efforts put in place, wastes have long outstripped the capacity of city authorities to manage safely and efficiently (see Table 2).

The contributory factors to the challenge of non-regular clearance of municipal solid waste include ineffective management framework, manifested through poor implementation of environmental policies and enforcement of environmental laws, poor flow of funds to the relevant environmental agencies of government, poor budgetary allocation for environmental cleanliness, improper coordination, lack of interest of private sector investment, the psychological effect on the personality of laborers engaged in waste management, low political will, poor data information for planning, wrong attitude of waste generators, ever-increasing population, affluence of some urban dwellers and lack of advance technology and equipment to treat solid wastes. Therefore, there is need to re-orientate Nigerians towards achieving attitudinal change through sound

education and technological development in the area of environmental management. Nigeria cannot afford to waste enormous volumes of waste being generated at the conservative estimate of 25 million tonnes per annum [17]. By proper utilization of solid waste through such strategies as waste prevention, waste minimization, waste re-use, recycling and recovery, Nigeria can benefit immensely in the following ways:

- **Generation of Waste-derived Fuel:** Solid wastes normally contain organic and inorganic matter and the latent energy can be recovered through adoption of suitable processing and treatment technology for gainful utilization such as private generation of electricity to light homes, offices and heat water. According to US-EPA [18], the USA municipal solid waste generation was more than 255 million tonnes in 2006 and currently over 30% of the waste is recycled annually, with about 89 operational municipal solid waste-fired power generation plants; producing about 2500mw which is about 0.3% of total national power generation. It is therefore economically, socially and health wise for Nigeria to embark on establishing more waste recycling plants because no new fuel sources are used other than the waste that would otherwise be left dangerously in the environment or sent to landfills, hence it will go a long way to augment the energy deficiency we are experiencing in the country.
- **Economic Development:** Proper conversion of refuse can directly and indirectly create employment opportunities to many jobless Nigerian youths, as no technical skills are required for the collection, handling and processing of solid wastes.
- **Wealth Creation:** Scavenging for scraps in Nigeria is said to be a lucrative thriving business that has the tendency to uplift people's standard of living. Mohammed [19], reported that dealers in scrap metals can realize between ₦50,000 and ₦100,000 as profit monthly for sale to recycling companies. This implies that there is wealth in waste if only this informal sector of the economy can be properly encouraged and brought into the mainstream by the relevant authorities. Generation of incomes can no doubt, uplift

the general well-being of the hitherto unemployed Nigerians.

- **Basis for Industrial Development:** Waste recycling plants like the compost plant at Ikorodu, waste-to-energy plant at Ikosi and plastic recycling plant at Olushosun are doing well in Lagos State. This implies that *in as much as* there is regular supply of both degradable and non-degradable solid wastes from what Essia [20] described as *buy-back centers, the establishment of more waste recycling plants in major cities of the country can serve as basis for industrial development.* The expansion of waste recycling plants can also have multiplier – effects of further creating job opportunities, generation of income and revenue as well as improving the standard of living of many Nigerians.
- **Production of Valuable Products:** Valuable materials can be derived through processing of waste. For instance, garbage can be transformed into organic manure to boost food production and food waste for piggery farms; scrap glass can be made into new glass; waste paper can be converted into quality paper, tissue paper, cardboard and paper bags; plastic can be transformed into new packs like soft waxes, greases and adhesives; used-tyre casings can be utilized for the manufacture of synthetic rubber while fly ash can serve as a substitute for cement in making bricks for buildings.
- **Conservation of Natural Resources:** Since the products that yield waste are harnessed from the environment recycling, recovery and re-use of waste will curtail over-exploitation and depletion. Consequently, this can further prolong the life of Nigeria's treasures for sustainable development.
- **Reduction of Hazards in the Environment:** The availability of such sharp objects as bottles, nails, nuts and other scraps are injurious to human beings and animals. Their collection for use by waste recycling companies will no doubt make the environment clean, serene and safe for human beings and their socio – economic activities.

The foregoing analysis has clearly shown that opportunities for establishing waste recycling and waste recovery companies exist for interested individuals, group of people or firms in Nigeria's

municipal areas. Investors are expected to take advantage of the opportunity by bringing modern technology and equipment into these state capitals to partner with local operators and government in order to help make wealth out of waste (WOOW) as well as help to keep Nigeria's landscape free of injurious solid objects and pave way for sustainable development.

8. RECOMMENDATION

From the foregoing, an approach towards this problem of indiscriminate disposal of refuse and the wanton destruction of the environment should be sought. The following are the measures proffered in order to address the problem.

1. Various strategies of public enlightenment and mobilization should be put in place to improve public attitude towards waste management that would ensure clean and friendly environment to offer good health and comfort to human beings in urban areas.
2. Waste dumps should be adequately provided in every ward and refuse collected at dumps should be cleared and disposed of regularly.
3. Urban authorities should commercialize the collection of refuse such that adequate containers should be provided at designated points whereby the households will pay some token as dues by the end of every month as monthly bill for evacuation of wastes.
4. Government should partner with companies and establish waste-recycling plants to take care of growing numbers of non-biodegradable wastes like metal scraps, bottles, plastic materials and polythene bags in order to make our 'urbanscape' free of refuse dumps. Once recycling plants are established, many Nigerians can make a living by picking over rubbish heaps, collecting some solid waste materials especially bottles, spoiled rubber shoes, plastic and metal scraps and sell them to be recycled. This has the dual advantage of providing job opportunities to many people and will help in making our environment clean and habitable.
5. Government should treat the issue of urban waste management with all seriousness through: provision of adequate funds for research into the more scientific way of recycling and disposal of waste that is not injurious to the environment;

procurement and disbursement of evacuation facilities to relevant authorities charged with the responsibility of maintaining and protecting the environment from deterioration; declaring certain days every month as environmental sanitation days; and awarding prizes periodically to people whose residential areas and streets are considered environmentally clean and friendly so that others may like to emulate them.

9. CONCLUSION

Human, social and economic activities in urban centres are generally generating a lot of solid wastes which are fast degrading the environment and causing public health hazards in municipal areas of Nigeria. The hazards stemmed from continued unethical practices of dumping solid wastes carelessly around residential and public areas. The paper discussed some of the hazards to include rapid infestation of the environment with disease – causing insects and rodents as well as pollution of land, air and water. Therefore, there is urgent need by the relevant authorities to develop a more comprehensive programme which will involve partnering with the general public to establish waste-recycling plants, motivating the people at all the wards through award of prizes for maintaining clean environment, provision of waste disposal facilities and supporting research activities aimed at improving the present waste management systems. Educating the general public will also enable them understand how their socio- economic activities and cultural attitude are disrupting the urban natural ecosystem so as to reverse the trends.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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