

# Assessment of Solid Waste Management Practices Following Private Partnership Operations in Zaria Urban Area of Kaduna, Nigeria

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## Abstract

The safe disposal of municipal waste is very important in promoting healthy environment. High quality public services and promoting competition in the waste management sector leads to formation of private sector participation (PSP) to handle solid waste management in Kaduna. A multi stage sampling technique was adopted where involves dividing the local government into localities. Stage two involves the purposive sampling technique which was adopted in selecting locality with high population and low population density area, a total of 400 households from both stratum were interviewed. Descriptive statistics was used to analyse the information from the questionnaires and results were presented using frequency tables and charts. The findings revealed that quality of service among the PSP operators recorded high success in the high income areas and much less in the low and medium income areas. On the average, industry productivity was 5.63 tonnes per day per vehicle. 12 out of which in the study area were above this average and in meeting increased productivity, year of experience in operations, number of trips made, number of times trucks were serviced, and adhering to regulatory agency requirement were among the factors influencing company's productivity in the state. It also shows less effectiveness of the system in waste management in the area. The study, therefore, recommends that regulatory agency should be more aggressive in playing its statutory roles of managing the PSP operators.

**Keywords:** Solid Waste, Environment, Health, Life, Quality.

## Introduction

The need for waste management in any nation cannot be over emphasized regardless of their size, knowledge of the environment and level of technological advancement, as human settlements are characterized generally with wastes generation resulting in various degrees of air, water and land pollution. Waste management in general is the process of collecting, transporting, processing or disposing and managing waste materials (Adeoti 2001). Adeoti (2001); further state that "wastes management practices encompass all activities undertaken from the point of waste generation up to the final disposal". In developing countries, waste management especially solid waste management according to UNEP (2018) is a major environmental issue particularly in their municipalities as they estimated 11.2 billion tons of solid waste collected yearly worldwide with most from the

municipalities. This calls for the crucial need of waste management to avert the negative impacts of waste on the environment, and its consequences on man and animals, as studies reveals that disposal methods are directly related to human health issues, as well as the environment.

Municipal solid waste management constitutes one of the most crucial health and environmental problems facing governments of African cities. This is because even though these cities are using 20–50 percent of their budget in solid waste management, only 20–80 percent of the waste is collected. The uncollected or illegally dumped wastes constitute a disaster for human health and the environmental degradation (Nabegu, 2017). The failure of the government and waste management agencies to address the issues of waste holistically has resulted to environmental problems (water, air and land pollutions), obnoxious odour, breeding place of mosquitoes and rodents, irritation, making the environment filthy for habitation and blocking of gutter and roads which can lead to flooding. Other problems are diseases such as cholera, typhoid, and malaria infections. These health and environmental problems are facilitated by the poor wastes management. For example, the study of UNEP (2018) shows that landfills are highest source of methane emission, a greenhouse gas contributing to global warming. the studies of Vincent (2000) and Alamgir *et al.*, (2005) also shows that the increase in the production or generation of solid wastes in most municipalities of middle and low income countries is exacerbated by illegal wastes dumps on streets, open spaces and wetlands, urban population growth and economic development and increasing unplanned urbanization along with user's mind set of 'out of sight out of mind' of wastes disposal. Thus, issue of solid wastes management is a major concern in African municipalities and Nigeria is not excluded.

However, as countries in the world are committed to establishing safe and efficient waste management techniques to minimize the negative impacts of waste on their environment. Nigeria on the other hand is also expanding its waste management efforts in order to deal with its huge quantity of waste. As the most populous country in Africa, the current thinking is that poor waste management reflects largely the failure of the existing institutions to adequately address the waste management challenges (Yekeen, 2010). In Nigeria, urban solid waste management is constitutionally the responsibility of the third tiers of government, which is, the local government council. Financial, material and human resources that have been committed to waste management by this tier of government have not matched this responsibility. This is evident by the poor management of many landfill sites, soil and groundwater pollution due to often mixing of household, industrial and toxic waste (UNEP, 2017). This current trend in waste generation and management in Nigeria requires application of more desirable methods of waste management so that we can reduce negative impacts of waste on the environment. It is based on this backdrop that this research seeks to assess waste management practice following Private Partnership Operations in Zaria Local Government Area of Kaduna State.

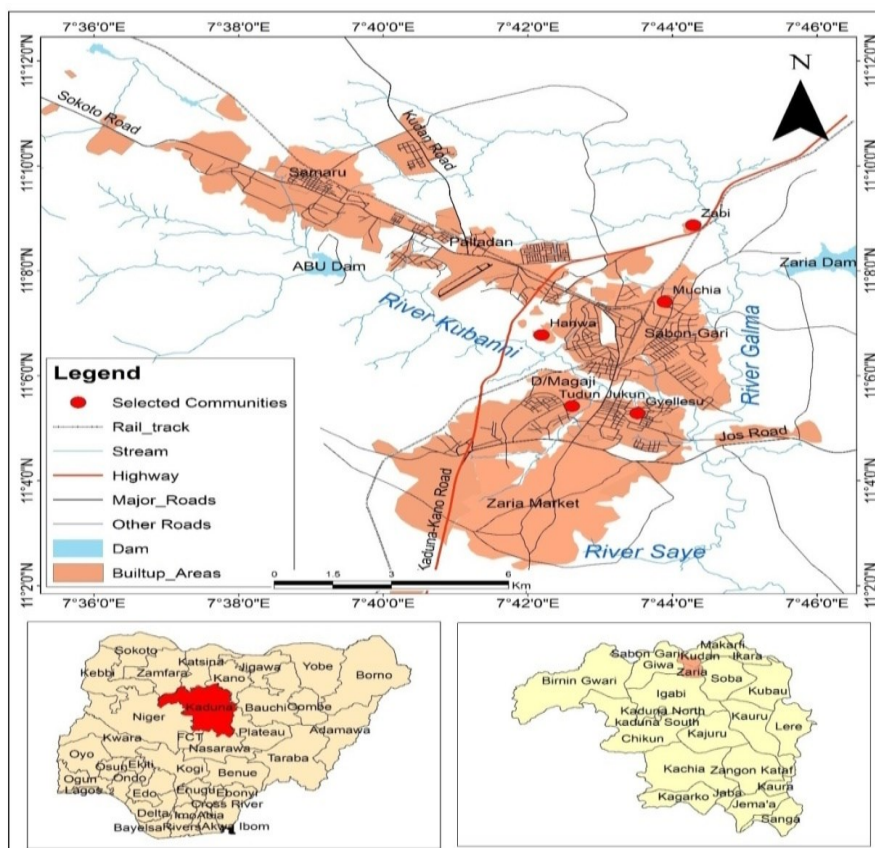
## Materials and Methods

### Location

#### Study Area

The study area is Zaria Urban Area (ZUA) is a combination of two different LGAs (Zaria and Sabon Gari Local Government Area) it lies within latitudes 11°00'00"N to 11°16'00"N of the equator and longitudes 07°34'00"E to 07°46'00"E of the green which meridian. Zaria lies at about 700 metres above sea level within the high plains of the Northern Nigeria. It is located a distance of about 962 kilometres from the Atlantic Ocean, and 80 kilometres from Kaduna metropolis (Ndabule in Dabo, Shehu, Muhammed and Umar, 2016).

Over the last century, Zaria Urban Area has undergone structural changes in its physical form, population, economic and social composition due to urban growth (Saleh in Dabo, Shehu, Muhammed and Umar, 2016). The population of Zaria Urban Area has shown rapid increase from 19,434 in 1953 to 389,858 in 1991 and 695,069 by 2006 (NPC, 2006) adopting the population projection formula,  $(Po=Pi(1+r)^n)$ , at 3% growth rate, where  $Po$ = projected population,  $Pi$ = initial population,  $r$  = Growth rate and  $n$  = Number of years projected (NPC, 2006). The population of Zaria is estimated at 1,083,089 in 2023.



**Figure 1:** Zaria Urban Area Showing Sampling Location.

**Source:** Modified from administrative map of Kaduna State

Zaria Urban Area fall within the tropical wet-dry climate and experiences two distinct seasons (wet and dry seasons) caused by the movement of the inter-tropical Discontinuity (ITD) under the influence of two major air masses namely the tropical continental (CT) and the tropical maritime (MT) (Yakubu, 2009). It also lies within the basement complex of central northern Nigeria, with basically igneous rocks, ferruginous tropical soils which those in the fadama as hydromorphic soils (Ali in Dabo, Shehu, Sarki, Likoro and John, 2016) and drained mainly by the Galma river with river Kubanni, Shika and Saye as its tributaries. It has a mean annual rainfall of about 800mm, concentrated on a wet season between April and October. The temperature is high throughout the year, with the monthly mean rising from January (22°C) and attaining a maximum in April (29°C) (Yakubu, 2009).

### **Sources of Data and Methods**

The types of data used for this study includes: socioeconomic and demographic characteristics of the respondents, municipal solid waste management methods, institutions/agencies or stakeholders involve in the management practices in Zaria LGA, functions, effectiveness and capacities of the agencies responsible for the management of wastes in the study area. Other data are on problems or constraints of solid waste management practices by the households and the waste management agencies. The data were obtained firstly, through the reconnaissance survey. Primary data were generated from structured and semi structured survey questionnaires and field interview questions of municipal solid wastes mismanagement practices by the three major stakeholders; Households, Kaduna state Environmental protection Agency (KEPA) and Private Waste Management Institutions/Agencies. The interview questions were self-structured, open and closed-ended questionnaire in a pre-formulated form where follow up questions were asked for further clarity.

The study aimed at assessing the impact of waste management practice in Zaria local government area, by identifying the types of wastes generated, examine the challenges of the waste management practice and examine the effectiveness of the waste management practice as well as identifying some of the major causes of indiscriminate waste disposal. A multi stage sampling technique was adopted where involves dividing the local government into localities. Stage two involves the purposive sampling technique which was adopted in selecting locality with high population and low population density area sampling method was used by the researcher to derive its samples out of the population, a total of 125 households from both stratum were interviewed. Descriptive statistics was used to analyse the information from the questionnaires and results were presented using frequency tables and charts were presented using tables for easy understanding.

### **Results and Discussions**

Table 1 shows the socio-demographic data of respondents for age, revealed that 48% falls between 37-45 years, 31.4% were between 60 years and above, 16% were between 46-60

years while 5.6% falls within 18-36 years. Since majority of the respondents fall within 37-45 years 48% invariably, that may be why many of the respondents were married. males were made up of 72.8% of the respondents while 27.2% were females. There is more likely have a cleaner environment, this is because married people are likely to be more responsible to keep the environment clean. Consequently, in the area, 75.2% of the respondents were married while the remaining 24.8% were single. This is an indication that they are more likely to be more conscious towards environmental sanitation since their marriage is intact.

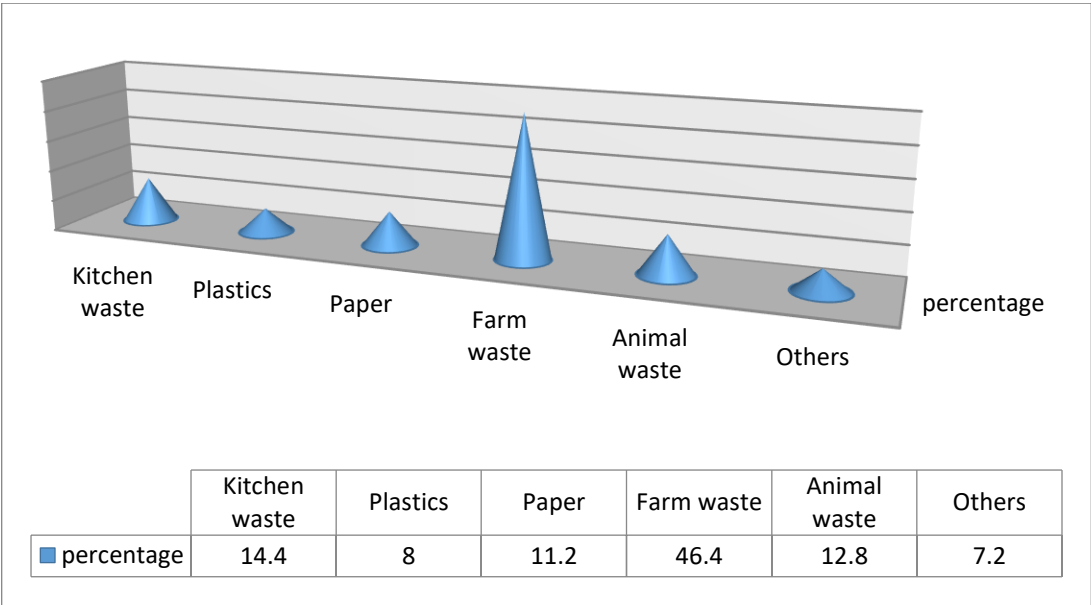
**Table 1:** Socio-Demographic Data of Respondents.

Age (years)	Frequency	Percentage
18-36	21	5.6
37-45	180	48.0
46-60	60	16.0
60 years & Above	114	30.4
Total	375	100.0
GENDER		
Male	273	72.8
Female	102	27.2
Total	378	100.0
MARITAL STATUS		
Single	93	24.8
Married	282	75.2
Total	375	100.0
FAMILY SIZE		
1-2	36	9.6
3-4	192	51.2
5-6	18	4.8
7 and Above	129	34.4
Total	375	100.0
OCCUPATION		
Farming	147	39.2
Civil Servant	105	28.0
Unemployed	69	18.4
Others	54	14.4
TOTAL	375	100
EDUCATION		
No formal Education	54	14.4
Primary School	81	21.6
Secondary School	165	44.0
Tertiary	75	20.0
Total	375	100.0

**Source:** Field survey, 2024

Family sizes of 1-2 constitute 9.6%, 3-4 (51.2%) whereas 5-6 constitute only 4.8% as against the family size that is 7 and above which constitute 34.4%. Table 1 also shows that 39.2% of the respondents were farmers, 28% were civil servant, and 18.4% were unemployed while 14.4% engage in one thing or the other area. This means that majority of the respondents were farmers between the ages of 18-45 years.

Its further shows that 44% had secondary education, 20% had tertiary education where as 21.6% of the respondents had primary education as against 14.4% who had no formal education.



**Figure 2:** Major types of waste generated in households by respondents.  
**Source:** Field survey, 2024

Figure 2 shows the composition of the major source of household wastes generated in the study area, in which farm waste accounted for 46.4%. Other sources of waste include kitchen waste 14.4%, animal waste 12.8%, and paper 11.2%, plastics 8% other unidentified wastes 7.2%. This result apparently revealed that the inhabitants of the study area are predominantly farmers with agricultural waste being the major waste generated from households.

**Table 2:** Challenges of waste management practice

Challenges of waste management practice	Responses	
	Frequency	Percentage
Increased in population	141	37.6
Urbanization	30	8.0
Low standard of living	66	17.6
Inadequate government commitment	84	22.4
Other	54	14.4
Total	375	100.0

**Source:** Field survey, 2024

Table 2 indicate the challenges faced by waste management practices within study area. Indicate that increase population account for 37.6%, 37.0% This is inline by the study of Oyeboode (2018) as he testified that increased in urban population as a result of rural-urban migration is adding alot of pressure on the waste management system in Nigerian urban areas. While, inadequate government commitment and low standard of living having 22.4% and 17.6% respectively are the major challenges affecting waste management practices in study area. This was supported by Amosun *et al.*, (2018) as they also shows that lack of government commitment at the local tier is a major challenge affecting waste management system in rural and urban areas of Nigeria. Additionally, study of Oyeboode (2018) in their paper on waste logistics, also testifies to government commitment as one of the major challenges affecting waste management system in Nigeria". Butu and Mshelia (2017) disagreed with this as he indicated low standard of living as the major challenge facing waste management system in northern Nigeria. Modernization, technological advancement and increase in global population created rising in demand for food and other essentials. This has led to the increase of amount of waste being generated daily by each household (Dernbach and Henning, 1987; Hamer and Zwiefelhofer, 1986).

**Table 3:** Effectiveness of the waste management practice

effectiveness of the waste management practice	Responses	
	Frequency	Percentage
Highly effective	57	15.2
Less effective	192	51.2
Totally not effective	126	33.6
Total	375	100.0

**Source:** Field survey, 2024.

From the table 3, the waste management practice in the study area can be seen to be less effective with a response rate of 51.2% respectively. This due to the fact that resident admit



less facilities of waste disposal in the area, the only facility is the activities of the state environmental protection agency which only carries out duty of drainage cleaning every end of the month. They also complained of transport logistic and lack of authority to make financial and administrative decision as contributory factors to the less effectiveness of the system as it hinders waste collection, this is in line with the study of Amosun *et al.*, (2018). Recycling activities have been more of the informal sector on selected valuable materials such as plastics and metals waste, as was agreed by Oyeboode (2018) where he said in his paper "The Informal recycling sector is very active in waste management system in Nigeria, either as itinerant waste buyers or scavengers targeting valuable materials such as plastics, paper, used electronic electrical equipment, glass, metal making the system less effective". the least response indicating highly effective with 15.2% are mostly from respondents that believes that waste management should be a public responsibility as such they come together to take care of their households' waste within their street, this was also testified by Oyeboode (2018)" that residents participation plays a greater role in effective waste management system in Nigeria".

**Table 4:** Method of solid waste disposal

Method of solid waste disposal	Responses	
	Frequency	Percentage
Open space method	141	37.6
Water bodies method	114	30.4
Refuse deports method	66	17.6
Private operators	54	14.4
Total	375	100.0

**Source:** Field survey, 2024

### Treatment of Waste Disposal

There are wide ranges of method involved in waste disposal. Disposal activities usually involve both the processing and release of solid waste into the environment. The disposal of solid waste principally should involve the use of modified technological methods. Current treatment strategies are focusing towards reducing the amount of solid waste that needs to be landfills, as well as recycling and utilizing the materials present in the discarded wastes as a resource to the largest possible extent. Different methods are used for treatment of solid waste, and the best solution is application of proper method which depends upon refuse composition, land area available and disposal cost they are as follows (Moeller 2005).

### Impact of Solid Waste on Environment

Dumpsite may be source of air borne chemical contamination via offsite migration of gasses, particles and chemical adhering to dust, especially during the period of active



operation of the site (Wrensh, 1990). Contamination of soil and ground water may lead to direct pollution. In case volatile organic chemical into basement of hereby residents and in case consumption of home grown vegetable as well, the potential for surface water contamination increase in rainy season because of flooding in low lying areas in proximity of open dumps (United Nations Environmental Programmes, 1996).

The decomposition of solid waste into constituent chemicals is a common source of local environmental pollution. This problem is especially acute in underdeveloped nations. Very few existing landfills are in the world's poorest countries that would meet environmental standards accepted in industrialized nations, and with inadequate budget, there is likely to be few sites rigorously evaluated prior to use in the future. The main problem compounded by the issues associated with rapid urbanization (Foday *et al.*, 2013).

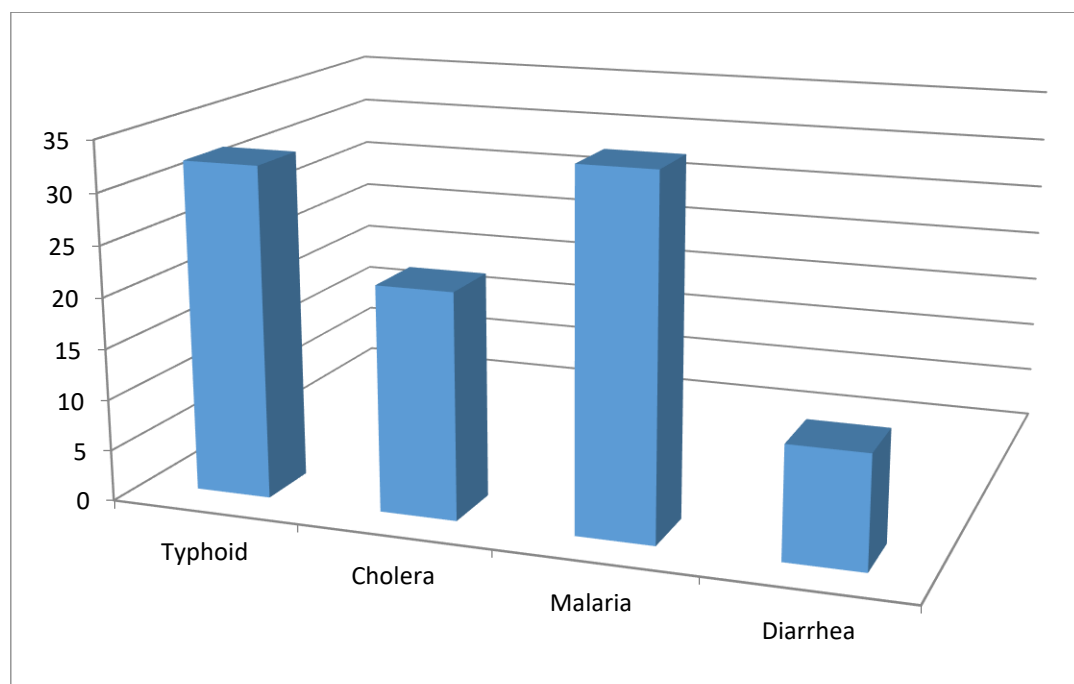
A major environmental concern is gas release by decomposing garbage. Methane is a by-product of the anaerobic respiration of bacteria, and these bacteria thrive in landfills with high amounts of moisture. Methane concentrations can reach up to 50% of the composition of landfill gas at maximum anaerobic decomposition (Mshelia *et al.*, 2020). A second problem with these gasses is their contribution to the enhanced greenhouse gas effect and climate change (Foday *et al.*, 2013). Solid waste may eventually get washed away by rainfall water to contaminate water bodies or block drainage channels (Nabegu and Mustapha, 2014). Open dumps are associated with bad odours and unpleasant odours.

### **Effect of Solid Waste on Human Health and Other Living Organisms**

There are potential risks to environment and health from improper handling of solid wastes. Direct health risks concern mainly the workers in this field, who need to be protected, as far as possible, from contact with wastes. There are also specific risks in handling wastes from hospitals and clinics. For the public, the main risks to health are indirect and arise from the breeding of disease vectors, primarily flies and rats (Hamer and Zwiefelhofer 1986). Uncontrolled hazardous wastes from industries mixing up with municipal wastes create potential risks to human health. Traffic accidents can result from toxic spilled wastes. There is specific danger related to concentration of heavy metals in the food chain. A problem that illustrates the relationship between municipal solid wastes and liquid industrial effluents containing heavy metals discharged to a drainage/sewerage system and /or open dumping sites of municipal solid wastes and the wastes discharged thereby maintains a vicious cycle including these some other types of problem are as follows (Foday *et al.*, 2013).

Consequently, dumping site have an economic and social cost on public health service and have not yet estimated by government, industries and families. The group at risk from unscientific disposal of solid waste include the population in areas where there is no proper waste disposal method especially the pre-school children; waste workers; and workers of facilities producing toxic and infectious materials. Other groups that are facing high risk include the population living close to waste sites and water supply has become

contaminated either due to waste dumping or leakage from landfill of injury and infection (Oyebode, 2018).



**Figure 3:** Opinion of respondents on Diseases cause by solid waste disposal.

**Source:** Field survey, 2024

### Preventive Solution for Minimization of Adverse Impact of Solid Waste

Proper care needs to be taken by government and communities, on how waste could be handled in cities in order to ensure waste does not affect environment and cause health hazard to those people living in areas. At household level, separation of waste should be adopted and ensure that manure is kept aside for composting, which is the best method of handling household solid waste. Consequently, generation of organic matter attract insect and cause outbreak of diseases.

Generation of waste should minimize. Improve method of production to those that minimize waste generation after use. Items recycling and recovery should be encouraged. Kano state government should increase the level of its public services regarding solid waste treatments. Enlightens of producer, the public and people that work at waste sector should be increase. Government should encourage the use of less hazardous alternatives to hazardous chemical during production. Collection of hazardous waste at source points shall be safe, secure and performed in an environmentally sound manner. The Government should initiate policies that will force industries to treat their sewage before discharging it, to the environment. Community based organization should be encouraged by the government to help in evacuating waste in drainages.

**Conclusion**

The study assesses the waste management practice following Private Partnership Operations in Zaria Urban Area of Kaduna State. The findings reveal the less effectiveness of the waste management practice in waste disposal and management of the urban and peri-urban areas of zaria which is exacerbated by inadequate government commitment in waste management and increase in urban population due to rural-urban migration. The study also examined the problems of solid waste disposal and environmental and health implication associated with improper disposal of solid waste. Access to safe disposal facilities is limited for the majority of households of Zaria, and this circumstance resulted in indiscriminate disposal practices, improper burning, and burying of solid waste. Deteriorating environmental quality is a major cause of high infectious and parasitic diseases. These problems obstruct way of sustainable development possibilities in developing cities. An efficient solid waste management system remains as appropriate tool for achieving sound environmental health in Zaria area. Improving access to safe disposal facilities, in addition to conducting awareness campaigns on health impacts of poor sanitation, will help alleviate the problems of improper waste disposal and eventually improve the quality of the environment in the city.

Recycling mountains of waste into useful resource will create jobs for recyclers, while also improving the environment by reducing indiscriminate disposal, the amount of waste being disposal of in open space, and the depletion of resource. Metals such as aluminum can be recovered and sold to small-scale recyclers to produce valuable items such as lamps and cooking utensils to compete with imported products, organic waste can be composted and used as manure in urban farming and help reduce reliance on inorganic fertilizers. Waste recycling is usually undertaken by informal recyclers can be mobilized into cooperative organizations to pull resources together for investment, which can be provided with training, protective clothing, and equipment to reduce accidents, infections, deaths and environmental problems (such as pollution, flooding and erosion).

**Recommendations**

Based on the findings of this study, the following recommendations are put forward:

- The government should encourage Public–Private Partnership (PPP) programme that can facilitate Waste management system.
- There should be an aggressive enlightenment campaign for segregation of waste and recycling Programmes and support for scavengers in every community in the study area.
- High investment in infrastructure and adequate human capacity to check the administrative and technical issues of the waste management system should be encouraged.

- There is the for proper planning high data management and controlled urbanization for an effective management system.
- Coordinated institutional functions such as high academic research and industry linkages should be funded at all.
- Levels to checkmate the waste management system and support innovative ideas for an effective waste management system.

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