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## PATTERN AND DISPOSAL METHODS OF MUNICIPAL WASTE GENERATION IN KADUNA METROPOLIS OF KADUNA STATE, NIGERIA

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### Abstract

*This paper examines pattern and techniques for municipal waste disposal and the consequent on the health of the population. Data were sought and obtained from observations and administration of semi-structured scheduled interviews to key societal stakeholders and duty-bearers. Findings reveal that unprecedented waste generation in Kaduna Metropolis were spurred by emergent historical population growth. The major municipal waste identified include; biodegradables, non- biodegradables, recyclables and inert materials. These were household and industrially generated. Wastes are derelict at open spaces within and between the neighbourhoods; roadsides and channels of river Kaduna, very insignificant area takes their waste to designated dump sites. Preponderant of infectious diseases and annual occurrence of flooding of river Kaduna are linked to improper disposal of wastes, uncollected wastes are threatening human lives and eco-system sustainability. Functional interventions through institutionalisation of public capacity building programmes were identified as sine qua non for effective and efficient waste management at long-run.*

**Keywords:** Municipal wastes, Population growth, Disposal, Refuges areas, Dumping sites, Kaduna Metropolis.

### Introduction

Human population size is one of the most problematic environmental concerns. United Nations (2007) reiterates that population size directly affects other environmental issues, like pollution and resource depletion. Because human interactions with the environment are mediated through society, human environmental impact is thus, a social question. The social dimension becomes especially clear when population issues are approached using term such as ecology. The huge increases in size of the human population have resulted in a substantial degradation of environmental conditions. The changes have largely been characterized by deforestation, unsustainable harvesting of potentially renewable resources such as wild

animals and plants that are of economic importance, rapid mining of non-renewable resources for instance metals and fossil fuels, pollution, and other ecological damages. At the same time human populations have been increasing, there has also been a great intensification of per-capita environmental impacts. This has occurred through the direct and indirect consequences of increased resource use to sustain individual human beings and their social and technological infrastructure. Solid waste generation is undoubtedly related to anthropogenic activities and culture. The management of solid waste becomes more challenging in densely populated heterogeneous cultures in developing countries. Thus, generation of solid waste in urban areas is an obvious result of human activities. Natural growth of population, reclassification of habitation and migration trends are common in urban populations. Urbanization is now becoming a global phenomenon, but its ramifications are more pronounced in developing countries. This urbanization, economic growth, and improved living standards in cities led to an increase in quantity and complexity of generated waste. This increase induces unhygienic conditions on the surface and also affects both the surface and under groundwater quality of water to an alarming extent. The concern about waste is not only because of the rising quantities but also principally because of a derisory management system. It is a convenient but potentially dangerous fiction to treat population projections as exogenous inputs to economic, environmental, cultural, and political scenarios, as if population processes were autonomous. Belief in this fiction is encouraged by conventional population projections, which ignore food, water, housing, education, health, physical infrastructure, religion, values, institutions, laws, family structure, domestic and international order, and the physical and biological environment. (Cohen et al., 2003) Evidently, from aforementioned issues of urban population and waste generation, the world has experienced unprecedented urban growth in recent decades. In 2008, for the first time, the world's population was evenly split between urban and rural areas. There were more than 400 cities over 1 million and 19 over 10 million. More developed nations were about 74% urban, while 44% of residents of less developed countries lived in urban areas. However, urbanization is occurring rapidly in many less developed countries. It is expected that 70% of the world population will be urban by 2050, and that most urban growth will occur in less developed countries (United Nations, 2007). This foreseen development is already taking its full-blown in Nigeria, the evidence of the recent skewed pattern of rural-urban migration as empirically illustrated by the National population Commission (1991, 2006) census figures shows rapid urbanisation growth in Nigeria also, in a larger perspective the United Nation's (2011) comparative report reveals that between 1950 and 2010 the developed countries had below 2% urban growth rate. The case of developing countries was different, declares that Nigeria and Bangladesh had the highest growth rate of 5.9% and 5.6% respectively. The multiplier effect of increase in urbanization is a product of population growth and resultant of proliferation of wastes in the nooks and crannies of urban cities. Thus, Butuet al (2013) observes that urbanization affects land-use, when not controlled causes the emergence of illegal structures. This type of illegal and unplanned residential areas endangered waste collection services and eventually enhances indiscriminate dumping of domestic waste generated. Despite the importance of adequate solid waste management to the urban environment, the performance of many city authorities in Africa and Nigeria in this respect leaves much to be desired. Kaduna metropolis fits perfectly into this scenario, the

slums, ghettos, sprawls and filthy neighborhood often refers to as Angwarareas that formed more than 70% of residential areas are poorly planned with pitiable sites for human habitation. The fast tracking development in Kaduna metropolis is surpassing conurbation into megacity operates within this scenario. This development is beginning to show evidence especially in the area of quantity and quality of different types of municipal wastes generation. The issues of waste collection, disposal and dumpsites management are of immediate importance particularly when this is combined with rapid urbanization. Butuet al (2013) states that between one-third and one-half of the solid wastes generated within most cities in Nigeria are not collected. They usually end up as illegal dumps on streets, open spaces and waste land. This buttresses Ajibuah (2013) claims that indiscriminate disposal of wastes along Kaduna Metropolis is the main factor influencing susceptibility of residents along Kaduna River to floods annually. Although Kaduna State Government instituted various agencies for city planning and developmental control such institutions include; Kaduna Environmental Protection Agency (KEPA) and Kaduna State Urban Development Authority (KASUDA) but they are bedeviled by sharp practices, professional inadequacy and technical inefficiency by all standards. For instance the Kaduna Master Plan that was drawn in 1957 by Max Losch and Partners was expected to be reviewed at every 10 years interval, but this envisioned objective that ought to be monitored and guide physical development plans is a mirage as no review has been carried out since 1957. Hence, distortion of Kaduna Metropolitan Master Plan of 1957 became inevitable planned. This paper therefore, is aimed at identifying types, pattern and disposal techniques of wastes within the Metropolis and also examines the health implications on the people.

## **The Study Area**

Kaduna State was created in May 27th 1967. It lies within the sub-humid agro-ecological zone of north central Nigeria, the state shares boundary with the following states; Zamfara, Katsina, Kano, in the North, Bauchi, Plateau in the Eastern part of the country, while Nassarawa and Federal Capital Territory (F.C.T) in the South and Niger State in the West. The State is between longitudes 70 and 90 East of the Greenwich Meridian and also between latitudes 90 and 110 north of the equator. The State occupies an area of approximately 48,473.2 square kilometres. Kaduna metropolis is the capital city of the State. The Metropolis is located between latitude 100 28I and 100 37I North and longitude 070 19I and 070 31I East (See Fig. 1)occupies an area of about 260km<sup>2</sup>; the distance between the eastern and western limits of the city is approximately 13.7km (Fingesi, 2001). It is made up of two main local government areas, the Kaduna North and the Kaduna South, other adjoining local government areas that makes up the entire metropolis are Igabi and Chikun.

## **Methodology**

An in-depth and holistic reviewed of population growth and sequences developments of Kaduna metropolis were assessed. Qualitative spatial locations of collection and dumping sites of wastes in the Metropolis were assessed and purposive sampling method of semi-structured questionnaires was administered to key stakeholders and residents. Simple descriptive analysis was employed for the presentation findings.

## **Conceptual Framework and Clarification**

Human needs are infinitudes and means of satisfying them are ambitiously intricate so the definition of wastes is of complex nature, however, few views are critically examined. Ali (1996) opines waste from classificatory lens as where it originates from and the properties it contains. The general framework of this is as follows: clinical waste, commercial waste, household waste, control waste, industrial waste, packaging waste, municipal waste, non-municipal waste, inert waste, special waste etc. He further explains that under each of the above, there are a number of different categories of wastes. Consequently, any waste arising from medical, nursing, dental, veterinary, pharmaceutical or similar practices, investigation, treatment, care, teaching or research, or the collection of blood for transfusion, being waste which may cause infection to any person coming into contact with it. Any waste consisting wholly or partly of human or animal tissue, blood or other body fluids, excretions, drugs or pharmaceutical products, swabs or dressings, syringes, needles or other sharp instruments, being waste which unless rendered safe may prove hazardous to any person coming into contact with it. Ali (1996) conceptualization of waste dwells mostly on categorization of waste and not really a definition. This is because he focused more on classifying waste in terms of their sources and their effects, but he did not provide any explicit definition of waste. In the opinion of Beukering et al (1999), many items can be considered as waste e.g., household rubbish, sewage sludge, wastes from manufacturing activities, packaging items, discarded cars, old televisions, garden waste, old paint containers etc. All our daily activities can give rise to a large variety of different wastes arising from different sources. Therefore, the word “waste” is related to the way we behave in the context of the consumer society. In order for communities to function smoothly, people assume and accept the generation of a certain level of waste. The above conception of waste is more of examples of what constitutes waste and not definition. Chandrasekar (2002) on the other hand defines waste as substances or objects discarded as worthless or unwanted, defective or of no other value from a manufacturing or production process. This definition is restricted to the manufacturing or production process. It does not cover other human activities like domestic and commercial activities, which also contribute to the generation of wastes. Given the complex and interdependent activities that go on in the urban centres, urban waste cannot be said to be completely without any value. This definition is also not encompassing.

Ludwig et al (2003) defines waste as any unavoidable material resulting from domestic activity or industrial operations for which there is no economic demand and which must be disposed off. While this definition covers both domestic and industrial activities, it does not cover the commercial aspect. Furthermore, it gives the impression that waste has no other value. Hence, Chandrasekar (2002) definition of waste as materials which though may no longer be needed here, but may become a feedstock or raw material elsewhere fills this gap. This conceptualization is inclusive as waste is seen as material or substances or objects resulting from domestic, commercial and industrial activities, which may not be needed by the primary generator, but may become raw material or of economic value elsewhere.

Geoffrey (2005) conceives waste as anything which people decides to, or is required to dispose of. It includes all items that people no longer have any use for, which they either intend to get rid of or have already discarded. Wastes are such items which people are required to discard, for example by law because of their hazardous properties. This definition fails to distinguish between items that are no longer useful and those that are no longer needed by a household but could still be useful to another.

Wastes according to the Basel convention are substances or objects which are disposed or are intended to be disposed or are required to be disposed off by the provisions of national laws. The United Nations Statistics Division (2011) sees wastes as materials that are not prime products (that is products produced for the market) for which the generator has no further use in terms of his/her own purposes of production, transformation or consumption, and of which he/she wants to dispose. Wastes therefore, may be generated during the extraction of raw materials, the processing of raw materials into intermediate and final products, the consumption of final products, and other human activities.

The United States Environmental Protection Agency (2012) defines waste as “refuse from places of human or animal habitation.” This definition is somewhat narrow in that it seems to refer to waste generated from residential areas and probably farms only. It fails to include other human activities that contribute to the generation of waste. It can therefore, be deduced that waste could arise from every stage of human activities and therefore could take different forms depending on the activity being carried out. Urban waste could therefore take the form of gas, liquid or solid. Solid waste is, however, peculiar in that it can flows, evaporates or dissolves. The categories of solid waste include the non-biodegradables like glass, metal, plastic, rubber, fines and the biodegradable classified as putrescible such as paper, cloth, leather and wood. All these sum-up into what often refers to as municipal waste, commonly known as trash or garbage, a combination of all of a city's solid and semisolid waste. It includes mainly household or domestic waste, but it can also contain commercial and industrial waste with the exception of industrial hazardous waste (waste from industrial practices that causes a threat to human or environmental health). Industrial hazardous waste is excluded from municipal waste because it is typically dealt with separately based on environmental regulations.

Waste of any sort especially municipal waste constitutes a worrisome nuisance if not physically removed. Prominent among the problems is, the generation of which has increased phenomenally in volume and diversity in all urban centres. Several studies therefore direct attention to the problem of uncontrolled heaps of waste in all urban centres. As long as human activities cannot be stopped, the generation of waste is inevitable. However, human activities, habits and culture differ from place to place, so is the type of waste generated. The composition of solid waste is unique to the source of generation. Thus, it is long overdue to begin to examine the hazardous and possibility of inducing disaster at micro-community level, all these informed this paper.

## Result and Discussion

Historically, Temple et al (1966) and Oyedele (1987) traced early migration into Kaduna metropolis to the quest for a change of the Capital of northern region/northern region protectorate from Zungeru to Kaduna metropolis in 1913, this marked the beginning of population influx into the Metropolis. During this period under discussion different migration phases were witnessed ignited by the substantive and socio-economic induced by economic and political activities changes in the newly created Capital of northern region.

In the same sequence Ajibuah (2009) illustrates in Table 1 that Kaduna metropolis was one of the fast growing cities in Nigeria between years 1952 to 1963 with 10.6% growth rate leading other major cities in Nigeria. Ajibuah further asserts that Kaduna metropolis population rose by three- folds between 1921 and 1931 when compared to the period between 1952 and 1963 when it grew by 25.1% and 67.4% at 10 years interval respectively.

Contemporarily, the report of last national census exercise conducted by National Population Commission (2006) put Kaduna Metropolis as third in position after Lagos and Kano in population growth in Nigeria. Thus, this historical background of its population growth allude to the fact that Kaduna metropolis had its roots within the context of the evolution and consolidation of the Nigerian state and its concomitant national, albeit colonial guided economic structure. This fundamental political development further enhanced the mass movements of Nigerians from other parts into Kaduna during and after the completion of the colonization process in the country as Crowder (1968) succinctly puts it “under colonial rule, the scale of movement of people increased enormously”. It was this growth that informed the Regional Government then to collaborate with Max Losch and Partner in 1957 to draw Kaduna Master Plan as a guide to monitor the physical planning and development of the Metropolis (Max, L. and Partners, 1967). Consequently, with increase in the population and concomitant rising demand for food and other essentials, have been on the rise in the amount of waste generated daily by each household in the Kaduna metropolis.

### Categories of Waste Generation in Kaduna Metropolis

In Kaduna metropolis the following types of wastes and trash are generated. The biodegradable, which includes things like food and kitchen waste such as meat trimmings or vegetable peelings, yard or green waste and paper. These particular wastes are common in the residential areas. The recyclable materials include paper and stationeries materials and non-biodegradable items such as glass, plastic bottles, other plastics, chemical, pesticides, dye, refining, rubber goods industries, metals and aluminum cans, these categories are easily accessible and commonly seen along the NnamidAzikwe Express way where related companies are located. The Inert waste materials are those that are not necessarily toxic to all species but can be harmful or toxic to humans. These involve construction and demolition. Others identified include composite waste includes items that are composed of more than one material, typical examples are clothing and plastics such as children's toys are composite waste, and household hazardous waste comprises medicines, paint, batteries, light bulbs, fertilizer and pesticide containers and e-waste like old computers, printers, and cellular

phones. These households hazardous waste cannot be recycled or disposed of with compared with other waste categories so the Central Business District of Kaduna metropolis is where this is highly concentrated. These categorization buttresses the findings of Igbaonugo (2004), that municipal wastes consists of household waste, construction and demolition debris, sanitation residue, and waste from streets. This garbage is generated mainly from residential and commercial complexes. With rising urbanization and change in lifestyle and food habits, the amount of municipal solid waste has been increasing rapidly particularly in developing countries and its composition changing.

### **General Mode of Waste Disposal in Kaduna Metropolis**

The wastes generated in Kaduna metropolis are deposited in the following ways: the first and most common practice within the slums, ghetto, and sprawl neighbourhoods of Ungwar residential areas is the open ranges, are used as refuge dump sites, these are carried out along major routes, footpath and piece of undeveloped land or abandoned residential structure, the second method, is collection sites are employed among those that lives in Government Reserved Areas or Ungwar extension where necessary town plan layout are done but these collection sites have often located far away into the Ungwar areas. Third group are the combination of the first two groups that normally use the bank of River Kaduna as their dumping sites, while the fourth group area the two institutionally designated areas as dumping sites. These are areas that are specially created so waste can be put into the ground with little or no harm to the natural environment through pollution. They are located outskirts the Metropolis. One is along Birinin-Gwari road in the northern part and another along Abuja highway in the southern part of the Metropolis. It is important to note that very insignificant number of residences at reserves and extension areas and other industries could afford the services of KEPA for the evacuation of wastes generated to these dumping sites. Fig. 3 shows the spatial pattern of locations and sites of the various methods of waste disposal in Kaduna Metropolis.

### **Consequences of Present Waste Disposal Systems**

Waste has hazardous effect on the environment including every living thing. It does not only pollute the land but also affect indirectly living beings. The sequence discussion and Figures 2 and 3 affirmatively, shows that waste are not properly managed in Kaduna metropolis, especially waste from households, certain types of household waste are also hazardous which could be highly toxic to humans, animals, and plants; are corrosive, highly inflammable, or explosive; and react when exposed to certain things. Thus, household wastes that can be categorized as hazardous waste include old batteries, shoe polish, paint tins, old medicines, and medicine bottles. It is common sight to find heaps of waste, with its attendant decay and foul smells, serving as reception in the nooks and crannies of Kaduna metropolis especially Angwars that are densely populated. These present looms of serious health hazard and can lead to the spread of infectious diseases. The unattended waste lying around the Angwars that attracts flies, rats, and other creatures that in turn spread disease. This could lead to unhygienic conditions that pose varying challenges to human health. Direct dumping of untreated waste in rivers, like what is ongoing in river Kaduna engendered the accumulation

of toxic substances in the food chain, through the plants and animals that feed on it directly or indirectly. River Kaduna is one of the sources of domestic water supply to people living along its banks and animals during the dry season. Also, wastes dumped along the bank of river Kaduna are constitutes the main cause of annual susceptible flooding in residential areas of; Angwar/Rimi, Kigo, and Kakuri, apart from creating breeding ground for mosquitoes, that enhances the spread of malaria, the degradation of the aesthetic value of the river and death of aquatic organisms of immense of value to the economy of the Metropolis.

Effective waste management is an important component of a strategy for improving environmental health, waste that is not properly managed, especially uncollected solid wastes from households and other communal activities are serious health hazard which could manifest through the spread of infectious diseases, for instance, organic domestic waste poses a serious threat, since they ferment, creating conditions favourable to the survival and growth of microbial pathogens and also increase risk of injury particularly children and other high-risk group population living close to waste disposal sites in the angwar areas of the Metropolis. Other than this, co-disposal of industrial hazardous waste generated in the industrial annexes of the Metropolis exposes the people to chemical and radioactive hazards in the residential areas of; Kakuri and Makera where textile industries are found, Kudended and Nasarawa areas for bottling companies, Panteka in Tudunwada area and Panteka along the road to National Eye Centre where all sorts of accident vehicles are abandon, imported scraps, rusted iron, household equipment and materials are deposited,.

In conclusion, solid waste in urban areas is an obvious result of human activities. Natural growth of population, reclassification of habitation and migration trends are common in urban populations. Urbanization is now becoming a global phenomenon, but its ramifications are more pronounced in developing countries. This urbanization, economic growth, and improved living standards in cities led to an increase in quantity and complexity of generated Waste, one obvious consequence of rapid urbanization of Kaduna metropolis is the growing generation of solid wastes in all its alcoves. The Metropolis is presently confronted with unprecedented challenges of managing wastes, especially as it relates to problems of coping with their collections and disposal. To ameliorate this unacceptable scenario of municipal waste generation in Kaduna metropolis proper waste management that is inclusive, driven by people must be formulated. This can be achieved through mobilization and capacity building intervention programmes of the people on the essence of monitoring transportation of wastes, processing, disposal and recycle mechanisms not theoretically and ivory tower compelling but practical, and participatory in delivery, chary of the level of literacy of the people is pivot to enhance result. If these steps are followed effectively in a proper cycle, waste management challenge will be ameliorated at long-run.

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