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Solid Waste Generation and Disposal by Informal Sector Participants in Barkin Ladi Town Plateau State, Nigeria.

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Abstract
The present paper examines solid waste generation and disposal by informal sector participants **in** Barkin Ladi town Plateau State, Nigeria. A reconnaissance survey was conducted in 2017 which provided the basis for the classification of informal commercial activities in the town, while sites where informal activities clustered in the town were mapped. Nine major spatial clusters were identified. From the reconnaissance survey, a total of 1,878 informal land use activities were identified which formed the sample frame for the study. A total of 187 questionnaires were administered on three categories of informal sector activities in the area. The findings revealed that 41% of waste materials generated by the informal sector are biodegradable and include polythene bags, plastics material, glass and metals. 54.5 percent of 187 dispose their waste in open spaces and on streets. The study concluded that informal sector participants have low educational training hence, their care for environmental quality is low, their waste disposal methods are crude which leads to poor sanitation, health hazard and poor urban environment. In addition, general organization of solid waste collection and disposal are also very poor. The study recommends the adoption of the '**R**^{3}' of Reduce, Reuse and Recycle solid waste generated by informal sector activities especially those in tertiary services and trading categories for a healthy environment and efficient solid waste management in the study area. Educating informal sector workers on the dangers of environmental degradation, dumping of refuse in open spaces and other planning regulations, and the benefits of an organized urban environment. Organizing informal sector workers into co-operative societies so as to provide forum to educate them and enjoy government assistance.
Keywords: Solid waste, generation, disposal informal sector, participants

1. Introduction

Various municipal authorities are incapable to cope with the fast-tracking growth of municipal waste stemming from informal sector activities to the extent that waste disposal is now one of the most noticeable environmental problems of Africa's urban areas (Dungwom and Musa, 2018). This condition also exists in Nigerian towns, where quantitative and qualitative information available reveals that both the absolute and the per capita quantity of wastes generated is growing steadily (Onyenechere, 2011). The generation of wastes from discarded pure water bottles and sachets by hawkers/vendors and their customers is a typical example. It is not only the quantity of municipal waste that is growing but also its variety and character, including its changing biodegradability and toxicity. The per capita municipal waste production in African cities averaged about 0.5 kg/day (Ashiri, 2006). The rate increases as urban informal sector activities accelerate. Rising production and consumption of goods imply that waste generation will continue to grow as population and cities in Africa continue to expand along with their productive economic base (Hove, Ngwerume, & Muchemwa, 2013).

Informal sector activities are often seen as "eye-sores" by most people and are evicted from city centers in the name of "public cleanliness and orderliness" (World Bank, 1991, Cross 2017). However, some see the environmental problems associated with the informal sector as mostly manifestations of unresponsive physical planning systems while others see them as resulting from attributes inherent to the sector's activities (Perera & Amin, 1996, Hadebe, 2010, Onyenechere, 2011). Most operators of the informal sector in Nigeria especially street hawkers, market vendors, small automotive and machine repairers, shoemakers, barbers, hairdressers and tailors generate by-products in their daily efforts to provide goods and render services. These byproducts deface the streets, and clog the drains (Daniels 2016). The concomitance of these actions is the stimulation of health hazards, flooding, noise pollution, traffic obstruction and nuisances even road accidents. Their ignorance, attitude and insufficient knowledge of techniques and materials for managing and disposing of wastes among others are causal factors (Khan, 2016).

The infiltration of the informal sector in the urban built environment has turned out to be a considerable challenge to urban planning in Nigeria. This challenge is borne out of the capacity of the sector to generate environmental problems such as sprawl problem, waste management problems, incongruous land uses, building alterations, and the menace of temporary structures, alteration of land use functions, open space conversions and

land degradation (Okeke, 2000).

These problems are being aggravated due to urban growth and the consequent phenomenal increase in population. Also, the unstable state of the urban economy whereby more people are diverting into these informal activities for daily survival and sustenance of livelihoods compounds the problems. This is especially for millions of people who have either been retrenched from their jobs, or whose incomes are no longer sufficient to support their basic needs (Meagher and Yunusa, 1996).

Many municipal authorities are unable to cope with the accelerating growth of municipal waste emanating from informal sector activities to the extent that waste disposal is now one of the most conspicuous environmental problems of Africa's urban areas. This situation also exists in Nigerian towns, where quantitative and qualitative information available reveals that both the absolute and the per capita quantity of wastes generated is growing steadily. It is not only the quantity of municipal waste that is growing but also its variety and character, including its changing biodegradability and toxicity (Ashiri, 2006).

The per capita municipal waste production in African cities averaged about 0.5 kg/day (Ashiri, 2006). The rate increases as urban informal sector activities accelerate. This thus compounds the present problems of disposal and management. Some tangible and effective measures should be taken quickly so as to ensure that the problem does not continue to be a major source of health hazards and a catalyst to an upsurge of environmental degradation in the rapidly growing urban areas (Onyenechere, 2011).

The urban informal sector raises the expectation of potential migrants to urban areas who believe that opportunities exist there for them to explore. The rising urban population resulting from these expectations often creates further urban environmental problems due to the inability of the urban system to handle the influx of population. The appalling environmental conditions associated with informal sector activities constitute a major threat to the health and well-being of urban life (Nwaka, 2004). The environmental degradation resulting from the activities of the sector should promptly be checked, owing to the fact that man's activities, positive and negative, within and outside an ecosystem have disastrous repercussions (Onyenechere, 2011).

The present paper examines solid waste generation and disposal by informal sector participants **in** Barkin Ladi town Plateau State, Nigeria.

2. Study Area and Methodology

2.1 The study area

The study area is Barkin-ladi town (Gwol), which is located in Ropp District of the Local Government on coordinates: 9032'00"N and 8054'00"E (see figure 1). The town is situated on the high north central plateau with an average height of 1,200 meters above sea level. The area is blessed with a large exposure of basement complex rocks and some volcanic rocks. The rocks contain large deposit of minerals such as Tin and Colum bite. It is also characterized by gentle slope (undulating) flat surfaced with some granite hills and ridges owing to the mining activities that took place in the area. This gave way for the number of streams and ponds found in most parts of Barkin-ladi town.

The change in the economic and political status of the town has brought a corresponding increase in the number of its inhabitant. As one of the Local Government located within the mining region of the Jos plateau, it is endowed with abundant human and natural resources. The L.G.A. headquarter is surrounded by large number of abandoned mining ponds which are used as source of water for irrigation and domestic use. The town has grown from a mining settlement into a town centre with an approximate population of 71,626 at 4.7 % growth rate as at 2016 (Dungwom Musa, 2018).

2.2 Methodology of the Study

The data upon which the research results are described have come from both primary and secondary sources. The primary data was collected through the use of a questionnaire. The secondary data was sourced from published literature and desk top research. **A** reconnaissance survey was conducted in 2017 which provided the basis for the classification of informal commercial activities in the town, while sites where informal activities clustered in the town were mapped (see figure 2). Nine major spatial clusters were identified (see, Figure 1). From the reconnaissance survey, a total of 1,878 informal land use activities were identified which formed the sample frame for the study (see figure 2). Informal land use activities fall into three main categories: trading and commercial activities, cottage industries, and services.

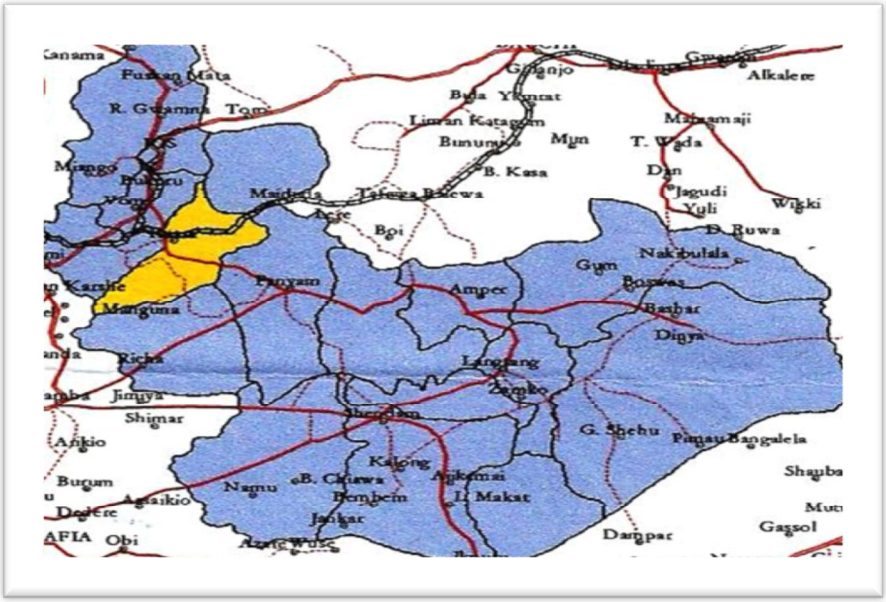

Figure 1. Study area on map of Plateau State

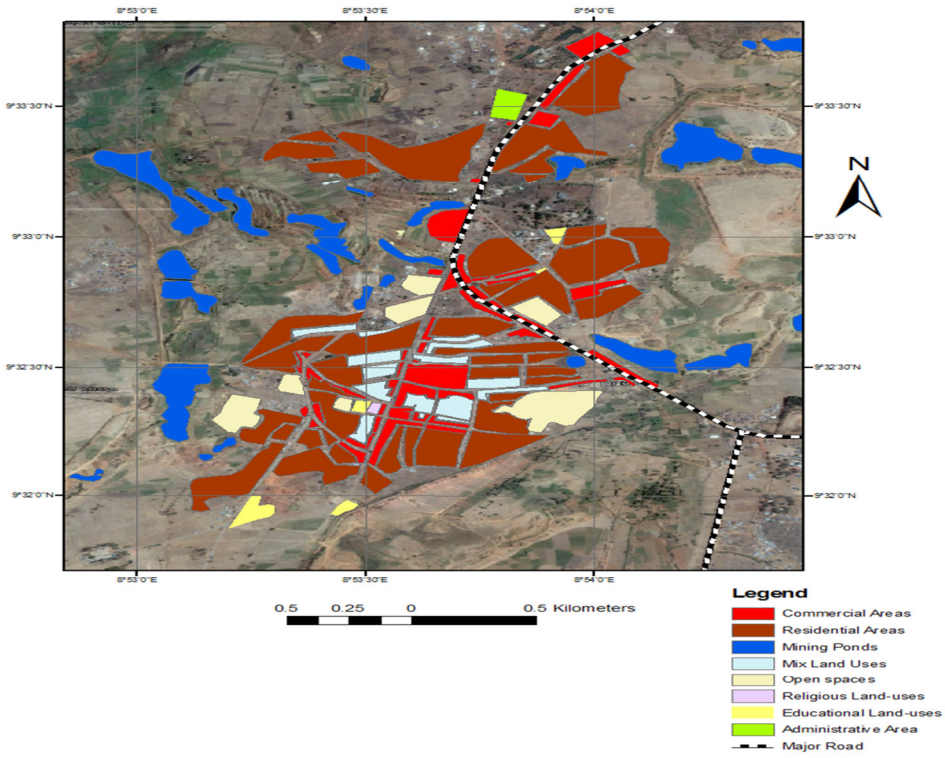

Figure 2: Aerial photographs of the study area showing commercial areas and other land uses
Source:Dungwom and Musa,2018.

3. Result and Discussion

The poor surface drainage in urban areas as a result of informal land use activities, leads to stagnant pools where mosquitoes and other disease carrying vectors breed (see plate 1). Often in towns and cities, public drains are used as substitutes for toilets and waste disposal facilities. This causes blockage of the drains and is usually responsible for environmental problems such as flooding, erosion and landslide, which destroy homes built on marginal land, and causes major damage to public infrastructure and private property.

Plate 1: Nature of waste generated from Tertiary services in Barki ladi

Plate 2: Blocked drainage from informal sector activity

3.1 Solid Waste Materials Generated from Informal Sector Activities

It will be deduced from table 1 that metal waste constitutes about 275.60kg (44.1 percent) representing the highest, paper/cartons with 102.13kg representing 16.3 percent, fruits and vegetable peels have 86.50kg represents 13.9 percent of waste generated, saw dust/ wooden materials accounted for 67.25kg representing 10.8 percent, glass materials and plastics constitute 3.2 and 3.4 respectively. It will be inferred that 41% of waste materials generated by the informal sector are biodegradable and include polythene bags, plastics material, glass and metals (see Plate 3). It is quite common to observe mountains of refuse at market places. The heaps of refuse provide excellent breeding grounds for vectors of communicable diseases including rodents, insects, etc which increases the potential for the spread of infectious diseases.

Plate 3: Scrap metals generated by the informal sector in Barkin-ladi town.

Table 1 : Amount of Waste Materials Generated from Informal Sector Activities **per day**

Material	Amount Generated (Kg)	Percentage
Metals	275.60	44.1
Paper/ cartons	102.13	16.3
Fruit peels/vegetables	86.50	13.9
Saw dust/wooden materials	67.25	10.8
Polythene bags	51.75	8.3
Plastics	21.41	3.4
Glass	20.50	3.2
Total	625.14	100

Source: Water and Sanitation Unit, B/ladi LGC. 2016.

3.2 Methods of Waste Disposal by Informal Sector Participants

Indiscriminate waste disposal is a common attribute of the informal sector (see Table 2). 102 of the respondents representing 54.5 percent of 187 dispose their waste in open spaces and on streets. 93 respondents representing 49.7 percent dumps their waste in drainages. 72 respondents representing 38.5 percent of 187 burns waste close to their businesses.20.2 percent uses waste bins; 11.2 percent uses carts and wheel barrow while only 9 percent of the sample size uses collection trucks. Generally, informal sector participants have low educational training hence, their care for the environmental quality is low. Therefore, their waste disposal methods are crude; this leads to poor sanitation, health hazard and poor urban environment. General organization of solid waste collection and disposal is also very poor.

Table 2: Waste Disposal Methods

Method	Number of Response	Percentages
Disposal in open space	102	54.5
Burning	72	38.5
Dumping in drainages	93	49.7
Waste bins	38	20.2
Carts and wheel barrow	21	11.2
Collection trucks.	17	9

4.0 Conclusion and Recommendations

The study examined solid waste generation and disposal by informal sector participants in Barkin Ladi town Plateau State, Nigeria and findings revealed that informal sector participants have low educational training hence, their care for environmental quality is low, their waste disposal methods are crude which leads to poor sanitation, health hazard and poor urban environment. In addition, general organization of solid waste collection and disposal are also very poor. The following recommendation is therefore based on the findings of the study:

i. Recommend the adoption of the '**R**^{3}' of Reduce, Reuse and Recycle solid waste generated by informal sector activities especially those in tertiary services and trading categories for a healthy environment and efficient solid waste management in the study area.

Plate 4: A system of Reduce, Reuse and Recycle

ii. Educating informal sector workers on the dangers of environmental degradation, dumping of refuse in open spaces and other planning regulations, and the benefits of an organized urban environment.

iii. Organizing informal sector workers into co-operative societies so as to provide forum to educate them and enjoy government assistance.

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