

Effect of Plastic Wastes in the Context of Architectural Composition of Urban Slum Settlements in Nigeria's Built Environment

***Alhassan Faiza Abdullahi, Yahya Kauthar and Hassan Bilkisu**

Department of Architecture, College of Environmental Studies,
Kaduna Polytechnic, Nigeria

*Corresponding Author E-mail: mfaiza@kadunapolytechnic.edu.ng

D.O.I: 10.56201/ijgem.v9.no3.2023.pg25.36

ABSTRACT

A report by the Federal minister of environment, in December 2013, revealed that the uncontrolled use of plastic materials and the indiscriminate disposal present a clear and imminent danger to our environment and Nigerians. Therefore, this study attempt to uncover the effect of plastic wastes in the context of architectural composition of urban slum settlements with a view to improve the quality of the built environment in Jos Metropolis, Plateau State. Its objectives are to examine the characteristics of slum settlements in study area, and identify strategies for solving plastic waste in the context of architectural composition of urban slum settlements. The study area is Anguwan Rogo community in Jos Metropolis, Plateau State, Nigeria. The methodology employed for this study is physical observation, digital photography, case study and the review of related literature. The study revealed plastic wastes generation has indeed presented negative impacts such as environmental pollution and foul smells, large scale flooding, aesthetic defacement of the built environment. The study therefore recommends that sufficient awareness programmes on dangers of plastic in the environment be organized; improvement in proper plastic waste collection, treatment and disposal, among others.

Keywords: Architectural, Composition, Plastic wastes, Slum, Urban

INTRODUCTION

Plastics play an important role in every aspect of our life; they are of extreme importance by their applications in human society, public health and medical uses. Such as water bottles, clothing, food packaging, electrical instruments, telephones, optical instruments, medical supplies (intravenous bags, disposable syringes, joint replacements, etc.) electronic goods, construction materials, and more (Pavani & Rajeswari 2014; Onwuka & Ajator, 2018; Zarma, 2018; Danladi, 2019; Ajoku & Okoro, 2020). However, the current level of their usage and disposal generate several environmental problems. As cities grow in size, with a rise in population, the amount of waste generated is increasingly becoming unmanageable (Ali, Vivan, Ombugadu, Wambai, Dahiru, Njila & Mafuyai, 2016).

Generally, plastic is the third component of solid waste stream after food and paper, (UNEP, 2009). Plastics are defined as synthetic or semisynthetic materials which could be

molded into any object and still retain its plastic characteristic (Pavani *et al.*, 2014; Ajoku *et al.*, 2020; Kehinde, Ramonu, Babaremu, & Justin, 2020). They are light in weight, durable, versatile and resistant to moisture, chemicals and decays, yet these properties can bring challenges to waste managers in local and national authorities. These generated plastic wastes which end up in solid waste stream constitute a serious environmental challenge to municipal solid waste management authorities/agencies in most Nigerian urban Centre's (Kehinde *et al.*, 2020).

In December 2013, the Federal minister of environment, during his speech in a workshop held at Maitama Abuja, stated that the uncontrolled use of plastic materials and the indiscriminate disposal present a clear and imminent danger to our environment and Nigerians. He further emphasized that the indiscriminate disposal of plastic waste has caused large scale of flooding of major Nigerian cities and villages in recent years, particularly in 2012 (Ishaku, 2013). Similarly, this view is consistent with that echoed by Ajoku *et al.*, (2020) who stressed that, despite the environmental problems posed by plastic waste, both the government and the individuals have not taken adequate sustainable approach towards its management.

Considerable amount of plastic wastes end up in the environment, clogging sewers and drains causing air pollution when burnt, posing a danger to marine life and causing death to livestock when inadvertently consumed, (Onwuka *et al.*, 2018; Alabi, Ologbonjaye, Awosolu & Alalade 2019; Danladi, 2019; Kehinde *et al.*, 2020). This view was also emphasized by Ajoku *et al.*, (2020) who asserted that plastic wastes litter the environment thus, reducing its aesthetic value, when burnt introduces harmful substances with toxic fumes that contain chemicals such as dioxin, furan, etc which have been linked with cancer. As noted by Alabi *et al.*, (2019), it also abuse arable soil for farm work, creates conducive environment for breeding mosquitoes and other disease causing vectors and production of foul smells.

Also, the pursuit to achieve the Sustainable Development Goal (SDGs) 11 which aims "*to make cities and human settlements inclusive, safe, resilient, and sustainable,*" is of particular importance. This pursuit encourages policies and programmes for concrete actions, social inclusion and the creation of an urban identity that give rise to maximum social ties (United Nations [UN], 2019). Thus, Wash, Omar, Mohammed & Isa, (2022) affirmed that there must be a healthy, rich and adequately protected environment in order to have a healthy, prosperous society.

As asserted by Sati (2015), architectural composition is the man- made environs that provide the habitation for human activity ranging in scale from buildings, green spaces and their infrastructure, access roads to neighbourhoods and cities that include their supporting infrastructure. It is a material, spatial and cultural product of human labour that combines physical elements and energy in forms for living, working and playing. It has been defined as the human-made space in which people live, work and recreate on a day-to-day basis. It also encompasses places and spaces created or modified by people including buildings, parks, and transportation systems (Sati 2015). The architect is among other things; an artist who is responsible for the building to finally be faithful to the original design, hence trends to lead the design-construction team (Chigozie & Jide, 2015; Adegbembo, Bamisaye & Aghimien, 2016; Sati, 2015; Hamma-Adama & Kouider, 2017). Furthermore, Sani, Hassan, Sani & Kawuwa, (2016) opined that waste materials could be used as a complete building material for construction through the concept of *Eco architecture*. They further said that construction waste could also be used as a complimentary material to reduce cost and waste generated from site. Additionally,

waste materials could be used as finishing in normal construction in form of decoration, cladding, landscape elements in form of sculptures, artworks on buildings, and furniture.

Several researches have been conducted (in Ali *et al.*, 2016; Onwuka *et al.*, 2018; Ilyas, Ahmad, Khan, Yousaf, Khan & Nazir, 2018; Zarma, 2018; Alabi *et al.*, 2019; Danladi, 2019; Ajoku *et al.*, 2020) on negative impact of plastic waste on the environment, yet the studies have their limitations as the majority of these studies focus on environmental sustainability (Ilyas *et al.*, 2018; Ajoku *et al.*, 2020); public and environmental health effects (Alabi *et al.*, 2019); waste generation, collection and management pattern (Ali *et al.*, 2016); Environmental Pollution (Pavani *et al.*, 2014). However, not much research has been carried out to examine the effect of plastic wastes in the context of architectural composition of urban slum settlements with a view to improve the quality of the built environment in Jos Metropolis, Nigeria. This was considered a gap that the present study seeks to fill.

Preliminary study reveals plastics are seen littered almost everywhere comprising of empty plastic bottles, take away plates and spoons, poly bags or Nylon bags, pure water sachet etc. in urban slums of Jos metropolis, which pose a great challenge on the effort of achieving clean and safe environment. It was also discovered that the quality of the environment and human landscape value are deteriorating at rapid rate with little or no intervention from the government and individuals. Previous studies on impact of plastics on the environment and public health in Jos metropolis has been documented by Lekwot, Yakubu, Kwesaba & Sahabo, (2015) and Danladi, (2019). Consequently, the objectives are to: (1) examine the characteristics of slum settlements in study area, (2) identify strategies for solving plastic waste in the context of architectural composition of urban slum settlements. This study contributes to literature and knowledge on observed environmental deterioration of plastic wastes in urban slum settlements. It will be of good importance to those in the academia and to construction professionals.

MATERIALS AND METHOD

The Study Area

Jos, the capital of Plateau State is situated approximately on latitude 9.6° North and Latitude 8.5° East. The city lies close to the geographical center of Nigeria (Figure 1). Jos metropolitan area is made up of two main local government areas, Jos North and Jos South. However, with recent expansion of the city it has extended into Bassa and Jos East Local Government Areas. During British colonial rule (1900 to 1960) it was an important Centre for tin mining. With an altitude of 4,062 feet (1,217 m) above sea level, it enjoys a more temperate climate than much of the rest of Nigeria (average monthly temperatures range from 70° to 77°F or 21° to 25°C). The weather has played an important role in attracting population into the city, coupled with its unique terrain and topography (National Population Commission [NPC], 2019).

Geographically, Angwan Rogo is a community, in Naraguta 'B' electoral ward of Jos North L.G.A. of Plateau State. It lies on latitude 9° 56' 47 N and longitude 8° 53' 12 E with an altitude of 1276m (Figure 2). According to Musa & Dung-Gwom (2018), it is a high density residential area dominated by Muslim and foreigners, with a total of 3,980 units as at 2014. It is accessed through the Bauchi Road and the Bauchi Ring Road with poor setbacks and airspaces which would have helped in curbing the effect of fire outbreaks. Their main occupation is trading in the formal and informal sectors.



Figure 1: Location of Jos Metropolis in Plateau State and Local Government Areas
Source: Department of Urban and Regional Planning, University of Jos, 2021.

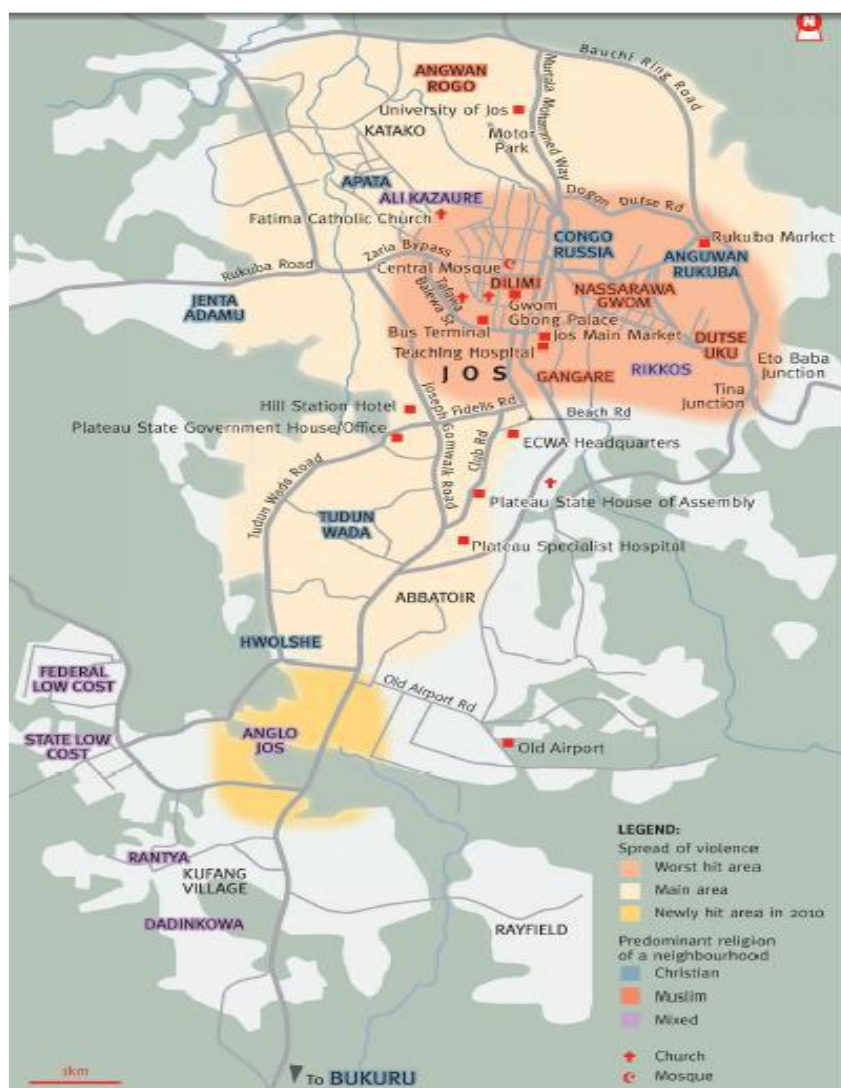


Figure 2: Location of Angwan Rogo within Jos Metropolis in Plateau State
Source: Department of Urban and Regional Planning, University of Jos, 2021

Method of Data Collection

This study employed the use of data and information from both primary and secondary sources. Primary data were obtained by physical observation, digital photography and case study. The secondary data involves the use of information already in existence and this was sourced largely through literature review.

RESULTS AND DISCUSSION

The Characteristics of Slums

A review of the definitions used by national and local governments, statistical offices, institutions involved in slum issues and public perceptions reveals the following attributes of slums.

i. Physical Environment and inadequate building structures:

Slum areas are associated with a high number of substandard housing structures, often built with non-permanent materials unsuitable for housing given local conditions of climate and location. The condition of housing in the study area is very poor due to the low quality of materials used for their construction, inadequate technology and poor planning standards of the building components. This compares with the findings of Bello, Ogunrayewa & Hassan, (2018) who posited that the living conditions of the slum dwellers is very poor. (Plate i). Factors contributing to a structure being considered substandard are, for example, earthen floors, mud-and-wattle walls or straw roofs. Various space and dwelling placement bylaws may also be extensively violated (The challenge of slums: global report on human settlements, 2003).

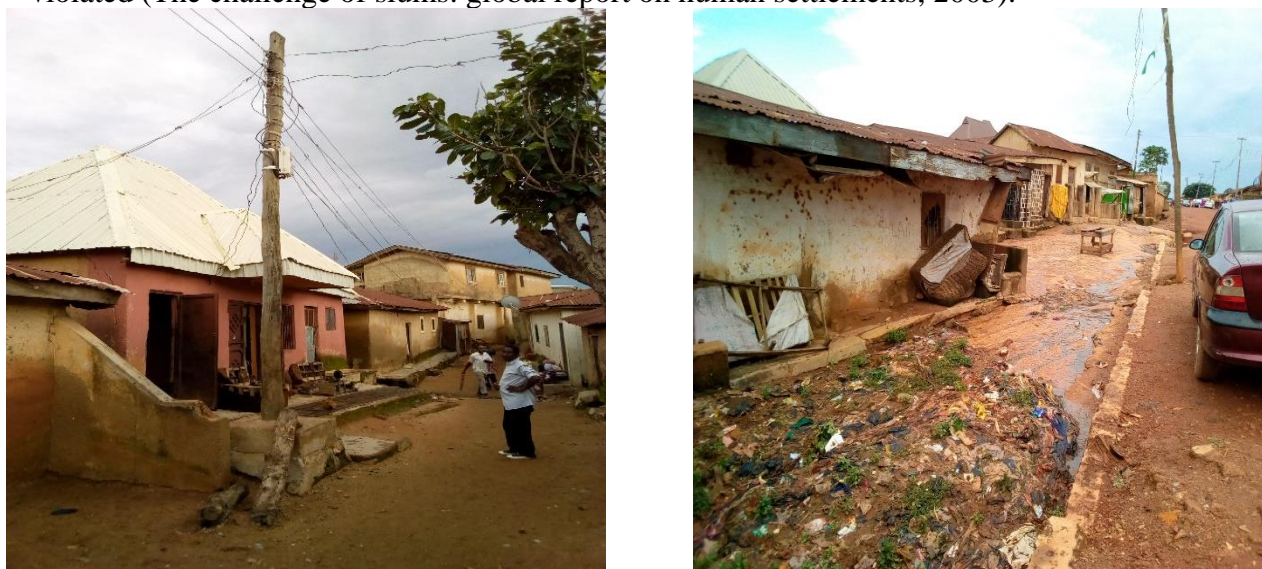


Plate i: Physical housing condition.
Source: Field photographs, 2023.

ii. Lack of basic services

The findings from physical observation indicated the absence of pipe borne water supply leaving the inhabitants of the area with no option than to buy water for drinking and other domestic use from water vendors and from people who have sunk in boreholes for commercial purposes. (Plate ii & iii). Here 50 litres water-can (10 in number) sells for N500.00. This compares with the findings of Daniel, Wapwera, Akande, Musa & Aliyu, (2015) who discovered that slum residents in Jos, Port Harcourt, Abuja and Makoko area of Lagos State are deprived and excluded from getting access to safe drinking water. The slum resident have to travel some distance to get water or buy from '*mairuwa*' (water vendor) who sell water that is fetched from the commercial boreholes or from distant rivers and streams.



Plate ii: Flowing water with waste in it



Plate iii: Water supply from a water vendor

Source: Field photographs, 2023.

iii. Unhealthy living conditions and hazardous location

Unhealthy living conditions are the result of a lack of basic services, with visible, open sewers, lack of pathways, uncontrolled dumping of waste, polluted environments, etc. Houses may be built on hazardous locations or land unsuitable for settlement, such as floodplains, in proximity to industrial plants with toxic emissions or waste disposal sites, and on areas subject to landslip. The layout of the settlement may be hazardous because of a lack of access ways and high densities of dilapidated structures (Daniel *et al.*, 2015 and Bello *et al.*, 2018).

iv. Insecure tenure; irregular or informal settlements

A number of definitions consider lack of security of tenure as a central characteristic of slums, and regard lack of any formal document entitling the occupant to occupy the land or structure as *prima facie* evidence of illegality and slum occupation. Informal or unplanned settlements are often regarded as synonymous with slums. Many definitions emphasize both informality of occupation and the non-compliance of settlements with land-use plans. The main factors contributing to non-compliance are settlements built on land reserved for non-residential purposes, or which are invasions of non-urban land (The challenge of slums: global report on human settlements, 2003).

v. Poverty and social exclusion

Income or capability poverty is considered, with some exceptions, as a central characteristic of slum areas. It is not seen as an inherent characteristic of slums, but as a cause (and, to a large extent, a consequence) of slum conditions. Slum conditions are physical and statutory manifestations that create barriers to human and social development. Furthermore, slums are areas of social exclusion that are often perceived to have high levels of crime and other measures of social dislocation. In some definitions, such areas are associated with certain vulnerable groups of population, such as recent immigrants, internally displaced persons or ethnic minorities (Daniel *et al.*, 2015 and Bello *et al.*, 2018).

vi. Minimum settlement size

Many slum definitions also require some minimum settlement size for an area to be considered a slum, so that the slum constitutes a distinct precinct and is not a single dwelling (The challenge of slums: global report on human settlements, 2003).

Sources of Plastic Wastes in the Environment

Plastics have permeated every facet of human life and researchers such as Yakubu, 2017; Ilyas *et al.*, 2018; Alabi *et al.*, 2019; Danladi, 2019; Ajoku *et al.*, 2020; and Kehinde *et al.*, 2020 categorised the sources of solid waste (plastics) as residential (water bottles, plastic cutlery, plates, jerry cans, salad dressing, biscuit trays, straws and salad domes); industrial (Plastic films, shampoo, detergents bottles, big shopping bags, drums); commercial (plastic chairs, milk bottles, ice cream containers, juice bottles, chemical and detergent bottles, rigid agricultural pipe, crates, potato chip bags); Institutional (e-waste (e.g. computers, phones); medical (Intravenous bags, disposable syringes, joint replacements, medical supplies, gloves); agricultural (agricultural waste (e.g. rice husks, cotton stalks, coconut shells, coffee waste), hazardous wastes); construction and demolition (C&D).

Table 1: Quantity (in kg) of plastics sold by 15 shops in Jos per day

S/No	Name of shop	Location	Types of goods sold	Qty/Day in kg
1	Tem Provision Store	Bukuru	Provisions	2.3
2	Hillary Eze & Sons	Dadin Kowa	Provisions	2.6
3	Lizzy Provisions	Kugya, Bukuru	Provisions	2.3
4	Peter Provisions	Rwang Pam Street	Provisions	1.8
5	Mandela shop	Rantya, State lowcost	Clothing	1.7
6	Elegant world	Ahmadu Bello way	Clothing	1.1
7	Jossey Electronics	Old Bukuru Park	Electronics	12.4
8	De-Roy Ventures	Laranto, Jos	Furniture	0.9
9	Ochy Brothers int.	Dilmi Street	Spare parts	5.4
10	Okoye & Sons Ltd	Rwang Pam St.	Building materials	7
11	Sule Store	AngwanRimi	Provisions	1.1
12	Chi-God Ent.	Rayfield	Building materials	5.6
13	Hademy	Old Bukuru Park	Drawing equipment	2.8
14	Dele Oluyomi	Etobaba	Provisions	1.4
15	Zira Provisions	Rayfield	Provisions	4.8

	Total			53.2 kg
--	--------------	--	--	----------------

Source: Field Survey, 2023 as documented by Agada, (2017).

Table 1, above reveals the situation of sales of plastics in Jos metropolis, Plateau State has over 22,000 shops, each of which sells an average of about 3.5kg of plastic materials per day. This result when multiplied by the number of shops in the state totals about 77,000kg/day (77tonnes/day). This figure is most likely to double by 2040. This compares with the findings of Agada, (2017) and Yakubu, (2017) whose research revealed amount of plastic waste being generated in the metropolis.

Strategies for Solving Plastic Waste in the Context of Architectural Composition of Urban Slum Settlements.

The results of the studies carried out by Alabi *et al.*, (2019), Ali *et al.*, (2016), Onwuka *et al.*, (2018), and Danladi, (2019) in some residential, commercial and institutional areas of Nigeria have put forward some strategies for solving environmental deterioration from plastic wastes:

- i. Since the major sources of plastic waste generation in the study area are residential and commercial there is need to educate grassroots residents on the impacts of plastic wastes and the need for a healthy lifestyle should be employed for effective transitioning.
- ii. There is need for improvement in proper plastic waste collection, treatment and disposal. Inadequate management of landfills will make way for harmful chemicals in plastic wastes to leach into the environment, polluting the soil, air and underground water.
- iii. There should be sufficient awareness of citizens on dangers of plastic in the environment through the mass media.
- iv. Government can introduce the ‘wealth to waste scheme’ where plastic wastes can be recycled and generates income as well as employment for the unemployed youths in the society.

CONCLUSION

This research was able to reveal the extent to which plastic wastes generation has indeed presented negative impacts such as environmental pollution and foul smells, large scale flooding, aesthetic defacement of the built environment, etc. on the residents of Angwan Rogo slum community in Jos Metropolis of Plateau State. The secondary data reviewed related generally to the current state of solid waste management in Jos metropolis particularly the study site. There is the need to urgently address these challenges in order to lay a solid foundation for the Sustainable Development Goals (SDGs) for the environment. This can be achieved through participatory approach by all built environment professionals, increase financing and private sector involvement and planned maintenance of infrastructures. Also the Jos Metropolitan Development Board (JMDB) of the State, should embark on more awareness of citizens on environmental sanitation in line with the mandatory month-end sanitation exercise and enforcement of penalties to defaulters.

REFERENCES

- Adegbembo, T. F.; Bamisaye, O. P. & Aghimien, D. O. (2016). Assessment of Lean Construction Practice in the Nigerian Construction Industry. In Ebohon, O. J., Ayeni, D. A., Egbu, C. O, and Omole, F. K. Procs. of the Joint International Conference (JIC) on 21st Century Human Habitat: Issues, Sustainability and Development, 21-24 March 2016, Akure, Nigeria, pp. 756-764
- Agada, S. J. (2017). *Plastic Waste Recycling Plant, Jos: Towards Achieving Effective Fire Safety in Industrial Buildings*. Thesis in the Department of Architecture, Faculty of Environmental Sciences. Submitted to the School of Postgraduate Studies, University of Jos, in Partial Fulfilment of the requirements for the award of the degree of Masters in Architecture of the University of Jos. Pp. 10 – 12.
- Ajoku, B.C., & Okoro, P.G. (2020). Plastic Waste and Environmental Sustainability in Obio/Akpor Local Government Area, Rivers State, Nigeria. *IOSR Journal of Humanities and Social Science (IOSR-JHSS)*. 25(5): 1 -8. DOI: 10.9790/0837-2505100108
- Alabi, O. A., Ologbonjaye, K. I., Awosolu, O., & Alalade, O. E. (2019). Public and Environmental Health Effects of Plastic Wastes Disposal: A Review. *Journal of Toxicology and Risk Assessment*. 5(1): 1 -13. DOI: 10.23937/2572-4061.1510021
- Ali, A. Y., Vivan, E. L., Ombugadu, A., Wambai, M. W., Dahiru, M. K., Njila, H. L., & Mafuyai, M. J.(2016). *Waste Generation, Collection and Management Pattern in Jos City of Plateau State, Nigeria*. Book of Proceedings of 2nd Annual Conference of FULafia (2016). pp. 213 – 229.
- Bello, M.M., Ogunrayewa, M. O., & Hassan, B. (2018). Examining the Prevalence of Contradictory Tendencies and Prognosis for the Problem of Slums in Nigeria. *International Journal of Geography and Environmental Management*. 4(1), 10 -24 ISSN 2504-8821
- Chigozie, C.A., & Jide, K.A. (2015). The Contemporary Roles of Architect and other Building Professionals “Panacea to The Menace of Quacks and Quackery in Building Construction Industry” *Civil and Environmental Research*, 7 (10), 68-75.
- Daniel, M.O., Wapwera, S.D., Akande, E.M., Musa, C.C., & Aliyu, A. A. (2015). Slum Housing Conditions and Eradication Practices in Some Selected Nigerian Cities. *Journal of Sustainable Development*. 8(2):230-241
- Danladi, F.O. (2019). Follow the Plastic: Research Report on Plastic Waste in Jos, North Central Nigeria. Research Report on Plastic Waste in Jos, North Central Nigeria. pp.1-50.
- Hamma-Adama, M., & Kouider, T. (2017). Causes of Building Failure and Collapse in Nigeria: Professionals’ View. *American Journal of Engineering Research (AJER)*, 6(12), 289-300.
- Ilyas, M., Ahmad, W., Khan, H., Yousaf, S., Khan, K., & Nazir, S. (2018). Plastic Waste as a Significant Threat to Environment – A Systematic Literature Review. *Environmental Health*. 1-24. <https://doi.org/10.1515/reveh-2017-0035>

- Ishaku, D. (2013). FG Pledges to phase out the production of non- biodegradable waste in Nigeria. A speech presented by the supervising minister of Environment December 2013 (<http://www.gov.ng/index.php/news-media/press-release>).
- Kehinde, O., Ramonu, O. J., Babaremu, K.O., & Justin, L.D. (2020). Plastic wastes: environmental hazard and instrument for wealth creation in Nigeria. *Heliyon* 6 (2020) e05131. pp. 1 -7. <https://doi.org/10.1016/j.heliyon.2020.e05131>
- Lekwot, E.V., Yakubu, A. A., Kwesaba, A.D., & Sahabo, A.A. (2015). An Analysis of Inner City Decay: A Study of Some Selected Slums in Jos Metropolis, Plateau State, Nigeria. *International Journal of Scientific & Technology Research* 4(2), 171-176.
- Musa, J., & Dung-Gwom, J.Y. (2018).Assessment of urban regeneration activities in the central area of Jos town, Nigeria. *UPLanD – Journal of Urban Planning, Landscape & Environmental Design*, 3(1), 75-88.
- NPC (2019). National Population Commission and the National Bureau of Statistics, Nigeria.
- Onwuka, S. U., & Ajator, U. (2018). Evaluation of People’s Perception on Plastic Waste Management, a Study of Nnamdi Azikiwe University in Awka Anambra State. *International Journal of Environment and Pollution Research*. 6(2): 54 -69.
- Pavani, P., & Rajeswari, T.R. (2014). Impact of Plastics on Environmental Pollution. *Journal of Chemical and Pharmaceutical Sciences*. (3): 87 -93.
- Sani, A. A., Hassan, O. S.,Sani, M., & Kawuwa, A. S. (2016). Trash to Treasures Exploring ‘Re-Material’ In Architecture as a Means of Reducing Waste Generated in Urban Centres. In Ebohon, O. J., Ayeni, D. A, Egbu, C. O, and Omole, F. K. Procs. of the Joint International Conference (JIC) on 21st Century Human Habitat: Issues, Sustainability and Development, 21-24 March 2016, Akure, Nigeria, page number 433-439
- Sati, Y.C. (2015). User Perception of Green Spaces in the Context of Architectural Composition of Jos Metropolis, Nigeria. *Journal of Environment and Earth Science*, 5(18), 74-101.
- Sustainable Development Goals | UNDP. Retrieved March 12, 2023 from <https://www.undp.org/content/undp/en/home/sustainable-development-goals.html>
- The challenge of slums: global report on human settlements, 2003 / United Nations Human Settlements Programme. Earth scan Publications Ltd.
- UNEP, (2005): Municipal solid waste in the United States, 2005 Facts and Figures.
- United Nations (2019). *The Sustainable Development Goals Report 2019*. New York, United Nation Publication. Retrieved from <https://unstats.un.org/sdgs>
- Wash, P.M., Omar, S. I., Mohammed, B., & Isa, M.I. (2022).The Recreation as a Social Factor in Urban Development: A Response to COvid-19 Pandemic in Greater Jos, Nigeria.

International Journal of Built Environment and Sustainability, 9(2-3), 91-101. DOI: 10.11113/ijbes.v9.n2-3.1042.

Yakubu, A. J. (2017). *The Waste Management System in Low Income Areas of Jos, Nigeria: The Challenges and Waste Reduction Opportunities*. A thesis submitted in partial fulfilment of the requirements of the University of Brighton for the degree of Doctor of Philosophy. pp. 22 – 24; 134-136.

Zarma, I.H.J. (2018). Assessment of Solid Waste Disposal System in Jimeta, Adamawa State, Nigeria. *British Journal of Environmental Sciences*, 7(1): 43 -52.