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The impact of environmental education and awareness on the effective management of solid wastes among residents of Jos-Bukuru Metropolis, Plateau State, Nigeria

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ABSTRACT: This paper examined the impact of Environmental Education and Awareness on the Effective Management of Solid Wastes among residents of Jos-Bukuru Metropolis, Plateau State, Nigeria with a view to making recommendations on environmental awareness and education for the area. It is by examining the existing policy on environmental awareness and its effect on people's attitudes to solid waste management. It is by determining the relationship between attitude and solid waste management practices and also evaluating the influence of the level of environmental awareness on the solid waste management practices among residents. A structured questionnaire was used to obtain data from 400 respondents, selected through a systematic random sampling technique from six zones namely; Fari-gada, Angwan-Rukuba, Tudun-Wada, Rantya, Rayfield and Bukuru in the Jos-Bukuru metropolis. The data obtained from the questionnaire were analysed using spearman's rank correlation (rho) and analysis of variance (F-ratio) statistical techniques. The results obtained showed that there was a provision for a policy on environmental awareness and its effects on people's attitudes to solid waste management. Also, there was no relationship between attitude and solid waste management practice in Jos Metropolis and there was a low level of influence of environmental awareness and education on people's attitudes towards solid waste management in Jos Metropolis, Nigeria. Based on these results a set of recommendations was made to help policy makers, practitioners and the academia in solid waste management.

Keywords: Education, environmental awareness, Jos-Bukuru, solid waste management.

INTRODUCTION

In recent years, anthropogenic activities have emitted various trace elements into ambient environments; some of such elements are solid waste deposits from human activities. Solid waste includes waste materials arising from domestic, commercial, industrial, agriculture, mining activities and public services amongst others. It is any movable solid object that the owner decides to dispose of (Obi-Anija, 2016).

Solid waste is disposed of in dumpsites on designated land either owned by the government or private owner and in some cases in burrow pits and empty spaces unauthorized. Hence, the attitude of residents on indiscriminate dumping of solid waste in strategic locations mounting to heaps of refuse and pervading dirty environments has bred concern. Human attitude toward solid waste management was investigated in a location that serves as a receptacle. When the refuse dumped remains un-evacuated, they constitute dirtiness and hazards (Floyd, 2013). Most of the environmental problems are caused by manmade pollution which not only damages natural resources, but also its effect is also dangerous as there are no effective policies put in place to encourage waste minimisation, re-use, recycling, and reduction as presented by Obi-Anija (2016).

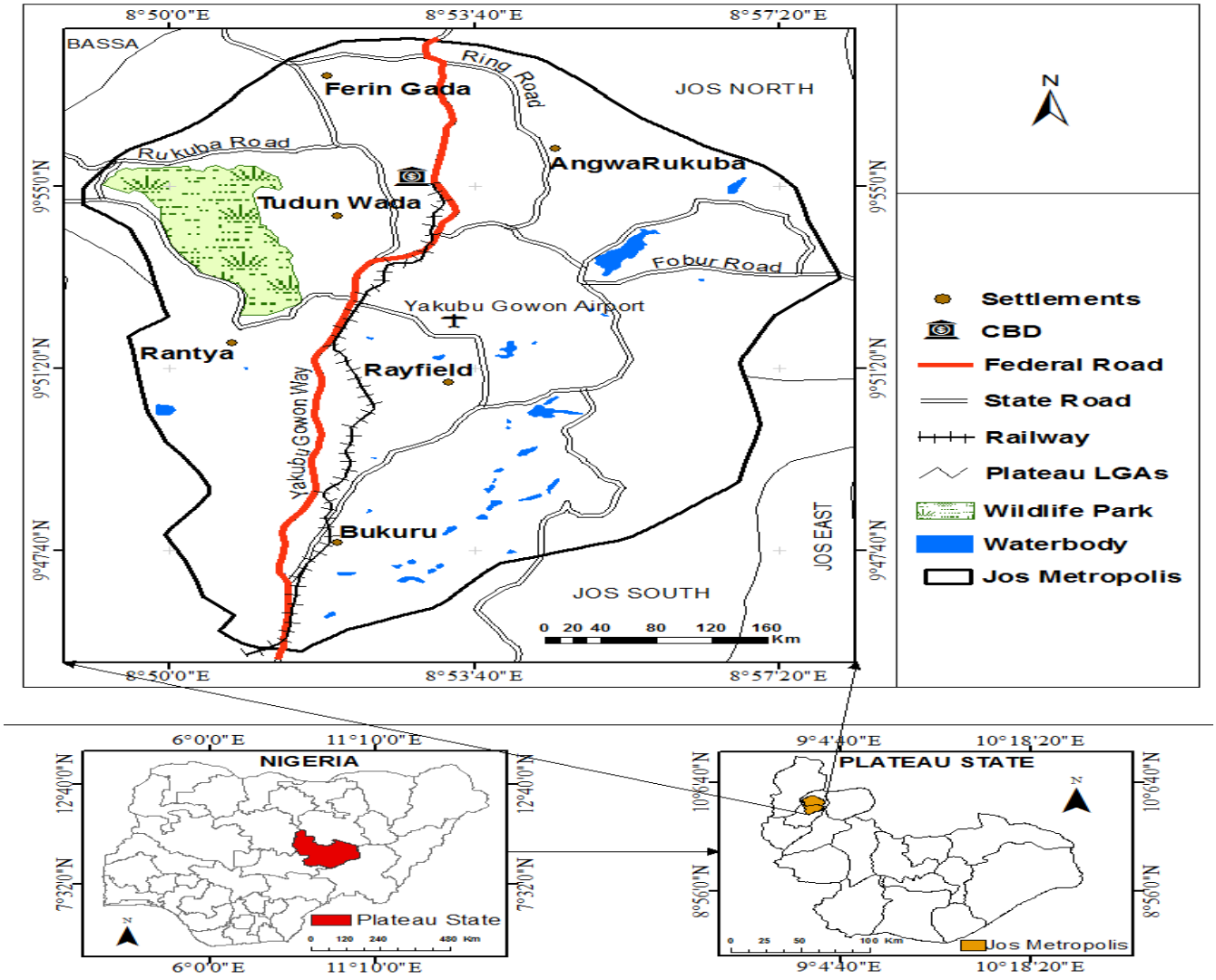

Figure 1. Jos metropolis, Nigeria within the Nigerian context.

The society believes it is the government's sole responsibility to collect and dispose of solid waste. But where the evacuation of the dumpsite is delayed or left un-evacuated, the stench becomes toxic. Waste comprises household garbage, rubbish, yard waste, commercial refuse, street cleaning, dead animals, bulky waste, abandoned vehicles, hospital waste and sanitation residues or weeds. With the compendium of the listed solid waste, its management becomes very pertinent (Lamond et al., 2012).

In many developing countries, most of the waste generated is indiscriminately dumped on the streets, market places, homes, roadsides and open land. These wastes find their way into water ways and drainage systems resulting in serious environmental problems in the urban area which is expected to be a planned part of the state with a master plan. A good planning approach has a great tendency to contribute to general physical development because it has the capacity to deliver pro-poor planning for solid waste management from which the Local and State, as well as the National and Regional levels, can bring about sustainable urban solid waste management for a lively city or an urban area. This is necessitated by the fact that there is no effective development of solid waste management plans in most cities in developing countries (Abang, 2016).

The choice of Jos metropolis, Nigeria, is informed by the fact that it is the administrative capital and commercial centre of Plateau State, one of the 36 states of the Federal Republic of Nigeria (Figure 1). The study area covers a land area of approximately 1362 km^2 and it is made up of six local government areas/councils (Jos North, Jos East, Jos South, Bassa, Barkin Ladi and Riyom Local Government Areas) which are jointly referred to as Jos Metropolis. It is located in the North central geo-political region, 3 hours away from the Federal Capital Territory

(Abuja) by road. It lies between latitude 09° 52′ N and longitude 008° 54′ E. Jos is connected to other Nigerian cities by air, rail and road. The metropolis is experiencing an increasing population; it has a population of 1,315,301 according to the 2007 population census with a growth rate of 4.5%. It is one of the planned towns (Bingel, 1978), in recent times, some residential areas in Jos have developed into slums over time. The region has had violent attacks by a group of religious extremists known as “Boko Haram” meaning western education is a Taboo. Unless the planning authorities become more determined to address the issue of urban waste and management, the situation is likely to degenerate. Additional details on Jos Metropolis is presented in Figure 1.

The theory adopted for this study is the institutional deficiency theory. The theory relates to the effective management of the solid waste in the Urban Jos metropolis, of Plateau State, Nigeria. In the Greater Jos urban metropolis, Nigeria, there are not enough public waste receptacles for waste. Solid waste dumps are located on the side of the highway and when it accumulates, households and businesses pile them up in the major road median without any concern for the pollution. This is largely due to the inadequate funding of the agencies saddled with the responsibility of waste generation and its management, inadequate man power, bureaucratic bottleneck and red tapism and high level of corruption amongst others as argued by Mahalingam and Levitt (2007). It is in the light of the above-mentioned problem that this paper seeks to examine the level of environmental awareness and education on solid waste management in Jos-Bukuru Metropolis, Nigeria with a view to developing a framework for environmental awareness and education by considering the level of environmental awareness and education; and identifying and examining planning strategies adopted to address the solid waste management using the physical planning approach for the area.

LITERATURE REVIEW

Environmental awareness, knowledge and practices of solid waste management

A discussion on the environmental awareness, knowledge and practices of solid waste management will go a long way in bringing about in-depth understanding as it relates to the subject matter. The creation of awareness about solid waste management will be followed by the level of knowledge about solid waste management and finally on the practice by individuals and organisations both private and government/public on the solid waste management.

The past two decades have delivered a number of studies throughout the world that were conducted on combinations of the awareness, knowledge and practices of school students with regard to waste management (Hausbeck, 2013). No studies could however be found in international and Nigerian literature where the combination of awareness, knowledge and practices of school children with regards to waste management was studied. The following subsections will discuss the literature found in each of the aspects: awareness, knowledge and practice and the relation to waste management.

Awareness and solid waste management

Awareness is the state or ability to perceive, feel, or be conscious of events, objects, or sensory patterns. In this level of consciousness, sense data can be confirmed by an observer without necessarily implying an understanding (Oxford Dictionary, 2013). Education and awareness are often crucial and a key part of any country’s waste management strategy. This is also the case for Nigeria’s integrated waste management strategy under the national environmental management waste Act (Act 59, 2008).

Korai et al. (2017) state that “components of environmental awareness can be classified into two aspects: perception and behaviour, that is, the perception of environmental problems and the behavioural inclination to protect the environment. The perception of environmental problems involves people’s objective knowledge, perception and environmental realities”. A number of studies propose that environmental education is an integral part of raising environmental awareness in its citizenry. Education would raise their environmental awareness and improve their knowledge so that they could make informed and responsible decisions as adults (Littledyke, 2016).

From the international literature, there is strong evidence which suggests that awareness and attitudes towards waste generation and management are critical to supporting the human race’s endeavour to address the current waste management challenge. Literature on the environmental awareness of children is not abundant in the case of Nigerian studies. It is also indicated that the environmental curriculum in schools needs to be evaluated to ensure a quality environmental education to children to increase knowledge and awareness. Furthermore, in a related study in Iran and India by Shobeiri *et al*. (2007), it was revealed that it is necessary to give mass awareness to the impact of waste disposal practices from the beginning of school education. Also it is pertinent to be committed to environmental education which will inculcate a proper and appropriate environmental culture in the students. The study revealed awareness of e-waste disposal is lacking, therefore, there is an urgent need to rectify this gap in knowledge and practice.

Knowledge of solid waste management

According to the Oxford dictionary (2013) the definition of knowledge is: *“knowledge is a familiar with someone or something, which can include facts, information, descript-*

tions, or skills acquired through experience or education. It can refer to the theoretical or practical understanding of a subject. It can be implicit (as with practical skill or expertise) or explicit (as with the theoretical understanding of a subject); it can be more or less formal or systematic".

Knowledge with regards to a specific subject is intimately linked to some form of education in that subject. Education has been recognized to possess the capability to meet these challenges through promoting awareness and knowledge on various environmental issues, changing the attitudes of people, generating critical thinking, actions and working towards achieving sustainable development. Education should also aim to increase public awareness about environmental problems and their solutions and provide required skills and knowledge.

However, attitude cannot be changed by simple education. Wahid (2015) stated that: *"Acceptance of new attitude depends on the knowledge obtained, how it is presented, how the person is perceived, the credibility of the communicator, and the conditions by which the knowledge was received".* Research in social sciences has also shown that knowledge on a selected topic may increase; people may even change attitudes, but that the step to improved behaviours and practice depends on a complex set of social and psychological factors (Wahid, 2015).

Hassan (2004) reported that people's environmental knowledge is highly specific to the issue and geographic scale and this was supported through research adds that one of the reasons for poor decision making in environmental issues is a lack of basic environmental knowledge as argued by Ifegbesan(2010). Knowledge can therefore be seen as a critical component, in determining a person's understanding of environmental issues and therefore environmental awareness that leads to practice. Most research in recent times has shown that 40 per cent of people involved in environmental activity could be explained in terms of their knowledge. However, there are a number of studies that indicate that although a person's awareness and behaviour are directly impacted and affected by knowledge, their commitment and sound environmental practice remain the responsibility of the individual and their attitude towards the environment (Dunlap, 2015, Akintunde, 2017). Based on the results of the literature cited it is vital to assess and understand the citizens' knowledge to enable a more accurate understanding of responses towards awareness and practice as evaluated in this study.

Practice solid waste management

Practice is the actual application or use of an idea, belief, or method as opposed to theories about such application or use (Oxford Dictionary, 2013). In an ideal world, all people on earth should demonstrate high levels of good practices and responsibility regarding environmental matters including waste management. Rim (2018) highlighted that research has shown that awareness and knowledge of environmental matters may increase, people may even change attitudes, but that the critical steps to improve behaviour and practice are dependent on a complex set of social and psychological factors. It is however imperative to translate all knowledge, awareness and attitude into practice because without effective practice actual results will not materialize in the solving of complex and integrated problems such as waste management (IUCN, 2010). Therefore, there must be a constant drive to encourage and promote awareness through education towards effective waste management and sustainable environmental practices. School students in general have poor waste management practices all over the world and a number of papers have investigated the link between poor waste management practice and aspects such as awareness, attitude and knowledge (IUCN, 2010). In most cases, these studies found direct correlations between poor waste management practices and a lack of environmental knowledge and awareness. They also highlighted that a more active and focused approach is required to put all the philosophy from environmental studies into good practice towards sustainable development.

If word is not put to deed all research efforts will be pointless and poor waste management will be a consistent problem for the future human race. This focussed approach to turning philosophy from environmental studies into good practice towards sustainable development is also critical for Nigeria. There is a need to embrace the contribution of the country's citenzry in the effort of achieving sustainable development. Fundamentals in the understanding of awareness, knowledge and practice in waste management can contribute to improved waste management, improved education and evidently to a more sustainable future.

Effectiveness of the authorities saddled with solid waste management

Waste can be defined in many forms depending on the category or context it is being used. It can basically be defined as any material considered to be useless, which means, it is no longer needed for its intended purpose. Wastes can be seen from two perspectives which are based on their primary and secondary function. In regards to the primary function, something becomes a waste when it cannot perform its actual purpose. On the other hand, when something is no longer useful to someone, it is useful to another person thus someone's waste could become another's raw material. Furthermore, waste according to the EU Waste Directive (Article 1(a) of Directive 75/442/EEC), is any substance that the owner discards or intends to discard. Lutui (2011) considers waste as any material classified to be waste by national legislation or

Table 1. Sources and Types of solid waste

SN	Source	Types of solid waste
1	Residential	Food wastes, rubbish, ashes, paper, cardboard, plastics, textiles, special wastes
2	Commercial/Municipal	Food wastes, rubbish, ashes, demolition, Paper, cardboard, plastics, wood, glass, metals, special and construction.
3	Industrial	Demolition and construction wastes, special wastes, occasionally hazardous wastes, Housekeeping wastes, packaging, and food wastes.
4	Open areas	Special wastes, rubbish, paper, plastics, and glasses.
5	Treatment plant site	Treatment plant wastes, principally composed of residual sludge
6	Agricultural	Spoiled food wastes, agricultural wastes, rubbish, hazardous wastes

Source: Sangufta (2010) and Biswas (2012).

any materials that are no longer useful that need to be discarded.

Solid waste is made up of organic and inorganic waste materials, a product of human and animal activities and that is no longer needed and needs to be discarded due to its value loss to the user and its subsequent disposal indiscriminately making the environment unhealthy and prone to and causes diseases such as cholera, dysentery and diarrhoea amongst others (Chengula *et al*., 2015). Waste is generated from many sources such as; domestic household waste, industrial waste, commercial waste, agricultural waste, building and demolishing waste, amongst others as seen in Table 1.

Waste generated from many sources in most cities in Sub-Saharan Africa produces waste with a carbon content that is 40% greater than that of many developed countries. In many cities, waste is poorly managed hence uncontrolled refuse dumps and landfill sites produce large amounts of methane gas, which is linked to greenhouse gas emissions. Furthermore, the challenges of e-waste, produced from discarded electronic devices, are becoming a serious urban challenge (Amasuomo et al., 2015).

Solid wastes generated are different from country to country or region to region which means the management system also varies. Solid waste is generated due to a lot of factors which include the abundance and type of natural resources available, the lifestyle of citizens as well as their living standards. Solid waste is embarrassing and difficult to discuss with reason that policy-making and political discussions must deal with taboos in various localities which affects the process of arriving at achievable goals (UN-HABITAT, 2010).

In countries located in humid, tropical, and semitropical areas, wastes generated are characterised by a high concentration of plant litter whereas waste generated in countries with seasonal change may contain an abundance of ash due to coal or wood used for cooking and heating, especially during winter (UNEP, 2015).

The EU Waste Directive 2008, defines waste management as the collection, transport, recovery and disposal of waste as well as the supervision of the operations at the disposal sites. Management of solid waste is a problem in most developing countries as compared to developed countries. The difference between the developing and the developed countries is not only in waste composition but also in the standard of waste management services provided.

It is seen in the attention given in developing countries to the attainment of proper collection, treatment and disposal whereas developed countries are concentrating on turning waste into resources. Many of our developing countries especially in Africa are currently facing difficulties in dealing with solid waste management, from the collection, treatment to disposal since waste is not considered to be a resource, hence, the inability to generate wealth by most countries from this venture (Mungure, 2017). Since this is the case in many developing countries where Nigeria is not an exception, hence, considering the sustainability of such be put in place.

Sustainable development and solid waste management

The management of waste has become one of the most significant problems for mankind in this day and age. The urbanisation/industrialization of the planet by mankind has resulted in the production of waste volumes that are now growing to such an extent that it negatively impacts the planet's environmental systems (Woroniuk and Schalkwyk, 1998). The generation of these volumes of waste cannot continue indefinitely as it results in the total destruction of environmental systems that would also negatively impact the survival of the human race. It is from this risk to the environment that the concept of sustainable development evolved.

According to the United Nations (1987), "Our Common Future: Report of the World Commission on Environment and Development" the definition of sustainable development was first released in 1987 by the United Nations in the famous Brundtland Report (1987, p 27), which included what, is now one of the most widely recognized definitions: *"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs."*

According to the same report, the above definition contains within it two key concepts:

- *"the concept of 'needs', in particular the essential needs of the world's poor, to which overriding priority should be given; and*
- *the idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs."*

The efforts toward sustainable development in Nigeria would have significant challenges, some of the most pronounced challenges are that Nigeria has one of the largest income inequalities of any country in the world, overcrowding of the population in the townships and weighty dependence on the export of non-renewable minerals. These challenges are still prevalent today and directly impact the effective application of the concept of sustainable development in Nigeria (Munslow and Fitzgerald, 1997).

The concept of sustainable development is rooted in a systems approach of thinking; to recognize and successfully fulfil this concept the human race will need to do introspection; understand the environment and the number of serious complex problems associated with effectively managing nature and its resources. As highlighted in the section above, waste management is one of the complex problems mankind will have to understand together with introspective evaluation of how mankind will realize sustainable development (IPCC, 2014).

Historically, the focus of waste management was a cleansing function only. This includes waste storage, collection, transport and disposal. The management of waste in this way upholds and protects public health and quality of life, by removing the waste from the living band working areas. The removal of waste was seen as the fundamental core of basic waste management (Brown and Fraser, 2006; Wilson, 2007; UN-HABITAT, 2010). Waste removal and disposal is however only a short-term solution and can never be seen as the ultimate solution to waste management. Once the fundamental removal of waste is in place to uphold and protect public health the focus can shift towards promoting sustainability with regard to waste management. Appropriate solutions based on integrated waste management principles can then be considered. These solutions could potentially include the waste hierarchy of preferred options namely: Waste avoidance; reduction of waste at source; resource recovery; re-use; recycling; treatment and only as final option disposal. These solutions are not easy to achieve and will require a radical mind shift in society. However, the quest for zero waste and achieving sustainable waste management can be realized through the processes of awareness; education (knowledge) and the actual practice.

Environmental awareness and education about waste management has gone from strength to strength in Nigeria during the past two decades, not only in the government but also to some degree the awareness of the general Nigerian public. It is this awareness on the individual level which can develop into attitudes that will guide countries to sustainable development solutions for environmental problems such as waste management (Umuhire and Fang, 2016).

Individuals that are constantly adopting and modifying attitudes to fit their ever-changing needs and interest have attitudes that cannot simply be changed by education. Acceptance of new attitudes depends on who is presenting the knowledge, how it is presented, how the person is perceived, the credibility of the communicator, and the conditions by which the knowledge was received (Woroniuk and Schalkwyk, 1998; Plavsic, 2013).

Studies in the social sciences have shown that knowledge on a topic may increase people's understanding and may even change their attitudes, but that the step to improved behaviours and practices is dependent on a set of complex social and psychological factors. Han et al. (2018) argued that desired, behaviours and attitudes that are rewarded and reinforced are likely to be repeated and, ultimately, incorporated into an individual's personal value set and routine behaviour. It helps develop people's awareness, knowledge and attitudes and enables them to be effectively involved in sustainable development (Woroniuk and Schalkwyk, 1998). People's desired, behaviours and attitudes toward sustainable development are known as pro-environmental behaviour and refer to behaviour that harms the environment as little as possible or even benefits the environment which can best be acquired through the education of school students has also been advocated by many scholars (Plavsic,2 013).

Education and public awareness, as well as participation, is a critical component in any waste management program, in addition to appropriate legislation, strong technical support and adequate funding. Waste is a result of human activities and everyone needs to have a proper understanding of waste management issues, without which the success of even the best conceived waste management plan becomes questionable (Hasan, 2004).

Education of the public and the creation of awareness and attitudes to waste can affect all stages in the solid waste management process. This has an impact on household waste storage, waste segregation, recycling, collection frequency, littering and fly-tipping, wiliness to pay for waste management services and the level and type of opposition to waste treatment and disposal facilities (Gwom *et al*., 2014).

Waste management hierarchy

Everyone has the responsibility of ensuring a healthy environment by reducing the amount of waste generated. This responsibility has brought about waste management hierarchy with the aim of minimizing the amount of waste

Figure 2. Hierarchy of waste management (Source: Southern California Conversion Technology, 2015).

generated from entering landfill or dump sites. The earliest usage of the 'waste management hierarchy' appears to be Ontario's Pollution Probe in the early 1970s (Hoornweg and Bhada-Tata, 2012). Its emphasis is on the 3Rs which are Reduce, Reuse and Recycle. The hierarchy helps in the enhancement of economic activities and the habit of reducing environmental impacts from waste disposal (UNEP, 2018). Figure 2 shows the hierarchy of waste management (traditional waste hierarchy and new waste management paradigm).

The waste hierarchy is in pyramid form which shows how action must or needs to be taken. From the new waste management paradigm, the first action must be taken on the prevention, generation and reduction in the quantity of waste generated (e.g. through re-use), recycling, composting or anaerobic digestion, recovery and waste-to-energy and if energy is not recovered from processes then it ends up in the landfill. Waste disposal in landfills is the last resort only when waste can not be prevented, diverted or recovered in the preceding steps (Eco-Waste, 2018). This new waste management paradigm is the reverse of the traditional waste hierarchy with the aim of not ensuring compliance with waste management regulations. Its focus is on improving limited resources in the form of preventing waste generation as well as ensuring that waste is treated as a resource.

Handling solid waste: Handling solid waste in most developing countries are mostly two system approach which is the formal and informal system. The formal system is managed by the government where responsibilities are given to the municipality to ensure safe, reliable and cost-effective collection and disposal of solid waste which often requires large financial resources, making it very difficult to deal with waste management issues (Gombya and Mukunya, 2016). The informal system is managed by individual or private dealers which includes communities of scavengers and private associations. They usually see the potential aspect of certain materials for domestic purposes such as plastics, paper, bottles and cans. The private dealers charge for their operation or services from residents which involves collecting, sorting, recycling and selling waste (Eco-Waste, 2018).

In Africa, the problem of waste management is not only the accumulation of waste in cities or streets but also the ineffectiveness of waste management authorities and the government to tackle the problem of waste appropriately (Binbol *et al*., 2013). In order to understand the problems of waste management, it is therefore important to check policy structure, implementation strategies as well as the economic framework of the country. For effective governance to solve waste management problems, there is the need for adequate managerial and organizational structure, accountability and transparency in decision making (Mungure, 2017).

Environmental education on solid waste management

Lack of education and awareness of effective waste management practices is one of the major issues in developing countries. According to McAllister (2015), a study in Gaborone, Botswana, found that even though citizens were aware of recycling and other sustainable waste-management techniques, this did not necessarily translate into participation in pro-environmental activities such as recycling initiatives. This was also corroborated by Akintunde (2017), awareness and knowledge did not necessarily imply pro-environmental action. When people

lack interest in environmental issues, it means that they are not well informed which affects their actions and also makes them feel not included in waste management decision making.

In Nigeria, due to a lack of education and awareness in waste management, individuals in various communities turn to blame the government for improper waste management. McAllister (2015), observed that a lack of interest in the environment brings about a culture of non-participation of communities in decision-making processes which enhances the lack of responsibility for pollution and waste issues. When citizens are given education or awareness about waste, they turn to be informed as well as know the essence of waste management which will make them responsible. Keeping them informed or educated means improving their knowledge in waste management which will call for participation in decision making. The community's participation in waste management activities from decision making, and structural reforms among others, will increase their sense of belonging and ownership which can bring about improvement rather than blaming.

According to Martin and Garcia (2014) as cited in McAllister (2015), it has been recognized by researchers that it is important to create sustainable waste systems as well as promote environmental awareness and amongst citizens community members through improved public awareness and community participation in waste management.

A research conducted in Jos by Inyang-Abia and Usang (2015) concluded that, to overcome the solid waste crisis, "conscience of the individual needs to be raised through environmental awareness and concern, inculcation of sustainable consumption practices and education on waste management". They went further to say that environmental awareness and knowledge about environmental conservation were found to affect recycling attitudes positively, so, therefore, waste managers need to take steps to enhance the public knowledge of waste management (McAllister, 2015).

Legal mandate/basis of waste management in Nigeria

During the past two decades, Nigerians made significant strides in addressing key issues, requirements and problems experienced in waste management. The constitution of Nigeria (Act 108 of 1996) provides the foundation for environmental regulation and policy in Nigeria. The right to environmental protection and to live in an environment that is not harmful to health or well-being is set out in the Bill of Rights (section 24 of Chapter 2). "Everyone has the right to:

1. an environment that is not harmful to their health or well-being; and
2. have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that –

i. prevent pollution and ecological degradation;
ii. promote conservation; and
iii. secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development."

Prior to 1998, the Environmental Conservation Act (ECA) (Act 73 of 1989) was the only piece of legislation that addressed waste issues such as littering, permitting of waste disposal sites and regulatory competency. This was followed in 1998, by the Draft White Paper on Integrated Pollution and Waste Management for Nigeria. The White Paper advocated a shift from the focus on waste disposal and impact control to a more integrated approach to waste management and prevention as well as minimisation. In terms of legal changes, this has entailed national government drafting and promulgating legislation requiring the prevention and minimisation of waste.

Legislation governing waste in Nigeria

The Nigerian Constitution (Act 108 of 1996), the Constitution is the highest source of law in Nigeria. The Constitution is relevant to this study in two regards. Firstly, it contains an environmental right as well as certain administrative rights which provide a mandate for waste management regulation. Secondly, it also provides the regulatory mandate for the protection of everyone's right to have an environment that is not harmful to his or her health. Therefore, the constitution accordingly sets the broad framework for environmental governance and protection. Waste in Nigeria is currently governed by means of a number of pieces of legislation, including the Nigerian Waste Information Centre (2013): See Table 2.

The Legislative Acts related to waste management have significant strategies set to achieve some targets as discussed in the sections below. These strategies are targeted at a waste reduction based on the principles of the waste hierarchy (Table 3).

It is clear from the Nigerian waste legislation framework discussed above that there is significant fragmentation that needs to be addressed by the Nigerian Government. Legislative fragmentation is not conducive to sustainable environmental and governance efforts as observed by Kotze (2016). Kotze (2016) further states that fragmentation can be attributed to inter alia historical developments such as apartheid and that a developing country such as Nigeria also inherited fragmented and uncoordinated legislation that was not focused on sustainable development. It is then also proposed that fragmentation should be addressed as a matter of priority in all environmental legislation in Nigeria.

Fragmentation is a complex problem and not easy to solve, however possible solutions to overcome the

Table 2. Legislative Acts relating to waste management in Nigeria.

SN	Legislation on waste used in Nigeria	Act	Year
1	The Nigerian Constitution	Act 108	1996
2	Hazardous Substances Act	Act 5	1973
3	Health Act	Act 63	1977
4	Environment Conservation Act	Act 73	1989
5	Occupational Health and Safety Act	Act 85	1993
6	National Water Act	Act 36	1998
7	The National Environmental Management Act	Act 107	1998
8	Municipal Structures Act	Act 117	1998
9	Municipal Systems Act	Act 32	2000
10	Mineral and Petroleum Resources Development Act	Act 28	2002
11	NEM: Air Quality Act	Act 39	2004
12	National Environmental Management: Waste Act, 2008	Act 59	2008

Source: Compiled by author from various sources.

Table 3. Objectives and strategies set to reduce waste in the Acts.

SN	Objectives of the acts	Strategies
1	To protect health, well-being and the environment by providing reasonable measures for	(i) minimising the consumption of natural resources; (ii) avoiding and minimising the generation of waste; (iii) reducing, re-using, recycling and recovering waste; (iv) treating and safely disposing of waste as a last resort; (v) preventing pollution and ecological degradation; (vi) securing ecologically sustainable development while promoting justifiable economic and social development; (vii) promoting and ensuring the effective delivery of waste services; (viii) remediating land where contamination presents, or may present, a significant risk of harm to health or the environment; and (ix) achieving integrated waste management reporting and planning;
2	To ensure that people are aware of the impact of waste on their health, well-being and the environment;	(a) General campaign to educate the people from local government level to wards and community level on their health and environment (b) Fines are introduced for defaulters
3	To provide for compliance with the measures set out in paragraph (a) and	(a) Start a deliberate enlightenment campaign to educate the local communities on health and environmental sanitation
4	To give effect to section 24 of the Constitution in order to secure an environment that is not harmful to health and well-being of the people.	(a) Put up a regular sanitation exercise; monthly, quarterly to improve the environmental conditions

Source: Government of Nigeria, 2008.

problems generated by legislative fragmentation could be to reduce the fragmentation or to use tools such as quality education (Awareness and Knowledge). Quality education could lead to a better understanding of the fragmented legal framework and how to address the problems generated more effectively. Educating young and adults on environmental problems such as fragmentation of the legislative framework could have positive spin-offs for waste management, environmental management and sustainable development as a whole.

The attitude and behaviour of inhabitants towards waste management

The negative behaviours with solid waste management in most developing countries are on littering which has a lot of causes. These causes include a lack of social pressure to prevent littering, the absence of realistic penalties or consistent enforcement, and a lack of knowledge of the environmental effects of littering (Al-Khatib *et al*., 2015). Other causes are due to amount of litter found in a

particular location and the number of waste collection bins available on a site (McAllister, 2015).

Most communities have the attitude but not the concern of waste management which reduces their responsibility for the environment. This is the reason that most community members are not involved in decision making therefore develop the attitude of not concern which makes them not responsible for waste management (McAllister, 2015; Akintunde *et al*., 2019). This attitude differs among socio-economic groups. However, the attitude and behaviour of individuals can be positively influenced by implementing quality waste management systems to properly manage waste generated. When requirements for basic food and shelter absorb the attention of the largest portion of the community, then many environmental values are neglected. This means that people who satisfy or are satisfied with their basic needs are sensitive to the management of waste.

Level of awareness and attitudes to solid waste management

Public awareness and participation are critical components in any waste management program, in addition to appropriate legislation, strong technical support and adequate funding. Waste is a result of human activities and everyone needs to have a proper understanding of waste management issues, without which the success of even the best conceived waste management plan becomes questionable (Hasan, 2004).

Public awareness and attitudes to waste can affect all stages in the solid waste management process. This has an impact on household waste segregation, waste storage, recycling, collection frequency, littering and fly-tipping, wiliness to pay for waste management services and the level and type of opposition to waste treatment and disposal facilities (Gwom *et al*., 2014).

In general, people in Jos-Bukuru have a poor attitude towards waste management (Agunwamba, 2003), people who handle solid waste are mostly regarded as dirty, poor, and inferior. And carrying household waste to bins or waste collection sites is often regarded as a duty for children (Gwom *et al.*, 2014). According to Gwom (2016), it is not just the responsibility of the government to create awareness of the need for public information about environmental management processes, but, the individual also has an important role to play.

METHODOLOGY

The nature of the data used for this study is both quantitative and qualitative. The qualitative approach used was derived from secondary sources in the literature review of related and relevant sources. On the other hand, the quantitative approach adopted systematic random sampling. The quantitative data was derived from the 400 structured questionnaires administered. The two major sources of data were the primary and secondary sources of data. The primary data was obtained from the use of questionnaires, distributed to four hundred (400) respondents specifically from Fari-gada, Angwan-Rukuba, Tudun-Wada, Rantya, Rayfield and Bukuru in the Jos-Bukuru metropolis. The criterion for the selection of the survey respondents was based on the observation of the apparently the most affected area with heap of refuse within the study area, especially within the Jos-Bukuru Metropolis. The respondents were drowned from the study area, they are basically household heads from the general population within Jos North and south Local Governments of the State. The secondary data was gotten from the relevant literature, maps and some important geographical information regarding the study area Jos-Bukuru metropolis. The data obtained from the questionnaire were analysed using spearman's rank correlation (rho) and analysis of variance (F-ratio) statistical techniques. The data obtained from the secondary sources and the face-to-face interview conducted were analysed using the content analysis.

RESULTS AND DISCUSSION

Environmental awareness of solid waste management

The study explored the linkage that ensures effective flow of information from one part of a system (Jos South LGA), to another, as it is obtained within the metropolis on the environmental awareness and its effects on the people's attitude to solid waste management. It is an important aspect to be considered as it relates to environmental awareness as it relates to the institutional framework, legal and administrative frameworks that affect the solid waste management in the Jos metropolis, Nigeria. The relationship between the use of the policy on environmental awareness and solid waste management in Jos metropolis was explored using the spearman correlation (Table 4).

Table 4 shows the distribution of the ranked data from environmental awareness and solid waste management and the analysis of correlation shows a value of 0.139. The Correlation was used to measure the strength of the relationship between variables. Hence, it shows that there is a weak relationship between environmental awareness and solid waste management in Jos metropolis, the study area. This has also confirmed the work of Shobeiri *et al*. (2007) in Iran and India.

The implication of these results means that there is arrangement for policy on environmental awareness and that people are the aware of solid waste management system in Jos metropolis for the State and Local Governments. Furthermore, it indicates that there is a possibility that there is a high level of awareness about solid waste management in Jos metropolis, which did not translate to positive waste management practices,

Table 4 Correlation: Relationship between environmental awareness and solid waste management.

Environmental awareness		Solid waste management	
Rank	**Outcomes**	**Rank**	**Outcomes**
1	32	1	56
2	16	2	18
3	20	3	16
4	48	4	24
5	84	5	64

Source: Authors field work, 2018.

considering the poor waste management practices in the metropolis.

The constraint is manifested in the non-provision of equipment, qualified manpower and inadequate funding of the agencies. This has made the operating practices of solid waste management authorities erratic; leading to haphazard dumping of waste in the study area. As a political commitment on the part of the government, plans were prepared at both the Local Government and State levels. The preparation and implementation of the plans are political commitments to the people but, as observed by 50% of the respondents, while these stages were ongoing many stakeholders were not involved. Those in the Local Government were not involved but were in direct contact with the community.

The implementation of the waste policy and plan has been constrained as the institutions have no control over the dumping of solid waste. The political environment of the government tiers lies in their powers to operate as the government of the people, for the people and by the people and its authority is concerned with the politics and the way in which it operates and influences decisions. Understanding the law and the outcome of the political process is, therefore, fundamental to practitioners. The political constraints and the non-implementation of the solid waste plan, there is, thus, a need to reform the political structures within which the waste management authorities operate and to measure their ability to support credible policy commitments. The institutions that control solid waste management within each jurisdiction are very vital, and as observed earlier, the institutions represented at this point are the State and Local Governments.

The reason could be that smaller authorities have less power in the political process unless they establish a coalition and configure a reasonable lobbying strategy. The issue of lobbying determines how plans are designed and implemented because it is as a result of the good lobby that an organisation is financed to build and achieve its aim. The impact of plan implementation is felt more strongly at state and local government levels than at the federal level. This is because, at state and government, levels of awareness of culture, religion, social, welfare and economics abound. Furthermore, whilst efforts are being made to sensitize the general public to the provisions contained in the waste plan, a greater section of the population must be able to read the recommendations made about the general efforts made towards addressing the solid waste generated, collected and disposed. See the work of Shobeiri *et al*. (2007) in Iran and India and Ifegbesan (2010) in Ibadan Nigeria.

Effectiveness of waste management authorities in solid waste management practices

The relationship between attitude and solid waste management practice in Jos Metropolis determines how clean and hygienic environment could be found, hence the question here is what is the level of effectiveness of the solid waste management authorities and solid waste management practice in Jos Metropolis?

Further analysis of the data collected showed details on the state of the effectiveness of the waste management organisations in Jos Metropolis, Nigeria (Table 5). In Table 5, an F value of 2.33 and the F-critical (crit) value of 2.38 was obtained. Since the value of F is greater than the value for F crit., the research hypothesis could not be accepted. It means that the level of effectiveness of the solid waste management authorities and solid waste management practice in Jos Metropolis, Nigeria is high. The major problem with this result is the fact that why is the urban area still unkempt and not beautiful over the past five years. See IPCC (2014) on the synthesis report summary for policymakers where issues related to the effectiveness of waste management authorities in solid waste management practices were raised.

The level of environmental education on solid waste management and practice

The level of environmental education on solid waste management and practice among residents was obtained from data collected from Jos metropolis, Nigeria (Table 6). The table shows the analysis that F value = 5.10 and P value = 1.94. The p-value is greater than the F value. Base on the rule for making the decision which stated that: if the critical F ratio is greater/equal to the P value at alpha 0.05,

Table 5. Analysis of effectiveness the waste management orgainsations in Jos Metropolis, Nigeria.

Source of variation	SS	df	MS	F	P-value	F crit
Between Groups	17.824	4	4.456	2.338263	0.053609	2.380876
Within Groups	1896.16	995	1.905688			
Total	1913.984	999				

Source: Authors field work, 2018.

Table 6. Level of environmental education on solid waste management and practice.

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	73.45778	8	9.182222	5.107508	2.62E-06	1.943564
Within Groups	3219.84	1791	1.797789			
Total	3293.298	1799				

Source Authors field work 2018.

we disagree with the statement. Therefore, it says that the level of environmental awareness and its effects on people's attitude to solid waste management is not pronounced and as such there are no sections responsible for solid waste management in Jos Metropolis, Nigeria. The implication of these results means that there is a low level of environmental awareness and its effects on people's attitude to solid waste management in Jos Metropolis, Nigeria. This has also confirmed the works of Ifegbesan (2010) who revealed that secondary school students from an area in Ibadan, Nigeria were aware of waste problems in their school compounds, but possessed poor waste management practices. The study also showed that the propensity for waste management practices differs by sex, class and age of students and finally, it showed significant relationships that exist between students' sex, age and class and their level of awareness, knowledge and practices of waste management. This was also acknowledged and verify the work by Shobeiri *et al*. (2007) in Iran and India where a comparative study of environmental awareness among secondary school students revealed that committed environmental education will inculcate a proper and appropriate environmental culture in the students because there is a low level awareness on e-waste disposal, hence, the need for urgent attention to rectify this gap in knowledge and practice.

Conclusion

This paper examined the level of environmental awareness and education on solid waste management in the Jos-Bukuru Metropolis, Nigeria, with a view to developing a framework for environmental awareness and education for the area. This was done by a careful examination of the existing policy on environmental awareness and its effect on people's attitudes towards solid waste management; determining the relationship between attitude and solid waste management practices; and evaluating how the level of environmental awareness influences the practice of solid waste management among residents. Hence, it was found that:

1. There was a high level of awareness about solid waste management in Jos metropolis, Nigeria, however, the question remains, why is the metropolis not always in a constant state of cleanliness?
2. The level of effectiveness of the solid waste management authorities and solid waste management practice in Jos Metropolis, Nigeria is high.
3. There was a low level of environmental education on solid waste management and its effects on people's attitudes in Jos Metropolis, Nigeria.

Recommendation

Based on that the results obtained, the following recommendations were made, that;

1. There is a need to make arrangement for policy on environmental awareness on solid waste management in Jos metropolis. It is pertinent that a related and relevant policy be developed and implemented.
2. The fact that there is a high level of effectiveness of the solid waste management authorities and solid waste management practice in Jos Metropolis, Nigeria, there is need for a constant attention to ensure solid waste management practice is maintained for sustainability.
3. There is a low level of environmental education on solid waste management in Jos Metropolis, Nigeria, hence, there should be a continuous campaign to ensure regular updates for sustainability.

CONFLICT OF INTERESTS

The authors declare that they have no conflicts of interests.

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