



Public Awareness Regarding E-Waste Hazard and its Effect on Purchasing and Disposal Habit in Kaduna South Local Government Area, Kaduna State

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Abstract

This study examined Public Awareness Regarding E-Waste Hazard and its Effect on Purchasing and Disposal Habit in Kaduna South Local Government Area of Kaduna State. The study here attempted to assess this aspect of the e-waste situation through the use of questionnaire to families, formal & informal e-waste collectors, manufacturers, dealers, consumers and government officials in Kaduna South LGA, a large part of the city of Kaduna Metropolis. Insight from various respondents and workers were also sought. It was found that most respondents do not participate in formal e-waste recycling systems, are not aware of any specific details about the health and environmental hazards of e-waste, and do not know about any e-waste Act or legislation. 52.5% of the respondents believe that the knowledge of e-waste hazard definitely will influence their attitude toward disposal of e-waste. 58.5% of the respondents are not aware of e-waste hazard on health and environment. While 66.5% of the respondents are not aware of any policy/ regulation on e-waste including the 16.5% that are not sure or undecided about knowing any e-waste legislation in the state. Additionally, only about one quarter have the knowledge of the possibility of reusability of used electronics. Majority of the respondents purchased electronic products due to the desire for new technology and need for greater functionality. However, they lack direct contact to dispose off the older and damaged electronics for recycling or economic reward once the electronics are damaged or obsolete. Therefore, public awareness campaign should be done through the use of public media such as billboards, posters, TV/ Radio sets to convey the message to the target audience. Finally, informal waste collectors and scavengers could be gainfully employed to collect and submit discarded e-waste, to help mop-up wrongly disposed e-waste.

Keywords: Environmental Health, E-waste Hazard, Disposal, Dumpsites, Reduction, Re-use, Recycle, Recover, (WEEE) Waste Electrical and Electronics Equipment.



Introduction

Studies conducted on Indian e-waste policy awareness described public awareness of government policy and e-waste hazards as key to both active participations in management systems and the ability to put pressure on producer compliance towards e-waste management (Sinuj, 2014). The level of public awareness regarding e-waste hazards, purchasing, disposal and management strategies in Nigeria determines the level of e-waste generation and contamination (Ongondo *et al.*, 2011). Thus, with the proper public infrastructure and greater awareness, the government could motivate the public to partake in e-waste management strategies (Afroz, Masud, Akhtar, and Duasa, 2013).

Most Nigerians make use of and dispose off old or damaged electronic devices without any prior knowledge of the composition of such waste, their effects on health and environment and the regulatory laws governing the disposal of such waste (Ongondo *et al.*, 2014). Consumer electronics are the fastest growing sector of municipal solid waste (MSW) in both developed and developing countries and arguably one of the most toxic (Osibanjo, 2007). Hence, the need to improve the level of awareness on electronic waste generation and disposal is a matter of urgency, in order to prevent future catastrophic events related to e-waste (Ongondo *et al.*, 2014). Knowledge is key to getting a solution to the problem of e-waste generation and disposal (Ongondo *et al.*, 2014).

The study was limited to Kaduna South LGA in Kaduna Metropolitan area. It has an area of 59km² and a population of 605,049 according to the 2006 national population census. Kaduna South LGA is among the three Local Government Areas that made up Kaduna metropolis: these include Kaduna South, Kaduna North and Chikun LGAs, making up the Capital of Kaduna State (Kaduna State Environmental Protection Agency, 2019). The study shall be covering on the public awareness regarding e-waste hazards, purchasing, disposal habits and challenges related to e-waste management in the state (KEPA, 2019). The international boom in technological innovation has propelled the global electronics industry to become the largest manufacturing industry in the world (Wath, Sushant, Dutt & Chakrabarti, 2011).

The International Telecommunication Union, ITU (2020) reported, discarded electrical and electronic equipment (such as phones, laptops, fridges, sensors and TVs) is referred to as e-waste or Waste, Electrical and Electronic Equipment (ITU, 2020). E-waste is a growing challenge, matching the growth of the information and communication technology (ICT) industry (ITU, 2020). Currently, there are more mobile cellular subscriptions on earth than there are humans (ITU, 2020). Studies carried out by the International Telecommunication Union (2020), emphasized that since 2014, the global generation of e-waste has grown by 9.2 million Metric tonnes (Mt) (21%). The fate of over four-fifths (82.6% or 44.3 Mt) of e-waste generated in 2019 is unknown, as well as its impact on the environment (ITU, 2020).

Improper e-waste management contributes to global warming, especially since refrigerants in some temperatures are potent greenhouse gases exchangers (ITU, 2020). A total of 98 Mt of CO₂-equivalents were potentially released into the atmosphere globally in 2019 from the discarded fridges and air conditioners that were not managed in an environmentally sound manner (ITU, 2020). Hazardous chemicals typically found in e-waste include (but are not limited to) various heavy metals—mercury, cadmium, and lead—Brominated Flame-Retardant plastics (BFRs) that can easily be converted into dioxins and furans when burned at high temperatures, and polychlorinated biphenyls (PCBs) (Terada, 2012).

It contains more than a thousand different substances, which fall under “hazardous” and “non-hazardous” categories (Terada, 2012). Broadly, it consists of ferrous and non-ferrous



metals, plastics, glass, wood and plywood, printed circuit boards, concrete and ceramics, rubber and other items (Terada, 2012). Iron and steel constitute about 50% of the WEEE followed by plastics (21%), non-ferrous metals (13%) and other constituents (Terada, 2012). Non-ferrous metals consist of metals like copper, aluminium and precious metals like silver, gold, platinum, palladium and more (Wath *et al.*, 2010). The presence of elements like lead, mercury, and arsenic, cadmium, selenium, and hexavalent chromium and flame retardants were beyond threshold quantities in WEEE, which e-waste classifies as hazardous waste (Wath *et al.*, 2011).

A similar public awareness study was conducted in Kuala Lumpur, which is the capital city of Malaysia, a country with similar issues of domestic production and import of WEEE to India (Afroz, Masud, Akhtar, and Duasa, 2013). The researchers found that 59% of respondents had some knowledge about the health and environmental impacts of e-waste, and that 65% considered environmental factors when purchasing electronics for household use. Unfortunately, very few respondents seemed to put this knowledge to its full use, as only 2-3% were involved in the recycling of e-waste. However, 52.5% of households surveyed were willing to pay to improve the WEEE management system in Kuala Lumpur (Afroz, Masud, Akhtar, and Duasa, 2013).

The United Nation Environmental Protection (UNEP) (2017), defined electrical and electronic products (e-products) as any household or business item with circuitry, or electrical components with power or battery supply. This includes products from basic kitchen appliances to computers to cellphones (UNEP, 2017). The significant potential risks and adverse hazardous effects of e-wastes to humans, livestock and ecosystem were established to be on the increase (Central Pollution Control Board, 2003). Every day, household use e-products, which are also becoming increasingly integrated in transport, energy supply, health, and security systems, making them a major part of modern society (UNEP, 2017). These gadgets become e-waste when it is useless, damaged, nonfunctional or obsolete to use (UNEP, 2017).

However, research by Azodo; Ogban and Okpor (2017), stated that lack of awareness and cautionary information on effective and appropriate management operations associated with this e-waste may pose potential threat to human health and the environment. Wath *et al.*, (2011) expressed that e-waste dismantling or incineration is considered toxic. Therefore, they are targeted for reuse, recovery or hazardous waste disposal (Wath *et al.*, 2011). The recovery of metals is a profitable business, which results in local, trans-boundary and global trade (Wath *et al.*, 2011). According to studies carried out by Okoye and Odoh (2014), public awareness is critical in achieving environmental attitudes, skills and behaviour consistent with sustainable development and environmental protection. Awareness is an important tool for sensitization of public opinion to environmental issues and challenges. Educating all and sundry on the importance of environmental protection is one of the most effective ways to protect nature (Okoye and Odoh, 2014). Literatures have shown that most developing nations of the world, Nigeria inclusive, use dump sites, lack collection point for electronic waste, time to transport the e-waste to the safe disposal site, appropriate infrastructure for sound hazardous waste management and lack of awareness among both individuals and the informal sector on the dangers of electronic waste (Paul and Tshetlthane, 2013; Lundgren 2012; Terada, 2012; Basel Action Network, 2011; SAICM, 2009).

Van der Voet; Salminen; Eckelman; Mudd; Norgate; Hirschier (2013), highlighted that all e-products come with a life expectancy, and once they stop functioning or new technology makes them obsolete, they must be discarded. Electronic waste (e-waste) is a term used for all types of e-products, and their parts, which was added to replace that discarded material as waste without the intention of reuse (Van der Voet *et al.*, 2013). Around 50 million metric tons of e-



waste are generated globally per year, with an average of more than 6 kg per person (Van der Voet *et al.*, 2013). Poor level of awareness of people in general on the hazardous nature of e-waste as well as crude and unskilled approaches to e-waste management has adversely contributed to the e-waste problems in Africa (eStewards, 2013).

Baldé, *et al.*, (2017) highlighted the Significance of e-waste management to governmental and legislative authorities to enforce regulations and policies to ensure proper management of the returned used products and end of life cycle products (Baldé, *et al.*, 2017). European Union is one of the few regions in the world which has a legislation regarding the e-waste collection and management (Baldé, *et al.*, 2017). With about 3.75 million computers in addition to the 0.25 million bought in the formal market, the total figure bought per year comes to about four million computers; and this are daring statistics when it is viewed from the e-waste angle (Efem, 2008).

Objectives of the Study

1. To assess the extent to which awareness of e-waste hazard affect public disposal habit.
2. To examine the extent to which the public have an awareness on e-waste implication on health and environment.
3. To assess the extent to which awareness of e-waste hazard affect the purchasing habit among residents of Kaduna South LGA.
4. To examine the extent to which Kaduna State Environmental Protection Agency (KEPA) and NASREA educate the public on policies and laws regulating e-waste hazard, purchasing and disposal habit.

Research Questions

1. To what extent does the awareness of e-waste hazard affect public disposal habit?
2. To what extent does the public have an awareness on e-waste implication on health and environment?
3. To what extent does the awareness of e-waste hazard affect the purchasing habit among residents of Kaduna South LGA?
4. To what extent does Kaduna State Environmental Protection Agency (KEPA) and NASREA educate the public on policies and laws regulating e-waste hazard, purchasing and disposal habit?

Methodology

The tool used for data collection was a questionnaire developed after consultation of related studies. The same was pretested and validated for the study purpose efficacy and suitability. The designed questionnaire was divided into four sections and the categories of information assessed in each of the sections includes, participant's demography, effect of awareness e-waste hazard on public disposal habit, public awareness on e-waste health and environment implication, effect of public awareness the purchasing habit among residents, role of Kaduna State Environmental Protection Agency (KEPA) and NASREA in educating the public on policies and laws guiding e-waste management.

The Likert scale tool was adopted in the questionnaire to measure public response to the questions, that is, the response variables for the questions enumerated under e-waste knowledge, awareness, purchasing and disposal habit each of which were assigned with 5 for Strongly Agreed, 4 for agreed, 3 for undecided, 2 for disagree and 1 for strongly disagreed. Data collected were from various sources, these include; primary and secondary data. Primary data were collected through the following means; interview, observations from the field and



answers gotten from randomly distributed questionnaires to the residents of Television, Tudun Wada, Makeri, Barnawa and Kakuri areas of Kaduna South LGA, Kaduna state. While, secondary data were gotten from books, journals, encyclopedia and other published articles related to e-waste management.

Using Krejcie and Morgan (1970) sampling frame method of determining sample size, population of over 146,000 at a confidence level of 95% and error margin of 5% we arrived at a sample size of two hundred and twenty 220. The sampling techniques adopted for this research work are the simple random technique, purposive and the cluster sampling techniques. The purposive random technique was adopted for sampling the community members in order to administer the questionnaires to areas with high rate of e-waste generation. The response rate for the two hundred and twenty questionnaires distributed to the formal and informal sectors as well as individual respondents in Kaduna South Local Government of Kaduna State (200/220) 90.9%. Meaning 90.9% of the respondents returned their responses, suitable for analysis. The predominant age range among the participants was 16-30 years (54.8%). One hundred and fifteen (115) participants representing 57.5% of the study population were male while the remaining 42.5% were female. Most of the participants (80.1%) reside within Kaduna South LGA of the State.

Results

Research Question 1

To what extent does the awareness of e-waste hazard affect public disposal habit?

Table 1: Mean scores of responses on extent to which awareness of e-waste hazard affect public disposal habit (Cut-off Mean =3.0)

Variable Description	SA	A	UND	D	SD	Mean	STD
Awareness of e-waste hazard and its effect on public disposal habit	60 (30%)	45 (22.5%)	25 (12.5%)	30 (15%)	40 (20%)	3.2	1.51

The data in Table 1 shows descriptive statistics of participants' responses to extent of awareness on e-waste hazard and its effect on public disposal habit of Kaduna State residents. The score of 3.2 exceeds the cut-off threshold of 3.0, hence it reveals that awareness of e-waste hazard affect public disposal habit among residents of Kaduna South LGA.

Research Question 2

To what extent does the public have an awareness on e-waste implication on health and environment?

Table 2: Mean scores of responses on extent to which public have awareness on e-waste implication on environment (Cut-off Mean =3.0)

Variable Description	SA	A	UND	D	SD	Mean	STD
Public awareness on e-waste implication on health and environment	20 (10%)	30 (15%)	33 (16.5%)	45 (22.5%)	72 (36%)	2.6	1.46

The data in Table 2 shows descriptive statistics of participants' responses to extent of public awareness on e-waste implication on health and environment among Kaduna State residents. The score of 2.6 is less than the cut-off threshold of 3.0, hence it reveals that public awareness of e-waste implication on health and environment is low among residents of Kaduna South LGA.



Research Question 3

To what extent does the awareness of e-waste hazard affect the purchasing habit among residents of Kaduna South LGA?

Table 3: Mean scores of responses on extent to which awareness of e-waste hazard affect the purchasing habit among residents of Kaduna South LGA (Cut-off Mean =3.0)

Variable Description	SA	A	UND	D	SD	Mean	STD
Awareness of e-waste hazard & its effect on purchasing habit of residents of Kaduna South LGA	65 (32.5%)	45 (22.5%)	20 (10%)	34 (17%)	36 (18%)	3.3	1.44

The data in Table 3 shows descriptive statistics of participants' responses to extent of awareness on e-waste hazard and its effect on purchasing habit of residents Kaduna South LGA. The score of 3.3 exceeds the cut-off threshold of 3.0, hence it reveals that awareness of e-waste hazard does affect purchasing habit among residents of Kaduna South LGA.

Research Question 4

To what extent does Kaduna State Environmental Protection Agency (KEPA) and NASREA educate the public on policies and laws regulating e-waste hazard, purchasing and disposal habit?

Table 4: Mean scores of responses on extent which Kaduna State Environmental Protection Agency (KEPA) and NASREA educate the public on policies and laws regulating e-waste hazard, purchasing and disposal habit

Variable Description	SA	A	UND	D	SD	Mean	STD
Efforts of KEPA and NASREA on awareness campaign on policies and laws regulating e-waste hazard, purchasing and disposal habit	10 (5%)	25 (12.5%)	32 (16%)	85 (42.5%)	48 (24%)	2.3	1.57

The data in Table 4 shows descriptive statistics of participants' responses to extent of awareness campaign/education on policies and laws regulating e-waste hazard, purchasing and disposal habit of residents of Kaduna South LGA. The score of 2.3 is less than the cut-off threshold of 3.0, hence it reveals that there is low level of educational campaign efforts by KEPA and NASREA relating to policies and laws regulating e-waste hazard, purchasing and disposal habit in Kaduna South LGA.

Discussion of Findings

From the charts above, it was observed that 60 respondents which constitute 30% of the respondents strongly agreed that the awareness of the hazards posed by e-waste greatly affect the disposal habit of the public in an environment. 45 which constitute 22.5% of the respondent agreed that the awareness of e-waste hazard positively affect public disposal habit. 25 which constitute 12.5% of the respondents are in-between while 30 which constitute 15% of the respondents disagreed and 40 which constitute 20% strongly disagreed that the awareness of e-waste hazard positively impacts public disposal habit. Thus, this shows that 52.5% of the respondents accepted the fact that providing a sufficient awareness on e-waste hazards can positively affect the disposal habit of the public with respect to electronic waste. This response answers research question one that awareness on e-waste hazard affect disposal habit.



While, 58.5% of the respondents disagree or do not accept that there is a significant public awareness regarding the implication of e-waste on health and environment. Also, this has answered research question two that there is a low level of awareness in the society regarding e-waste hazards, health and environment implication. However, 55% of the residents accepted that public awareness about e-waste hazard on health and environment will greatly affects and will go a long way to regulate the attitude and control public attitude towards purchasing and disposal of electronic waste among residents in Kaduna South Local Government Area of the State.

Finally, 66.5% disagreed to having the knowledge about any policies or regulation on e-waste. They also disagreed with the statement that the Kaduna State Environmental Protection Agency (KEPA), NASREA or any Non-Government organizations regularly educate the public on policies and laws regulating e-waste hazards, handling, disposal or reuse. Hence, there is general lack of information dispensation from governmental authorities to communities. Therefore, the need for all government and non-governmental organizations to do more in creating public awareness and campaign to draw people's attention to the basic knowledge of what e-waste which represents policies & regulations governing the use, reuse, recycling and disposal of electronic waste materials. The need to disclose the idea of e-waste taking over our environment and certainly the risk to our health and environment is crucial. This awareness campaign will definitely affect the manner of purchasing and disposal habits of electronics among residents in Kaduna South Local Government Area, the State and nation at large.

Thus an increase in public awareness will definitely affect the manner and habit of disposal and burning of e-waste indiscriminately. This will also affect the rate of consumer and manufacturer interest in the 4Rs (Reduce, Re-use, Recover and Recycle before finally disposing), for health, environmental and economic gains.

Conclusion

The present study attempted to assess public awareness of both toxic chemicals in WEEE, e-waste hazard, federal policies and how it affects proper disposal and management of e-waste, an extra step and contribution to the study of e-waste management in Nigeria. The questionnaire data greatly validated previous claims that technological innovation has led to rapid product obsolescence, as majority of respondents indicated that there is the need or desire for new technology to motivate them to purchase new products. The data also pointed to lack of government incentive for the consumer to participate in formal e-waste management strategies – strikingly, the number of respondents who never knew of formal e-waste services outnumbered those who actually knew and participate in them.

Majority of respondents agreed that the use of billboards/ posters and TV/ Radio set as a means of creating awareness will go a long way to educate the populace on the hazard attached to poor management of electrical waste materials as well as enlighten them on the economic wealth and benefits that lies in recycling e-waste and solid waste in general. Perceptions of unused electronics indicated that approximately a quarter of respondents recognized the possibility of end-of-life recycling and reprocessing, while other responses suggested a disconnect from proper e-waste management. As 52.5% of the respondents agreed that the knowledge and awareness of e-waste will definitely affect their attitude, ways and manner used in handling e-waste, it will as well reduce indiscriminate throwing away, dumping and burning off e-waste while encouraging the culture of electrical waste recycling and segregation.



Recommendation

1. From the findings of this study, it can be concluded that public awareness regarding e-waste hazard is quite low while the effects of the awareness on purchasing and disposal habit is quite significant due to the fact that most individuals tend to be proactive at the hearing of the health and environmental impact of indiscriminate disposal of e-waste while the value attached to the scraps and vital components of the e-waste makes a lot of people interested in carefully selecting and disposing their electronics for the purpose of recycling and monetary gain.
2. Government at all level should negotiate with private electronic manufacturers on how to recover damaged and end-of-life e-waste from consumers, with some monetary reward attached to it. Public awareness campaign should be embarked on e-waste hazard and disposal habit within households and communities. This should be promoted through social media, billboards, posters and radio houses as these are the easiest and fastest means of transmitting information and creating mass awareness. Reduction, reuse and recycling of e-waste are the best measure for waste management, health and environmental control as against the usual land filling method. Also, manufacturers and government agencies should create a means or medium of collecting damaged electronics from households, monetizing such collections and recycling this e-waste for income generation and environmental protection.
3. Government agencies such as NESREA, NOSDRA, Ministry of Environment and KEPA should take up the responsibility of educating the citizens on e-waste hazard to health and environment, and policies that guide against indiscriminate disposal or burning of e-waste. By doing so, many households and members of community will take responsibility of disposing the waste to the right place and facilitates in ensuring environmental safety and health condition of the citizens through an integrated e-products use and recycle.
4. The study recommends that further research should be conducted to ascertain the major implication of lack of clear policy, regulations and laws on e-waste management in Kaduna State and Nigeria in general. The study should also be conducted on the possibility of training special e-wastes scavengers and vendors to reduce the level of risks and hazards to both citizens and scavengers.

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