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Environmental Hazards And Management Of Electronic Wastes In Enugu State, Nigeria

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ABSTRACT

The research explored environmental risks in Enugu Province, Nigeria, and the disposal of electronic waste. A descriptive analysis style has been implemented in this report. The research was completed by 258 respondents in the State of Enugu. To address the study queries, frequency counts were used. Results from the analysis found that environmental danger recognition and electronic waste management in the Enugu state was very poor. It was advice to raise consciousness of the hazards of electronic waste and its management in local and indigenous languages and to distribute it through social networking channels to ensure the protection of life and community as a whole..

***Keywords:* Electronic Waste; Environmental Hazards; Waste Management; Human Health; Hazardous Substances; Toxic Substances; Recycling.**

1. Introduction

In every area of human life computer devices are becoming rapidly incorporated. Every day as completely new mobile computer devices enter the market, old models are quickly fading, which is a waste. This indicates a reduced life cycle (than what it used to be) in mobile gadgets. Therefore, today's devices are the electronic waste of tomorrow (e-waste).

Electronic waste is a concept used as an expression of the old and end-of-life electronic equipment that people have abandoned, such as computers, tablets, televisions, radios and fridges (Sharma, 2018; Oteng-Ababio, 2012). E-waste is a mixture of electronic goods utilised or unwanted and have passed their lifespan (Shah & Shaikh, 2008). According to the United Nations University (2019), e-waste encompasses discarded equipment such as smart phones, laptops and desktop computers, refrigerators, sensors, and TVs, that contains substances that pose substantial environmental and health risks, especially if inadequately treated or improperly disposed of. In this analysis, e-waste is a technological device that the initial owner has abandoned, and that endangers human and environmental life, where it is not disposed or dismantled correctly (recycled).

E-waste has been categorised into three major categories: broad domestic appliances such as fridges and washing machines; IT and telecommunications technology such as personal computers (PC), monitor systems and laptops; and electronic equipment such as TV sets, DVD players, cell phones, MP3 players and recreational sports equipment (Bazaz, 2020; Shanti & Sujana, 2018; and Pinto, 2008). In comparison to IT and telecommunication waste a on average PC comprises plastics of 7,24kg, lead of 1,98kg, mercury of 0,693g, arsenic of 2.961g, cadmium of 1.98g, barium of 9.92g and beryllium of 4,94g (Kumar & Singh, 2014). The locally created e-waste rises everyday and more e-waste is transported from abroad. At the same period. In 2019 the record was produced worldwide for 53,6 million tonnes of electronic waste; by 2030 it is estimated to be 74 million tonnes (Forti, Balde, Kuehr & Bel, 2020). E-waste is a rich store of hazardous compounds and valuable products.

E-waste has multiple commercial possibilities in it (Iwenwanne, 2019). For many people in developing countries, repairing discarded electronic appliances or dismantling them for spare parts, and also selling valuable materials recovered through recycling e-waste constitutes an important source of livelihood which is in line with the sustainable development goals. E-waste produces work, profits and bi-products of waste, which are used for feeding other industries in the area. E-waste includes a number of precious resources such as titanium, iron, copepress, copper, platinum and palladium that can be retrieved (Ari, 2016). Electric waste includes other essential products, including plastics, glass and ceramics, in addition to these metals. However it is by primitive rudimentary methods such as open burning or direct boiling, the usage of acid baths, and other chemical processes that the mining of these precious metals releases harmful materials to the atmosphere through pollution (Ari, 2016).

E-waste includes numerous toxic compounds (Teja, Lalithakumari & Jalajakshi, 2015; Mundada, Kumar and Shekdar, 2004), which can pollute the habitat and generate a health danger to animals and humans in this area (e.g. Teja, Lalithakumari & Jalajakshi, 2015; Mundada, Kumar and Shekdar). Cathode ray tubes (CRT) often include heavy metals including lead, barium, and cadmium that, when reached in water systems, can inflict harm for the human nervous and respiratory system (Deng, 2019); arsenic, lithium and plum; cadmium, lead, antimony, and beryllium found in the imprinted circuit board (Tsydenowa and Bengtszon, 2011). Those pollutants are inhaled, ingested or absorbed in the human body. E-waste exposure to toxic chemicals can contribute to extreme, often fatal health risks.

Negative human health consequences include: bronchitis-like asthma; nervous system harm; lung cancer; deoxyribonucleic acid (DNA), muscle weakness; heart, liver, kidney and spleen damage; brain, reproductive and endocrine

systems damage persistent and some e-waste are carcinogenic (Yong, 2019). Lead-contaminated drinking water has consequences for central nervous system and poor brain development, dwarfism, hearing deficiency, blood cell production and operation (Raj, 2020). The gases created by the combustion of the mother circuit board inhale lung cancer, as well as dermatological diseases. Low birth weight and enhanced unintended abortion were related to maternal sensitivity to cadmium (Emokpae, Agbonlahor & Evbuomwan, 2016). This pollutants will leach into the groundwater and impact local infrastructure as electronics are tossed to sites.

Acid rain, soil degradation, soil acidification, air pollution, ozone depletion, water drainage channels, global change and adverse impacts to other living species in an ecosystem is among the environmental concerns of concern. Air contamination happens whenever hydrocarbons are freely burnt in the atmosphere (Akotkar, 2018). Soil contamination happens as e-waste heavy metals are ingested into the food chain by the plants of the field (E-Terra Technologies, 2017). Not only can these metals kill plants, but even living creatures then absorb them and build a toxic food chain. The water pollution occurs when electronics containing heavy metals, such as plum, barium, arsenic, lithium etc. are unsuitable, these heavy metals leach into the soil and enter drainage pipes that ultimately reach the surface like streams or small ponds (E-Terra Technologies, 2017; Akotkar, 2018).

The control of e-waste consists of an efficient recycling of and responsible disposal of all recycled products from waste electrical and computer equipment (WEEE) in order to avoid environmental emissions (Waste Management in Obaje, 2013). It includes waste generation, transport, recovery and disposal, including management of those processes and after-service of waste disposal areas (Ferronato and Torretta, 2019). Therefore, recycling is the major means of handling e-waste.

Recycling splits disposable gadgets down into key reuse items. The disposal of e-waste is the reprocessing, for use, of electrical and electronic appliances of various types (Conserve Energy Future, 2020). Recycling e-waste removes electronics from deposits and aims to restore precious energy. Electric waste treatment preserves public wellbeing and the climate. The e-waste industry provides a chance to build millions of decent jobs, the trust of Sustainable Development Goals (SDG) 8, and the promotion of more responsible use and processing in line with SDG 12, when e-Waste is recycled or treated properly. E-waste management is also a crucial and environmentally important problem in the fulfilment of the objectives of sustainable growth.

Another approach to accomplish e-waste control is to legislate focused on the EPR, which allows the electronics sector to render green (environmentally friendly) goods as well as the taking-back of electrical products used to recycle end-of-life (EoL). In addition, the government could guarantee and endorse the strict implementation of the Basel Convention on the Management and Disposal of Transboundary Movements of Dangerous e-wastes.

But key problems for successful e-waste management include: the recycling of e-waste in non-formal units by non-scientific, unsafe, and non-environnementally friendly techniques (Taneja, 2018), lesser awareness of the toxicity of e-waste and the hazards faced by inappropriate recycling techniques for the users, collectors and crude recyclers (Nduneseokwu, Qu & Appolloni, 2017); (Osibanjo & Nnorom, 2007).

Statement of the Problem

Electronic devices make it simple and straightforward. However, the disposal and inappropriate recycling is a nightmare because hazardous chemicals are used in the units. Crude e-waste disposal activity is heavily polluting and not successful in resource recovery. The fact that the amount of reasonably used (second-hand) electronics transported into the state is on the increase is therefore a major challenge to Enugu state management; ignorance of e-waste toxicity and hazardousness; lack of environmental regulations specific to e-waste; absence of facilities for the storage, recycling and recovery of e-waste (Osibanjo & Nnoro) (EPR). The effect is decreased population leading to poor health and mortality in highly serious circumstances.

Unfortunately, this email waste is buried, burning in the open air or poured into surface water sources owing to the absence of sufficient waste-management facilities. This bad e-waste treatment and recycling systems dump hazardous heavy metals, for example mercury, into an atmosphere that depletes the ozone layer; prevents irrigation channels; and induces harmful effects on living species in an ecosystem, including cancer. Disposal of electrical waste becomes environmental and wellbeing nightmare with the inclusion of hazardous chemicals in electronic gadgets. Therefore, a report on environmental hazards and electronic waste management in the State of Enugu is required..

Purpose of the Study

a) The primary objective of this thesis is to recognise environmental hazards and electronic waste management in Enugu Province, Nigeria. In specific, the analysis aimed at determining: a) the consciousness of citizens in the Enugu State for electrical waste management.
b) b) the approach of the citizens in Enugu State to e-waste management.

c) c) condition in the Enugu State of e-waste management activities.

Research Questions

a) Clear goals of the analysis to direct the investigation:
b) a) Have the people of Enugu State been informed of e-waste management been conceived in accordance with three study questions?
c) b) What are the approaches of citizens in the Enugu nation towards e-waste management?
d) c) the condition in the Enugu State of e-waste management activities?

Methodology

A descriptive analysis style has been implemented in this report. The research was completed by 258 respondents in the state of Enugu. The data collection instrument was established by the researchers via a systematic questionnaire named "Environmental Hazards and Electronic Waste Questionnaire Management (EHMEWQ). Three experts in Computer and Robotics Research, University of Nigeria, Nsukka, sent the EHMEWQ to face validity. Any of these experts was asked to make use of their know-how to determine the suitability, conformity and language of the data collection instrument. In order to increase the consistency of instruments, findings and recommendations were included. Online survey was used to gather data. The processing of online data is beneficial in that it is easy, time and cost-efficient, especially in the context of this COVID-19 pandemic lock-out. The researcher downloaded the questionnaire as a web site survey and submitted a uniform URL to respondents in the country whose e-mail addresses and social networking profiles were randomly collected (WhatsApp, Telegram, and Facebook). Cronbach Alpha stability approach has been used to show the reliability of the instrument. Tests were carried out by 25 respondents from the State of Anambra beyond the field of research. For internal consistence, the collected data were evaluated, which produced a very strong reliability index of 0.93. Frequency count was used to answer questions from the study.

Results

Research Questions 1

Are people aware of e-waste management in Enugu State?

Table 1: Frequency count of people's aware of e-waste management in Enugu State.

S/N	ITEM STATEMENT	YES Frequency (%)	NO Frequency (%)
1	Are you aware of the volume of e-waste that you generate?	58 (22.50%)	200 (77.50%)
2	Are you aware of what happens to the e-waste you have discarded?	74 (28.70%)	184 (71.30%)
3	Are you aware that improper disposal method leads to pollution?	68 (26.40%)	190 (73.60%)
4	Are you aware of the environmental hazards caused by discarded e-waste you have generated?	37 (14.30%)	221 (85.70%)
5	Are you aware that e-waste contains toxic substances that are harmful to human health?	98 (38.00%)	160 (62.00%)
6	Are you aware that e-wastes should be disposed separately from general household wastes?	84 (32.60%)	174 (67.40%)
7	Are you aware of any company that collects discarded e-waste for recycling in your locality?	8 (3.10%)	250 (96.90%)
8	Are you aware that some hazardous fractions in e-waste need a special treatment in order to be safely disposed of?	23 (8.90%)	235 (91.10%)
9	Are you aware that proper management of e-waste reduces the use of landfills and emissions of poisonous gasses?	43 (16.70%)	215 (83.30%)
10	Are you aware of any e-waste guidelines by the government of Enugu state?	64 (24.80%)	194 (75.20%)
11	Are you aware that some electronic parts can be a resource if properly recycled?	18 (7.00%)	240 (93.00%)

N=258 (N = Number of Respondents)

The details in Table 1 shows that all respondents have approved the unexplained management of e-waste in the State of Enugu. 77.50% of those polled did not know the amount of e-waste they produced; 85.70% of respondents did not know the volume; 96.90.0% of respondents did not know of any organisation which collects discarded e-waste for recycling in a specific area. 91.10% did not understand that some unsafe e-waste fractions needed special care in order to be disposed of safely, and 73.30% of respondents did not know that certain harmful e-waste fractions required special treatment..

Research Questions 2: What are people's approaches towards e-waste management in Enugu State?

Table 2: Frequency count of people's approach towards e-waste management in Enugu State.

S/N	ITEM STATEMENT	YES Frequency (%)	NO Frequency (%)
1	Would you keep e-waste that you generated?	200 (77.50%)	58 (22.50%)
2	Would you burn/incinerate e-waste you have discarded?	215 (83.30%)	43 (16.70%)
3	Would you dump e-waste you have generated in gutter, river or sea?	165 (64.00%)	93 (36.00%)
4	Do you bury e-waste you have discarded?	125 (48.40%)	133 (51.60%)
5	Would you participate in a formal e-waste collection if you are satisfied with the collection measures by the government?	240 (93.00%)	18 (7.00%)
6	Would you dispose e-waste along with other household waste?	210 (81.40%)	48 (18.60%)
7	Would you give out your e-waste to the waste collectors for free if you could be sure that the waste will be well taken care of in a way that is useful and that does not pollute the environment?	190 (73.60%)	68 (26.40%)
8	Would you be willing to pay for your e-waste to be collected and treated?	250 (96.90%)	8 (3.10%)
9	Would you like to be paid for your e-waste to be collected and treated?	258 (100.00%)	0 (0.00%)

N=258 (N = Number of Respondents)

The data in table 1 indicate that the mysterious management of e-waste in the State of Enugu was accepted by all the respondents. 77.5% of respondents were unaware of how much e-waste was generated by them; 85.70% did not realise the amount by the respondents;

96.90.0% of respondents were unaware of an agency that was able to gather e-waste for recycling in a local region. 91.10% didn't recognise that certain dangerous e-waste classes needed extra consideration to ensure proper handling, and 73.30% did not know that certain toxic e-waste fractions need special care..

Research Questions 3: What is the situation of e-waste management practices adopted in Enugu State?

Table 3: Frequency count of situation of e-waste management practices adopted in Enugu State.

S/N	ITEM STATEMENT	YES Frequency (%)	NO Frequency (%)
1	Does crude e-waste recycling still exist in your community?	214 (82.90%)	44 (17.10%)
2	Is there any e-waste recycling center in your state?	0 (0.00%)	258 (100.00%)
3	Does e-waste collection centers situate close to your locality?	0 (0.00%)	258 (100.00%)
4	Do waste collectors come and pick up e-waste at your door step?	222 (86.00%)	36 (14.00%)
5	Does your state government have a policy or strategy for the management of e- waste?	150 (58.10%)	108 (41.90%)
6	Does your state government collaborate with any company or group in charge of proper e-waste management (collection & recycling)?	13 (5.00%)	245 (95.00%)
7	Is the principle “Extended Producer Responsibility” (EPR) practiced by your state government?	6 (2.30%)	252 (97.70%)
8	Does your state government keep inventories of the electric and electronic waste it has collated or discards?	8 (3.10%)	250 (96.90%)
9	Do your state governments have any special treatment of e-waste at disposal?	18 (7.00%)	240 (93.00%)
10	Does your state government lack e-waste recycling infrastructure?	249 (96.50%)	9 (3.50%)
11	Are you satisfied with the current e-waste collection practices in your state?	58 (22.50%)	200 (77.50%)

N=258 (N = Number of Responde

Data from table 3 indicate that 82,90% of respondents acknowledged that there is only rough e-waste recycling in their communities; 86,00% agreed that waste collectors come to collect e-waste at their door; and 96.50% claimed their state government has no e-waste recycling infrastructure. 100.00% disagreed with the lack of e-waste disposal centres; 100.00% of those who responded accepted that e-waste processing facilities were not situated in your neighbourhoods; 97.70% of citizens assumed that their state government did not exercise expanded production accountability (EPrinciple) and 77.50% disagreed..

Discussion of the Findings

The data shows that citizens in Enugu State did not realise e-waste management. The results found that citizens were not informed of the environmental threats posed by recycled e-waste, that unsafe disposal practises contribute to contamination (73,6%) (85,70%) and to hazardous substances to human health (62.00 percent). The findings of the study is in agreement with the findings of Okoye and Odoh (2014) and Ohajinwa, Bodegom, Vijver and Peijnenburg, (2017) who found that the the importers, the scavengers and the householders were not aware of the hazardous nature of e-waste.

The data indicate the attitude of the public to e-waste management in the State of Enugu. The findings revealed that people are: burning/burning e-waste they discard (83,30%), waste generated by them in gutters, rivers or seas (64,0%), distributing e-waste to the waste collector for free (73,0%), are willing to pay for the collection and treatment of your e-waste (96,90%). (100.00 percent).

The results demonstrated the condition of the management of e-waste implemented in the State of Enugu. It is seen by the data: waste disposal firms come and collect e-waste at doors (86.00 per cent), crude e-waste recycling is also present (82.90 per cent) (96.50 percent). The findings showed that the State Government did not have an e-waste recycling centre (100.00%), the State Government did not exercise the concept of "extended development duty" (EPR) (97.70%), the State Government did not hold inventories of electrical and electronic waste that it produced, or discards (96.90%). (93.00 percent). The results of the study were consistent avec the conclusions of Osibanjo and Nnorom, who claimed, (2007), that insufficient recycling plants in the country and no basic framework exists for waste management..

Implications of the Findings

The swift upgrading of technologies ensures the everyday production of very big e-waste. As e-wastes are treated correctly (recycled), they produce profits, generate energy and provide job

opportunities for local businesses. But poor management of e-waste will contribute to many air, water and soil contaminants that impact human and environmental health..

Conclusion

Finally, because of accelerated technical trends, shortened commodity life and the need for innovative goods from customers, e-waste is increasing faster.. The public should not realise the risks found in the disposal of informal waste. Improper handling of the e-waste results in contamination of the atmosphere, which may affect the wellbeing of humans. Environmental threats are very little understood and electronic waste is being handled in the State of Enugu. Thus a better knowledge of unsafe materials e-waste is urgently needed..

Recommendations

a) The following suggestions were made based on the conclusions of the study:
b) a) General awareness of the risks of technological wastes for human and environmental wellbeing through utilising social media must be increased in local and indigenous languages.
c) b) warn citizens of the risks of informal e-waste management systems by publications and the National Orientation Department.
d) c) Electrical collection centres must be developed in all locations; and at least an e-waste recycling centre must also be installed in each federal state..

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