
Waste and its Impacts on Environment and Health (Case Study: Jimeta, Adamawa State)

Friday Adejoh Ogwu

Department of Urban and Regional Planning

Modibbo Adama University of Technology, Yola

Email: fridayogwu@mautech.edu.ng; fridayogwu@hotmail.com

ABSTRACT

A good E-waste management and disposal method is one of the major problems many developing countries are facing nowadays. Most of these wastes are imported from developed countries in large quantities without considering its environmental and health implications. Major African cities such as Lagos in Nigeria and Accra in Ghana are now the centers of E-waste trade in Africa. Some of these cities lack good methods of disposing even the municipal waste that are generated everyday in the cities. E-Wastes are dumped everywhere in the cities including backyards, open dumps and even on streets. Diseases, which are mostly caused by E-waste, are among the major causes of deaths in the world; E-waste mostly caused these diseases as a result of the toxic chemical and radioactive element it is composed of. For example chemicals such as mercury, lead and cadmium are very dangerous to human health and the environment. Some of these chemicals are responsible for the increase in cardiovascular, pulmonary and respiratory diseases. Environmentally, E-waste effects the environment by contaminating the soil and water, which can lead to the loss of biodiversity and marine habitats. It also releases pollutants (greenhouse gases), which disrupt the ozone layer and causes global warming. This paper investigates the impacts of E-waste on the environment and health of people in Jimeta, Adamawa state. The paper also categorizes the kinds of E-waste observed during data collection in the communities and identifies the hazardous substances they are composed of. It also accesses the knowledge of respondents living in the communities on E-waste and its effects. Lastly, the paper provides a list of economical and beneficial methods of E-waste management, which can be adapted by the community.

Key Words: E-waste, Environment, Health, Adamawa State.

INTRODUCTION

Electronic equipment in this generation has help in so many ways and also made life and work easy due to the efficiency and time saving. The Advancement in our communication system have now help in communicating from different parts of the world with different people, also our entertainment industries have now improve through the invention of new televisions, cameras and radios (A.Abdulkarim, 2012). These improvements and development are all brought about through the advancement of the electronic technology. The advancement in electronic technology has also help in making our work easier and convenient in our household through the use of some electronics that uses electricity, these equipment include Heaters, electric irons, washing and cleaning machines and so on (Ewuim, 2014).

Most of these electrical and electronic equipments that we buy in our houses and workplaces become outdated in some months or years and we will intent to buy new models. The increase in the invention and manufacturing of new electronic equipment has led to the generation of high rate of electronic waste in our societies. Every year about 20-50 million metric tons of electronic waste is generate worldwide, and in the United states only, every year about 14-20 million computers are thrown out with 3-5% increase annually (Lundgren, The global impact of e-waste: Addressing the challenge , 2012). Out of these computers that are thrown out, only 12-18% are recycled. The remainders are disposed in landfills while others are incinerated causing harmful effect on both the health and the environment. Some of the electronics that can be used again are transported to developing countries, where they are sold again. Most of these developing countries are carelessly handling the electronic waste that was transported to them, as a result causing adverse effect on both the environment and the health of people living or coming around the areas where it is dumped.

The electronic waste that was of no use again is known as the waste of electronic and electric equipment (Waste-EEE) and it is also known as E-waste. This paper focuses on the effects of E-waste on environment and health of people and also identifies the components of the E-waste that are responding for the effects. The paper also identifies the sources of E-waste and categorized them in to different parts. Lastly, the paper suggests ways to effectively and economically manage E-waste in Nigeria (Obaje, 2013) (Olowu, 2012).

BACKGROUND TO THE PAPER

The problem of E-waste disposal has been one of the major problems that many developing countries are facing nowadays. The idea that the disposal of electronic equipment's that of no use again in our environment can affect of health and environment is not well known in the countries. People have been buying electronics such as televisions, electric iron, heaters, refrigerators and air conditions in their houses for many years and when these appliances have spoiled and of no use again to them, they dispose than in dumping sites without knowing that it is dangerous to them. This implies that people especially in the developing countries where used electronics are transported are not well educated to know that electronic waste that are not properly dispose in their communities are very dangerous to their health and the environment.

Improper E-waste disposal has been a major issue in many developing countries and had led to loss of many lives due to pulmonary and respiratory diseases. It has also contributed to the increase in greenhouse gases that also cause global warming. Soil and water are also polluted by the heavy metals that are present in the electronics causing biodiversity loss and death of aquatic and marine habitats. The effects caused as a result of improper E-waste disposal in our communities have drawn the attention of many countries and international governments to come up with rules and regulations. These regulations are enforced by the environmental agencies and some countries have now successfully

stopped improper E-waste disposal. Some have come up with effective and economical ways of managing E-waste generated in the countries.

STATEMENT OF PROBLEM

This paper investigates the negative effects caused as a result of improper disposal and handling of E-waste on human health and the environment. As said earlier in the introduction part, improper disposal of E-waste generated in our houses had led to loss of many lives, destruction of ecosystem and polluting water, air and soil. This happened due to the toxic chemicals and metal the E-waste are containing, when not carefully handled and dispose they are released to the atmosphere which then caused cardiovascular and pulmonary diseases to people living around the dumping site. They can also pollute the soil and contribute to global warming, because most of them are greenhouse gas.

AIM AND OBJECTIVES

The main aim of this paper is to investigate the effects of improper E-waste disposal on human health and the environment. The set objectives include:

- Identify sources of E-waste and categorize them into different parts.
- Identify the hazardous components of E-waste and explain effects to human and the environment.
- Find out the level of knowledge on E-waste and its management methods from the people living around the dumping sites.
- Propose an effective and economical solution of managing E-waste.

STUDY AREA AND SCOPE

The area of the study is Jimeta, Yola North Local Government Area of Adamawa state. The scope of the study is the E-waste dumping site and

some places where used electronics and appliances are repaired. The reason why the paper focuses on places where electronics are repaired is that, in these places there are some electronics that cannot be repaired but just dumped on the other sites of the shops, which are also very dangerous.

Summary

The issue to E-waste has been one of the major problems in many developing countries. It has led to increase in the number of pulmonary, respiratory and cardiovascular diseases while environmentally it has led to destruction of many eco-system and pollution of our water and soil. There is a need of good and effective ways of managing E-waste generated in our houses so as to live healthy and protect our environment. Lastly, countries all over the world should join their hands together in order to stop the transportation of E-waste from one country to another.

LITERATURE REVIEW

Many studies and papers has been conducted and written by researchers on the issue of E-waste all over the world. People have been conducting these researches for many years and so many findings have published. It was through these researches that scientists find out about the effect of E-waste on human health and the environment. It was found out that improper E-waste disposal is among the factor that contribute to global warming and increase in number of people infected with pulmonary, cardiovascular and respiratory diseases. This has drawn the attention of many people and also increases the number researchers who are interested on researching on E-waste and find out more about it. This finding by the researchers has also raise an alarm all over the world and has led to the implementation different ways of Managing E-waste in many developing countries. Other countries have also enacted laws and regulations on improper E-waste disposal and it is being enforced by the various environmental agencies in the country. Till now, many

researchers continue to do their research on E-waste and their findings are published every year in different parts of the world (Ewuim, 2014).

Definition of Terms

Waste- A waste is any substance or object that has no value or use to the owner and is also intended to be discarded either from residential or commercial sources. Waste are of different kinds and are classified based on the source they are generated every day, these include municipal or solid waste, industrial waste and agricultural waste. From the name municipal we will understand that it implies to the type of waste generated in our houses everyday while for that of agriculture it's also a waste that is generated in our farms. Industrial wastes are the kind of waste that is generated in industries and factories.

E-waste or waste EEE- is a waste of any equipment that is dependent on electric current or electromagnetic field in order to work properly (Obaje, 2013). From the definition of E-waste we can see that it can be classified as waste that is generated in our houses, offices, hospitals and soon, therefore we can say E-waste can be under municipal waste.

Effective waste management- this is the process of collecting, transporting and disposing waste of any kind in good and proper way. This has to do with the disposal of waste properly in such a way that it cannot affect human and their environment. In some cases wastes are also managed in a way that is going to be beneficial and sustainable, these include the Reuse and recycling method of managing waste that is practiced in some developed and developing countries.

Need for Effective E-waste management in Developing countries

In many developing countries around the world, there is a need of a good and effective method of managing E-waste that are generated and

transported into the country. These countries are mostly the ones having problems in improper disposal of not only E-waste but other waste like municipal, Agricultural and industrial. This problem has continued intensifying due to the increase in population and urbanization; this has led to the generation of huge amount of wastes every day. Wastes such as E-wastes are not only generated by people in these countries but also imported into the countries from both developed to developing and developing to developed countries (Terada, Recycling Electronic Wastes in Nigeria: Putting Environmental and Human Rights at Risk , 2012) It is estimated that china receives about 70% of E-waste and still raising. Some other Asian countries that receive E-waste are Vietnam, Malaysia, Pakistan, India, Singapore, Philippines and Thailand (Lundgren, The global impact of e-waste: Addressing the challenge, 2012). It is also observed that Singapore and Dubai are the main transits of E-waste from developed countries.

In Africa, it is observed that more E-waste will flow to West Africa due to the tightening of regulation of E-waste in some Asian countries. Nigeria and Ghana are said to be the main import hubs of E-waste in West Africa. Nigeria had dominates the West African region on the total amount of E-waste imports. This has led to the increase in E-waste in major cities like Lagos, Port Harcourt and Kano in the country. In Asia, India is also growing in E-waste trade problem, it is estimated that by 2020 India could see a 500% rise in number of old computers dumped (Obaje, 2013).

These countries lack good and effective methods of managing the E-waste that was been imported to them. Most of the E-waste contains toxic chemicals such as heavy metals, POP's, flame-retardants and other hazardous substances. If not properly managed substances such as cyanide; lead and mercury can pose significant human and environmental risks during processes such as burning, leaching and so on (Lundgren, The global impact of e-waste: Addressing the challenge,

2012). The most common management method is the recycling and E-waste is one of the difficult and complex forms of waste to recycle. There are some cases of workers and resident's exposure to heavy metals in the process of recycling especially in developed countries. This has led to breathing difficulties, choking, respiratory irritation, tremors, neuropsychiatric, pneumonitis, coma and death (Ewuim, 2014).

The increase in quantity of E-waste we generate every day and lack of proper disposal and management that has led to increase in number of diseases due to exposure to heavy metals and chemicals is what has driving many countries to find a good and effective method of managing waste.

Current efforts and challenges on E-waste Management

Countries and other international organizations such as IPCC have been working together to ensure that the issue of E-waste are dispose properly in such a way that it doesn't affect the Earth and its inhabitants. One of the effort made by some countries are the laws, rules and regulations that are enacted concerning the issue of E-waste. The regulations are enforced by different agencies and had reduced the importation of E-waste into the countries. In Asia, which serves as the popular dumping ground of E-waste had enacted and tightened their regulation on E-waste some years ago, this led to the movement of the E-waste trade to other regions particularly west Africa (Lundgren, The global impact of e-waste: Addressing the challenge, 2012). This clearly shows that some of the countries that now serve as the dumping ground of E-waste lack regulations like the other countries while some have it but they were not enforced due to corruption (Terada, Recycling Electronic Wastes in Nigeria: Putting Environmental and Human Rights at Risk, 2012).

Most developing countries lack a good waste removal infrastructure and technical capacity to ensure a safe and unharmed disposal of waste. There are no well-established system of separation, sorting, storage,

collection, transportation and disposal of the waste. Others use rudimentary technique such as manual disassembly, heating printed circuit board and burning without considering the hazardous chemical and heavy metals on the E-waste (Lundgren, The global impact of e-waste: Addressing the challenge, 2012). Some developing countries have E-waste regulations but are limited, this is because some chemical that are used in electronics are excluded. Furthermore, many regulations failed to address the issue of E-waste.

Currently, recycling is the method use in managing E-waste but it faces a great number of challenges especially in dealing with the hazardous substances and the heavy metals E-waste like CRT glass and flame-retardant plastics are containing (Terada, Recycling Electronic Wastes in Nigeria: Putting Environmental and Human Rights at Risk , 2012). Till now, there is technology to recycle from E-waste that contains heavy chemicals and metals in a way that does not affect humans and environment (Ewuim, 2014).

Below are some initiatives that have been taken by international organizations; these initiatives are in recognition in the fact that there is a huge gap between developing countries in terms of policies, regulations, infrastructure and legislation of E-waste.

1. **The Basel convention** is an international treaty signed in order to control the trans- boundary movement of waste that are hazardous and their disposal. This is designed in order to reduce the transfer of hazardous waste form developed to developing countries. Countries such as Nigeria and Ghana have also signed the treaty. This initiative is one of the bold to control the flow of waste between developed and developing countries and it also makes illegal hazardous waste traffic criminal (Olowu, 2012).

2. **StEP**-(Solving the E-waste Problem) - The role of this initiative is to provide dialogue and reduce environmental risk and enhance development (Olowu, 2012).
3. **GeSI** (Global e-Sustainability Initiative) - This initiative consist of ICT suppliers and providers, it is also supported by organizations such as UNEP and ITU. Their main objective to work with stakeholders, share awareness and engage in benchmarking and research (Lundgren, The global impact of e-waste: Addressing the challenge, 2012).
4. **GTZ**- The main aim of this initiative is to provide support in managing E-waste in different countries. They also support Endo-European E-waste initiative.

In Nigeria, there is no serious initiative concerning E-waste, but some national organizations are working directly and indirectly of E-waste management. The following below are some of the national organization in Nigeria working on E-waste management:

1. Federal Environmental Protection Agency (FEPA)
2. National Space Research and Development Agency (NPRD)
3. National Emergency Management Agency (NEMA)
4. Nigerian Customs Service (NCS)
5. National Environmental Standards and Regulations Enforcement Agency (NESREA)

Benefits of Effective E-waste management on Human and the Environment

There are many benefits that can be derived from good and effective waste management. These are very beneficial to both humans and the environment. In many developed and developing countries, Recycling is one of the popular E-waste management methods used and it is one of the components of the 3R's (Gaidajis, Angelakoglou, & Aktsoglou, 2010). Below are some of the benefits of good and effective E-waste management:

1. Through recycling and re-use natural resources can be conserved for future use.
2. Air, soil and water pollution that are very dangerous to both human health and the environment can also be avoided.
3. Some electronic devices contain variety of materials, including some metals that can be recovered and use in the future.
4. Recycling and reuse can also reduce the emission of greenhouse gases that can be caused by manufacturing new products.
5. Recycling and reuse can also provide job opportunities and contribute more to Economy.

Legislation (Local, national and international)

There are many national, regional and international regulations that are set up concerning the issue of E-waste in different parts of the world. These regulations and legislation varies between countries. All these three bodies play very important roles in reducing E-waste trade, disposal and transportation. Below are examples of multi- lateral and regional environment agreements signed by different countries and also enforced by their environmental agencies:

1. **Rotterdam Convention-** This is a multi- lateral environmental agreement that was signed by many countries which promotes shared responsibly between exporting and importing countries in order to protect human health and the environment. The agreement was also signed in order to provide information on potential hazardous chemicals that may be imported or exported (Obaje, 2013).
2. **Montreal protocol-**This is a protocol on substances that deplete the ozone layer. The main objective of the Montreal protocol is to protect the ozone layer from some chemical that are destroying it. Currently, more than ninety-six chemicals are under the control of Montreal protocol (Ewuim, 2014).
3. **A global on mercury under negotiation-**This is aimed to protect human health and environment and from release of mercury and its

compound. An intergovernmental Negotiation committee (INC) was setup and its mandate to reduce the supply of mercury and also enhance environmentally sound storage and reduce demands and processes of products. These products processes are international trade, electronics, and greenhouse emissions and also address compliance. The work of INC is expected to complete since 2013 (Olowu, 2012).

4. **Bamako convention-** This is a regional convention that was signed between African countries, it bans Import of E-waste into African countries and the control trans-boundary movement of E-waste across African countries is also adopted in the year 1991 and entered into force in 1998. This convention has more restrictive framework for regulating trans-boundary E-waste trade than the Basel convention. The Bamako convention has active guidelines for E-waste trade than the Basel convention (Terada, Recycling Electronic Wastes in Nigeria: Putting Environmental and Human Rights at Risk , 2012).

5. **Reach-** The main aim of the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH) is to ensure that there is high level of protection on human health and environment risk that can be posed by chemicals. REACH makes industries and factories responsible for managing and assessing the risks posed by chemicals and also providing adequate and appropriate safety information for users (Olowu, 2012).

Below are national legislations that were enacted by some countries concerning the issue of E-wastes. These legislations are enforced by various agencies in these countries.

India

India is one of the countries where E-waste is imported in Asia. It is also forecasted that India is going to be the popular spot for E-waste trade in the future. The country is among the countries that signed the Basel convention but not the Ban amendment (Rani, Singh, Maheshwari, & Chauhan, 2012). Nationally, there are wide ranges of Environmental

regulations in the countries but there are no specific regulations for E-waste. Although some laws in areas such as importation, Environment, labor, factories could have an impact on E-waste but none apply to the informal sectors. The absence of E-waste regulation is one of the stumbling blocks in India. It was until 2010 that the Indian government enacted legislation of E-waste in the country, the rules call for those formal and informal sectors that are dealing with E-waste to register and also imposes the provisions for EPR. The rule also provides the possibility of formalizing the informal sector stakeholders of E-waste (Lundgren, The global impact of e-waste: Addressing the challenge, 2012).

United States of America

The United States of America is one of the country that did not sign the Basel convention, it therefore legalize export of E-waste to developing countries. The country lacks E-waste regulation but have Cathode Ray Tube (CRT) regulations, because of the CRT contains lead and it is considered hazardous. The exporters of CRT are therefore required to report to the Environmental Protection Agency and obtain consent from importing country when exporting CRT (Lundgren, The global impact of e-waste: Addressing the challenge, 2012). About 25 states in the Country have Extended producer responsibility (EPR) laws which place the responsibility of collecting E-waste to manufacturers of the various products at the End of Life (EOL). Presently, in the United States California is the only state that has the Advance recycling Fee (ARF) law. In this program customers are required to pay additional fee that will be used in covering the expenses of managing a recycling program in the future. In 2011, President Barack Obama commissioned a group of task force for electronic stewards with the aim introducing a national strategy on electronic steward and the procedures on how the agencies can manage their E-waste (Ewuim, 2014). In 2013, the responsible E-waste act was proposed to the congress and when enacted, the country will stop exporting E-waste to developing countries.

Nigeria

Nigeria is among the countries that receive huge quantity of E-waste from developing countries. The country is also the highest E-waste receiving country in West Africa. Nigeria is also among the countries that sign the Basel and Bamako convention. The country has a quite number of regulations on E-waste. An example of regulation on E-waste is the National Environmental (Electrical Electronic Sector) and the harmful waste (Special Criminal provision) came into act in 2011 (Terada, Recycling Electronic Wastes in Nigeria: Putting Environmental and Human Rights at Risk , 2012). The law prohibits the importation of E-waste into the country. A multi- stakeholder consultative committee has also been established in order to prepare national policy guidelines on E-waste in the country. In 2007, the National Environmental Standards and Regulations Enforcement Agency (NESREA) was established with the aim of enforcing environmental guidelines and regulations including the control of E-waste (Lundgren, The global impact of e-waste: Addressing the challenge, 2012). There is also a National Toxic Dump Watch Program (NTDWP) are also working on making sure that the importers of E-waste have registered with NESREA (Obaje, 2013).

Implications of the Review

With all the conventions and laws Enacted by both International, national, state and local level the issue of E-waste still remain the major challenges in many developing countries. This is because of the poverty, lack of funds and government capacity for enforcement, lack of awareness, high illiteracy, poverty and attitudinal issue. Many agencies have been set up in order to make sure that E-wastes are dispose properly in many African Countries. Example of such agencies is the National Environmental standard and Regulation Enforcement Agency (NESREA) in Nigeria, this agency had implemented many laws and regulations concerning E-waste disposal in the country. Due to the lack of support from government and inadequate resources to enforce the

laws, many of the regulation and laws were no longer abided by the masses in the country. Governments in developing countries should support and provide all the resources needed by such agencies in order to address the issue of E-waste and provide good and effective methods of managing it.

Summary of the Review

In summary, we have seen how improper E-waste disposal has become a major problem that many countries are facing. Developed countries had already addressed this problem by implementing different methods of managing waste. Examples of E-waste management methods they came up with are recycling and reuse and they are beneficial to both people and the environment. Laws and regulations on E-waste have also been implemented in many countries in order to reduce the importation of E-waste into developing countries but they were unable to enforce them well due to high level of corruption, poverty and lack of good governance. The countries with E-waste problem made many efforts in finding good disposal and management methods and some of them have already implemented.

METHODOLOGY

The primary data for this paper was obtained through interviews, questionnaire and direct observation. A purposive sampling method was used in choosing the population of interest. These populations are the residents living in E-waste disposal areas in Jimeta, Adamawa state. Both questionnaire and the interviews were administered and conducted among the residents whom are randomly selected. A direct observation method was used in analyzing the kinds of E-waste dispose in the areas. The data obtained were analyzed using inferential and descriptive statistics.

Research Strategy

Three data collection instruments were used in this paper, these are interviews, questionnaires and direct observation. All the data obtained were analyzed carefully and interpreted based on the response obtained. The results obtained are discussed and final conclusions are drawn.

Population Sample

For the questionnaire, samples of 20 people were randomly selected from the population of interest and the questionnaire were distributed and administered. Ten (10) people were also randomly selected and interviewed from the population of interest.

Primary and Secondary Data

The primary data in this research are the data obtained from the residents that are randomly selected and responded to the questionnaires and the interviews. The secondary data is the one gathered from journals, articles and other research that are already conducted in relation to this research.

Data Collection Instrument

Questionnaires and interviews are the main data collection instrument of this paper. Another data collection instrument was the direct observation, which is used in determining the kinds of E-waste and its components.

RESULTS AND DISCUSSIONS

Demographic Information of Respondents

The Table 1.0 below shows that the majorities (80) % of the respondents are male while 20% are female. From this table, we can also see that most of the respondents that filled out the questionnaires are Male who are mostly found sitting in front of their houses. Most of the female were at home and we were unable to reach them, so instead we gave the questionnaire to those that are available in the community.

Table 1.0

Sex	Frequency	Percentage
Male	16	80
Female	4	20
Total	20	100

The table 1.1 below shows that the majority of the respondents in the community are civil servant (30%) and students (30%). The occupations of other people in the community are businessmen and housewives. The result implies that most people in the community have something to do and they can at least afford to pay for disposal services if needed.

Table 1.1

Occupation	Frequency	Percentage
Civil servant	6	30
Businessman	4	20
House wife	4	20
Student	6	30
Total	20	100

The results in table 1.2 below shows that majority (50%) of the respondents have tertiary education followed by secondary (30%) and primary education (20%). Some of the respondents (10%) have informal education as stated by them in the questionnaire. The results implies that the respondents are educated enough to know what is good and harmful to their health and the environment.

Table 1.2

Educational Level	Frequency	Percentage
Primary	2	10
Secondary	6	30
Tertiary	10	50
Others	2	10
Total	20	100

Sources and Categories of E-waste

From the interview conducted and the kinds of E-waste observed in the community, most of the wastes dispose in the community are those waste that are generated at home. Most of the wastes observed are large household appliances such as refrigerators, microwaves, heaters, air conditions and electric gas cookers. Other electronic appliances that are dumped in the community include radio, televisions, decoders, audio amplifiers and other musical equipment. Most of the E-wastes dumped in the community are those electrical and electronic appliances that are mostly used at home and were of no longer used. For example, I interviewed an electrical engineer who repairs appliances such as Television, DVD's, recorders and computers. He said that he normally disposes most of the appliances that he was unable to repair in front of his shop. According to him, there are some appliances that are more than two years in front of his shop.

The table below shows the kinds of E-waste dispose by the respondents in the community. The result shows that most of the respondents dispose home appliances such as refrigerators, electric cookers, televisions, and so on.

Table 2.1

Kinds of E-waste dispose	Frequency	Percentage
Heaters, refrigerators, Fans, Air condition, Gas cookers	4	19.05
Television, recorders, radio, DVD's	4	19.05
Smartphones, Computers		9.52
Batteries, chargers,	10	47.62
Others	1	4.76
Total	21	100

The table 2.2 below shows the different categories of E-waste and the examples of some appliances and equipment under each of the category.

Table 2.2

S/ N	Category of Waste	Examples
1	Large Household Appliances	This includes some household appliance such as refrigerators, microwaves, radiators, heating appliances, washing machines, and cloth dryers, fanning/exhaust ventilation/conditioning equipment.
2	Small Household Appliances	Examples of small household appliances includes pressing iron, toasters, fryers, clocks, watches, Vacuum cleaners, other cleaners, weaving textile appliances, grinders, opening/sealing/packaging appliances, knives, hair cutting/drying/shaving devices.
3	IT and Telecommunication Equipment	Mainframes, microcomputers, printers, PC (desktop, notebooks, laptops), photocopiers, typewriters, fax/telex equipment, telephones
4	Consumer Equipment	An audio amplifier, Radio and TV sets, Hi- fi recorders, Video cameras/ decoders and musical instruments.
5	Lighting Equipment	Luminaires for fluorescent lamps, low pressure sodium lamps
6	Electrical and Electronic Tools (excluding large-scale	Drills, saws, sewing machines, turning/processing/sanding/sawing/cutting/shearing/penetrating/punching/collapsing/bowing hardware, riveting/nailing/screwing instruments, welding/binding devices,

	industrial tools)	splashing/spreading/scattering apparatuses,
7	Toys, Leisure and Sports Equipment	Car racing sets, coin slot machines, biking/diving/running/ rowing computers, Electric trains, video games and sports equipment
8	Medical Devices	Devices for radiotherapy/cardiology/dialysis, fertilization tests, ventilators, analyzers, freezers, detecting/preventing/monitoring/treating/alleviating illness, injury or disability
9	Monitoring and Control Instruments	Smoke detectors, heating regulators, thermostats, measuring/weighing/adjusting appliances for household or laboratory use, other industrial monitoring and control instruments
10	Automatic Dispensers	For hot drinks, hot or cold bottles/cans, solid, products, money, and all kinds of products

Note: The table above is obtained and adapted from a research conducted by (A.Abdulkarim, 2012) on the challenges of E-waste management in Nigeria.

Hazardous components and its effect on Human and Environment

Most E-waste contains hazardous materials that are very dangerous to the health of people living around and the environment when exposed. Some of the E-waste contains some radioactive elements that when exposed by humans can lead to respiratory, cardiovascular, neurological and pulmonary disease. Such elements can also contaminate water and

soil, which can lead to the death of many important organism and marine ecosystem. They can also cause atmospheric pollution and occupational health hazards. Apart from the environmental and health effects, some of the elements in E-waste can cause uncontrolled fire, which can lead inhalation of toxic fumes by people around.

Table 3.0: The table below shows different items and the hazardous components they contain.

ITEM	HAZARDOUS COMPONENTS
Cathode Ray Tube	Mercury, phosphorous Lead, antimony
Liquid Crystal Display	Mercury
Circuit Board	Lead, BFR, beryllium, antimony
Fluorescent Lamp	Phosphorous, Mercury flame retardants
Cooling systems	Ozone depleting substance (ODS)
Plastic	BFR, phthalate plasticizer
Insulation	Refractory ceramic fiber ODS in foam, asbestos
Rubber	Phthalate plasticizer, BFR, lead
Electrical Wiring	Phthalate plasticizer, BFR
Batteries	Lithium, cadmium, Lead, mercury

Note: This table is adapted from a research conducted by (A.Abdulkarim, 2012) on the challenges of E-waste Management in Nigeria.

Table 3.1: The table below shows the components of E-waste and their effects on Humans.

Toxin	Sources	Effects in Humans
Mercury	Fluorescent, LCD screen, switches, level board screens	Impairment of neurological development in fetuses and small children, tremors, emotional changes, cognition, motor function, insomnia, headaches, changes in nervous response, kidney effects, respiratory failures, death
Lead	CRT of TV, PC screen, circuit sheets	Likely human cancer-causing agent, harm to mind and sensory systems, moderate development in youngsters, listening issues, visual deficiency, the runs, perception, behavioral changes (e.g. reprobate), physical issue.
Chromium	Untreated and excited steel plates, decorator or hardener	Asthmatic bronchitis, skin aggravation,

	for steel lodgings	ulceration, respiratory bothering, punctured eardrums, kidney harm, liver harm, pneumonic blockage, oedema, epigastric torment, disintegration and discolouration of the teeth.
BFR	Plastic casings, circuit boards	May expand tumor danger to digestive and lymph frameworks, endocrine issue
Cadmium	Light-touchy resistors, as consumption retardant, Ni-Cd battery.	Inward breath because of vicinity to risky dump can bring about serious harm to the lungs, kidney harm, insight

Knowledge on E-waste and its Management by respondents

Most of the people interviewed replied that they don't know that E-waste that are improperly dispose in the community can have effects on their health and the environment. One Mr. Imeka in the study area said that he had been living in the community for the past 10 years and he had never had of anything about the effects of the E-waste dispose in the community. Some others who were interviewed knew about E-waste and its negative effects in the community. For instance, One Mr Musa who was a graduate from Modibbo Adamawa University of Technology Yola said he knew about E-waste and its effects on humans and the

environment. Mr. Musa listed some of the diseases caused by E-waste due to the chemical and radioactive element and their effects on environment also. From the data collected using the questionnaire it is also observed that there is a strong relationship between Educational level of the respondents and knowledge about E-waste and its effects.

Table 4.0 below shows that majority (55%) of the respondents are aware on the effects of improper disposal in the community while 45% are not aware. The result implies that majority of the people living around the E-waste dumping region are at least educated enough to know the effects of the waste that was dumped in the community. As a said earlier when explaining table 1.2 on educational level of the respondent, majority of the respondents are educated enough to know what is good and what harmful to their health and the environment.

Table 4.0

Aware on the effects of improper E-waste disposal	Frequenc y	Percentag e
Yes	11	55
No	9	45
Total	20	100

The table 4.1 below shows that most people knew about the effects of E-waste through school and media. Others knew about it through campaign and awareness and from family and friends. This result implies that social media and schools play very important role in making people aware that improper Waste disposal is dangerous to our health and environment. Other sources such as family and friends and campaign and awareness organize by organizations also play very important role in educating people.

Table 4.1

Knew about the effects through/ from	Frequency	Percentage
Media	4	36.4
School	4	36.4
Family and friends	2	18.2
Awareness and Campaign	1	9.1
Total	11	100

Table 4.2 below shows that the majority (80%) are not aware of any organization or company that comes to the community and collects E-waste for disposal or any other purpose. Other respondents (20%) said they were aware of a company/agency that collects E-waste.

Table 4.2

Aware of any Agency or company that collects E-waste after disposal	Frequency	Percentage
Yes	4	20
No	16	80
Total	20	100

Table 4.3 below shows that out of the 20% (4 people) in table 4.2 that are aware of agency that collects E-waste in the community, 3 people have an idea on what the agency does with the E-waste while 1 don't.

Table 4.3

Any idea of what is done with the wastes	Frequency	Percentage
Yes, I do	3	75
No, I don't	1	25
Total	4	100

When the respondent that have an idea on what the agency does with the E-waste that was collected are been asked, 2 people (66.67%) out of the 3 said they burn the waste while other person (33.3) said the repair them. Even though the number of people that said there is an agency that collect waste in the community is not that many and also the

number of people that have an idea on what the agencies does with the waste, this result clearly shows that the community lack good E-waste management methods. The result in the table below also shows that the method (burning) used in the community is very dangerous to the health of people and the environment if not in proper way.

Table 4.4

What is done with the waste by company or organization	Frequency	Percentage
Burning them	2	66.67
Repairing	1	33.3
Recycling	0	0
Export to other countries	0	0
Others	3	100

Table 4.5 below shows the respondents rating of the waste management method in the community. Majority (45%) of the of the respondent rated the management method very poor then followed by 35% poor, 15% rated good and 5% rated the waste management method as excellent. This result implies that the waste management method used in the community is not very effective even though the question is not specific to E-waste but for all kinds of waste in the community.

Table 4.5

The overall rating of Waste management Methods and ways in the community	Frequency	Percentage
Excellent	1	5
Good	3	15
Poor	7	35
Very Poor	9	45
Total	20	100

The effects of the E-waste on Respondents Health and Environment

When the respondents are being asked whether if there is prevalence of respiratory, cardiovascular or pulmonary disease in the area of the study, many of them said they have no idea on that. During the interview some of them said they knew that E-waste is harmful to human health and the environment but they can't really say that the E-waste causes some of the infectious disease. Nearby hospitals and clinics were visited but no data relating to the diseases caused by E-waste were obtained. Lack of data in most hospitals and clinics is one of the major problem people are encountering especially when doing a research. With enough data, one can analyze them and clearly finds the relationship between the two factors. Lack of getting the data on the number of people with the diseases caused by E-waste is a limiting factor in this research.

Effective and Economical methods of Managing E-waste

There are many effective and economical methods of managing E-waste that we generate in our communities. These methods are very effective and also beneficial to the people in the community and also the environment. One of the effective and economical methods of managing E-waste is recycling, many benefits can be derived using this method and also factor such as environmental pollution can be reduced (Gaidajis, Angelakoglou, & Aktsoglou, 2010). The following are some of the benefits of recycling

- Materials and metals in some electronic devices can be recovered and saved for future use.
- The polluting of air and water as a result of improper disposal can also be avoided through recycling of E-waste.
- The amount of greenhouse gases that will be emitted by the new products that will be produced by companies can also be reduced using recycling.
- Resources can also be conserved through recycling of electronic and electrical devices.

The recycling method has so many advantages, which include providing jobs opportunities, and reducing diseases are caused as a result of exposure to chemicals in most E-waste. Other economic benefits of recycling are that it helps in providing business opportunities to people, reduce the cost of management and transportation and also provide subject for research on more efficient and profitable recycling methods in different parts of the world.

Another economic and effective method of managing E-waste is the refurbishing, in this method people in the community who had old electronics can take the items for refurbishing instead of dumping them in garbage or in open dumps. The items are going to be used as such or refurbished by the vendor. The refurbished items can then be sold at lower price for other people, which are beneficial to both the owner and the environment, instead of dumping them and affecting the environment and people's health.

These management methods are mostly used in developed countries in managing E-waste and people in developing countries such as Nigeria, Ghana and others can easily adapt them. These methods are not that expensive and they can be afforded by many states and local governments, which could serve as a good source of revenue.

CONCLUSION AND RECOMMENDATIONS

E-waste had been one of the major problems that had led to the increased in the emitting of greenhouse gases, water pollution and prevalence of cardiovascular and pulmonary diseases in many developing countries. It has also led to the destruction of many ecosystems, which are beneficial to humans and the environment. Lack of good and effective methods of managing E-waste had also become a problem in many developing countries making E-waste abundant everywhere and people everyday becoming exposed to the radioactive element they are composed of.

Looking at the results obtained, the paper recommends the following points in order to reduce the issue of E-waste and also provide effective and beneficial methods of managing them.

- Both state and federal government in Nigeria should implement and enforce laws on E-waste and punished those people who are caught dumping E-waste in open dumps and backyards.
- The state and federal ministries of environment and health should organize a campaign and awareness on the dangers of E-waste and how people can handle them properly.
- A strict rule on the importation of E-waste into Nigeria should be implemented and should be monitored by Law enforcement such as the Nigerian Customs services and others.
- More E-waste recycling facilities should be set up in different parts of the country in order to reduce E-waste and provide job opportunities.
- Residents living in communities should also contribute more by making sure that E-wastes are properly disposed, so as to have a safe and healthy environment.
- Federal, state and local governments should also provide support and infrastructure to the agencies that collect waste and manage them in different parts of the country.

Future Study

Due to lack of enough data on hospitals and clinics on the number of people infected with diseases caused by chemicals and radioactive elements found on E-waste, one can continue this research to see the health impact when such data are obtained. The water in the wells and rivers can also be tested to determine the environmental impact of the E-waste dump if adequate resources for such tests are available.

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