CZECH UNIVERSITY OF LIFE SCIENCES PRAGUE

FACULTY OF ECONOMICS AND MANAGEMENT

DIPLOMA THESIS

ECONOMIC ANALYSIS OF ENVIRONMENTAL PROBLEM IN NIGERIA

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DECLARATION

While acknowledging information from other sources, I will like to state with academic honesty that this is my original work. This thesis has never been presented either in part or in whole for any purpose anywhere. I am solely responsible for any error in this work.

In Prague, 31st March, 2014

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OTEKHILE Cathy-Austin

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"Learning is a continuous process, the moment we stop learning we are dead"- **Cathy-Austin Otekhile**

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DEDICATION

To The Lord God Almighty –The blessed and only Potentate, The King of kings and Lord of lords. Who knew me and my assignment even before I was conceived. To HIM alone by all the praise and glory. Amen!

To My Darling husband and Children

Abstract

The problem of E-Waste is growing at an alarming rate in Lagos state, Nigeria; due to the high poverty level, the demand for second hand EEE is high. The importation of the second hand EEE into Nigeria legally and illegally cannot be banned out rightly; the transboundary of E-Waste into Africa is seen more of an opportunity than a problem because a large percentage of the unemployed youths derive their source of livelihood from this informal sector. This study analyzes the problem of e-waste in Lagos state based on the survey carried out in Ojo Local government area of Lagos state.

It is revealed in our study that more people are becoming aware of the risk posed by e-waste to human health and the environment and that the people believe that the government is not doing enough. The government needs to go beyond the enactment of national policies on e-waste and move ahead to implementing national polices on e-waste. Recycling plants should be established to help in recycling of end of life EEE, collection centers where the consumers can return non-functioning EEE should be set up and the producers of EEE should be enforced to take responsibility for the take back of non functioning EEE.

Keywords: Environmental problems, E-Waste, Electronics and Electrical Equipment (EEE), Lagos state

Abstrakt

Problém s E-odpadem roste ve státě Lagos (Federativní republika Nigérie) alarmujícím tempem. Kvůli velké míře chudoby obyvatelstva je po elektronických a elektrických zařízeních (EEE) z druhé ruky velká poptávka. Import této komodity do Nigérie, ať již je legální či ilegální, lze v současné době jen těžko zcela zakázat - obchod s EEE z druhé ruky je totiž spíš než jako problém vnímán jako ekonomická příležitost, protože velké procento oficiálně nezaměstnaných, převážně mladých lidí, nachází zdroj svého živobytí právě v obchodu s těmito artikly. Tato studie analyzuje pomocí výzkumných metod praktiky obyvatel "Festac town" a oblasti "Ojo" při zbavování se E-odpadu.

Naše studie rovněž odhaluje rostoucí povědomí obyvatel o rizicích spojených s E-odpadem jak pro lidské zdraví, tak i životní prostředí a setkává se s názory lidí, že nigerijská vláda nejedná dostatečně efektivně. Vláda by měla přejít od formálního přijetí národních zákonů pro obchod a manipulaci s EEE k naplňování závazků v reálu. Recyklační provozy by měly v daleko větší míře fungovat při zpracování EEE, jakmile tato přestanou fungovat, měla by být založena další sběrná místa, kam mohou uživatelé nepracující EEE uložit a výrobci EEE by měli být podněcováni k převzetí zodpovědnosti za zpětný příjem svých nefungujících zařízení.

Klíčová slova: Federativní republika Nigérie, Problémy životního prostředí, E-odpad, Elektronická a elektrická zařízení (EEE)

List of Abbreviations

CRT	Cathode Ray Tubes
IT	Information Technology
ICT	Information and Communication Technology
EEA	European Environment Agency
EPR	Extended Producer Responsibility
EU	European Union
EEE	Electrical and Electronic Equipment
E-Waste	Electronic waste
GDP	Gross Domestic Product
WEEE	Waste Electrical and Electronic Equipment
FEPA	Federal Environmental Protection Agency
LCD	Liquid Crystal Display Television
OECD	Organization for Economic Co-operation and Development
NGOs	Non-Governmental Organizations
NNPC	Nigeria National Petroleum Corporation
NESREA	National Environmental Standards and Regulations Enforcement Agency
PRO	Producer Responsibility Organization
PVC	Polyvinyl Chlorides
SENS	Stiftung Entsorgung Schweiz.
SMEs	Small-Medium Enterprises
SWICO	Swiss Association for Information, Communication and Organizational Technologies

UN	United Nations
UNEP	United Nations Environmental Programme

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1. Introduction

Environmental problems are majorly caused by human activities among which are overexploitation of natural resources and improper waste disposal and poor management; this problem abounds globally. The quest of man for development, industrialization and civilization has caused a lot of problems for planet earth. Nigeria is a developing country with the highest population in Africa; with a population of over 150 million people. Due to concentration of industries in major cities or urban areas, the urban areas like Lagos State are congested and much more importantly the advancement in information technology in terms of computers, telephones, and electronics has contributed to one of the problems faced by cities or urban areas. This advancement in technology gave birth to "throw away culture" in the developed world and exportation of these used electronics to developing countries is the cheapest means of disposing these obsolete used electronics.

Lagos state, south west, Nigeria is one of the highly populated mega cities in the world with an estimated population of over 20 million. According to 2006 estimate, the population is increasing at an alarming rate as a result of influx of youths seeking white collar jobs and better life without a matching increase in the facilities to maintain the environment. Lagos state's sea ports (tin-can Island, Apapa) and Benin republic border has become the major gateway for this ''used electronics'' to be imported into Nigeria and other West African countries; developing countries are fast becoming a dumping ground for developed countries like United States, United Kingdom and European countries. A huge amount of e-waste is generated without appropriate management measures by the authorities to manage the waste and this constitutes hazards to the health of the inhabitants and the environment.

The Obsolete office equipment or electronics are not properly disposed; they are either stock-piled up in a place or find their way into illegal dumpsite or into the water streams and thereby contaminating the water. And some of these electronics are burned in public waste disposal site by scavengers who are usually young people who are looking for valuable substances in these electronics to sell to make a living.

The main aim of this study is to analyze the problem of e-waste in Lagos metropolis of Nigeria and also to examine the effectiveness of the legislation regulating the importation

of used electronics from industrialized countries into Nigeria. And to make useful suggestions and recommendations that will help to improve the present e-waste situation in Nigeria

1.1 Structure of the Study

This study is divided into five chapters. The first chapter is the introductory part containing the objectives and the research question. The second chapter outlined the methodological approach used; the survey and the quantitative methods used in the analysis. The third chapter focuses on the theoretical review: the concept of e-waste and the methods of e-waste management. The forth chapter presents the analysis and discussions on the results of the results. The final part which is the last chapter underlines the conclusions and makes recommendations on how e-waste can be properly managed to ensure environmental sustainability.

Chapter Two

This chapter focuses on the methodological approach used in this study, method of collection of data and analysis, sampling technique and sampling size determination, the hotspot of e-waste in Lagos state, the research question and the limitation of the study**.**

2. Objectives and Methodological Approach

2.1 Methodological Approach

The methodological approach adopted in this study is both qualitative and quantitative based; the qualitative aspect is based on the review of existing literatures. The quantitative aspect is made possible based on the primary data collected through the use of a well structured questionnaire designed to find out how some households in some selected areas of Lagos State; some inhabitants of selected areas of Ojo and Amuwo-Odofin were asked on how they dispose their e-waste.and this would further be analyzed with the use of quantitative methods. The secondary data are based on internet sources, journals, and data from UN Comrades, National Bureau of Statistics, Newspaper articles and World Bank.

2.2 Objective of the Study

Based on the fact that problem of e-waste is an emerging problem both in the developed and developing countries and a number of studies and research carried out in this field emphasized lack of effective regulations in the developing countries and the huge amount of illegal transboundary movement of e-waste in to developing countries like Africa. The main aim of this study is to analyze the environmental problem caused by e-waste in Lagos metropolis of Nigeria in order to ascertain the extent of the problem of e-waste; the households' disposal habits are analyzed and we also examine the challenges of implementing national policies on e-waste in Nigeria.

2.3 Specific objectives

- To identify environmental problems in Nigeria and why e-waste forms a huge problem for the health of the inhabitants and constitute environmental hazards.
- To determine the extent of the problem of e-waste in Lagos metropolis.

- ❖ To examine the challenges or obstacles hindering the implementation of national policy on e-waste.
- ❖ To examine how people in selected areas of Lagos dispose their e-waste.

2.4 Research Question

In order to accomplish the set objectives of this thesis, the following research question will serve as guideline: Why e-waste disposal and constitutes an environmental problem in Lagos Metropolis? This question would be answered with the aid of the following sub-questions:

1. How people in Lagos metropolis dispose their e-waste?
2. What are the legislation and regulations regulating the E-Waste in Nigeria?
3. What are the challenges of e-waste management in Nigeria?
4. Are the national policies on e-waste implemented by the government?
5. What are the efforts of Lagos state authorities to curb the problem of e-waste?

2.5 Methods of Data Collection and Analysis

The primary data used in this study was collected from two different local governments in Lagos state; Amuwo-Odofin and Ojo Local government areas. A well structured questionnaire was used to collect the data; 50 households were randomly selected from each local government and the questionnaires were administered to them with the assistance of the researcher. The data were collected in the period of December 2013-February 2014. In the process of carrying out this research both primary and secondary data were collected and are analysed.

Data collected were further processed, transmitted into electronic database and statistically analysed using the gretl with the aid of the econometric technique. Descriptive statistics was used to characterize the information supplied by the respondents

2.6 Hotspot of E-Waste in Lagos State

The hotspots of EEE are indicated on the map of Lagos state; the major entry point of EEE into Nigeria is through the Apapa/Tin can Island sea port, and through the international airport and the border. The Alaba International electronics market and the Ikeja computer village are centers for selling, refurbishing and servicing.

Figure 1: Map of Lagos State indicating Hotspot of E-Waste

2.7 Sampling technique and Sampling size determination

The sampling method used in the study is random sampling method the households close to the open dumpsites were randomly selected and 100 questionnaires was administered to 100 households within the study area.

There are different sampling techniques that can be used; however the sampling technique adopted in this study is based on simplified sampling technique provided by Yamane, 1967. To determine the sample size; 95% confidence level, degree of variability or standard deviation of .5 and ±10% precision level will be used.

$$n = \frac{N}{1 + (e)^2}$$

Where n is the sample size, N is the population size and e is the level of precision or margin of error. Based on the formula above and the population size which is greater than 100,000 a minimum of 100 responses is required for this study. This survey was carried out using 100 respondents.

2.8 Limitation of Study

In the course of carrying out our research we were faced with the following limitations:

- Difficulty arising from inability to access the relevant data from the authorities; data regarding the importation of used EEE into Nigeria were inaccessible. One reason is that some cars or buses imported are often loaded with used EEE and sealed in such a way to hinder the customs from checking the contents of the vehicles.
- Unavailability of relevant data from the National Bureau of Statistics and the Nigeria Customs department.
- The importation of EEE data for 2004 and 2005 are not published on UN comtrade.com

Chapter Three

In this chapter, the diverse environmental problem Nigeria is presently facing is enumerated while e-waste is identified as a huge growing environmental problem in Nigeria and especially Lagos state, one of the commercial nerves of the country. The definition of e-waste from different points of view is looked at and the export of e-waste into Nigeria, Literature relating to the problem of e-waste in general is reviewed and the components of e-waste are mentioned in order to identify the hazardous contents. The global perspective of e-waste was also discussed, the transboundary of e-waste across borders or countries; is it a problem or opportunity for economic gains. Furthermore, the environmental and health impact and the legal framework regulating e-waste in Nigeria are discussed. Lastly in this chapter we looked at the efforts made by the UNEP in West Africa and also the efforts by the Lagos State Waste Management Authorities in Lagos in curbing this menace.

3. Literature Review

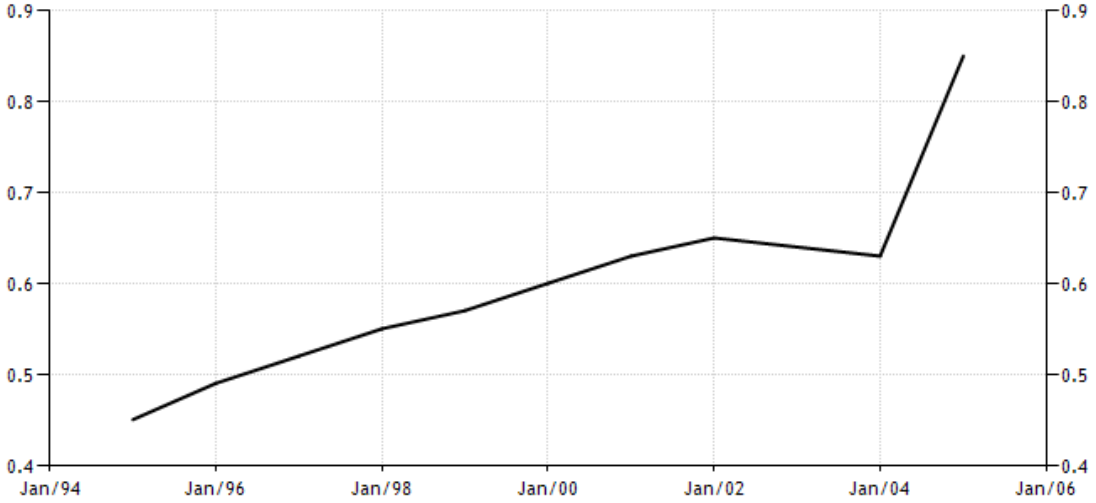
3.1 Environmental Problems in Nigeria.

Nigeria is plagued with diverse environmental problems:

1. Urbanization
2. Deforestation
3. Pollution
4. Environmental Degradation
5. Erosion
6. Desertification
7. Waste Disposal & Management Problem

The problem of electronic waste is becoming a huge problem in Nigeria which demands urgent attention from the appropriate authorities; the influx of importation of secondhand electronics into developing countries like Nigeria is growing daily.

Figure 2: Personal computers (per 100 people) in Nigeria.



Source: tradingeconomics.com

The fig two above reveals that more people are using personal computers from 1994-2006. The situation when more people are using computers without matching or corresponding efforts by the government or the system to manage the e-waste generated will rather worsen the problems of e-waste in the system.

3.2 Definition

The concept of e-waste is imperative; there is no one definition of e-waste as each country has its own definition, it is not established yet if micro wave oven and other similar appliances like refrigerators and washing machines should be included however it is defined as unwanted electronic products close to the end of their useful life for example computers, televisions, VCRs, copiers and fax machine. These electronic products can be reused, refurbished or recycled. (California Electronic Waste Recycling, Act of 2003). According to the electronic recyclers International, e-waste is defined as all obsolete or outdated computers, televisions, cell phones, printers, PDAs, and thousands of other devices commonly used in offices, homes, and by people on the go. The definition of E-Waste as per the EU directive is widely acceptable definition and used among the EU countries. E-waste is any electrical appliances that have reached its end of life which comprises of a range of EEE ranging from large household appliances such as refrigerators, air conditioners, cell phones, personal stereos, and consumer electronics to

personal computers and cellular phones which have been discarded by their users. (OECD, 2001; Basel Action Network, 2002; Azuka, 2009). E-waste refers to those who processes E-waste, collects EEE that the consumers no longer wants and refurbishes, recycles for the re-use of other consumers. (Solving the E-waste Problem, StEP, 2005)

The Directive 2002/96/EC on Waste Electrical and Electronic Equipment (WEEE) which is implemented in all EU member States; a key element of the European Union's environmental policy on waste. It focuses complex waste flow in terms of different materials and components, types of products, the hazardous substance used and the growth patterns of this waste stream with changes in technology, design and marketing. This directive desire to influence the modification of the electronics designs in order to make WEEE easier to dismantle, recycle and recover and plays a vital role in helping to decease the release of hazardous substance into the environment by not only regulating the use of hazardous substance in manufacturing of electronics but to help in controlling the way the older electronics are disposed at the end of its life..Emphasized that the aim of directive should be redefined to target efficient waste management rather than targeting product design electronics.

Figure 3: Export of E-Waste to Nigeria

Source: Greenpeace/Basel Action Network.

E-Waste is been exported into Nigeria from developed countries; Western Europe, United Kingdom and USA. According to Margaret Bates, a professor of sustainable waste management at the University of Northampton, the e-waste are shipped under disguise and illegally finds its way into the Nigeria market with about 75 per cent of it being junks according to 2005 estimates. Due to the high poverty level, a greater number of the population cannot afford to buy new EEE so they opt for second hand EEE therefore the demand for second hand EEE is high. According to the Basel convention on transboundary movement of hazardous wastes 2010, it revealed that 1.2million tones of EEE were exported into Nigeria.

Table 1 below partially reveals the importation of EEE into Nigeria; the figures are not accurate because a lot of illegal importations are carried out at the seaports in Nigeria and the legislation regulating importations are lax. But the table reveals that a lot of large household appliances and consumer equipment are imported into Nigeria between 2000-2010

Table 1: Import statistics 2000 – 2010 for Nigeria

WEEE Cat.[1)]	2000	2001	2002	2003	2006	2007	2008	2009	2010
1	50,500	51,200	38,900	87,500	329,800	51,800	42,700	631,900	220,400
2	12,000	15,900	15,400	15,300	87,900	3,000	3,600	52,600	4,900
3	5,300	6,300	9,000	23,100	409,300	50	50	644,100	41,900
4	44,000	48,800	68,900	58,900	1,967,400	2,200	400	1,482,300	135,900
Total	112,200	122,200	132,000	184,800	2,794,400	57,050	46,750	2,810,900	403,100

1) Categories according to the EU WEEE Directive: 1 = large household appliances; 2 = small household appliances; 3 = IT and telecommunications equipment; 4 = consumer equipment

Source: UN Comtrade 2011) (in tonnes)

3.3 Literature Review

The major problem of waste management in Nigeria is that of inadequately formulated and poor implementation of environmental policy. This environmental problem is worsened by the increasing population growth rate and growing urbanization which has made it impossible for the State Waste Management board to contend with the daily increasing waste generation in the urban areas. Waste collection has become irregular and therefore wastes are dumped at illegal dumping site and sometimes are left to litter major roads in the cities. The once in a month sanitization exercise to keep the urban areas like Lagos clean is not sufficient to do the job. And the public attitude towards waste disposal needs to be corrected by continual public enlightenment programmes. The environmental agencies activities is slowed down or hindered by lack of sufficient funds, inadequate manpower and lack of modern day technology to manage the waste generated. They therefore stressed that a holistic approach that will integrate all aspects of the lives of the people ranging from socio-cultural, economic and psychological and technical should be employed to tackle this problem. (Agunwaba, 1998)

The material inflow of used electronics into Africa using Nigeria as a case study; used electronics find their way into business places, printing house, cyber café, homes and computer training centers and a larger percentage are unusable and end up in the dumpsite. There are no well established management practices for separating waste, storage, collection and disposal of waste and the environmental and health implications resulting from the improper disposal and management practices. Lack of recycling facilities in Nigeria and most developing countries make this e-waste to end up being recycled in a crude way such as open burning of e-waste thereby polluting the air, water and environment. (Nnorom and Osibanjo, 2008)

In addition, three ways by which computers enters the Kenyan consumer market with the aid of a material flow diagram were highlighted: firstly through the importation of new and used computers, assembly of computers locally to service the local market and the direct importation by the users themselves. The data which was collected for a period 2004-2007 revealed that a total of 135,385 IT or IT-related units were imported / assembled. In 2007, 1,513 tonnes entered the market but 93.4 percent of this was supplied to the consumer, suggesting that importers retained a stock of 6.6 percent. The consumer in addition to receiving 1489.4 tonnes also received 151.3 tonnes from the secondhand market; huge e-

waste is held by the consumers and structures that are not developed enough to manage waste disposal. Anticipating disposal level poses a problem; based on the interview with the consumers it is assumed that consumers are likely to dispose 1,210.4 tonnes to the second-hard market, and 18.6 tons to collectors or as general waste which was sent to refurbishers. The consumer further disposes 18.6 tons directly to recyclers. (Waema and Mureithi, 2008)

The challenges of environmental problems in Nigeria; which is caused by the interaction of humans with the environment triggered by poverty and ignorance. The resultant negative impacts of human interaction with the environment such as urbanization, deforestation, desertification, overpopulation and pollutions are examined and their contributions to the environmental problems in Nigeria are enumerated. The quest of Nigerians to satisfy the desire for food, shelter, recreation and infrastructural facilities has led to these problems. Federal Environment Protection Agency was established to control all land-use activities in regards to resources exploitation and management. Solving these environmental problems go beyond the strategies, objectives and scope of the Federal Environment Protection Agency. The techniques used by FEPA should be indigenized and a “bottom-up” approach and community based approach should be used. (Omofonmwan and Osa-Edoh, 2008)

Furthermore, the rising generation of e-waste is a present problem in India due to the increasing dependence on EEE; and the two small recycling facilities in India is not sufficient to solve the present problem of rising e-waste in the country. The management policies are poorly implemented, the urban poor, children and women obtain their source of livelihood from scavenging. The importation of e-waste from the developed countries further aggravates the problem of e-waste in the country and lack of public awareness on the improper disposal of e-waste. Some households dispose their e-waste along with the solid waste without the knowledge of its impact on their health and the environment. (Borthakur and Singh, 2008).

Economic reasons was identified as the bottom-line of the shipment of the used electronic into Africa; some of these used electronics which are non-functional ends up as e-wastes at the open dumpsite, even though e-wastes may find their way into Africa under the guise of helping developing countries in Africa to bridge the digital gap between industrialized world and the developing countries as people were to believe. They may be shipped in agreement with the developing country to provide aids, money or execute a project in the

recipient country; innocent and illiterates or semi-literate people in the recipient countries are the targets of these waste merchants and countries generating theses wastes. They offer them little money and the e-wastes are stored in containers and disposed at a certain location within the target areas. In 1987, e-waste was dumped in a village called Koko in Delta State, Nigeria by an Italian businessman who shipped the toxic waste of several Italian industries and dumped them at the backyard of a businessman who described them as mere construction materials. He was lured with money to accept the hazardous waste. The cost of recycling these e-wastes in these industrialized countries is much more expensive; It is estimated that it costs about $50 to recycle a personal computer in the United States, while the importer pays $15 a piece to recycle, which makes the US recycler to have a net gain of $35. The useful parts are extracted while the wastes are dumped at the backyard of the scrap trading company. An average of 500 containers of used electronic and electrical appliances enters Nigeria monthly because it is a huge business in Nigeria and people are crazy for used electronics but 75 percent are irreparable and end up in the dumpsites. This reveals a big laxity in the environmental laws in Africa; the Bamako convention and other treaties drafted and signed by some developed countries have not been strictly adhered to by them. (Aniyie, 2009)

Daramola and Ibem (2010) emphasizes the causes and implications of urban environmental problems for sustainable development in Nigeria. These urban environmental problems are caused by rapid urbanization, issues arising from development of urban areas, consumption patterns and psychological orientation of the urban residents. The growth in urban population without a match of adequate housing, infrastructure has continually put a pressure on the environment thereby making the environment unclean with poor sanitation and improper waste disposal. Besides health implications, it is argued that urban poverty is strongly correlated with environmental problem such as environmental degradation and underdevelopment. In the case of the Niger-Delta, environmental problem has caused the people loss of livelihoods because many agricultural land and waters for fishing are polluted.

E-waste are everywhere in the world and they possess a composite chemical parts which could be recycled and also hazardous substance which poses health and environmental risk, it is difficult to measure the flow at the local and international level. The environmental problems caused by e –waste is mostly degrading in the third world

countries where these e-waste are exported to for recycling although there are no sufficient scientific evidences to proof the adverse effect on the ecosystems, human health and the environment. E-waste disposal and management practices of some countries like Greece, Japan and Switzerland are mentioned to show a varying degree in the management practices of these countries; Switzerland was the first country where an official e-waste management system was established and operated. The EU 2002 directives on electrical and electronics equipment have restricted the use of hazardous materials causing the main environmental problems to be replaced with other safer substances. And also electrical and electronic equipment has been improved to assist in reducing e-waste ending in the landfills as well as encouraging efficient use of resources through recycling and re-use. In order to minimize the effect of these hazardous materials on the environment many technological changes are taking place like the replacement of CRT monitors with LCD monitors, the introduction of optical fibres and rechargeable batteries; the involvement of the NGOs and press for the elimination of these hazardous material is also a contributing factor to manufacturers seeking a "green" way of producing electrical and electronic appliances. (Gaidajis et al., 2010)

The relationship between population growth and environmental problems in Nigeria; the population of urban centres in Nigeria is growing at an alarming rate without a match of resources to manage the environment. The rate of urbanization was estimated at 5.5 percent and urban unemployment rate estimated at 10.8 percent (NNPC, 2004). They identified that the drivers of urbanization to be high population growth rate, concentration of development in urban centres, rural-urban wage differentials and increase in formal education. The numerous environmental problems faced in Nigeria are caused majorly by exaction of humans on the natural resources and the environment; deforestation, desertification, poor sanitation, pollution and flooding and erosion. These problems are aggravated by inconsistency in government policies, inadequate technology and funding. (Babanyara et al., 2010)

The volume of electronic waste is growing in Rwanda like any other developing country as more and more secondhand electronics find their way from developed countries into developing countries. Rwanda believe in the use of ICT in all sectors of the economy in order to accelerate the pace of socio-economic development of the country; such programme like one laptop per child and electricity distribution in the whole country was

initiated in order to increase the people's value and use of electronics. The main problem mentioned in this study was that e-waste management in terms of recycling of used electronics does not exist in Rwanda; despite that it allows the importation of secondhand electronics and the country is a signatory to the Basel Convention on the control of trans-boundary movement of hazardous waste and their disposal. There are no legislation regulating the management and disposal of electronic waste in the country. (Nsengiman and Bazimana, 2011)

Electrical and Electronics Equipment becomes obsolete quickly due to continuous and fast development of new models (innovation). And most of these obsolete EEE finds their way into developing countries that are on the quest to have access to information technology; some of these used and obsolete EEE are at the end of life and finally are dumped on open dumpsites or landfill which poses risk to human health and the environment, livestock and ecology. They identified sources of e-waste and their hazardous components and discussed initiatives to manage e-waste nationally and internationally. And they stressed finally that everyone is a stakeholder in e-waste generation in one way or the other: sellers, distributors, recyclers and consumers. (Oyediran and Abdulkarim, 2012)

Wildmer et al. (2005) gives in-depth understanding into the legislative and initiatives that are proposed to assist in managing the increasing quantity of e-waste; the Extended Producer Responsibility (EPR) has been promoted as a new initiative in waste management. The EU WEEE Directive, which came into force in August of 2004, makes it obligatory for manufacturers and importers in EU states to take back their EEE from consumers and ensuring environmentally sound disposal of EEE. They also identified problems and challenges peculiar to some industrializing countries like Beijing-China, Delhi-India and Johannesburg-South Africa. The risky process of extracting copper from printed wiring boards is discussed as an example to illustrate the hazards of the e-waste recycling industry in India. The three countries are compared based on an assessment indicator system which takes into consideration the structural framework, the recycling system and its various impacts. The three key points which was made visible from the assessments are that e-waste recycling has evolved in all countries as economic activity, in China and India it is based SMEs in the informal sector, whereas in South Africa it is in the formal sector, and each country is trying to control the loopholes or setbacks in the current system by inventing strategies for improvement of recycling of e-waste.

According to report in the independent of Sunday January 2014, a joint investigation was carried out by *The Independent*, Sky News, and Greenpeace, broken televisions beyond repair was monitored from the UK and tracked down at Alaba electronics market in Lagos, Nigeria. Under British environmental protection laws; such electronics should have been dismantled or recycled in Britain but unfortunately they are illegally shipped to countries like Nigeria and Ghana where they are stripped of their raw metal by young children scavenging waste dump sites. The investigators bought back the televisions after tracking the televisions to Alaba electronics market in Lagos, where up to 15 shipping containers of discarded electronics from Europe and Asia arrive every day. At least a third of the contents of each container is broken beyond repair and transferred to open dumpsites.

Finally, Sarah Marriot stated in her article on "E-waste: A growing environmental problem in Africa" that the e-waste generation level is increasing because of the decreasing product life span and that the problem is aggravated by the low recycling rate. The illegally shipped second hand EEE from the developed countries to developing countries in Africa most especially Nigeria and Ghana is forecasted that it will increase in the future due to increasing population of the continent. Alternative solutions such as the building of modern recycling technology in Africa and the manufacturing taking the responsibility to reduce the hazardous substance in EEE in order to curb the problem of e-waste were mentioned instead of banning the importation of used EEE.

3.4 Global Perspective on E-Waste

Globally e-waste market is expected to grow at an annual growth of 8.8 percent from 2004 to 2009 due to increasing "obsolescence rate" of electrical and electronic equipment and decreasing product life span; the average lifespan of computers in developed countries has reduced from six years to two years and mobile phones have less than two years life span.

According to UN estimates, 20-50 million tonnes of e-wastes is generated worldwide every year. E-Waste is seen as a tradable commodity which contains metals of economic values and several thousand components which are hazardous and non-hazardous some of which can still be recycled. (UNEP, 2007). Huge amount of these e-waste end up in developing countries with no strict regulations on importation of e-waste and the management of e-waste in terms of recycling. Despite the UN report warning on the dangers of increasing

electronic wastes in West Africa, the problem is worsened by the developed countries importation of used electronics which often are unsuitable for re-use and end up discarded as waste at the landfill.

Furthermore, Robinson (2009) examines the global production of e-waste, the chemical contaminants associated with e-waste and the environmental impact of these contaminants associated with e-waste. The global production of e-waste can only be assessed from the rich countries due to the information needed for the calculation which are only available in the rich countries where the electronics are produced; e-waste production was calculated at 13.9 million tonnes per year in the middle of this decade based on the available data and this figure does not include Latin America, Canada, Asia, Russia or Africa and does not account for growth in the last four years. The calculated figure of 13.9 million tons per year for the 20percent growth in the World's Gross Domestic Product (GDP) over the last five years, gives 16.8 million tons; he anticipated that the production of e-waste will grow considering changes in world economies and development in technologies, the number of computers and other e-waste potential items was correlated against the GDP of the country because electronic and electrical appliances are vital for the functioning of all economies even the most primitive economy. The composition of e-waste is changing due to technological advancement and NGOs pressure on manufacturers of electronics, some of these components can be recycled and some form hazardous contaminants to the environment using the city of Guiyu with its surrounding towns in the Guangdong region of China as a case study. Guiyu is the largest e-waste recycling site in the world and this result in the contamination of the entire region, polluting the water, air, soil and biota contained.

3.5 Health and Environmental Impact of E-Waste

E-waste has a more negative impact on the environment and human health because it contains hazardous substances which are harmful. It contains thousands of harmful chemicals and metals like lead, cadmium, chromium, mercury, polyvinyl chlorides (PVC), brominates flame retardants, beryllium, antimony and phthalates. Long-term exposure to these substances damages the nervous systems, kidney, and bones, reproductive and endocrine systems (Nsengiman and Bazimana, 2011).

Similarly, Green Peace (2005), in recycling of electronic waste in China and India stresses the presence of heavy metals and hazardous substance like Cadmium, zinc and yttrium sulphides in the dust and soil samples collected from the two locations in New Delhi (Kantinagar and Brijgang) used to store cathode ray tubes (CRTs), from televisions or computer monitors. And analysis of five samples of ashes collected from burned electronic wastes in a dumpsite in Longgang village of Guiyu (China) exposed the degree of contaminants of present in the electronic wastes burned. They discovered the presence of abundant of cadmium, copper, lead and zinc in most samples. Levels of antimony were notably high, with concentrations in four of the five samples at or above 1000 mg/kg and in one of these reaching 15200 mg/kg. High level of the presence of cadmium, copper, lead and zinc were also present in the ashes collected from two waste burning sites in n New Delhi (India), at Ibrahimpur and Shashtri Park.

In addition, Green peace (2008), on poisoning the poor electronic waste in Ghana indicated that hazardous chemicals and toxic metals like lead were present in mostly all the soil samples collected ; in some cases the level of such contaminants were high. The presence of other contaminants like cadmium and antimony was also noticed and also two plastic softeners (phthalates) were found in some samples, which are classified in Europe as toxic to reproduction, due to their ability to interfere with sexual development in mammals, especially in males. The burning of PVC wire covers and cables is likely to release these phthalates into the environment. And are already been banned in Europe because of their toxicity and ability to accumulate in the environment. The finding in Ghana is similar to the findings in China and India.

The most affected communities in Lagos State based on the survey carried out recently by Basel; are Alaba International market, Ikeja computer village, Odo iya Alaro and Olushosun dump sites. The pollution spreads to the Ojota, Ikeja and Alaba environs, the burning and other activities of e-waste take place within residential areas. These activities have negative impact on the environment (air, soil and water) and the human health of the residents and workers. The soil, air and surface water are negatively affected; the soil sample taken contains ashes and cinder which are aftermath of burning of e-wastes; the ashes contain toxins which contaminates surface waters used for domestic purposes and farm lands. The air in the environs is polluted by highly toxic fumes. The health of the workers (scavengers and informal recyclers) is affected; according to the survey the

workers complain of dizziness and general weakness. They do not work with protective devices in dismantling and recycling the e-waste and as a result they are exposed to a lot of occupational health hazards. (Ogungbuyi et al., 2012).

Table 2: Key Hazardous and Toxic Metals Found Electronic Waste

Toxic Metal(s)	Components	Impact(s) on Human Health
Cadmium	CRT screens, printer inks and toners, photocopying machines, circuit boards and semiconductors and fluorescent layer	It can cause lung damage, elevated blood pressure and kidney problem
Lead	Batteries, printed wiring circuit boards, solder on components, mobile phone coatings, cathode ray tubes	Initial symptoms of exposure are anorexia, muscle pain, malaise, and headache. Long-term exposure to lead decreases the overall performance of the nervous system. High level exposure causes brain damage and death.
Mercury	laptops, batteries, printed circuit boards, fluorescent lamps providing backlighting in liquid crystal displays (LCDs) for monitors.	Short term exposure to all forms of mercury can cause lung damage, nausea, vomiting, diarrhoea, increases in blood pressure or heart rate, skin rashes, and eye irritation Long term exposure permanently damage the brain, kidneys, and developing foetus.
Lithium	Batteries including mobile phone batteries	It can cause burning sensation, Cough, labored breathing. Shortness of breath. Sore throat.
Antimony trioxide	a flame retardant, added to cathode ray tube (CRT) monitor glass, found in	Toxic to humans in ways similar to arsenic.

	printed circuit boards and cables	
Arsenic	in older cathode ray tubes and in light emitting diodes	It can cause cancer, skin and lung cancer
Barium	In Cathode ray tube (CRT)	It accumulates in the body of fish and other aquatic body when it is absorbed
Polybrominated flame retardants (including polychlorinated biphenyls (PCB), polybrominated biphenyls (PBB), Polybrominated diphenyl ethers (PBDE), and tetrabromo bis-biphenol-a (TBBA)	plastic casings, cables, and circuit boards, condensers, transformers	
Polyvinyl chloride (PVC)	Cable insulation	When burnt it produces high toxic dioxins.
Selenium	circuit boards as power to supply rectifier, photocopying-machines	hair loss, nail brittleness, and neurological abnormalities such as numbness and other odd sensations in the extremities
Zinc sulphide	interior of CRT screens, printed circuit boards	

Source: Adapted from http://ewasteguide.info/hazardous_substances with modifications

3.6 Transboundary Movement of E-waste: Problem or Opportunity?

International transboundary movements of e-waste are monitored by the UN via the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal. The purpose of the Convention is to protect human health and the environment from adverse effects caused by hazardous wastes, and the transboundary shipments of these wastes. Export of hazardous wastes from OECD countries to non‐OECD countries is banned according to the export ban amendment to the Convention. It highlights that transboundary movements of hazardous wastes to developing countries, many of which do not have the capacity and facilities to handle such waste, do not make a sound management of the environment as required by the Convention. In spite of this ban, large amount of e-wastes are still been illegally exported to developing countries like Nigeria, Ghana and Egypt thereby making the developing countries a dumping ground. EEA report revealed an increase in illegal movement of e-waste during the period of 2001-2005; cases reported vary between 6,000 and 47,000 tonnes with an average of 22,000 tonnes. Some of these e-wastes end up being burned in the open air to recover metals of economic values which can be resold; is a huge business for the informal sector in Nigeria where a number of people are employed to earn their daily living.

Widmer et al. (2005) underlined that in emerging economies, e-wastes is not only seen as a business opportunity for labour intensive recycling operators but bridges the gap of the "digital divide"; it provides a means of satisfying the demand of the people for a cheap used or second hand electronics and electrical devices. The lack of necessary infrastructures for dismantling and recycling of electronics and electrical appliances by the formal sector thus provide an opportunity for a reliance on the informal sector. The crude means of dismantling and recycling of e-waste puts the health of workers at risk and the poses environmental hazards.

3.7 Legal Framework Regulating E-Waste in Nigeria

Nigeria is a signatory to numerous agreements and conventions that foster the maintenance of the environment both at the international and regional level; notable to mention are:

- 1972 UN conference on human environment
- 1985 Vienna Convention for the protection of the ozone layers.
- 1988 Basel Convention dealt with transboundary of toxic and hazardous waste.
- 1988, the OAU adopted a resolution declaring the dumping of nuclear and industrial waste in Africa to be a crime against Africa and its people.
- 1991 the OAU adopted the Bamako convention on the ban and import into Africa of hazardous waste and the control of transboundary movement and the management of hazardous waste within Africa, under which members prohibit the importation of all hazardous waste for any reason into Africa by non-members.

There are quite a number of legislations regulating the environment in Nigeria; the first legislation is the enactment of Federal Environmental Protection Agency (FEPA) Decree No. 58 of 1988 which brought the establishment of FEPA on December 30th 1988. FEPA was vested with the statutory responsibility of overseeing the overall protection of the environment. This decree prohibits the dumping of harmful/hazardous waste on any land and water in Nigeria; the harmful waste Act cap 165 was enacted as part of the country's response to the dumping of toxic waste in Koko, Delta state, Nigeria in 1988.

The Environmental Impact Assessment decree No. 86 of 1992 was enacted to compliment the activities of FEPA. The environmental impact assessment of all proposed activities or projects in the area of land utilization and industries locality are carried out to determine the possible negative impacts and to address them prior to the project take off.

National Environment Regulations S.I. No. 23 adopted in 2011; is to prevent and reduce pollution from all the activities of electrical/electronic sector to the Nigeria environment. It covers all aspects of the sector from cradle to grave and the regulation is anchored on the 5Rs ('Reduce, Repair, Recover, Recycle and Re-use,') principle.

The National Environmental Standards and regulations Enforcement Agency (NESREA) was established in 2007 to enforce all environmental laws, regulations and guidelines, including monitoring and control of e-waste in Nigeria. It drafted guideline requirements for all importers of secondhand electrical and electronics appliances; the guideline contains description of items that are allowed and not allowed to be imported into Nigeria. All importers electrical and electronics appliances are expected to register with NESREA.

3.8 Initiatives and Efforts by the UNEP concerning E-Waste in Africa

Since Africa is facing a growing increase of e-waste exported from developed countries; the report of UNEP based on data from 11 representative developing countries in Asia, Africa and Latin America was used to estimate the current and future e-waste generated in developing countries; stressed that the developing countries will experience an increase in the environmental damages and health problems if the dismantling and recycling of e-waste is left in the hands of the informal sector.

In 2012, the UN, 18 African countries, non-governmental organizations, the private sectors and academia meet at the headquarters of the UNEP in Kenyan capital, Nairobi to address the problem of e-waste and to agree on measures to reduce the environmental and health hazards of electrical and electronics waste on the continent. They came up with eight point priority areas to improve the environmentally-sound management of e-waste in Africa such as improved collection strategies and setting up formal recycling structures which can help to reduce the harmful effects of e-waste on the environment and health and also help to provide economic opportunities in the region.

3.9 Efforts by the Lagos State Authorities to curb problem of E-waste

Due to the huge environmental and health hazards pose by e-waste in Lagos state, Ola Oresanya, the managing Director of LAWNA emphasized that the authorities have been educating people about the dangers of burning e-waste in open dumpsites and improper disposal of e-waste. Although LAWNA do not separate domestic waste from e-waste; all wastes collected from households and other places are taken to the dumpsite where scavengers or waste pickers are waiting to pick waste of economic values. The efforts of

the LASEPA cannot be overlooked; they recently got involved in disposal of e-waste. They through consultants go to companies and government offices to collect e-waste.

Secondly Lagos state authorities are assisted by private sector that has the wherewithal to manage the disposal of these e-wastes. Thirdly the State initiated a recycling programme called 'zero waste programmes' organic waste which makes up 60 percent of the city's waste is been recycled into compost. This is being utilized for a green programme aimed at beautifying the city with trees and flowers.

The report by Franklin Alli on Vanguard Newspaper of 28 October, 2010 stated that some NGOs and stakeholders in the Electrical and Electronic industry have started lobbying the Federal Government to ban the importation of EEE (e-waste) due to the country's inability to manage the e-waste in environmentally friendly way. And also seeking for the immediate enactment before 2011 the E-Waste Bill proposed to the National Assembly by NESREA/Federal Ministry of Environment.

The stakeholders further proposed strict penalty for law breakers and offenders who continue to import e-waste. Furthermore they pressed for the following: the urgent establishment of "Refurbished Computer Programme Initiative" as alternative SMEs schemes in each of the e-waste hot spots (Ikeja computer village, Alaba International markets and other hot spots identified across the country) as a green recycling industry for a sustainable livelihood; Intense awareness raising activities and projects for all major stakeholders and sectors including the general public, informal sector, politicians, civil society, industry and government; urgent capacity building for regulatory agents and law enforcement officials and informal sector. Their recommendations include; the protection of workers and community health throughout the life cycle of electrical and electronic products from manufacture to recycling and disposal; extended producer responsibility to take back programs, transparency of information on hazardous components of EEE in the workplace and communities around disposal sites; and the tracking of final disposal of e-wastes and Used EEE by recycling companies and manufacturers.

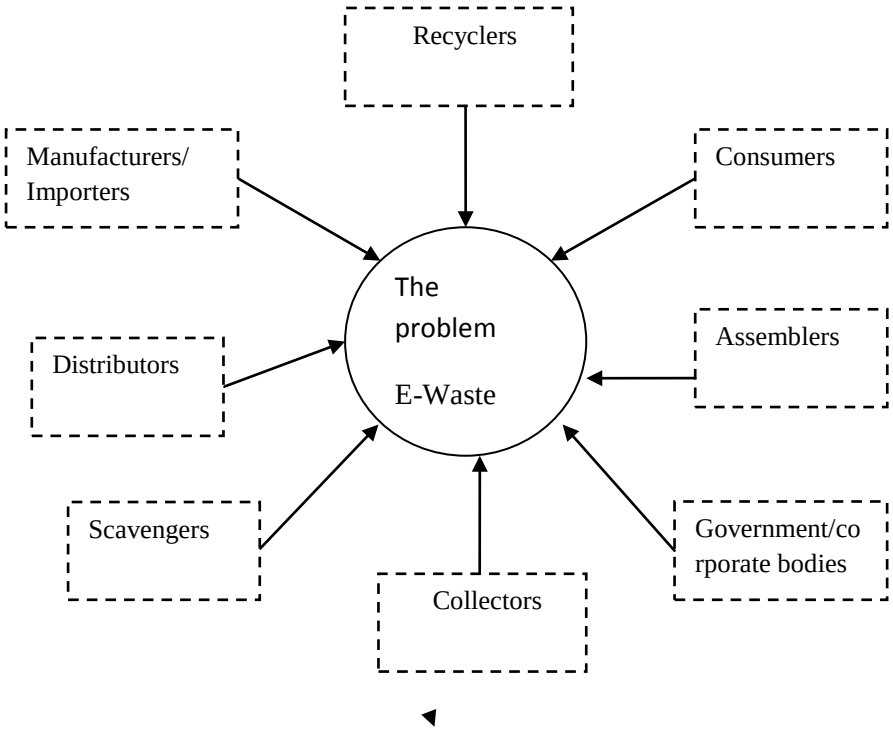
3.10 Sources of E-Waste in Nigeria

- Households
- Government, institutions and organizations
- Faulty imported used electronics
- Illegal importations

3.11 Stakeholders in E-Waste Problem in Nigeria

The stakeholders and drivers of e-waste in Nigeria are identified based on our survey and are illustrated by the flow chart below:

Figure 4: **Stakeholders of E-Waste in Nigeria**



Source: Based on own survey, 2014.

Manufacturers

Also know as producers; these are makers of the EEE products

Assemblers

Organizations whose job is to join small parts of large electronics or electrical appliances together to make them function or work.

Distributors

Distributors are group of individuals or companies involved in selling the EEE directly to the consumers; most of them are located in Alaba international market and computer village at Ikeja. From these major distributors the EEE are channeled to other places in Lagos and cities in the country like Aba, Abuja, Port Harcourt, and Kano.

Consumers

Consumers are the general public and any organization that uses EEE and dispose or stockpile them as when it reaches its end of life. They are three kinds of consumers; private consumers, institutional and corporate consumers.

Collectors

Collection of e-waste is carried out by the formal and informal sector. The informal sector is the major collector through waste pickers and scrap dealers scattered within the state. The waste pickers collect recyclable waste from households at a token price and also pick them from dumpsites with push carts or wheel barrow. The formal sector collection accounts for only 20 per cent while the informal sector accounts for 80 per cent based on e-waste assessment report in 2012

Refurbishers

These are people who are involved in repairing and servicing used electronics; some are manufacturers' representatives and while some importers also provide service centre.

Recyclers

This is an organization or a group of individuals involve in dismantling and recovering important materials like copper wire, aluminum parts etc by open air burning to separate

these materials. These materials are sold to brokers who in turn sell them manufacturers. There are no formal sector recyclers but informal sectors.

Government

The government plays a dual role; it acts as a regulator of e-waste through FEPA, NESREA, and LASEPA and also generates e-waste by disposing non- functioning EEE.

3.12 Conclusion from the Literature Review

In conclusion, e-waste is an emerging problem globally and in Nigeria and quite a number of studies has been carried out in this field without an in-depth understanding of the environmental and health hazards posed by this menace. The material inflow of the e—waste cannot be adequately determined because of the poor recording systems and the customs department. Based on this the following areas of concerns will be addressed:

- I will investigate how people in Festac Town and Ojo in Lagos State dispose their e-waste
- Analyze the relationship between the population and the categories of EEE imported Lagos
- Identify the PEST and SWOT analysis of e-waste in Nigeria
- Find out efforts made by the government in implementation of the national policies on e-waste
- Identify the obstacles and challenges in implementation of the national policies on e-waste
- Make recommendations to improve the present state of e-waste disposal in Lagos State

Chapter Four-Practical Part

The Chapter is focused on the conclusions drawn from the literature review. It deals with practical part of this study. The econometric analysis is based on the data generated from the survey is analyzed and a "SWOT" and "PEST" analysis of e-waste in Nigeria was also identified.

4. Methods of Data Collection and Analysis

The primary data used in this study was collected from two different local governments in Lagos state; Amuwo-Odofin and Ojo Local government areas. A well structured questionnaire was used to collect the data; 50 households were randomly selected from each local government and the questionnaires were administered to them with the assistance of the researcher. The data were collected in the period of December 2013-February 2014. In the process of carrying out this research both primary and secondary data were collected and are analyzed.

Data collected were further processed, transmitted into electronic database and statistically analyzed using the gretl and Microsoft Excel software with the aid of the econometric technique. Descriptive statistics was used to characterize the information supplied by the respondents.

4.1 Sampling technique and Sampling size determination

The sampling method used in the study is random sampling method the households close to the open dumpsites were randomly selected and 100 questionnaires was administered to 100 households within the study area.

There are different sampling techniques that can be used; however the sampling technique adopted in this study is based on simplified sampling technique provided by Yamane, 1967. To determine the sample size; 95 percent confidence level, degree of variability or standard deviation of .5 and ±10 percent precision level will be used.

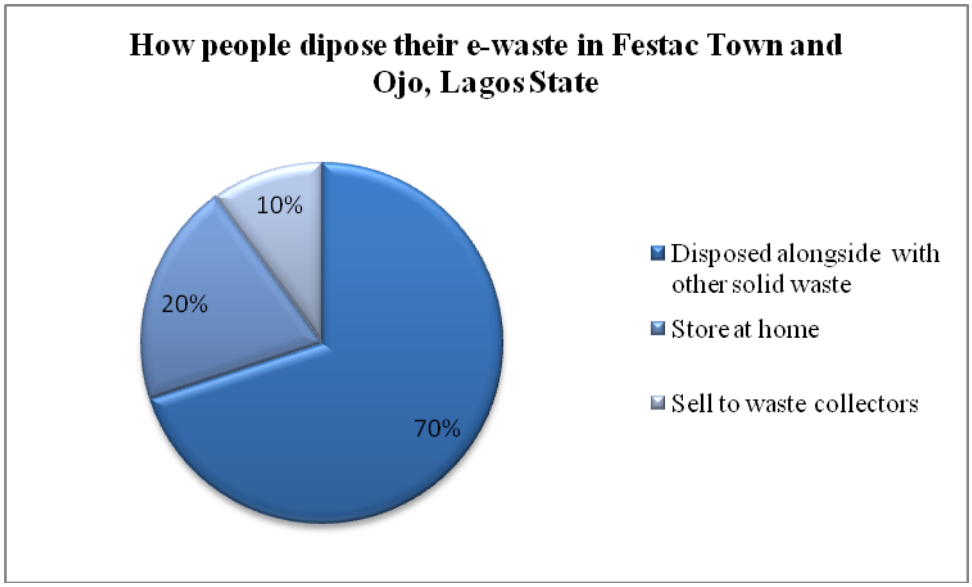
$$n = \frac{N}{1 + (e)^2}$$

Where n is the sample size, N is the population size and e is the level of precision or margin of error. Based on the formula above and the population size which is greater than 100,000 a minimum of 100 responses is required for this study. This survey was carried out using 100 respondents.

4.2 General characteristics of the Respondents.

Based on our findings, 66 percent of the respondents are male and 34 percent of the respondents are female. In terms of education 68 percent of the respondents have university education while 21 percent of the respondents have secondary school certificate, 2 percent have primary school certificate and 9 per cent have never been to school. 70 percent of our respondents dispose their e-waste alongside with the solid waste, 20 percent store non-functioning EEE at home while 10 per cent sell them to waste collectors. This is illustrated below by the pie chart.

Figure 5: **E-Waste Disposal Behaviour**

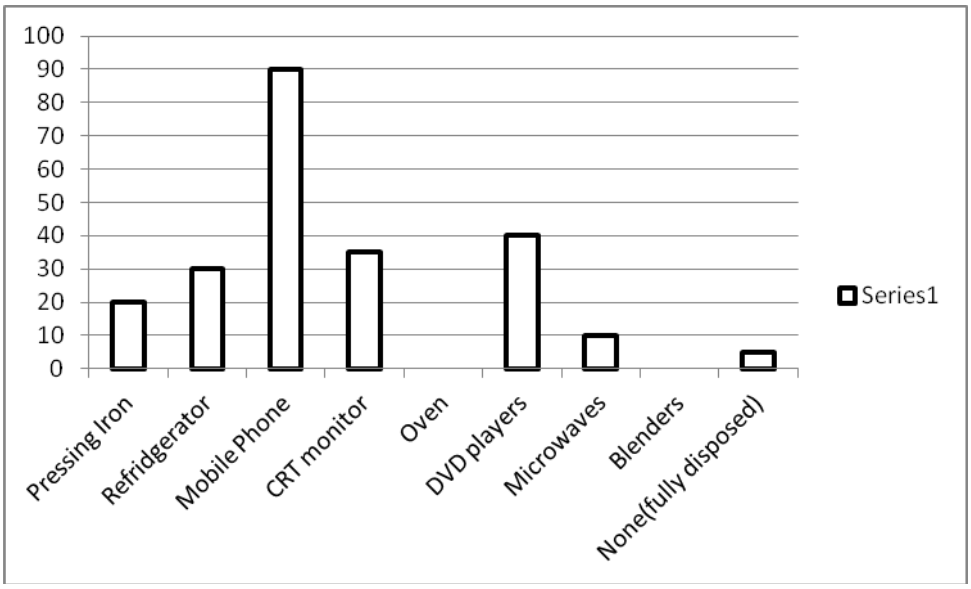


Source: Based on own Survey Data, 2014.

Figure 6: **Open dumpsite where e-waste is disposed alongside with solid waste in Ojo, Lagos state.**

The result of our survey also reveals that larger number (90) of our respondents store non-functioning mobile phones at home, 40 respondents have non-functioning DVD players at home, 35 respondents store non-functioning CRT monitors at home, 30 respondents store non-functioning refrigerators at home and 20 respondents have non-functioning pressing iron at home. 65 percent are aware that e-waste contains hazardous substance and 35 percent are not aware. 87 per cent know that the improper disposal of e-waste is risky to human health and the environment while 13 percent do not know. 90 percent believe that the government is not doing enough to manage and curb the problem of e-waste in Nigeria while 10 per cent believe government is doing enough. A larger population of our respondents (47 percent) falls within the income group of 20,001- 60,000 naira (equivalent to 121.44-364.32 US Dollars or 89.40-268.2 Euros)

Figure 7: **E-Waste stock-piled at home**



Source: Based on own survey Data, 2014

Table 3: **Household Income level of Respondents**

<20,000 Naira	30
20,001-60,000 Naira	47
60,001-100,000 Naira	8
100,001-200,000 Naira	8
>200,000 Naira	7
Total	100

Source: Based on own survey Data, 2014.

4.3 Interpretation of Analysis of the survey

The *Y* represents the Income level of the Respondents, the *X1* stands for the Household size, the *X2* stands for "would you give your e-waste for free to the e-waste collectors if you are sure it will be well taken care of in a way that is useful and would not pollute the environment", *X3* stands for " Are you aware that E-waste contains hazardous substance", *X4* stands for "Do you think Government is doing enough about the problem of e-waste in Nigeria", *X5* stands for " Do you know hazardous substance is risky to human health and the environment" and *X6* stands for the Educational qualification of the respondents.

The income level (*Y*) is the regressor while the variable(s) *X*1-*X*6 are the regressands.

$Y(i) = \beta 0 + \beta 1\ X1 + \beta 2X2 \ldots\ldots \beta 6X6- + \boldsymbol{\varepsilon}$ ---------- **(1)**

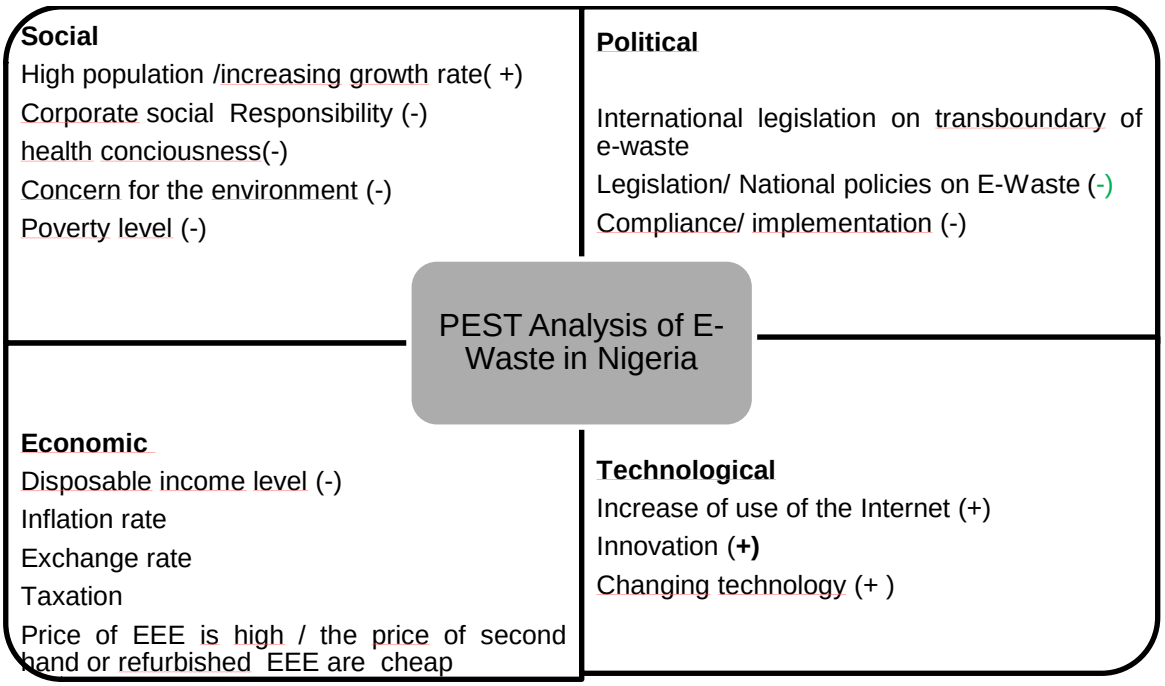
Where β0 is the intercept and βı is the slope or coefficients of the parameters *X1 –X6* in the model and **ε** is the error term.

The R-Square is 21 percent which reveals that 21 percent of the variation in the variables is explained by the linear equation. Besides the intercept, the p-value of *X3* (P=0.00504), *X5* (P=0.01841) and *X6* (P=0.00714) revealed that these variables are statistically significant at 0.01 and 0.05 level of significance.

If education (*X6*) goes up by 1 unit, household income increases by 0.33 and if the government is doing enough to control the problem of e-waste (*X5*) then household income increases by 0.32. And if the family size goes up by 1 unit, the household income increases by 0.04.

External factors that we identify in the course of carrying this study are illustrated in the diagram above. These factors can create opportunities in area of investment in the EEE industry and also constitute threats to the environment and human health.

Figure 8: **PEST Analysis of E-Waste in Nigeria**



Source: Own survey, 2014

Figure 9: **SWOT Analysis of E-Waste in Nigeria**

Strengths	**Opportunities**
❖ Existence of relevant legislations regulating the illegal dumping of hazardous e-waste in Nigeria ❖ Transfer of recycling technology to Nigeria ❖ Increasing demands for EEE as a result of high poverty rate or low disposable income	❖ Creates job opportunities for the jobless and source of livelihood for the informal sector. ❖ A source of valuable resources example gold etc ❖ Helps to bridge the gap of "digital divide"
Weaknesses	**Threats**
❖ Lack of infrastructure for recycling and managing e-waste in Nigeria ❖ Ineffective legislation controlling importation of e-waste into the country ❖ Lack of adequate statistics on e-waste ❖ Lack of skilled manpower in handling e-waste ❖ Lack of awareness of threats posed by e-waste	❖ Nigeria has become a dumping ground for e-waste all in the name of used or secondhand electronics ❖ Illegal dumping and burning of e-waste on open dumpsites has environmental and health impacts on inhabitants and workers. ❖ Pollution of the surface water and rivers

Source: Own survey, 2014

4.4 Implementation of National Policy on E-Waste

Despite all efforts made by the Nigerian Government in order to control and manage the problem of e-waste in Nigeria; the policies formulated are either not enforced or implemented but rather the problem is getting more aggravated. In the light of curbing the menace of e-waste problem in Nigeria; the government has recently inaugurated a National committee for the implementation of National chemical policy. This policy is expected to be tailored along the UNEP sanctioned strategies approach to international chemical management. (SAICM).

In Switzerland, the first electronic waste recycling policy was implemented in 1991 which begins with the collecting of old refrigerators. As the years went by, all other EEE were gradually added to the system. Legislation on e-waste management followed in 1998, and from January 2005 it has been possible to return all e-waste to sales points and other collection points free of charge. There are two established PROs; they are namely, SWICO which mainly handles e-waste and SENS mainly responsible for that of electronic appliances. The manufacturers and importers are responsible for their products (EPR); this system is well organized and developed, they share all their responsibilities with SWICO, S.EN.S, and PROs. Manufacturers set up collection centers for their e-waste only and return them to licensed recyclers (i.e. recyclers licensed by the government or PROs). Retailers have the obligation of “taking back” the e-waste in the same categories that they have on sale, free of charge. In comparison to the national policies on e-waste in Switzerland we can say Nigeria still has a long way to go in the area of implementation of national policies on e-waste.

4.5 Challenges of E-Waste

- Lax in legislative and regulations guiding importation and e-waste management
- Weak enforcement of existing related laws
- Lack of infrastructures for collection, dismantling and recycling e-waste
- Lack of public awareness on the risks associated with indiscriminate disposal of e-waste and the crude means implored in the dismantling and recovering of valuable substance from e-waste (i.e. the open air burning of e-waste)
- Poor corporate social responsibility on the part of the producers/manufacturers on e-waste
- Non functioning local take-back by producers of EEE (EPR); the generation of huge volume of e-waste requires a well functioning take-back system
- The collection, dismantling and recovering of e-waste is carried out majorly by the informal sector

Chapter Five

5. Conclusion and Recommendations

The problem of e-waste is a becoming a huge problem globally and most especially developing countries like Nigeria where the borders are porous and the regulations guiding the importation of EEE are not effectively enforced. And due to high poverty level, many people who cannot afford the new EEE opt for the secondhand EEE which is relatively cheaper; invariably the demand for secondhand EEE is high and a lucrative business. Therefore the importation of secondhand EEE into Nigeria cannot be banned out rightly but the government can put some measures in place to control and manage the situation. Furthermore many more people are becoming aware the risk posed by improper e-waste disposal and open air burning of e-waste at dumpsites close to residential areas to human health and the environment.

Based on the survey conducted in two local government areas in Lagos state; majority of our respondents believed that the government is not doing enough to manage the problem of e-waste, the government should therefore go beyond the enactment of legislations and regulations of e-waste management. Lastly there should be a shift of paradigm in the way people perceive e-waste; e-waste should be seen more of an economic opportunity to the country and the continent rather than being seen as a problem. And therefore the following recommendations are made to improve the situation:

5.1 Recommendations

- A holistic approach to tackling the problem of e-waste in Nigeria should be adopted; from the consumer proper disposal of e-waste to the formal sector (i.e. government) establishment of e-waste recycling plants or facilities and the enforcement and implementation of the national policies on e-waste management. And the need to also adopt and implement the EPR programme; ensuring that the producers take responsibility for the e-waste collection from the consumers.

- The joint participation of the government and the private sector (PPP) to establish recycling plants and to combine their efforts in combating this problem.

- The recycling technologies should be designed in such a way that it will be labour intensive rather than capital intensive because Nigeria has the adequate manpower to manage such facilities.

- Enactment of the legislation to enforce producers to take back or buy back non-functioning or obsolete EEE

- Establishments of collection centers where consumers can take the E-Waste.

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ANNEX 1

QUESTIONAIRE ON ELECTRONIC WASTE DISPOSAL

1. SEX i) Male ii) Female
2. Marital status i) Single ii) Married iii) Divorced iv) widow or widower
3. Educational qualification? Never been to school ☐ Primary School ☐ Secondary school cert. ☐ University/higher institution cert. ☐
4. Income level I) <20,000 Naira II) 20,000-60,000 Naira iii)60,000-100000 Naira iv) 100,000-200,000 Naira v) >200,000 Naira
5. How many people live in your household? I) 1 ii) 2 iii)4 iv)6 v)8
6. How do you dispose your spoilt household electronics? I)disposed alongside with solid waste II) store them at home III) sell them to e-waste collectors
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? YES ☐ NO ☐
8. Are you aware that electronics contain some hazardous contents and need special treatment in order to be safely disposed of? YES ☐ NO ☐
9. Do you think that the government is doing enough to control the problem of e-waste in Nigeria? YES ☐ NO ☐
10. Do you know that the improper disposal of e-waste is risky to the human health and the environment? YES ☐ NO ☐

11. How do you dispose your spoilt household electronics? I)disposed alongside with solid waste II) store them at home III) sell them to e-waste collectors

12. Indicate the electronics and electrical appliances you have in your home which is not in use? Indicate the number below:

Large household appliances (category 1)		**Small household appliances (category 2)**		**IT and telecommunications equipment (category 3)**		**Consumer equipment (category 4)**	
Product	N	*Product*	N	*Product*	N	*Product*	N
Fridges		Irons		PCs		TVs (CRT)	
Air conditioners		Kettles		CRT monitors		TVs (flat panel)	
Washing machines		Blenders		LCD monitors		Radios	
Freezers		Microwaves		Laptops		Stereos	
Clothes dryers		Hair dryers		Mobile phones		DVD players	
Electric heaters		Mixers		Phones		VCR players (video-cassette recorder)	
Dish washers		Fans		Printers		MP3-players	
Grillers		Vacuum cleaners		Copy machines		Cameras	
Electric/Gas stoves		Carpet sweepers		Scanners		Game consoles	
Ovens		Toasters		Fax machines			
Electric hot plate		Popcorn makers		Modems			
		Rice cooker					
		Water dispenser					
		Cables					
		Extension boxes (?)					
		Soldering iron					
		Alarm clocks					

ANNEX 2

OLS Result

Model 1: OLS, using observations 1-100

Dependent variable: Y

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
Const	2.58694	1.00128	2.5836	0.01133	**
X1	0.0421632	0.11876	0.3550	0.72337	
X2	-0.271816	0.345715	-0.7862	0.43372	
X3	-0.74031	0.257688	-2.8729	0.00504	***
X4	0.322123	0.377651	0.8530	0.39587	
X5	-0.866232	0.361007	-2.3995	0.01841	**
X6	0.33352	0.121226	2.7512	0.00714	***

Mean dependent var	2.170000	S.D. dependent var	1.189644
Sum squared resid	109.9809	S.E. of regression	1.087470
R-squared	0.215039	Adjusted R-squared	0.164396
F(6, 93)	4.246199	P-value(F)	0.000800
Log-likelihood	-146.6507	Akaike criterion	307.3014
Schwarz criterion	325.5376	Hannan-Quinn	314.6819

ANNEX 3

Model 2: OLS, using observations 2000-2008 (T = 9)

Dependent variable: y

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
Const	1.52163e+08	7.89813e+06	19.2657	0.00004	***
X1	37.3122	59.2362	0.6299	0.56296	
X2	-2066.25	552.324	-3.7410	0.02010	**
X3	-95.7422	59.4091	-1.6116	0.18235	
X4	101.352	26.1527	3.8754	0.01791	**

Mean dependent var	1.41e+08	S.D. dependent var	13545014
Sum squared resid	1.58e+14	S.E. of regression	6284657
R-squared	0.892360	Adjusted R-squared	0.784720
F(4, 4)	8.290213	P-value(F)	0.032265
Log-likelihood	-150.0039	Akaike criterion	310.0077
Schwarz criterion	310.9938	Hannan-Quinn	307.8797
rho	-0.013574	Durbin-Watson	1.351418