e-Waste Country Assessment Nigeria

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Summary

Access to Information & Communication Technology (ICT) is pivotal of a country's economic and social development and is currently improving throughout the developed and developing world. Still there is a relevant difference in access to ICT between developed and developing countries, which is commonly referred to as the "digital divide". Nigeria has been undergoing rapid ICT transformation in recent years, attempting to bridge this divide by importing new, second-hand or used computers, mobile phones, and TV sets from developed countries. These appliances together with other electrical and electronic equipment (EEE) are also contributing to the ever growing amount of waste electrical and electronic equipment (WEEE) or e-waste for short, when they reach their end of life.

This report presents a national e-waste assessment for Nigeria and investigates the situation with regard to e-waste looking into, *inter alia*, trends of EEE imports, use and e-waste generation. The Nigerian study is part of the e-waste Africa project of the Secretariat of the Basel Convention, with the overarching goal to enhance the capacity of West Africa and other African countries to tackle the growing problem of e-waste and thereby protect the health of citizens, particularly children, while providing economic opportunities.

Massflows

Most of the consumed EEE is imported into Nigeria, while there are only some assembling companies. In 2010 import statistics indicate that the share between new and used EEE was about 50%/50%, i.e. 600,000 of new EEE and 600,000 of used EEE imported into Nigeria. However this data was gathered at a time when stronger enforcement by the Nigerian government made it less attractive to import used EEE. Hence it is thought that the share of used EEE imports could have been higher in the years before (i.e. up to 70%). Approx. 30% of second-hand imports were estimated to be non-functioning (therefore need to be declared as e-waste): half of this amount was repaired locally and sold to consumers and the other half was un-repairable. In the case of Nigeria, this was at least 100,000 tonnes of e-waste entering the country illegally in 2010.

From the survey it was found that private households were by far the biggest consumers with an installed base of 6,400,000 tonnes of large and small household appliances, as well as IT, telecommunication, and consumer equipment. The installed base for institutional and corporate consumers was estimated at 400,000 tonnes, mainly constituting of IT and telecommunication equipment. All together approx. 1.1 Mio tonnes of EEE become obsolete each year. However only around 440,000 tonnes ends up as e-waste: the remaining volume is either stored at the consumer, or given a second life as donations and sales to repair and refurbishment shops.

For 2010 it is estimated that the informal recycling sector collected and processed around 360,000 tonnes of e-waste– 100,000 originating from the illegal e-waste imports and 160,000 from private households. Another 180,000 tonnes of WEEE was collected through communal collection via household waste, which sums up to 540,000 tonnes of e-waste being collected in one or the other way. This indicates a combined informal and formal collection efficiency of 75% for end-of-life equipment destined to be disposed of as waste, the remaining 25% being in storage at the consumer.

It is further assumed that the informal sector was recovering around 52% of the materials contained in the collected waste. This equals to approx. 280,000 tonnes, which were channelled further

to the formal recycling industry and subsequently were sold to the inland or export market as secondary raw material. While ferrous metals, aluminium and copper have high recovery rates, precious metals and plastics are only recovered to some extent, and other materials are mostly lost through burning and dumping.

Impacts

Informal e-waste recycling activities in Nigeria include mainly dismantling, uncontrolled dumping as well as pyrolytical processes. There are indications, but no proofs, for hydrolytical processes, such as leaching of precious metals from printed wiring boards. During collection as well as refurbishment or repair of EEE, negative impacts can partly occur, but are generally at a significantly lower level. Recycling activities often take place on unfortified ground where harmful substances released during dismantling are directly discharged to the soil. Burning copper cables and wires, as well as monitor and TV casings, creates an accumulation of ash and partially burned materials at the burning sites. Emissions occurring from open burning of cables can be assumed to be a major source of dioxin emissions for Nigeria.

Challenges

The National Environmental Standards and Regulations Enforcement Agency (NESREA) approved the National Environmental (Electrical/Electronic Sector) Regulations in 2011. This is an encouraging sign; however, with the implementation and enforcement of those regulations still ahead the main challenges are yet to be faced.

One major challenge for Nigeria is to avoid the import of e-waste and near-end-of-life equipment without hampering the socio-economically valuable trade of used EEE of good quality. In addition, high volumes of domestically generated e-waste require well-functioning local take-back and recycling systems. Challenges include the establishment of appropriate collection strategies, ensuring that high volumes of valuable and non-valuable waste fractions are collected equally and that those fractions reach appropriate treatment and disposal facilities. In addition, connecting informal collectors to a formal recycling structure is pivotal, along with appropriate capacity building and training.

Recommendations

Locally adapted recycling technologies for Nigeria should make use of the abundant labor force instead of deploying expensive shredding and sorting machinery. To ensure a maximum yield of valuable recycling fractions, Nigerian recyclers are encouraged to interlink with international recycling companies and networks for developing market outlets for their pre-processed e-waste fractions for a maximized return of value for secondary raw materials. A sustainable e-waste management system will also need an adequate financing scheme, a level playing field and appropriate market incentives. It is thought that similar to policies in OECD countries, an e-waste recycling system in Nigeria could be developed in line with the principle of Extended Producer Responsibility.

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1 Introduction

1.1 Problem identification

1.1.1 E-waste: an increasing global concern

Information and telecommunications technology (ICT) and computer Internet networking has penetrated nearly every aspect of modern life, and is positively affecting human life even in the most remote areas of developing countries (Osibanjo and Nnorom 2007).

Electrical and electronic equipment (EEE) have been instrumental to the revolution witnessed in various sectors of human endeavor around the world; in communication, entertainment, transport, education, and health care sectors. As there appears to be no signs of this revolution slowing down soon so also the growing concern on the increasing e-waste arising from the ICT sector.

There is a large digital divide in most developing countries, and only a small number of wealthy people have access to certain ICT-wares especially the branded new equipment. Consequently, most of the low-income earners rely on used ICT-wares considering that branded new electronic goods are relatively expensive for ordinary people.

While there are many factors contributing to the digital divide, the high price of information technology hardware is no doubt a significant one. Domestic and international trade in used EEE presents a possible important avenue to stimulate the dissemination of information technology and bridging the gap between the "haves" and the 'have nots". However, imports of used or rather end-of-life (EoL) electronics to the developing countries is a double-edged sword: the positive potential also carries with it the risk of becoming a dumping ground for waste equipment from rich developed countries (Schmidt 2006; Puckett et al. 2005).

Globally, e-waste is growing as consumers, in both developed and developing nations, buy new gadgets and discard their old ones. According to studies by the United Nations, anywhere between 20 and 50 million tonnes of e-waste are generated globally, an amount growing at a rate nearly three times faster than the overall municipal solid waste stream (Schluep et al. 2009). Electronic waste or e-waste is one of the fastest growing waste streams around the world, growing at a rate of 3–5% per annum or approximately three times faster than normal municipal solid waste. Today, the amount of e-waste is rapidly growing in developing countries as they join the global information society.

At present electronic appliances are rarely disposed of in an adequate manner and there is little regulation in place, creating hazards for local populations, as well as for the environment. While the environmental services industry has developed into a multi-billion dollar industry worldwide, it is largely absent in developing countries. This is both a missed business opportunity and a threat since the electronic waste contained in used computers consists of high-value components such as copper and gold, but also highly toxic substances such as lead, mercury and arsenic.

1.1.2 Electronic waste generation

Electronic waste is generated by three major sectors: individuals and small businesses; large businesses, institutions, and governments; and, original equipment manufacturers (OEMs). There are a number of reasons for a product reaching its end-of-life. These reasons include, technical obsolescence (the product itself is worn out and no longer function properly); economic obsolescence (new products in the market are more economic in terms of cost); feature obsolescence (new products have come onto the market that offer more or

better features); and, aesthetic obsolescence (new products in the market have a nicer look or more fashionable design from the point of view of the consumer) (Osibanjo and Nnorom 2008).

One reason for the increasing generation of e-waste is the constant availability of newer technology and design, and an increasingly early obsolescence. For example, the average lifespan of a new model computer has decreased from 4.5 years in 1992 to an estimated 2 years in 2005 and is further decreasing (Widmer et al. 2005). It has been estimated that 500 million PCs worldwide reached the end of their life in the decade between 1994 and 2003. This volume of obsolete PCs contain approximately 2 870 000 tons of plastics, 718 000 tons of lead, 1363 tons of Cd and 287 tons of mercury.

In the US e-waste accounted for 2.63 million tons of waste in 2005 (or 1.1% of the waste stream), with an increase of 7.8% since 2004. Of this volume, 87.5% was disposed rather than recycled. It is estimated that between 14 and 20 million are retired annually in the US. In the UK (Western Europe) in 1998, 6 million tons of WEEE was generated accounting for 4% of the MW stream. Increasing at 3–5% a year, WEEE generation in the UK is estimated to hit 12 million tons by 2010 (Cui and Forssberg 2003; Darby and Obara 2005).

1.1.3 Concern over e-waste composition

E-waste contains hazardous materials such as lead, mercury, beryllium, cadmium, and brominated flame-retardants that pose both human and environmental health threat. E-waste also contains some valuable metals, especially in the PWB. Some of these metals include iron, aluminum, nickel, copper, and some precious metals. The precious metals (PM) include gold, silver and the platinum-group metals (PGM): platinum, palladium, rhodium, ruthenium, iridium and osmium. All precious metals belong to the transition elements. Precious metals are characterized by high economic value, beauty and particular chemical and physical properties, i.e. low electron affinity, high resistance to corrosion and high density (Hagelüken 2005)

Some of the hazardous materials and valuable metals in e-waste are presented in Table 1.1 and Table 1.2 respectively. In the developing countries, inappropriate and crude techniques are adopted in material recovery from e-waste. This has four major effects:

- Low recovery of materials (Rochat et al. 2007);
- Recovered materials are often heavily contaminated
- Crude recovery techniques result in environmental contamination (Sepúlveda et al. 2010)
- Negative impacts on the health of workers and nearby residents (Schluep et al. 2009)

The possible health effects of exposure to some of the hazardous materials in e-waste are presented in Table 1.3.

Table 1.1: Contents of selected valuable metals in the printed circuit boards of seven types of electronic products

Products	Valuable metals contained in products
TV (CRT monitor)	gold, silver, copper, platinum, antimony, nickel, yttrium, neodymium, iron, and aluminum
Washing machine, Air conditioner, Refrigerator	gold, silver, copper, platinum, antimony, iron, and aluminum
TV (LCD, plasma)	gold, silver, platinum, antimony, indium, yttrium, iron, aluminum

Table 1.2: Contents of selected valuable metals in the printed circuit boards of seven types of electronic products

Products	Valuable metals contained in products
TV (CRT monitor)	gold, silver, copper, platinum, antimony, nickel, yttrium, neodymium, iron, and aluminum
Washing machine, Air conditioner, Refrigerator	gold, silver, copper, platinum, antimony, iron, and aluminum
TV (LCD, plasma)	gold, silver, platinum, antimony, indium, yttrium, iron, aluminum

Table 1.3: Effects of chemicals in e-waste on human health

e-toxin	Source of e-toxin	Health effects
Arsenic	Found in computer chips and light emitting diodes	Arsenic is a known cancer-causing substance (carcinogen). It is known to cause skin and lung cancer.
Brominated Flame Retardants	Added to plastic to prevent fires	Brominated Flame Retardants act as hormone disrupters. Children exposed to these substances show increased risk to thyroid disease and neurobehavioral disease
Cadmium	Cadmium coating of contacts and switches in the CPU and monitors is used to prevent corrosion. It is found in NiCd batteries	Breathing high levels of Cd can cause lung damage and death. Long term exposure to low levels of Cd can cause elevated blood pressure and kidney damage. Cadmium is a known carcinogen.
Chromium	It is used as a hardener in plastics and a dye in pigments. It may be present in the coatings on some metal parts.	Chromium has a variety of effects depending how it enters the body. Chromium is a carcinogen if inhaled. Chromium may also cause DNA damage.
Halogens	Plastics and insulation	These substances are of concern because of the possibility that toxins such as dioxins and furans may be created and released burning.
Lead	Cathode-ray tubes (about 5 lbs.) and Solders	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	Old battery and switches. Flat screen have mercury containing fluorescent tubes.	Short term exposure to all forms of mercury causes 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.
Polyvinyl chloride (PVC)	PVC plastic is used in the insulation f some cables used in ICT equipment.	When burnt it produces highly toxic dioxins; research is finding if PCV is a hormone disruptor.

1.1.4 Basel convention and e-waste exports

The Basel Convention on the Control of the Trans-boundary Movement of Hazardous Waste and their Disposal was adopted in 1989 in response to the tightening of waste legislation in industrialized countries. The convention came into force 5 May 1992 and there are currently 179 Parties. It was created to prevent the economically motivated dumping of hazardous wastes from richer to poorer countries.

The Basel Ban Amendment, adopted in 1995, prohibits all exports of hazardous wastes from Parties that are member states of the EU, OECD and Liechtenstein to all other Parties to the Convention. The "Ban Amendment" provides for the prohibition by each Party included in the Annex VII of the Basel Convention (Parties and other States which are members of the OECD, EC, Liechtenstein) of all transboundary movements to

States not included in Annex VII of hazardous wastes covered by the Convention that are intended for final disposal. Also all transboundary movements to States not included in Annex VII of hazardous wastes covered by paragraph 1 (a) of Article 1 of the Convention that are destined for reuse, recycling or recovery operations are prohibited.

In December 2011, the Ban amendment was not yet in force. Some Parties however have already incorporated the Ban amendment in their national or regional legislation, such as the European Union Member States. Other States have adopted regional agreements banning the import of hazardous and other wastes, for instance the Bamako Convention and the 1995 Convention to Ban the Importation into Forum Island Countries of Hazardous and Radioactive Wastes and to Control the Transboundary Movement and Management of Hazardous Wastes within the South Pacific Region (the Waigani Convention). The United States is the only OECD country not having ratified the original Basel Convention, nor the Basel Ban Amendment. Thus, the export of e-waste as has been witnessed in China, India, Pakistan, Nigeria, Ghana etc is in violation of the Basel Convention and the Basel Ban Amendment (Secretariat of the Basel Convention 2011).

The tightening of waste legislation in industrialized countries during the 1980s significantly increased the costs of domestic disposal and created a financial incentive to export waste for processing and disposal (Schmidt 2006). The Basel Convention is intended to work through a combination of a listing of defined hazardous wastes (Annex VIII of the Convention) and a principle of prior notification of intent to export and consent to import (Article 6, paragraph 1).

Sometimes illegal export is phrased as or hidden under the umbrella of charity ("computers for the poor") or as recycling. This comes from the fact that environmental and occupational regulations are lax or not well-enforced in some developing countries, and labour costs are much lower than in industrialized ones (for instance, $1.50 per day in China). A recent report by Toxic Links found that 70% of electronic waste collected at recycling units in New Delhi (India) was actually exported or dumped by developed countries (Toxics Link 2004).

The Basel Convention Regional Coordinating Centre for Africa and Technology transfer in collaboration with Basel Action Network BAN in 2005 reported that while some of the imported EEE into Nigeria are fully functional and are directly reused or can be repaired and reused, there is nevertheless a significant quantity of imported computing equipment or parts that are considered junk. The estimate figure as indicated by experts were 25- 75 % that is unmarketable due to either lack of computing effectiveness or due to the fact that it is uneconomical to repair from an estimated inflow of 500 containers of used computer scraps of various stages of condition and age entering through the Lagos Ports each month.

As used electrical equipment continues to flow into the country there remains a challenge to determine the official figures of e-waste internally generated from new or domestically assembled ones.

Consequently, the E-WASTES AFRICA PROJECT was conceived to assist selected African countries in building local capacity to address the flow of e-wastes and electrical and electronic products destined for reuse in selected African countries and augment the sustainable management of resources through the recovery of materials in e-wastes.

On the 16th and 17th of May 2009 the Basel Convention in Geneva launched the e-waste Africa Project that ran from 2009 until March 2012 2012 (and extended till June 2012). The e-waste Africa Project covers four components:

- A study of the flow of second hand equipment and e-waste (EEE and WEEE) from Europe to Africa;
- An assessment of e-waste management in African countries;
- A feasibility (and socio-economic) study for e-waste management in African countries; and
- The improvement and enforcement and control of shipment of EEE and WEEE.

1.1.5 Definition of e-waste

Electrical and electronic equipment (EEE) cover a broad spectrum of products used by businesses and consumers. As defined in the WEEE directive of the European Union (2002/96/EC), EEE include equipment that are dependent on electric currents or electromagnetic field in order to work properly, and include equipment for generation, transfer and measurement of such currents and fields.

It applies to products that are designed for use with a voltage rating not exceeding 1000 volts for alternating current and 1500 volts for direct current. Hence, the term electronic waste (e-waste) or waste electrical and electronic equipment (WEEE) refers to unwanted EEE that are obsolete, at the end of their lives or that have been discarded by their original users. The categories according to the EU WEEE Directive are listed in Table 1.4.

Table 1.4: WEEE categories according to the EU directive on WEEE

No.	Category	Label
1	Large household appliances	Large HH
2	Small household appliances	Small HH
3	IT and telecommunications equipment	ICT
4	Consumer equipment	CE
5	Lighting equipment	Lighting
6	Electrical and electronic tools (with the exception of large-scale stationary industrial tools)	E & E tools
7	Toys, leisure and sports equipment	Toys
8	Medical devices (with the exception of all implanted and infected products)	Medical equipment
9	Monitoring and control instruments	M & C
10	Automatic dispensers	Dispensers

Figure 1.1: Examples of used EEE displayed for sale in Nigeria.

Figure 1.2: Piles of printed wiring boards awaiting scrap buyers at Odo Iya Alaro Ojota, Lagos July 2010.

1.1.6 E-Waste in Nigeria

In Nigeria, the scale of urban consumption and waste generation and the negative impacts associated with them varies dramatically from city to city, depending in large part on a city's wealth and size. Perhaps the greatest environmental nuisance and threat facing the ever growing urban agglomeration in Nigeria today is the poor collection, transportation and disposal of both municipal and industrial wastes. Transverse the length and breadth of Nigerian urban centers and even rural communities are heaps of solid waste constituting eyes sore in the urban landscape thereby depreciating the value of properties, causing air and water pollution, and other aspects which are injurious to health. There is co-disposal of all waste in open dumpsites across the country susceptible to spontaneous burning and release of unintended persistent organic pollutants.

Coupled with this challenge is the increasing numbers of WEEE that gets to be shipped into the country and eventually gets dumped with general municipal waste and also burnt along thus releasing toxic pollutants into the environment.

In an attempt to bridge the digital divide, large quantities of used electronic equipment are exported to developing countries to assist in bridging the "gap" (Nnorom and Osibanjo 2008; Osibanjo and Nnorom 2007) . The export of used electronics leaves much to be desired:

- there is no distinction between items for reuse and items for recycling
- there is no guarantee of the functionality of the imported devices,
- some vital components of the imported devices are often missing. Sometimes they may not, for example, have the correct plug fitted, or the right software installed,

- most appliances that do work on arrival only have a short second life, as they were already old, obsolete and / or damaged during the transit.
- It is not easy to distinguish between legal and illegal exports.

In Nigeria, the importation of used electronics assumed an alarming dimension in the last ten years especially considering that un-reusable goods (wastes) destined for recycling are exported into Nigeria in the name of reuse . Furthermore the presence of a large highly educated and well trained but low waged informal sector technicians and engineers with an impressive ability to repairing and refurbishing of used electrical electronics equipment for local resale as in indicated in Figure 1.1 has fuelled the importation of used and obsolete electrical and electronic equipment from developed countries primarily from Europe and North America for such refurbishing purpose in the interest of bridging the digital gap.

In recent months, three ships at different times laden with toxic products, otherwise known as e-wastes, arrived the Lagos port and the Federal Government of Nigeria received an alert through a Dutch agency, VROM-Inspectorate and the International Network for Environmental Compliance and Enforcement (INECE) before the arrival of the ships. The ships which berthed at the Tin-can Port (Lagos), were detained on the orders of officials of the National Environmental Standards Regulations Enforcement Agency, NESREA and made to return with the e-waste at all the occasions.

In 2010, representatives for NESREA, (National Environmental Standards and Regulations Enforcement Agency, Nigeria) visited the Environment Agency, England & Wales, to receive training on detecting and preventing illegal shipments of waste. Following the visit, the Environment Agency provided intelligence to NESREA, via Interpol, regarding the export of electrical items from a site which was of illegally exporting waste electrical and electronic items (WEEE), including items that were considered hazardous waste.

1.1.7 Need for the study

It then became imperative to determine the influx of second hand electrical and electronic equipment into the country, the flow of e-waste stock and generation (as indicated in Figure 1.2) in and out of the country to support the institutional framework policy on e-waste.

An important issue is the present use of inappropriate management routes in e-waste management in most developing countries and the absence of regulation/legislation and take-back schemes

Hence the need for this project which aims at providing information on flows of used and end-of-life e-products into Nigeria, create awareness on potential hazards of importation of un-usable e-products and the adoption of inappropriate management practices for e-waste, and help develop environmentally sound management (ESM) practices for e-waste.

1.1.8 Overview of the e-waste Africa project

The E-waste Africa Project has four components with a time frame of 3 years from November 2009. The project's four components are:

Component 1: "Transboundary movement"

A fact finding study e carried out on flows in used and end-of-life e-products imported into Benin, Ghana, Nigeria, Côte d'Ivoire and Liberia, particular from European countries.

Component 2: "Country assessment"

National assessments of used and end-of-life e-equipment in Nigeria with the aim of preparing of national environmentally sound management plan for Nigeria. This encompasses the description and assessment of e-waste management practices in the formal and the informal sector, potential impact to human health and the environment, an assessment of needs to ensure environmentally sound management, and a detailed description of the legal and regulatory infrastructures in place.

Component 3: "Socioeconomic analysis"

This involved an in-depth socio-economic study on the functioning and the sustainability impacts of the e-waste sector in Nigeria and Ghana. There was a feasibility study of international co-operations between African Small and Medium Enterprises (SMEs) and European recycling companies by combining their specific competitive advantages in e-waste disassembly and material recovery.

Component 4: "Control of Transboundary Movement of Electronic Waste and illegal traffic".

This entailed training of custom officers, staff of ports authorities and environmental protection ministry/regulatory authorities in 5 selected African countries: Benin, Ghana, Nigeria, Egypt and Tunisia.

The countries involved in the E-waste Africa Project are: Benin, Nigeria, Ghana, Cote d'Ivoire, Liberia, Tunisia and Egypt. The project is implemented by the BCRC-Senegal, BCCC-Nigeria and BCRC-Egypt, IMPEL, EMPA and the Oko-Institute.

1.2 Objective of the assessment

The main objectives of the E-waste Africa Project are:

- Enhance environmental governance of e-wastes in African countries;
- Build capacity to monitor and control e-waste imports coming from the developed world, including Europe;
- Protect the health of citizens;
- Provide economic opportunities.

This report will address outcome of the assessment on:

- Component 1 of the project covers the transboundary flows (import and export) and
- Component 2 of the project is aimed at obtaining information on the electrical and electronic equipment consumption rates, e-waste stocks, and its management.

2 Methods

2.1 Data acquisition

Literature and statistical data on e-waste management practices, available technologies, and community participation in e-waste management were collected from the Internet. Specific reports, databases, national statistics on census, press reports and publications from private sector stakeholders, were sources of data utilized in the study.

Specifically on component 1, National data base for information assessed for the importation of EEE included:

- Manifests of shipments of new and used electronics into Nigeria.
- Data from the National Bureau of Statistics,
- Data from the Nigerian Customs Service.
- Interviews of personnel of the NPA and Customs and importers.
- Pictures during inspections and field visits

Consultations were made with key officials of the statutory regulatory bodies with responsibility for environmental issues, waste management, and port operations, which include the Federal Ministry of Environment (FMENV), the National Environmental Standard and Regulations Enforcement Agency (NESREA), the Lagos State Environmental Protection Agency (LASEPA), Lagos State Waste Management Authority (LAWMA), Kano State Ministry of Environment, Nigerian Port Authority (NPA) and the Nigerian Customs.

Previous inventories and registers from the Lagos State Environmental Protection Agency (LASEPA) were reviewed.

2.1.1 Meetings and workshops

- Initial take off meeting- Oct 2009
- Training of enumerators and Government Stakeholder- Oct 2009
- One day training and debriefing of enumerators for Lagos Inventory, 5th June 2010
- EMPA and Oko institute Midterm review meeting with enumerators and Government stakeholders 28th June – 1st July 2010.
- One day training and debriefing for Aba /Port Harcourt Inventory, 15th July 2010
- One day training and debriefing for Abuja and Kano Enumerators, 23rd July 2010 and 6th August 2010 respectively
- Weekly debriefing from the enumerators to coordinators.

2.1.2 Surveys

Comprehensive well-structured questionnaires were designed, pre – tested and administered to various stakeholders in Lagos State, the Federal Capital Territory Abuja, Kano State (Kano city), Rivers State (Port Harcourt), Abia State (Aba) Imo State (Owerri). The questionnaires were filled in by the research team based on face to face interviews with the corresponding stakeholder. A summary of the amount of questionnaires

administered by stakeholder is given in Table 6.1 and Table 6.6 in the corresponding results' chapters. The questionnaires addressed the following topics:

- General awareness level on e-waste issues
- Policies related to and influencing waste management,
- Stock and generation of e-waste
- Number of electrical and electronic equipment in use in households
- End of life management of electric and electronic equipment
- Loading Port of Entry
- Shipping Details

On-the -spot evaluation was carried out at selected facilities including Port terminals, recyclers, refurbishers, retailer, refuse dump site and recycle shops/markets and also at households (consumers) of electrical and electronic equipment for assessment in Lagos, Abuja, Kano, Aba, Owerri and Port Harcourt metropolitan areas. The study team also participated in the inspection/examination of imported goods at some port terminals. Comprehensive data on the importation of e-products into the country from the National Bureau of Statistics was assessed.

The annex, among others, contains the copies of questionnaires utilized for the component 1 and 2 studies respectively.

2.1.3 Field studies

This involved distributing questionnaires and oral interviews to obtain information such as quantity, quality and brands of export purchased, number of years stored before disposal and mode of disposal from different sectors (Institutions, Government, large businesses and households). This exercise was conducted by environmentalists, Socio-economists and assisted by project assistants from NGO's, Environmental Protection Agencies, Private sector and the Nigerian Ports.

2.2 Massflow assessment

The life cycle stages off EEE in Nigeria starts with import, distribution through retailers, refurbishment, consumption, repairs, disposal and exports of dismantled scraps. Once the equipment reaches the end of life as per the opinion of the first consumer (government sector, private companies and private households) it is normally stored for unspecified time. After storage, computers in the government sector and in private companies are auctioned, donated or sold directly to second hand consumers, which in most cases are private households. Other options are the use on-site and /or off-site as spare parts by technicians. Private households also store unused EEE. Some other equipment are imported directly just for refurbishment and repair while others are exported to neighbouring countries like Benin, Niger, Togo e.t.c.

Table 2.1: Likelihood of tracer products being installed in rural areas compared to urban areas

Tracer	Likelihood of appliances being installed	
	Urban	Rural
Fridges	100 %	20 %
Air Conditioners	100 %	10 %
Iron	100 %	20 %
Kettles	100 %	20 %
PCs	100 %	10 %
Laptops	100 %	10 %
Mobile Phones	100 %	40 %
TVs (CRT)	100 %	20 %
TVs (flat panel)	100 %	10 %
Radios & Stereos	100 %	40 %

2.3 Limitations

The main Limitation in the course of this project was the fact that some companies and households did not want to divulge information on how exactly their electronic wastes are handled. In addition to this, there was limited time to distribute more questionnaires and conduct oral interviews. This would have helped in having a wider range of results, thereby producing a more comprehensive statistical result.

3 System definition

3.1 Geographical Scope

Nigeria has a land mass of about 923,769 km^2 which is quite variable ecologically and physically. It is located roughly ten degrees north of the equator and eight degrees east of the Greenwich meridian, this West African country shares its 4,047-km international border with four Francophone nations Benin, Niger, Chad and Cameroon. Its southern border is the Atlantic Ocean's Gulf of Guinea.

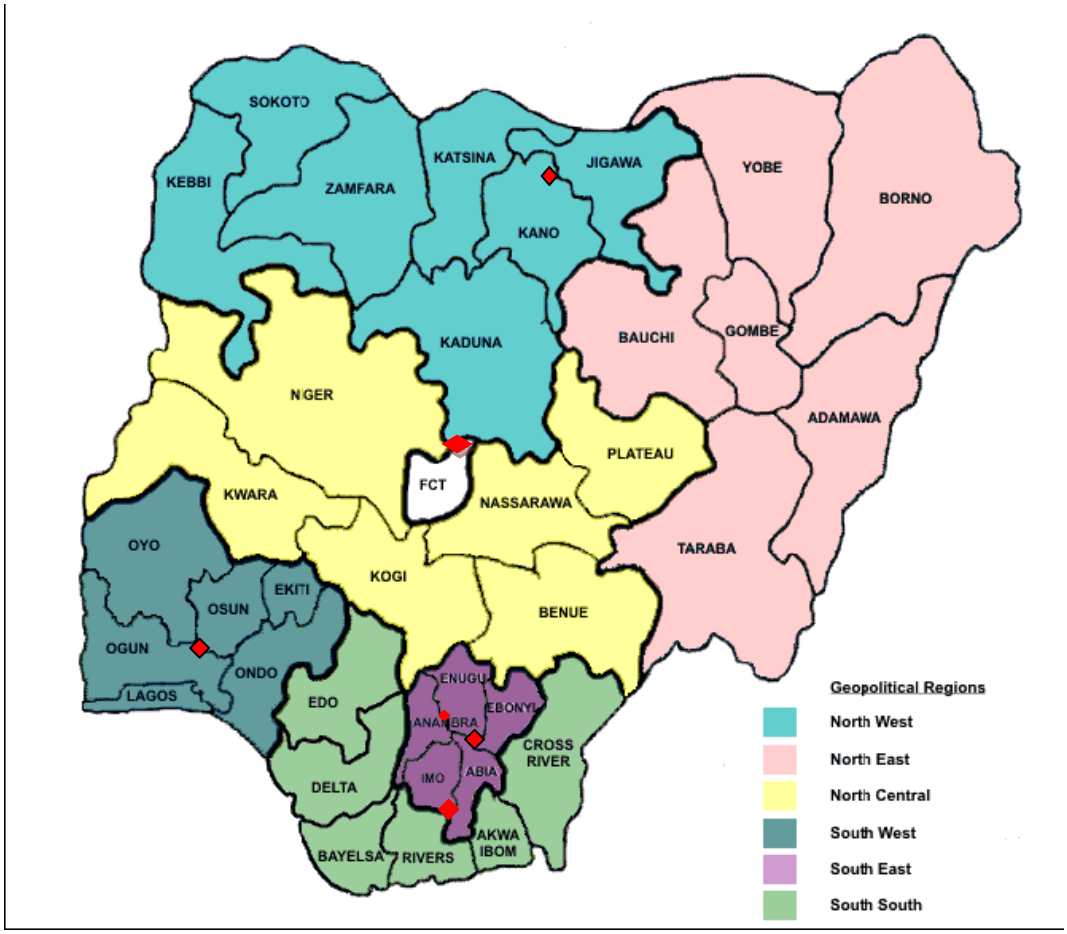
Nigeria is Africa's most populous nation; one out of every five people in sub-Saharan Africa lives here. The population is estimated at more than 150 million people from the last 2006 census. Almost half live in urban areas, the majority of them in large, sprawling cities in the south like Lagos, Ibadan, Warri, Benin City and Port Harcourt. Cities of over 5 million people like Kano, Kaduna and Sokoto also exist in the north. The population is characterized by a strong rural to urban migration, annual growth rate estimates are over 3%. Population densities, even in rural areas, especially in the southeast part of the country, are often above 200 persons /km^2.

This combination of expanding population and increasing poverty puts increasingly severe demands upon the natural environment, the institutional structures and the resources available to manage them. The technical capacity to deal with the enormity of the problem is generally weak and the lack of enforcement of (and compliance with) existing regulations make for huge institutional obstacles when trying to effectively tackle environmental issues.

Nigeria is comprised of 36 states and a Federal Capital Territory (FCT) (Figure 3.1) that are grouped in six geopolitical zones. Table 3.1 shows how the states are grouped by zone and Figure 3.1 presents the geographic distribution of the states. The nation's capital, Abuja, was officially moved from Lagos in 1991.

Table 3.1: Nigeria's Geopolitical Zones

S/N	Zone	Constituent States
1	North West	Jigawa, Kaduna, Kano, Katsina, Kebbi, Sokoto, Zamfara
2	North East	Adamawa, Bauchi, Borno, Gombe, Taraba, Yobe
3	North Central	Benue, Kogi, Kwara, Nassarawa, Niger, Plateau
4	South West	Ekiti, Lagos, Ogun, Ondo, Osun, Oyo
5	South East	Abia, Anambra, Ebonyi, Enugu, Imo
6	South South	Akwa-Ibom, Bayelsa, Cross-River, Delta, Edo, Rivers
	Federal Capital Territory	Abuja and environ.



Legend: ◆ Cities where filed studies were being conducted

Figure 3.1: The States and Federal Capital Territory of Nigeria

The current constitution was adopted in 1999 and the present government represents the third democratically elected body in more than 40 years. The executive branch consists of the president, who is both chief of state and the head of government, elected by popular vote for no more than two four-year terms. The Federal Executive Council, an appointed body, functions as a cabinet within the executive branch.

The legislature is bicameral consisting of a Senate (with 109 seats, three from each state, one from the FCT) elected by popular vote to serve four-year terms, and a House of Representatives (with 360 seats,), also elected by popular vote to serve four-year terms.

State governments are headed by a governor who appoints commissioners to oversee various state ministries. It is noteworthy that state ministry structure varies between states and does not necessarily follow the federal model. Local government area councils (LGAs) function as the main supporting bodies for activities within each state.

As a Federation, environmental regulation in the country concerns the thirty six states and one Federal capital territory. Each one is mainly responsible for its own environmental issues under various environmental and planning laws. The apex body in Nigeria is the Federal Ministry of Environment with the National Environmental Standards and Regulations Enforcement Agency as the main enforcement body.

3.1.1 Definition of the E-Waste Assessment System.

In Nigeria, the four most industrialized States are Lagos (home to approximately 60% of the Nigerian industries), Rivers, Kaduna and Kano. Collectively, these states share approximately 80% of the Nigerian industry.

The e - waste assessment was done in five cities namely, Lagos (Lagos State) in the South West region, Aba in the South East region, Port Harcourt (Rivers State) in the South South region, Abuja as the Federal Capital Territory, and Kano (Kano State) in the North West region.

The assessment in the Lagos Metropolitan Area focused on a comprehensive assessment (Figure 3.2) that included the land, sea and air ports of entry, corporate organisations, informal recyclers, refurbishers, retailers, importers, markets, government institutions, schools and tertiary institutions, dump sites, and private households.

Figure 3.2: Schematic representation of study areas within Lagos, Nigeria.

Assessment in Aba, Owerri and Port Harcourt covered the formal and informal recyclers, the downstream vendors and markets.

Assessment in Abuja focused on the Federal Governmental institutions and corporate organizations, while the Kano Assessment assessed the scrap metal recyclers /industries, refurbishers, markets, and ports of entry through the northern inland borders.

3.2 Product Scope

The emphasis of the study was on all new and second hand EEE imported and used in the country by all sectors of the population. For ease of assessment and comparability of data, national tracers were determined on the basis of prevalence in the market. These are indicated below for respective category.

- Large household appliances – refrigerators and air conditioners;
- Small household appliances – irons and kettles;
- Information and communication technologies – personal computers and mobile phones;
- Consumer electronics – televisions, radio and stereos.

3.3 Development indicators

3.3.1 People

Table 3.2: Development indicators for Nigeria with a bearing on e-waste, sector "people"

Indicator	Year	Value	Reference
Total population (millions)	2009	154.7	World Bank (2010)
Number of households	2006	28,900,492	NBS (General Household Survey Report 2004-2008
Household size urban (number of people)	2006	6.1	Togunde 2006
	2007	4.0	NBS (General Household Survey Report 2004-2008
	2008	4.6	
Household size rural	2007	4.7	NBS (General Household Survey Report 2004-2008
	2008	5.4	
Average annual population growth rate (%)	2005-2010	2.3	UN Data
Share of economically active children	1991	4.8%	NPC 1991 census
Unemployment	2009	19.7	NBS, labour force survey march 2009
Youth unemployment	1991	6.7%	NPC, 1991 Census
	2007	30.7%	NBS, General Household survey(1999-2007)
Urban (informal) sector employment	2009	92.1	NBS, Labour force survey , march 2009
Population below international poverty line (Population bellow 1$ per day, population below 2$ per day)			
GINI index	2003	43.7	World Bank, 2007

Table 3.3: Household distribution by income, class and by urban or rural areas

Income class (Naira/year, 2010)	Urban	Rural
A (<20,000)	31.34%	39.73%
B (20,000 – 60,000)	11.98%	9.67%
C (60,000 - 100,000)	3.55%	1.66%
D (100,000 - 200,000)	0.74%	0.62%
E (>200,000)	0.38%	0.31%
Grand Total	48.00%	52.00%

3.3.2 Environment

Table 3.4: Development Indicators for Nigeria with a bearing on e-waste, sector "Environment"

Indicator	Year	Value	Reference
Electrification rate	2007/2008	46%	UNDP, 2007/2008 Human Development Report
Energy use	2007	722.18839 kg	World Bank, 2007 (Development Indicator)
GDP per unit of energy use	2007	$2.59	World Bank, (Development indicator
Emissions of organic water pollutants	1996	82,477.21 kg per day	World Development Indicator
CO_2 emission estimates (000 metric tons and metric tons per capita)	2006	97191/0.6	UN Data
Land area (sq. km)	2010	923768	CIA 2010
Rural population (% of total population)	2008	52.0 %	CIA 2010
Urban population (% of total)	2008	48.0 %	CIA 2010
Population in urban agglomerations of more than 1 million	2005	14.3 %	World Bank 2007
Population in largest city	2005	15.5 Mio	Lagos State Government 2006
rate of urbanization (annual rate of change)	2005	3.8 %	CIA 2010

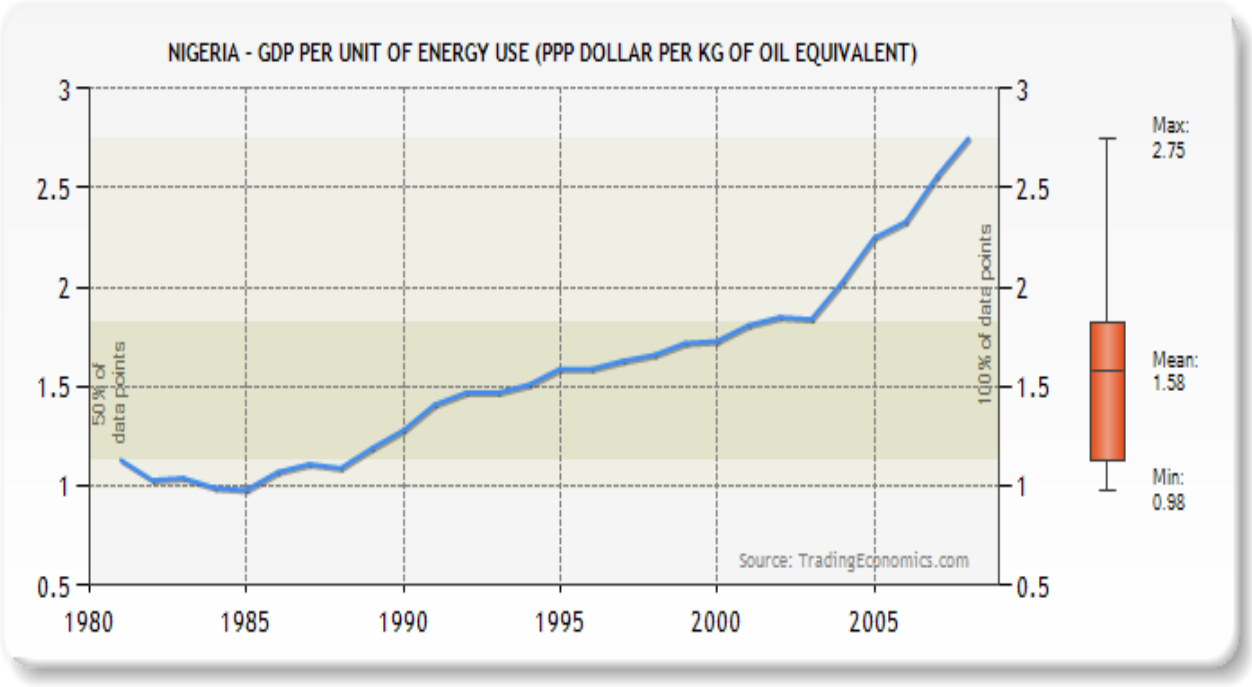


Figure 3.3: Nigeria- GDP per unit of Energy use (PPP per Kg of oil equivalent)

Table 3.5: Percentage distribution of households by State and type of electricity supply, 2008.

STATE	PHCN Only	Rural Electrification Only	Private Generator Only	PHCN/Generator	Rural Electrification /Generator	Solar energy	None
Abia	45.7	1.3	6.5	13.5	1.8	0.0	31.1
Adamawa	22.6	0.0	3.4	3.9	0.4	0.0	69.8
Akwa Ibom	40.6	1.7	7.9	5.9	0.2	0.2	44.6
Anambra	61.9	0.0	3.0	7.9	2.3	0.0	24.8
Bauchi	31.4	5.3	0.0	3.2	0.0	0.0	60.2
Bayelsa	21.6	13.3	8.6	7.5	12.2	0.0	36.9
Benue	22.8	0.0	4.2	0.9	0.2	0.0	72.0
Borno	15.2	0.0	3.8	3.6	0.0	0.2	77.3
C/River	40.6	0.3	3.4	9.0	0.3	0.0	46.3
Delta	56.8	0.0	2.9	7.5	3.1	0.0	29.6
Ebonyi	12.3	8.3	3.2	2.5	5.6	0.0	68.1
Edo	77.7	1.9	2.0	3.2	0.0	0.0	15.2
Ekiti	61.0	0.0	1.6	5.2	0.2	0.0	32.1
Enugu	44.9	0.5	3.6	4.8	0.3	0.0	45.8
Gombe	39.5	0.9	0.9	3.4	0.0	0.0	55.4
Imo	69.5	0.3	4.6	12.8	0.2	0.0	12.6
Jigawa	41.6	0.2	0.2	1.4	0.2	0.0	56.5
Kaduna	46.2	0.2	1.8	8.2	1.2	0.0	42.4
Kano	42.6	0.0	0.3	0.8	0.0	0.0	56.2
Katsina	36.2	1.0	0.2	2.9	0.0	0.0	59.7
Kebbi	42.7	0.0	0.4	2.5	0.0	0.0	54.4
Kogi	39.5	1.7	4.5	5.2	1.0	0.0	48.1
Kwara	56.4	0.0	1.5	3.6	0.0	0.0	38.5
Lagos	57.0	0.0	0.9	40.9	0.9	0.0	0.3
Nassarawa	21.3	0.2	2.4	3.6	1.9	0.0	70.6
Niger	35.6	0.0	6.2	1.6	0.0	0.0	56.6
Ogun	69.8	0.0	0.8	8.5	0.3	0.0	20.4
Ondo	50.3	1.7	3.8	2.2	0.0	0.0	41.9
Osun	63.6	0.0	1.2	1.4	0.0	0.0	33.9
Oyo	47.5	0.0	5.3	8.2	0.2	0.0	38.8
Plateau	18.8	1.4	5.7	2.1	0.7	0.0	71.3
Rivers	41.0	0.7	13.8	11.9	10.9	0.0	21.7
Sokoto	29.8	0.0	0.2	0.3	0.2	0.0	69.5
Taraba	2.8	0.0	1.2	5.9	1.4	0.0	88.8
Yobe	18.1	0.7	0.7	2.1	0.4	0.0	78.0
Zamfara	21.5	0.2	0.2	0.5	0.0	0.5	77.1
FCT	38.3	0.3	10.6	23.7	0.2	0.0	26.9
Total	**40.4**	**0.9**	**3.2**	**6.3**	**1.1**	**0.0**	**48.0**
Source: NBS/CBN/NCC Social-Economic Survey on Nigeria,2008.							

3.3.3 Economy

Table 3.6: Development indicators for Nigeria with a bearing on e-waste sector "Economy "

Indicator	Year	Value	Reference
Gross domestic product (GDP) (million current US$)	2008	219193	UN Data (UN Data (world Statistics Pocket Book/ United Nation Statistic Division)
Purchasing power parity (PPP) conversion factor	2007	84.426	UN Data (United Nations Statistics Division)
GDP per capita (PPP)	2009 (est)	$2,400	CIA World Fact book
GDP per capita (current US$)	2008	1449.6	UN Data (world Statistics Pocket Book/ United Nation Statistic Division)
GDP (purchasing power parity)	(2009 est.)	$353.2 billion	CIA World Fact book
GDP composition by sector (agriculture, industry, services)	(2009 est.)	agriculture: 33.4% industry: 34.1% services: 32.5%	;;
Labour Force national	2009	51,040,000	CIA World Fact book
Labour force by sector (agriculture, industry, services)	(1999 est.)	agriculture: 70% industry: 10% services: 20%	CIA World Fact book
Consumer price index (2000=100)	(2008	264	UN Data(UN Data (world Statistics Pocket Book/ United Nation Statistic Division)

3.3.4 States & Markets

Table 3.7: Development indicators for Nigeria with a bearing on e-waste, section "States and Markets"

Indicator	Year	Value	Reference
Telephones access			
Households with television	2004	25%	World Bank/Trading Economics.com
Personal computers per 1000 people	2006	0.85	World Bank/ Trading Economic.com
Internet users per 100 people	2008	1.59	World Bank/Trading Economics.com
Internet users in Nigeria		23,982200.0	
Mobile Phone subscribers per 1000 people (Telephone lines in cell Phones (mobile)	2007 2008	40,396 62, 988	Nigerian Communications Commission (NCC), Abuja
Telephone Lines in cell phone (fixed)	2007 2008	1,579 1,307	NCC
Total subscribers	2009	74,000,000	NCC
Teledensity (based on active subscribers)	2009 July 2010	53.23 57.62	NCC NCC
Information and communications technology expenditures (% of GDP)	2008	3.09	World Bank/ Trading economics.com
Contributions to GDP (%)			NBS
Contributions to GDP (%)	2009 2007	3.66 2.39	NCC
Tax revenue collected by central government	April 2010	N600 billion	*Daily Independent Report, Lagos (Newspaper)

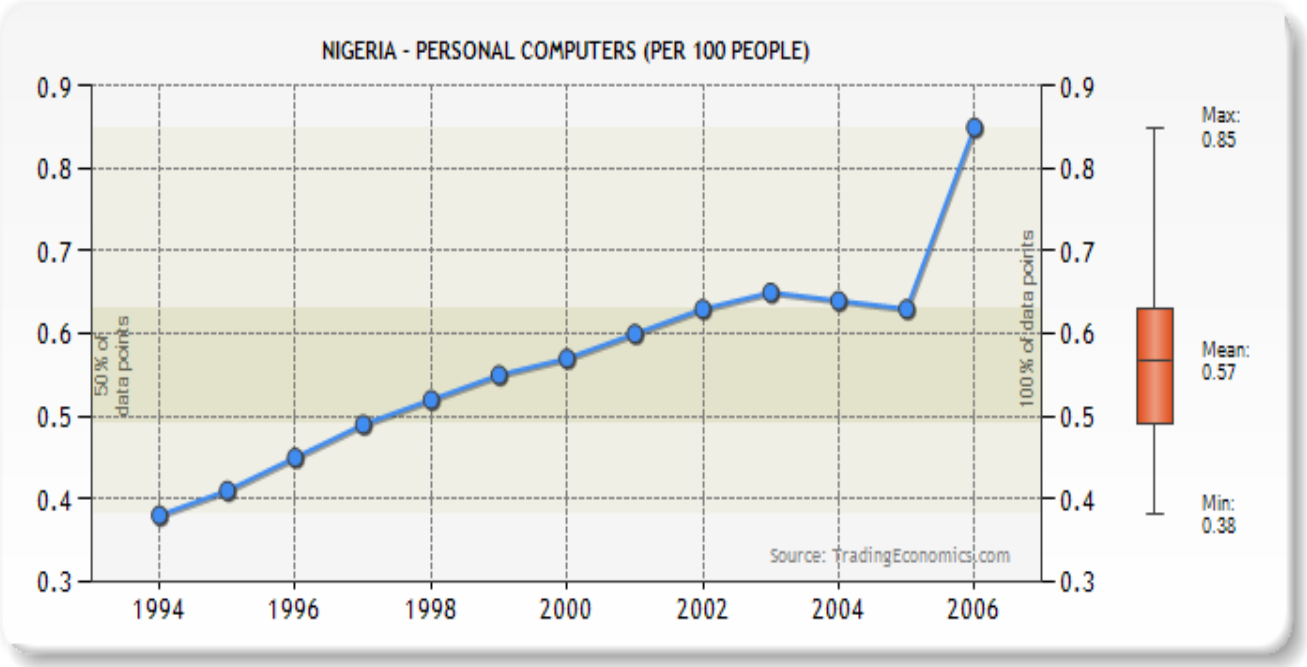


Figure 3.4: Nigeria-personal computers per 1000 people (Lagos Bureau of Statistics, 2008 Lagos Household Survey).

Micro, small, and medium-size enterprises

Given the paucity of available statistics, It is impossible to gauge the exact number of MSMEs segregated by size, but it is plausible to suggest that the number of microenterprises may comprise 80% of the number of potential MSME (approximately 6.7Million), that small business may account for 15% of the total (about 1.3 million), and that medium enterprises may comprises 5% of the total MSME (around 420,000).

Tax Revenue Collection by Central Government

Nigeria, especially with the unprecedented growth in the telecom sector within the last 10 years, has shown that there are potentials within its ICT market if government and the investors can tarry to tap from the available resources that are limited by environmental challenges through strong will and right policies.

Aside the terrific increase in teledensity from 0.44 per cent before 2001 to above 50 per cent in 2010, studies has made known the great contribution of the ICT sector to the nation's Gross Domestic Product (GDP). Within the last decade, the telecom sector in the estimation of the Chairman of Association of Licensed Telecommunications Companies of Nigeria (ALTON), Gbenga Adebayo, has raked in about N600 billion to government coffers in terms of tax, revenue and others. Adebayo also rued the effect of multiple-taxation by all tiers of government (Federal, State and Local Governments) on the same infrastructure in the sector as a major setback, thereby leaving the operators with no choice than to transfer the cost of the utilities to the consumers in order to offset expenses.

The Computer and Allied Products Dealers Association of Nigeria (CAPDAN), is still battling the imposition of 5 per cent tax on locally-assembled computer products in the market while on foreign products, the tax duty is almost absent.

According to Adebayo Nigeria arguably has the largest computer market in Africa with Lagos Computer Village controlling the largest share of the market.

3.4 Lagos State Profile

Lagos State is traditionally inhabited by the Aworis, and is the cradle of commercialization in the country. However, because of the long historical goodwill and benefit derived up to the present day, Lagos has attracted a lot of people from different ethnic nationalities working and living within the territory boundary. The industrial revolution of the 1970s and 1980s as well as being the former Federal capital contributed in no small measure to the attraction of diverse people to the city.

In spite of the cosmopolitan nature of Lagos city, the traditional institution represented by the monarchs is still relevant; likewise the traditional daily and weekly markets at Ipodo, Alausa and Ogba Sunday Market still function and are very relevant in the present day capital of the state - Ikeja.

According to 2006 National Population Commission census, (**Error! Reference source not found.**) the population of the various Local Government Areas in the Lagos State is as indicated below and supported by relevant data including existing housing stocks, school enrolments, vehicle and motor-bike registration and a host of other facts that cannot be disputed.

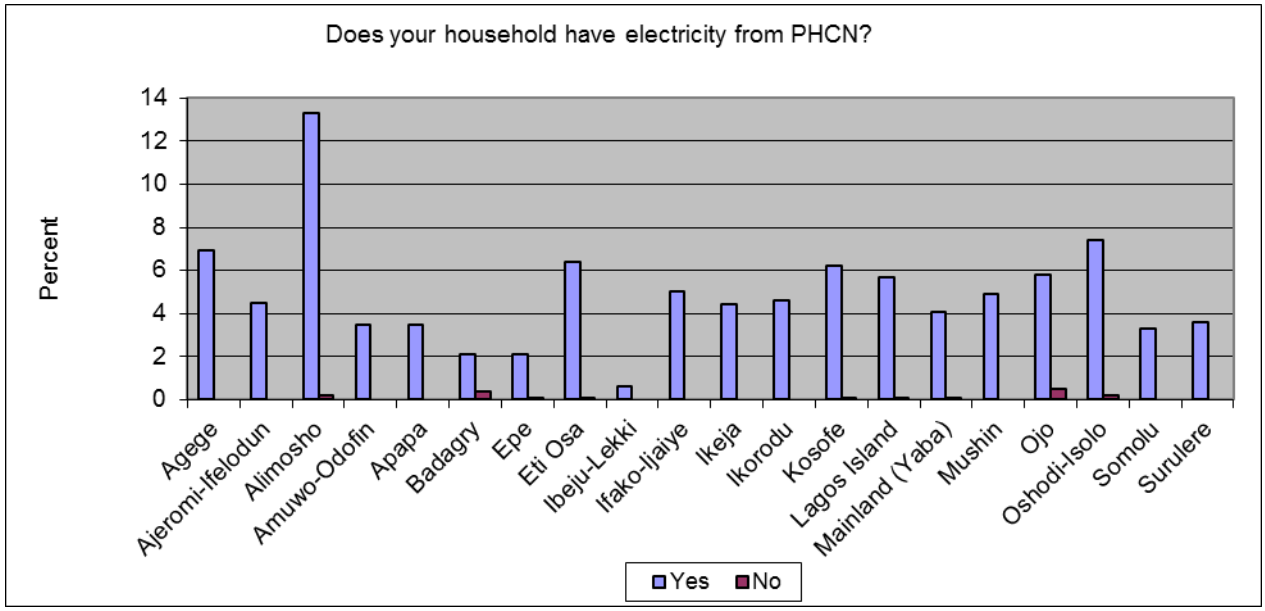


Figure 3.5: Access to electricity from the Power Holdings Company of Nigeria (PHCN) (Lagos Bureau of Statistics, 2008 Lagos Household Survey).

The result of a survey in Lagos State (Figure 3.5) showed that nine in ten (97.9%) of households said that they had electricity from Power Holdings Company of Nigeria PHCN; while 2.1% claimed they did not have electricity from PHCN.

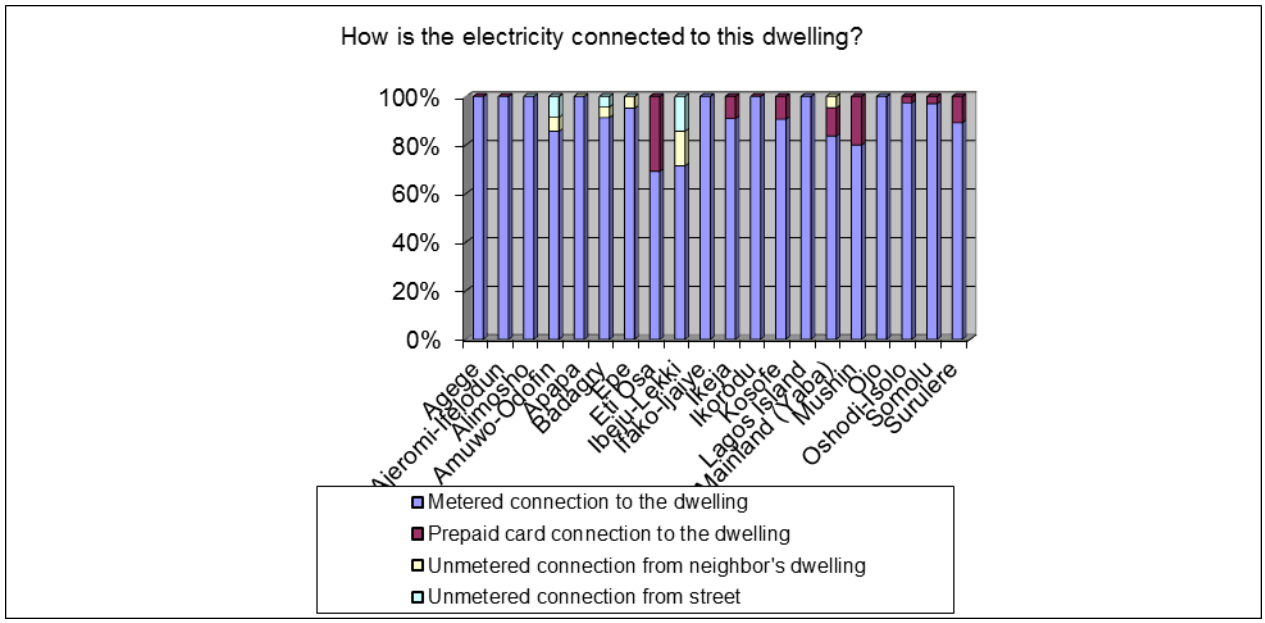


Figure 3.6: Connection of electricity to dwellings in Lagos State (Lagos Bureau of Statistics, 2008 Lagos Household Survey).

The analysis of the study also revealed that 93.4% of households (Figure 3.6) claimed that electricity are connected to their dwellings through meter; while 5.3% said that electricity are connected to their dwelling through prepaid cards.

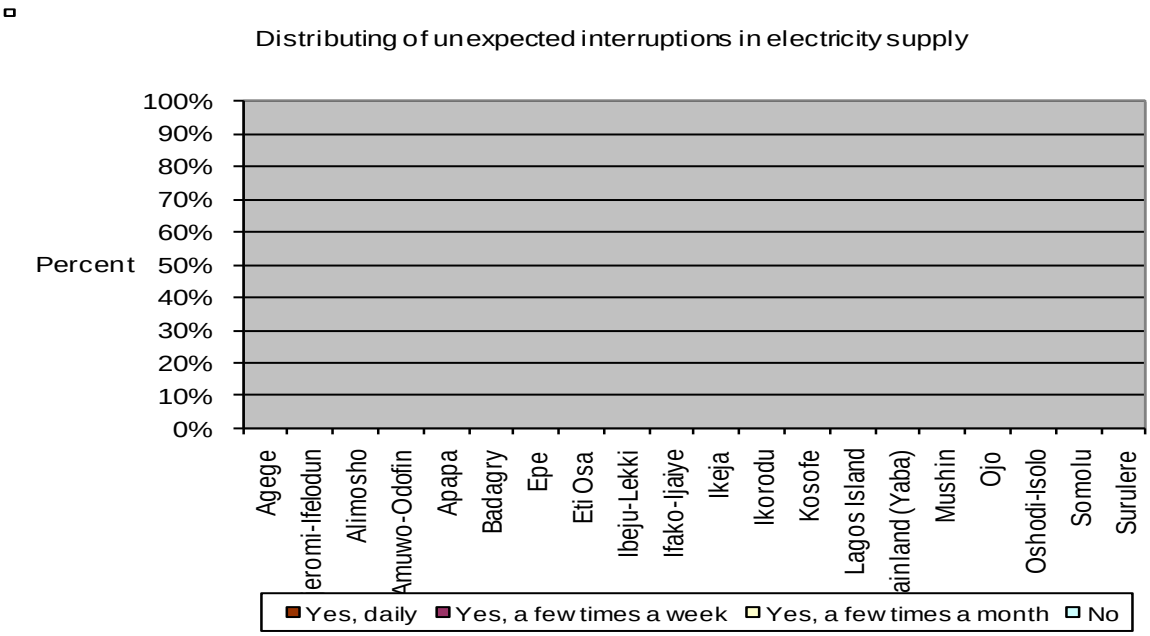


Figure 3.7: Distribution of unexpected interruption in electricity supply (Lagos Bureau of Statistics, 2008 Lagos Household Survey).

The 2008 household survey showed that nine in ten (94.4%) of households (Figure 3.7) reported that they experienced unexpected interruptions in electricity supply daily; while 2.7% claimed few times a month. On the number of hours household enjoyed electricity in a day, about 15.6% of households claimed that they enjoyed electricity for five hours in a day; while 0.3% claimed they had electricity for twenty four hours in a day. Many resident use electricity generating sets in Lagos (Figure 3.8)

Figure 3.8: Use of electric generators in Lagos households.

Table 3.8: Lagos State Population (NPC Figures)

LOCAL GOVERNMENT	TOTAL	MALE	FEMALE
Badagry	241,093	121,232	119,861
Ojo	598,071	310,100	287,971
Amuwo	318,166	167,856	150,310
Alimosho	1,277,744	649,460	628,254
Agege	459,939	242,520	217,419
Ifako-Ijaye	427,878	218,993	208,885
Ikeja	313,196	169,233	111,963
Oshodi-Isolo	621,509	321,767	299,742
Mushin	633,009	328,197	304,812
Surulere	503,975	261,265	242,740
Ajeromi-Ifelodun	684,105	352,238	331,867
Apapa	217,362	119,556	97,806
Lagos island	209,437	108,057	101,380
Lagos Mainland	317,720	166,163	151,557
Shomolu	402,673	207,649	195,024
Kosofe	665,393	350,120	315,273
Ikorodu	535,619	272,569	263,050
Eti-Osa	287,785	160,396	127,389
Ibeju-Lekki	117,481	59,544	57,937
Epe	181,409	91,105	90,304
Total	9,013,534	4,678,020	4,335,514

Source: National Population Commission (2006)

Table 3.9: Lagos State Population (Lagos State Government, 2006)

LOCAL GOVERNMENT	POPULATION	No. of Polling Wards.	No. of Households Listed.	No. of Polling Household Sampled
Badagry	332,685	11	614	214
Ojo	635,366	13	767	274
Amuwo-Odofin	560,814	12	833	259
Alimosho	1,175,622	11	947	379
Agege	1,180,358	10	1134	379
Ifako-Ijaye	654,471	14	924	274
Ikeja	533,237	10	929	274
Oshodi-Isolo	1,192,652	11	928	381
Mushin	1,439,556	15	981	428
Surulere	1,183,886	12	975	379
Ajeromi-Ifelodun	1,588,361	17	980	458
Apapa	432,686	09	750	234
Lagos Island	454,714	18	1328	239
Lagos Mainland	721,733	10	1005	289
Shomolu	949,730	08	967	334
Kosofe	1,102,661	12	1275	364
Ikorodu	558,422	18	1066	259
Eti-Osa	424,434	09	809	234
Ibeju- Lekki	62,988	16	1054	162
Epe	292,049	18	1410	207
Total	15,467,425	254	19667	6000

Table 3.10: Lagos State Projected Population Growth Trend (Comparison of NPC & Lagos State Government Figures) (Regional and Master Plan Department, Ministry of Planning and Urban Development, Ikeja; Lagos State. June 2008)

YEAR	Projected Population at 5.05% (NPC)	Projected Population at 5.05% (LASG)
2006	313,196	533,237
2007	329,012	560,165
2008	345,627	588,453
2009	363,081	618,170
2010	381.417	649,388
2011	400,678	682,182
2012	420,913	716,632
2013	442,169	752,822
2014	464,498	790,840
2015	487,956	830,777
2016	512,597	872,731
2017	538,484	916,804
2018	565,677	963,103
2019	594,244	1,011,740
2020	624,253	1,062,833

According to the 2008 household survey, the use of personal mobile phone was quite high in the state as 96.6% of households used it while 3.5% used personal phone (landline). However, 4.3% used public phone (general). The survey also revealed that 39.7% of households claimed that they used one mobile phone while 38.8% claimed they used two mobile phones

Lagos State's Economic Profile

Lagos is Nigeria's most prosperous city, and much of the nation's wealth and economic activity are concentrated in the city.

Lagos is Nigeria's financial, commercial and industrial nerve centre with over 2,000 manufacturing industries and over 200 financial institutions (Banks, Insurance companies etc) including the nation's premier stock exchange, the Nigeria Stock Exchange.

It also houses the nation's monetary authority, the Central Bank of Nigeria (CBN) and the Security and Exchange Commission (SEC). The State alone harbours 60% of the Federation's total industrial investments and foreign trade while also attracting 65% of Nigeria's commercial activities. It also accounts for more than 40% of all labour emoluments paid in the country.

Indeed, the headquarters of multinational conglomerates like UAC, Unilever, John Holts, BEWAC/VYB, Leventis, Churchgate, Chevron, Shell, Exxonmobil and the nation's giant public enterprises are all located within the State.

Figure 3.9: Market in Lagos

However, Lagos State is not industrially saturated. Most commercial and financial businesses are transacted at the Central Business District situated in the Ikeja area and in the Lagos Island. Lagos has one of the highest standards of living as compared to other cities in Nigeria as well as in Africa. The port of Lagos is Nigeria's leading port and one of the largest and busiest in Africa. It is administered by the Nigerian Ports Authority and is split into three main sections: Lagos port, in the main channel next to Lagos Island Apapa Port (site of the container terminal) and Tin Can Port, both located in Badagry Creek, which flows into Lagos Harbour from the west.

Lagos is served by Murtala Mohammed International Airport, one of the largest airports in Africa and a top international air passenger gateway to Nigeria. The airport is located in the northern suburb of Ikeja and has Domestic and International Terminals. With 5.1 million passengers in 2008, the airport accounts for almost fifty percent of all air traffic in Nigeria. Outbound international travel from Murtala Mohammed Airport accounts for the majority of all air passengers traveling to and from Nigeria. The airport has recently undergone upgrades along with the addition of a new terminal.

The estimated population of Lagos is clearly close to the 20 million mark based on the UN-Habitat's projection (the population is expected to hit 20.15 m by 2010 and 25 million by 2015 - Projected at a growth rate of 6% per annum). Despite a worsening poverty index for Nigeria, Lagos State has a relatively High Human Development Index (HDI). The State shows remarkably higher Human Development Index of 0.607 and the lowest Human Poverty Index of 14.5.

From the Year 2008 Household Surveys conducted by the Lagos Bureau of Statistics there are.

- 242 vehicles per square km in metropolis
- 25% Contribution to National GDP
- Est. GDP of US$53.5bn (US$214bn – National GDP (2008) –WEF)
- 45% of Nigeria's skilled labour force
- Over 10,000 industrial & commercial concerns
- Over 70% international air traffic (50% local)

4 Policy, legal and administrative framework

The environment has emerged as one of the most topical issues of contemporary times. This is in realization of the ever-increasing negative environmental impacts of rapid industrial development. As natural resources are being exploited at rates unprecedented in human history, the quality of the environment deteriorates and many of the development projects become unsustainable. This has therefore necessitated the enforcement of relevant environmental protection laws in order to protect and restore the Nigerian environment.

The requirement for an Environmental Impact Assessment is in compliance with the Federal Republic of Nigeria's (FRN) laws and policies geared towards achieving sustainable development goals through proper and adequate care of the environment, health and social well-being of her citizens.

The main aim of this chapter, therefore, is to review Nigerian legislation, guidelines and international conventions that are related and influencing e-waste management. The legislation outlined in the foregoing parts of this chapter are derived from the Nigerian Government laws and regulations, State Government laws as well as international conventions and other instruments that Nigeria is signatory to.

4.1 Regulatory framework related and influencing e-waste

The Constitution of the Federal Republic of Nigeria (CFRN) of 1999 provides the general thrust of the nation's environmental policy through S.20 that provides; "the state shall protect and improve the environment and safeguard the water, air and land, forest and wildlife of Nigeria". Consequently, subsidiary laws and regulations have been made and international conventions and other instruments entered into pursuant to the constitution's set objectives.

These include:

- Laws and regulations, standards, policies, codes and recommended practices relating to the industry sector by the Nigerian Government and its Agencies such as the Federal Ministry of Environment, the National Environmental Standards and Regulatory Enforcement Agencies, and State's Ministry of Environment, Ministry of Physical Planning, and the Lagos State Environmental Protection Agency (LASEPA).
- International guidelines and conventions to which Nigeria is a signatory.
- National policy on Environment (1989) and reviewed in 1999.

4.1.1 Federal regulatory bodies

Federal Ministry of Environment (1999 Presidential Directive)

The Federal Environmental Protection Agency (FEPA) was established by Decree No. 58 of 1988 and subsequently amended by Decree 59 of 1992 with further amendment by Decree 14 of 1999. FEPA was absorbed into the Federal Ministry of Environment (FMENV) in 1999 by a presidential directive and its functions among others are now the responsibility of the new Ministry. Though the FEPA Act has now been repealed in the NESREA Act No. 25 of 2007, the Regulations pursuant to it are still valid in Regulatory terms.

The National Environmental Standards and Regulations Enforcement Agency (NESREA) Act No. 25 of 2007

The Agency, shall, subject to the provisions of this Act, have responsibility for the protection and development of the environment, biodiversity conservation and sustainable development of Nigeria's natural resources in general and environmental technology, including coordination of environmental standards, regulations, rules, laws, policies and guidelines.

4.1.2 State regulatory bodies

At the state levels in almost the 36 states of the federation, there are similar regulatory bodies responsible for the environment protection, physical planning, solid waste management and environmental enforcement.

4.1.3 Specific environmental legislation

Environmental Impact Assessment (EIA) Act Cap 131 LFN 1992

This law makes it mandatory to have an EIA study for any major development project likely to have adverse effects on the environment and seeks to encourage the development of procedures for information exchange, notification and consultation between organs and persons when proposed activities are likely to have significant environmental effects on boundary or trans-state or on the environment of bordering towns and villages. The law prescribes the procedure for conducting and reporting EIAs.

Sectoral EIA Guidelines

In September 1995, FEPA (now Federal Ministry of Environment) published Sectoral EIA Guidelines for Infrastructural Projects. The Guidelines are for any project that involves:

- Coastal Development Project
- Port and Harbour Development Project
- Railways
- Roads and Highways,
- Airports
- Urban development project
- Domestic water supply and sanitation project
- Electrification projects

Land Use Act Cap 202 LFN 1990

This legislation put an end to absolute ownership of land by individual and the community and vests "all land comprised in the territory of each state (except land vested in the Federal Government or its agencies) solely in the Governor of the state, who would hold such land in trust for the people.

The National Urban and Regional Planning Decree No 58 of 1992

As earlier stated the physical planning dimensions of the management of solid waste cannot be underscored in terms of site location of industries and residential areas as well as site location for solid waste generation, collection and disposal resulting from activities in industrial and domestic sectors. The legislation provides for

the creation of physical development plans at Federal, State and Local Government levels. Local government for example, is responsible for the preparation and implementation of a town plan, a rural plan, a local plan, a subject plan (section 4). The State relevance lies in the fact that inter-sectoral cooperation is required in compliance with legal provisions on physical planning especially by private developers and government units and agencies. Effective enforcement of the provisions of physical planning laws viz a viz E.I.A. Provisions at all governmental levels and in both private and public sectors would result in more efficient management of solid waste at source

4.1.4 Air related legislation

Some of the Federal Regulations applicable at the State levels are:

- The National Guidelines and Standards for Environment Pollution Control in Nigeria (March, 1999), which is the basic instrument for monitoring and controlling industrial and urban pollution.
- The National Environmental Protection (Pollution Abatement in Industries and Facilities Generating Wastes) Regulations S.I.9 of 1991, which imposes restrictions on the release of toxic substances and stipulates requirements for monitoring of pollution; it also makes it mandatory for existing industries and facilities to conduct an environmental audit.
- Air Quality Standards (FEPA, 1991): there are ambient air quality limitations and standards in Nigeria enforced by the FMENV, NESREA and LASEPA.
- National Environmental (Permitting and Licensing system) Regulations S.1 No 29 of 2009.
- National Environmental (Ozone Layer Protection) Regulations S.1 No 32 of 2009. The regulations imposes prohibition on ozone depleting substance and the release of ozone depleting substances through importation, manufacture in part or in whole, installation, or offer for sale or buying of new or refurbished facilities intended to be used for the production of any ozone depleting substances (ODS), unless recovery and recycling of substances already in use.
- National Environmental (Mining and Processing of Coal, Ores and Industrial Minerals) regulations S.1 No 31 0f 2009: The regulation is to minimize pollution from the mining and processing of coal, ores, and industrial minerals. It stipulates new development in the mining and processing techniques shall apply up to date, efficient cleaner technologies to minimize pollution to the highest degree practicable.
- Noise Limitations as given by the FEPA regulations and the elements of the regulations include:
    - Noise standards including acoustic guarantee;
    - Guidelines for the control of neighborhood noises especially with respect to construction sites, market and meeting places;
    - Permissible noise levels in noise-prone industries and construction sites and to ensure the installation of noise dampers on noisy equipment.
- National Environmental (Noise Standards and Control) Regulations, S.1 No 35 of 2009: The purpose of the these regulations is to ensure maintenance of a healthy environment for all people in Nigeria, the tranquility of their surroundings and their psychological well being by regulating noise levels and generally, to elevate the standard of living o f the people by:
    - Prescribing the maximum permissible noise levels a facility or activity to which a person may be exposed;
    - Providing for the control of noise and for mitigating measures for the reduction of noise; and

- Generally for giving effect to the provisions of section 22 of the NESREA Act.

4.1.5 Water related legislation

With regard to effluent standards, and arising Sewage, The National Environmental Protection (Effluent Limitation) regulations S.1.8 of 1991, which makes it mandatory for industrial facilities to install anti-pollution equipment, makes provision for effluent treatment and prescribes maximum limits of effluent parameters allowed for contraventions. It also provides that all industries in Nigeria should be operated on the basis of Best Available Technology (BAT).

4.1.6 Solid waste related legislation

The Hazardous waste (Criminal Provisions) Decree No 42 of 1988

The law prohibits the carrying, depositing and dumping of harmful waste on any land, territorial waters and related matters. It prohibits activities relating to harmful wastes, and lists such activities.

The National Environmental Protection (Waste Management) Regulations S.I.15 of 1991

The law regulates the collection, treatment and disposal of solid and hazardous waste from municipal and industrial source.

National Environmental (Sanitation and Wastes Control) Regulation S.I.28 of 2009.

This regulation applies to issues in environmental sanitation and all categories of wastes including e-waste. It regulates the adoption of sustainable and environment friendly practices in environmental sanitation and waste management to minimize pollution.

It stipulates further the obligation of all manufacturers and importers of a various brands of products to comply with a product stewardship program and extended producers responsibility programme. In particular e-waste becomes amenable to extended producers responsibility programme from January 2011

4.1.7 Social legislation

Nigeria's legal system is based on the English common law, which continues to apply except to the extent it has been modified by statute. In relation to freedom of association and right to collective bargaining, forced labour and child labour, Government programmes to foster employment and alleviate poverty, Legal status of migrants including issuing of work permits and the termination of employment, the most important statutes are the Labour Act 1974 (LA) (also known as the Labour Decree 1974), as amended, and the Trade Disputes Act 1976 (TDA).

Consumer Protection Council Establishment Decree No 66 of 1992.

The Consumer Protection Council is the apex consumer protection agency of the Federal Government of Nigeria established to promote and protect consumers' interests.

4.1.8 Environmental legislation in Lagos State

The challenge of environmental management and regulation is immense in a state that has a megacity such as Lagos.

Over the years, legislation has evolved. With the enactment of the Environmental Pollution Control Edict, 1989 and the Lagos State Environmental Protection Agency, Edict 9 of 1997, the Environmental Sanitation Edict of 2002, the various rules and notifications, and the State Environment Policy, a credible legislative and policy base has been created.

The Lagos State Environmental Protection Agency, Edict 9 of 1997 in particular specified the responsibilities and functions of the Agency which include:

a) Advising the State Government on all environmental management policies.

b) Giving direction to the affairs of the Agency on all environmental matters.

c) Preparing periodic master plan to enhance capacity building of the Agency and for the environment and natural resources management.

d) Carrying out appropriate tests on insecticides, herbicides and other agricultural chemicals.

e) Carrying out public enlightenment and educate the general public on sound methods of environmental sanitation and management.

f) To monitor and control disposal of solids, gaseous and liquid wastes generated by both government and private facilities in the State.

g) Monitoring and controlling all forms of environmental degradation from agricultural, industrial and government operations.

h) Setting, monitoring and enforcing standards and guidelines on industrial effluent, air emissions (vehicular & stationary).

i) Surveying and monitoring surface, underground and potable water, air, land and soil environment in the State to determine pollution level in them and collect baseline data.

j) Promoting co-operation in environmental science and technologies with similar bodies in other contrives and international bodies connected with the protection of environment, and

k) Co-operation with the Federal, State and Local Governments, statutory bodies and research agencies on matters relating to environmental protection.

All the states in Nigeria have power to make laws with respect to the environment. This is because the subjects relating to the environment are contained in the Concurrent Legislative List. Other relevant States Statutory Laws, Regulations, Legislations and Guidelines related to industrial activities include the following.

- Lagos State Environmental Law, 1994 as amended in 1997
- Lagos State Sanitation Edict, 2002
- The Lagos State Town and Country (Building)Plan Regulations Of 1986
- Lagos State Urban and Regional Planning Board Law 1997
- Lagos State Urban and Development Regional Planning and Development Law Of 2005.

4.1.9 Specific e-waste management legislation

There are Regulations which may be cited as the National Environmental (Electrical/Electronics

Sector) Regulations S.I. No. 23, adopted in 2011.

The principal thrust of the Regulations is to prevent and minimize pollution from all operations and ancillary activities of Electrical/ Electronic Sector to the Nigerian environment. The Regulations are based on life cycle approach and shall cover all the aspects of the electrical/electronic sector from cradle to grave.

Also the Regulations are anchored on the 5Rs ('Reduce, Repair, Recover, Recycle and Re-use,') principle as the primary drivers of the sector and shall encompass all the categories and lists of electrical/electronic equipment.

NESREA also developed a guide for importers of used EEE into Nigeria, which contains the guiding principles, requirements for import of used EEE, and the description of items that are not allowed to be imported to Nigeria. According to this guide, all importers of used EEE in Nigeria are required to register with NESREA.

4.1.10 International guidelines and conventions

Nigeria is a signatory to several international conventions and treaties that promote the maintenance of a viable environment and achieving sustainable development. The Federal Ministry of Environment is the Focal Point and Designated National Authority for the implementation of a number of the international conventions. The ones relevant to the E-waste project at hand are:

- Basel Convention on Transboundary Movement of Hazardous Waste and its Disposal, 1992 1992 (Party, ratified in 1990)
- Ban Amendment (ratified in 2004. The Amendment has not yet entered into force)
- Bamako Convention on the Ban of the Import into Africa and the Control of Transboundary Movement and Management of Hazardous Wastes within Africa (1991) (Signatory).
- Framework Convention on Climate Change, 1992 (Party, ratified in 1994).
- Montreal Protocol on Substance that Deplete the Ozone Layer 1987 (Party, ratified 1991).
- The Stockholm Convention on Persistent Organic Pollutants (Party, ratified in 2004).

4.2 Constitutional framework for environmental management

The Constitution of the Government of the Federal Republic of Nigeria (GFRN-1999) provides for a three-tiered governmental structure that consists of the Federal Government (FG), the State Governments (SGs), and the Local Governments (LGs). The Constitution specifies the roles and jurisdictions of the three tiers of government and describes the powers vested in the three arms of government: the executive, the legislative and the judiciary at each tier. Their roles in environmental management and by extension solid waste management are discussed in this section.

The Environmental Objectives and Directive of State Policy on the Environment contained in the Constitution state that, "the State shall protect and improve the environment and safeguard the water, air and land, forest and wildlife of Nigeria" (Constitution, Chapter 2, Article 28).

In an effort to develop a framework within which the goals of protecting and improving the environment can be realized, the Constitution allocates certain legislative competencies to each of the three tiers of government. The responsibility for applying the legislation falls on the judiciary. The specific competencies of the National Assembly, the State Assemblies and the Local Government Councils are indicated below.

4.2.1 The executive legislative list

Part I of the Second Schedule to the Constitution contains the Exclusive Legislative List, which documents the realms over which the National Assembly of the GFRN is solely empowered to make, amend and repeal legislation. From the perspective of environmental management and protection these realms include, but are not limited to coastal and marine fisheries; mines and minerals including oil fields and oil mining, national parks, and water from sources affecting more than one state.

4.2.2 The concurrent legislative list

Part II of the Second Schedule to the Constitution, the Concurrent Legislative List, describes the realms over which both the National Assembly of the GFRN and the House of Assembly of any state, are empowered to act. From an environmental perspective these realms include the generation, transmission and distribution of electricity to areas not covered by the national grid system; the establishment of research centers for agricultural studies; the regulation and coordination of scientific research; industrial, commercial and agricultural development.

4.2.3 The functions of local government councils

Part I of the Fourth Schedule to the Constitution, the Functions of Local Government Councils, describe the roles and jurisdictions of local government councils. Again, from the perspective of environmental management and protection these realms include, the consideration and making of recommendations to a state commission on economic planning and development; the development of agriculture and natural resources other than the exploitation of minerals; and the establishment and maintenance of infrastructure, public markets, etc.

As a whole, the constitutional framework for environmental management remains highly centralized. The result is a system in which the federal and state governments are given the primary responsibility for developing and applying the legislative framework for environmental management, including the provision of supervisory and regulatory functions, while the primary responsibility for economic planning and development resides with LGs.

4.2.4 The Federal, State and Local government legislative framework for environmental management

The legislative framework for environmental management by the Federal Government, State and Local Governments are discussed below.

The federal legislative framework for environmental management

The legislative arm of the GFRN, the National Assembly, is a bicameral legislative body comprised of the Senate and the House of Representatives. In addition to participating in the general activities of the House and Senate, members are also assigned to topical committees. The House and Senate Committees on the Environment are given primary responsibility for the review and oversight of the existing environmental legislation, the collection and analysis of relevant information, and the development of informed draft legislation designed to strengthen the legal framework for environmental management. There are five sub-committees: Biodiversity Conservation, Desertification, Erosion and Flood Control, Industrial Waste Management, and Pol-

lution Control. It is the responsibility of these subcommittees to focus on strengthening the legislative framework relevant to their assigned technical areas.

The state legislative framework for environmental management

The State Government legislative arm is comprised of a unicameral legislative body, the House of Assembly, headed by the Speaker. As with federal legislation, many of the existing state environmental laws are remnants from the colonial era. However, the incidence in the development of new state-level environmental legislation appears to be increasing. In most cases, the development of new legislation is targeted to curtail the degradation or promote the improved management of those natural resources that are particularly important to a state's economy.

The Local Government Legislative Framework for Environmental Management

Nigeria's 36 states and the FCT are comprised of 774 LGAs. The LG legislative arm is the legislative council. Unlike their Federal and State Government counterparts, LGs are not empowered to enact, repeal or revise legislation (although they do have some latitude to develop and enforce local by-laws). Instead their role, in general terms, is twofold: to make recommendations to state institutions regarding economic planning and development, and to serve as the basic vehicle (of the state) for development at the LGA level (GFRN, Report of the Presidential Committee on the Review of the 1999 Constitution, Fourth Schedule, Part 1, 2001).

Within the current environmental management and protection framework, LGs are by and large excluded from participating in the legislative review, revision and redrafting process. This not only limits local-level inputs into the legislative process, but also serves to decrease local-level institutions awareness of and ownership over environmental management and protection.

4.2.5 The judicial framework for environmental protection

The judiciary arm of the government is responsible for applying the legal framework at the federal, state and local government levels. At the federal government level, the judiciary is comprised of the Supreme Court and the Federal Court of Appeals. At the state level, the judiciary is comprised of the Federal High Courts. There is no judiciary flow-down to LGs. Instead, state courts are responsible for applying the legal framework at the LG level. Also operating at the local level, but not under the control of the judiciary, are traditional courts.

4.2.6 Institutional and policy framework for environmental management

Historically, the institutional framework for environmental management in Nigeria has been highly centralized, which has resulted in inconsistent policy framework that lacked an integrated approach, both at the Federal level of policy development, and at the state and local government agency level of policy implementation. Consequently there are problems of institutional overlaps and associated problems, such as lack of adequate resources and role conflicts.

4.2.7 Federal institutional and policy framework

The Federal institutional framework for environmental management has been in a state of almost constant flux for the past quarter century. During this time, primary responsibility for environmental management by Federal government has shifted numerous times from the Ministry of Economic Development in 1975, to the Ministry of Works and Housing in 1979, to the Federal Environmental Protection Agency (FEPA) in 1988, and to the Federal Ministry of Environment (FMoE) in 1999 to the Federal Ministry of Environment, Housing and Urban Development in 2003 and currently back to the Federal Ministry of Environment since 2008.

This flux in the national-level institutions has resulted in an inconsistent approach toward policy development at the Federal level, and has led to an even more inconsistent approach toward policy implementation at the levels of state and local government as they tend to follow the Federal trend.

Primary responsibility for the development of policies, strategies and action plans resides with the sectoral Federal government agencies. Oftentimes participatory approaches/processes are utilizes in such policies development.

The Federal Ministry of Environment

In June 1999, the newly elected democratic government, in an effort to ensure that environmental issues receive priority attention in the Nigeria's development agenda, created the FMoE through a presidential directive. To consolidate the primary responsibility for environmental management in one institution, the FMENV absorbed FEPA and accepted the transfer of relevant departments and units from various other federal ministries (e.g., Forestry Department from the Federal Ministry of Agriculture [FMoA], Soil Erosion and Flood Control Department from the Ministry of Water Resources [MoWR]).

The broad mandate of the FMENV, as elaborated in the revised 1999 National Policy on the Environment, is to coordinate environmental protection and natural resource conservation for sustainable development, and specifically to:

- Secure a quality of environment adequate for good health and well being,
- Promote the sustainable use of natural resources,
- Restore and maintain the ecosystem and ecological processes and preserve biodiversity,
- Raise public awareness and promote understanding of linkages between environment and development, and
- Cooperate with government bodies and other countries and international organizations on environmental matters.

FMENV's structure is comprised of eight departments (seven technical and one administrative), four supporting services units, and four parastatals. As one can imagine with a new ministry, comprised primarily of departments and units absorbed from other federal agencies, the organization is undergoing some growing pains. But overall, the division of responsibilities for environmental management and protection among the seven technical departments and the four parastatals are fairly clear (with a few exceptions).

Its strategy for the discharge of its mandate consists of policy formulation, setting up of standards, establishment of guidelines and regulations. The major policies, regulations and guideline in solid waste management have been outlined above.

The National Environmental Standards and Regulations Enforcement Agency (NESREA)

This is the main enforcement parastatal of the Federal Ministry of Environment

NESREA is charged with the responsibility of enforcing all environmental laws, guidelines, policies, standards and regulations to enforce compliance with provisions of international agreements, protocols, conventions and treaties on the environment.

The State Level

The institutions at state Level for waste management can be grouped into 2 main types namely the

- Statutory bodies- Ministry /Agency/ Boards
- Quasi permanent bodies- Task forces, Project monitoring units (PMUs)

Each state of the Federation has a board or an Agency and supervising ministry that oversee the management of waste management. These agencies, board or ministry are marked with conflicts and overlap in roles and responsibilities among themselves and between them and sector ministries. Some of the agencies are within ministerial control while others are not.

The quasi permanent bodies are task forces created to deal with issues as determined by various administrations. On solid waste management, there are task forces in all the states such as the War Against Indiscipline (WAI) brigade / Kick Against Indiscipline (KAI) brigade in Lagos State.

5 Imports of EEE and WEEE

5.1 Stakeholders overview

Producers are defined as any organization manufacturing, assembling and / or importing EEE. This group is composed of the hardware brands and their associations (IT association, consumer electronics, electronic components, etc.), but also of "unidentified" producers, when the equipments are non-branded.

No major international manufacturer of EEE is presently operating a manufacturing facility in Nigeria. Most of the global manufacturers like Philip, Motorola, HP, Compaq, Dell, Toshiba, Nokia, Samsung, Sony Ericsson, LG, Sharp, Somotex, are key players in the Nigeria EEE market but do not have manufacturing/assembly plants in Nigeria except PZ CUSSONS Nigeria PLC the manufacturer of Haier Thermocool.

The business of these Global brands mainly comprise of export of readymade products into Nigeria via major marketers and distributors. Each of these distributing outlets is not particularly on a franchise or sole representative basis and with several locations.

There are few local assemblers/manufacturers in the Nigerian EEE sector. These include Zinox, Omatek, Brian, Beta and Adebowale. They often import completely knocked down parts to reassembly in the country for sale.

Most of the organisations have their head offices in Victoria Island Lagos and other central business districts of the various cities assessed. Somotex and Samsung are located at Ojota- Lagos which was the former Phillips company premises, while Adebowale and PZ CUSSONs Nigeria are located at Ikorodu-Lagos.

Evaluation of the assessment nationwide indicated the prevalence of the following organizations such as HP, SAMSUNG, SONY, DELL, NOKIA, LG, SOMOTEX, OMATEK, ZINOX, and ADEBOWALE ELECTRONICS as manufacturers/ importer. Table 5.1 gives an overview of organizations that are key players in EEE in Nigeria.

Table 5.1: Overview of key players in EEE in Nigeria.

Organisation	Types of EEE being Handled in Nigeria
Adebowale Electronics	White goods and electrical lightings
Dell	Computers
HP	Computers
LG	Large and Small house hold appliances
Nokia	Mobile Phones
Omatek	Computers, & Power Products
Somotex	Small Household Appliance and electrical lighting
Samsung	Large and Small Household Appliances, computers and mobile phones
Sony	Large and Small Household Appliance, Computers and mobile phones
Zinox	Computers

The marketing strategy employed by both the foreign based manufacturers and local assemblers is the use of registered distributors who will buy and sell to consumer on a need basis. The local assemblers sell direct to corporate organisation, they also form partnership with some government bodies and private sector whereby they enter into sales and services agreement.

For example in line with the Federal Government's "Vision 2020" and her attainment of the Millennium Development Goals (MDG), OMATEK is continuously marketing an initiative tagged "e-xpress" to help Nigerians realized their dreams of owing computers in an easy and convenient form. The same "e-xpress" initiative is

marketed in Ghana following the country's digital inclusion programme, under the supervision of Ghana's Ministry of Communication.

OMATEK has formed partnership with various banks with the aim of providing low-interest rate funding for the acquisition of computers by beneficiaries (including individuals, government and private companies) under the scheme.

These organisations (government and private companies) then sell the products e.g. computers and household appliances to the member of staff on credit basis. Through this credit scheme a number of government officials have been able to purchase new electrical equipments particularly computers and accessories and pay back on installment to their employers.

Manufacturer/ importer like LG, Haier Thermocool (PZ CUSSONS Nigeria PLC), Adebowale (Debo industries limited) and Somotex have shopping outlets all over the country.

Some of the manufacturers participate through donation of some of their product to schools and government ministries. Special economic schemes such as tax holidays are not in practice in the country yet. Procedures for de-bonded equipment through duty payment or waivers are in operation for some equipment, but its application to electronic equipment is considered to be in pilot stage. However there are promotional sales on the discretions of the manufacturer or importers.

Equally, producer responsibility organizations are not yet in existence in Nigeria. The HP representative explained that they have started this in some African countries, and expect that very soon the pilot scheme will start in Nigeria. Notwithstanding , the new regulation on waste control and the upcoming one on electrical/ electronic waste pursuant to the NESREA Act of 2007 will stimulate the set up of such an organisation soon as it has placed a product stewardship responsibility on the manufacturers/ importers/ producers/ assemblers of electrical/ electronic equipment.

5.2 Modes of importation

5.2.1 Importation through the seaports

Electronics are imported mostly with 40 feet containers. The study observed through the manifests /freight list that about 77% of imported used EEE came in 40 feet containers and about 23% in 20feet containers. An average weight of a 40feet container of used EEE weighs 9,158kg while that of a 20feet container is 4805kg. Irrespective of the size specifications an average weight of container of used EEE coming into Nigeria is 8341kg.

Most EEE in use in Nigeria are imported through the Lagos seaports. The Lagos seaports studied are the Tin Can ports Lagos, and the Apapa ports Lagos. Imported through the sea ports are both new and used EEE (Figure 5.1 - Figure 5.3). Such goods are inspected before clearance (Figure 5.4).

Figure 5.1: Importation of new EEE through the sea port (Tin Can port)

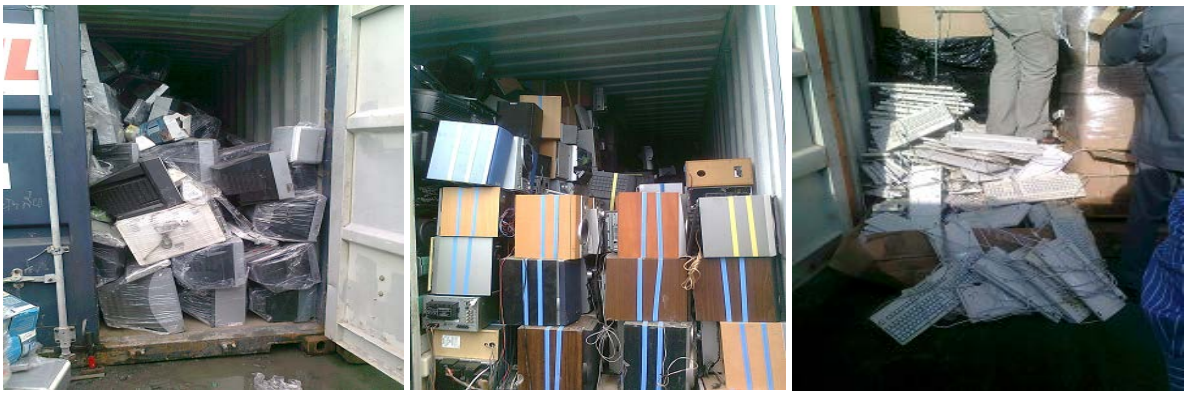


Figure 5.2: Importation of used EEE through the sea port (Tin Can port)

Figure 5.3:. Importation of used EEE through the seaport (Tin Can port)

Figure 5.4: Physical examination and inspection of containers of electronics goods at Lagos ports by the Nigeria Custom personnel.

5.2.2 Importation through airports

Electronic equipments are also imported through the airports. In Lagos, the main airport through which EEE are imported is the Murtala Mohammed International Airport. In Kano it is the Mallam Aminu Kano International Airport while the Federal Capital Territory- Nnamdi Azikwe International Airport - is more of recipient of the outflow from Lagos and Kano respectively. The study observed that mostly new EEE are imported through the airports considering the higher tariffs and cost of transportation. Also imported through the airport are the so-called personal effects (goods – not in large quantities - imported by individuals for personal use or for sale) and hand-me-down used EEE from family members and friends abroad. In Lagos the imported goods are cleared through the registered aviation handling companies such as the Skyway Aviation Handling Company Limited (Figure 5.5).

Figure 5.5: Cargo handling company at MM1A (Skyway Aviation Handling Company, one of the cargo handling companies at NAHCO)

5.2.3 Importation through land boarders (Seme boarder)

The study observed that significant quantities of EEE of different categories are imported through the land border. Because of the non-classification of imported EEE into used and new, this study could not estimate

the quantities of used EEE coming in through the land borders. Radio Cassette players, TV, air conditioner, Radio Pocket size, Refrigerators. The data also showed that refrigerator parts (Completely Knocked Down, CKD) are imported through the land border. Goods crossing the border are inspected by the relevant authorities (as indicated with red arrows in Figure 5.6).

Figure 5.6. Inspection of goods at the Seme border (the arrows indicates inspection bays).

5.3 Import volumes

5.3.1 Port survey

The port survey was executed between June – August 2010 and included unstructured stakeholder interviews at the ports (ports authority, customs officials, importers and traders), as well as visual inspections of container yards, containers and inspections bays. In addition, in order to retrieve quantitative data, ship manifests were inspected twice:

18 ship manifests dated between January and March 2010. These shipments contained 145 containers with used EEEs and 116 containers with new EEE. These ship manifests were analyzed for a typical container composition of used EEE and the share of imported used EEE vs new EEE.

16 ship manifests dated between March and July 2010. These shipments contained 176 containers of used EEE. These ship manifests were analyzed for the source of importation (port of origin).

Typical container composition of used EEE

Imported containers of used EEE contain varying compositions of used EEE. Usually, smaller devices such as DVD players and radio are used to fill the spaces left in between bigger EEEs such as TV. The analysis of the ship manifests indicated that on the average a 40feet container weighing 9.9 tonnes of used EEE can contain 195pieces (pcs) of TV, 94pcs of computer (monitor), 230pcs of DVD players, 322pcs of video player, 249pcs of pressing iron, 810pcs of blenders, 113pcs of microwave ovens, 106pcs of HiFi, 616pcs of radio, and 558pcs of electric kettles.

Figure 5.7: Various components of electronic goods in a container.

Share of imported used EEE vs. new EEE

The analysis of the ship manifest shows that 145 containers of used EEE were imported as against 116 containers of new EEEs. According to the manifests the 145 containers of used EEE were equal to 1,100 tonnes and 116 containers of new EEE equal to 2,500 tonnes. This result suggests that from January to March 2010 used EEE contributed with approx. 30% of all imported EEE through the Tin Can and Apapa port (Lagos), while new EEE accounted for 70% of these imports. It has to be noted that this data was gathered at a time when stronger enforcement by the Nigerian government made it less attractive to import used EEE. Hence it is thought that the share of used EEE imports could have been higher in the years before, e.g. in a similar range as in Ghana (Amoyaw-Osei et al. 2011). This is supported by statistical data from 2000 – 2010, which suggests that Nigeria saw a peak of category 4 equipment in particular from 2006-2009, with a clear drop in 2010 (Table 5.4).

Annual import of new equipment varies from one manufacturer to another for example in the course of the study Somotex claimed they import up to 10 containers per month which translates to 120 containers annually. Among the importers of used electronics surveyed in Alaba and computer village in Ikeja they import their goods from USA, China, Germany, Singapore, Hongkong UAE Dubai and Dubai and the quantity imported varies from one importer to the other.

From the market survey it was also revealed that on the average the registered importers in Alaba and Computer Village market brings in between 2-4 container per month.

Sources of importation of used EEE

The source of importation (port of origin) has been analyzed based on ship manifests available from a 5 months period (March-July, 2010) and results are depicted in Table 5.2. Results demonstrate that the UK dominates the exports with almost 60%, followed by Germany (Hamburg) with 16%. Of the 104 containers that came in from the UK, 75% were imported from the port of Felixstowe.

An analysis of a shipment of containers from one ship that berthed in Tin Can Port on 19/03/2010 indicated used EEE were loaded at 2 ports with Nigeria as the destination. These are:

7 containers of used EEE were loaded in the German port of Hamburg on 19/06/2010 destined for Nigeria with a total weight of 116 tonnes. The containers contained 44pcs of pressing iron, 575pcs of TV sets, 99pcs of DVDs, 202pcs of photocopiers, and 24pcs of radio sets. An analysis of these containers shows an average weight of 16.6 tonnes per container of used EEE from Germany in the ship. 8 containers of used EEE were loaded in UK port of Tilbury on 23/06/2010, destined for Nigeria with a total weight of 85 tonnes. The compositions of the containers were not indicated in the manifests. However, the types/categories of used EEE were indicated as "used TV, DVD, pressing iron, radio, phones, monitors and HiFi. An analysis of these containers shows an average weight of 13.4 tonnes per container of used EEE from the United Kingdom in the ship.

Table 5.2: Country of Importation of used EEE

Country	Ports	Number of containers	Percentage (%)
United Kingdom	Tilbury, Roydon Sussex Tilbury, Heinfield West Sussex, Felixstowe	104	59.1
Germany	Hamburg	28	15.91
US	Boston, Norfolk, Baltimore	5	2.84
Hong Kong	Shekou	2	1.14
China	Shanghai	15	8.52
Japan	Osaka, Yokohama Kanaga	4	2.27
Durban- South Africa		1	0.57
Taiwan	Port Kelany	6	3.40
Lebanon	Beirut	1	0.57
Canada	Montreal	1	0.57
Morocco	Tangier	7	3.98
Belgium	Antwerp	2	1.14
Total		176	100

Forms of Importation of used EEE into Nigeria

This study observed that large quantities of used EEE are imported with used cars. The used cars (some ironically are un-reusable) loaded with used EEE are locked to avert the inspection of the contents. This appears to be happening with the knowledge of the customs as no efforts seems to be made to force open the cars to inspect the contents. This was also observed in some of the manifests. For example one container from Baltimore USA weighing 81688kg contained only 186 units of used computers and 3 units of air conditioner and it appears the used EEE were imported with used cars. The Team was not permitted to take pictures during port inspections. However the Team observed over thirty cars loaded with used electronics at the port. These were imported as used cars/buses. Some of the cars/buses are un-reusable. Investigations further revealed that some of these vehicles are towed out of the port rather than driven (as cars/buses for reuse). All of the vehicles loaded with used electronics had their booth and doors permanently closed. The doors and booths in some of the buses were sealed by welding. Most also had their windows blinded using old blankets/clothes and polyethene materials or with painting. Also in these vehicles are un-reusable cloths, toys etc.

Figure 5.8: Importation of used EEE in used non-functional vehicles.

Branding of products

Through the survey it was discovered that the brands of EEE imported varies. The major brands consumed in Nigeria according to category are the following irrespective of new or used EEE.

- Refrigerator: Haier Thermocool, Ignis, Westpoint, Freshpoint, Scan Frost
- Phone: Nokia, Samsung, Sony Ericsson, Motorola, Sagem
- Computer: Dell, Zinox, Omatek, Compaq, HP
- TV: LG, Sony, Sharp, Samsung, Toshiba
- Radio: Sony, Philips, Panasonic

Based on the views of some retailers there is a school of thought that the second hands products in category 1 and 2 are more durable than the new electronics, as well as cheaper and more affordable.

5.3.2 Import statistic National Bureau of Statistics (NBS)

Data from the National Bureau of Statistics (NBS) was available for specific tracer products as a yearly average based on the import data from 2005 - 2010. The data does not distinguish between used and new EEE. Table 5.3 suggests that during this time frame an average of 1.7 Mio tonnes of used and new EEE was imported per year.

Table 5.3: Import statistics for Nigeria as yearly average (2005 – 2010) according to the National Bureau of Statistics (NBS 2010)

WEEE category	Tracer product	Imported volumes (tonnes)	Share of category[1)]	Extrapolated for entire category (tonnes)
1	Refrigerator	85,000	23% of cat. 1	370,000
2	NBS data was not available for category 2 tracer products; hence volumes were extrapolated assuming that category 2 equals to 12% of the sum of cat. 1-4 (see Table 6.5)			207,000
3	Computer	115,000	41% of cat. 3	295,000
3	Mobile phone	6,000		
4	TV	472,000	57% of cat. 4	828,000
Grand total				1,700,000

[1)] According to the share of EEE installed in households (see Table 6.5).

5.3.3 Import statistics UN Comtrade

The UN Comtrade database was analyzed by allocating the appropriate international commodity codes to the corresponding WEEE category 1-4 (see Annex for further details). The data does not distinguish between used and new EEE. As can be seen from Table 5.4 a steady increase of import volumes can be observed from the year 2000 until 2009. However numbers don't seem to be consistent throughout the years. E.g. import numbers for 2007 and 2008 seem to be too low. This can have various reasons, such as inconsistency in data entry, lower import activities due to economic reasons, etc. - of which all of them would be speculative. Still it seems like a clear drop of imports can be observed in 2010. This is consistent with the fact that stronger enforcement by the Nigerian government in 2010 made it less attractive for shipping companies to transport container with used EEE. The data also points to a strong increase of category 4 (consumer) equipment, beginning in 2006. It is thought this pattern is due to a peak of end-of-life CRT TVs in OECD countries, which was caused by the switch from analog to digital, and lower priced flat panel TVs, and – as a result – probably resulted in an increased flow of used CRT TVs into Nigeria.

In order to be consistent with the average numbers from the NBS statistics (see above) the yearly average of imports between 2005 – 2010 was calculated at 1.2 Mio tonnes. Not considering the years 2007 and 2008 in this calculation would result in approx. 2 Mio tonnes of imported used and new EEE per year.

Table 5.4: Import statistics 2000 – 2010 for Nigeria according to UN Comtrade database (UN Comtrade 2011) (in tonnes)

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	44,400	48,800	68,900	58,900	1,967,400	2,200	400	1,482,300	135,900
Total	112,200	122,200	132,200	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

5.4 Domestic manufacturing

The few local assemblers/manufacturers in the Nigerian EEE sector often import completely knocked down parts to reassembly in the country. Quantities produced between 2001 – 2005 are presented in Table 5.5. This was obtained through the national statistical data.

Table 5.5: Domestic manufacturing of EEE (in amount of equipment)

Electrical Equipment	2001	2002	2003	2004	2005
Refrigerators	24,912	25,119	24,830	24,953	24,967
Record Players	512,353	509,975	510,696	511,008	510,560
Loud Speakers	111,086	110,784	111,218	111,030	111,011
Radio Cassettes	26,164	26,164	26,164	26,164	26,164
Air Conditioners	19,149	19,264	19,123	19,179	19,189
Television Sets	3,048	3,047	3,048	3,047	3,047
Electrical Cables	3,496	3,600	3,450	3,522	3,522

6 Stakeholders assessment

6.1 Stakeholder overview

The actors involved in the e-waste flows in Nigeria are shown in the Figure 6.1 below.

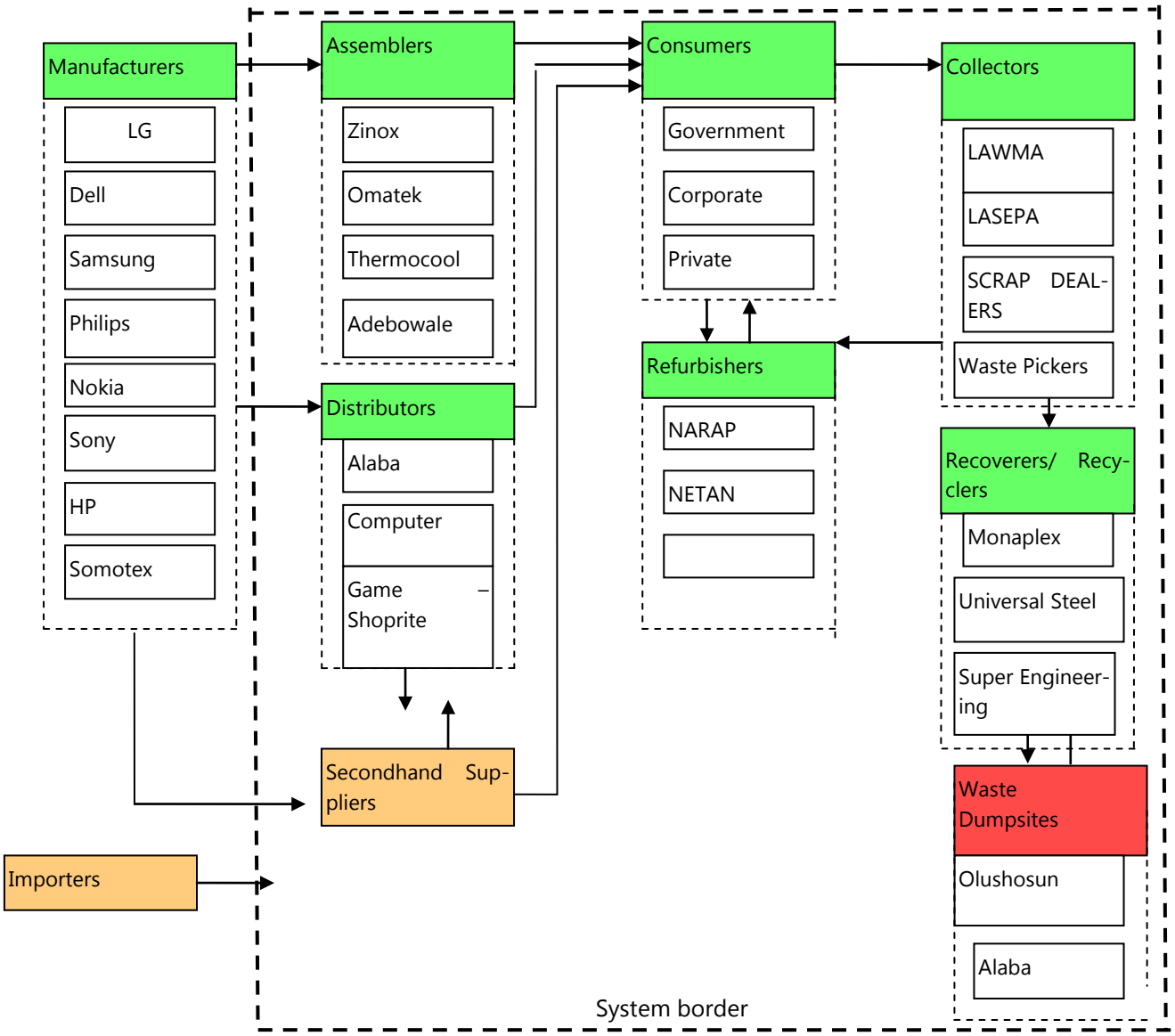


Figure 6.1: System overview of key players involved in e-waste management in Nigeria and their relationship to each other in the mass flows of electronics in Nigeria.

6.2 Distributors

Distributors are defined as all bodies selling the equipment directly to the consumers.

Most distributors of both the new and used EEE are located within the major markets in Alaba international market and Ikeja computer village. From these major distributors the EEE are channeled to other cities in the country like Aba, Abuja, Port Harcourt, and Kano.

Others are channeled through some shopping malls in the country like Game in Shoprite-Lagos, Park and shop, Amigos, and Sahad Stores- in Abuja and Kano. Others include various private distributors who are sub dealers to the major ones with retailing outlets. Their stock is dependent on the demand market.

The market serves as an outlet for Lagos and Nigeria as well as the neighboring West African countries.

Figure 6.2: A major distributors shop in Owerri

Figure 6.3: Display and sale of imported used EEE in markets in Lagos

6.3 Consumers

Consumers are the general public and any organization that uses EEE and castoffs, rejects or stores it as waste when it reaches its end of life. In this study, three types of consumers are considered:

- Private consumers (households, includes family businesses such as found in the agricultural sector)
- Institutional consumers (Public institution, government, parastatals, health and educational sector)
- Corporate consumers (large businesses (industries) and small business enterprise)

6.3.1 Private consumer

Interviews for the household survey were performed in 232 households in total, distributed over the five income classes as indicated in Table 6.1.

Table 6.1: Amount of interviews performed in households per income class

Income class (Naira per year)	Number of interviews performed	
No information	29	13%
A (<20,000)	12	5%
B (20,000 - 60,000)	69	30%
C (60,000 - 100,000)	41	18%
D (100,000 - 200,000)	45	19%
E (>200,000)	36	16%
Total	232	13%

Awareness and disposal practice

In this study households are analyzed as one consumer group. According to the results of a quick household survey conducted in eighty eight randomly sampled private households located in Lagos and Kano, about 70% of the people interviewed indicated their awareness to e-waste while about 30% are unaware of the environmental hazards caused by discarded e-waste.

The disposal behavior for individual tracer appliances from all WEEE categories 1-4 plus lightning equipment was evaluated through the household survey. It was found that differences between the individual appliances was minor, hence data is presented for the average of all WEEE in Figure 6.4. Consumers indicated that about 26% of the appliances, which were not of use in the household anymore were given away free of charge as donations to other consumers. Hence this appliances were in working conditions when given away and were used by the beneficiary for an unidentified time period again. Around 21% of the consumers sold the equipment to second hand dealers, which indicates, that also these appliances were expected to serve again as a working appliance for another consumer. Therefore it can be concluded that for almost half all the appliances the private consumer chose a re-use channel.

Storage was the preferred disposal option in approx. 17% of the consumers. The remaining, or approx. 35% was destined for final disposal (16% sold to scrap dealers, 18% disposed with household waste and 1% put on the street).

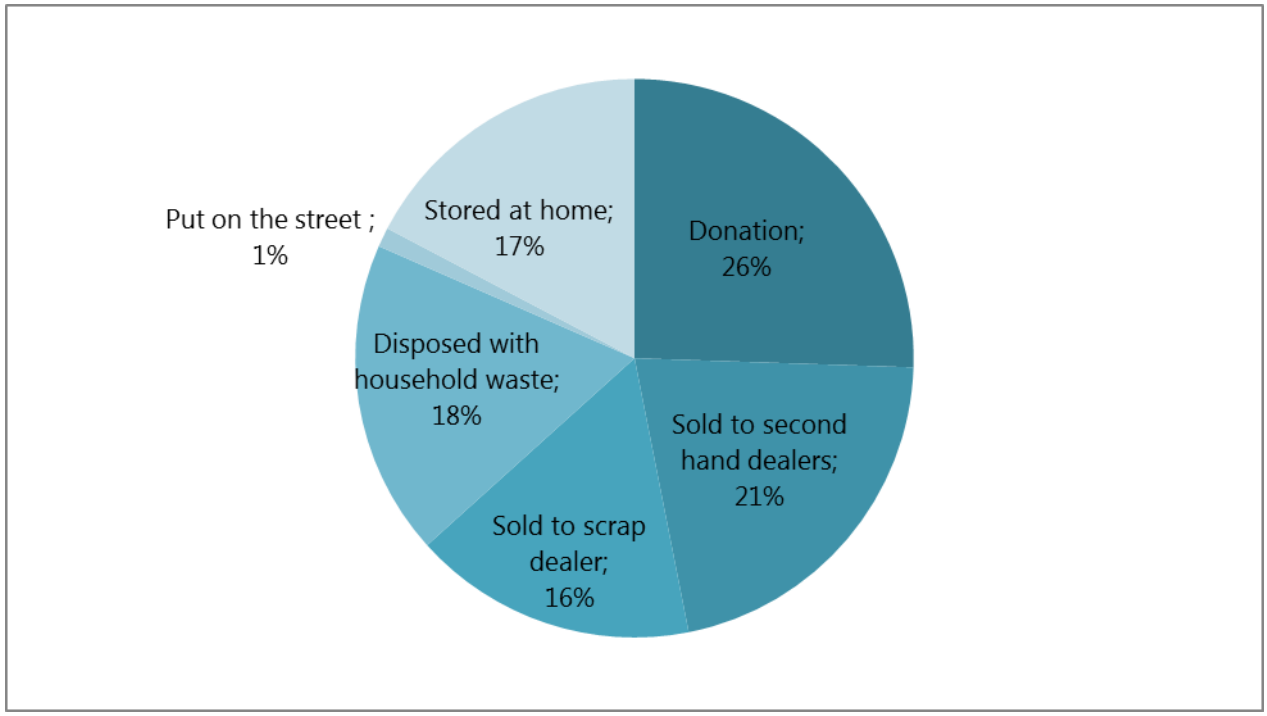


Figure 6.4: Disposal behaviour of private consumers

Installed base of EEE

Based on the full household survey (from urban areas) the average amount of installed appliances installed could be assessed (Table 6.2). Results indicate that the average amount of WEEE Directive category 1-4 appliances installed in urban households corresponds to ~47 appliances, which corresponds to approximately 460 kg per household.

Differences could be observed between different income classes. As can be seen in Table 6.3 the amount of installed appliances increases by a factor of up to 4 from the lower to the higher income classes. Whereas differences are higher for appliances like flat panel TVs, personal computers and air conditioners, the difference seems less relevant for appliances, such as CRT TVs, radios, irons and kettles. However a result not consistent with this observation is, that the lowest income class seems to own rather high amounts of PCs, laptops, mobile phones and flat panel TVs (see Table 6.3), which one would not have expected. We cannot explain this outcome unambiguously, however several factors could have a bearing on it, such as this income class was rather exaggerating about their possessions in the interview and/or is the major consumer of low quality and cheap used EEE (incl. donations).

There are obviously also substantial differences between urban and rural areas. Since this study did not concentrate on rural areas, the likelihood for the appliances to be installed in rural households had to be estimated. This has been done based on information such as electrification rate in rural areas (e.g. Table 3.4 and Table 3.5), which gives an indication for the possibility that EEE can be installed in a household. The likelihood estimations are summarized in Table 2.1 (chapter 2.2, page 19).

Table 6.2: Average amount of WEEE Directive category 1-4 appliances in urban households

Category 1	average per household	
	(items)	(kg)
Air Conditioners	1.7	30.7
Dish washer	0.3	14.6
Dryers	0.2	11.5
Electric Heaters	1.3	6.6
Fridge	1.8	61.7
Grillers	0.3	4.0
Hobs (burner)	0.4	0.0
(Steam-) Ovens	0.6	33.4
Stoves	1.4	76.3
Washing Machines	0.4	26.3
Total Category 1	8.3	265.1

Category 2	average per household	
	(items)	(kg)
Blenders	1.2	2.5
Cables	1.7	na
Extension Boxes	3.3	na
Electric Boilers	1.0	na
Electric Lawn Mowers	0.1	1.4
Fans	4.1	41.0
Hair Dryers	0.4	0.4
Irons	1.7	1.7
Kettles	1.4	1.4
Microwaves	0.7	10.4
Mixers	0.3	0.3
Popcorn Makers	0.1	0.1
Rice Cooker	0.4	na
Soldering Iron	0.2	na
Toasters	0.8	0.8
Vacuum Cleaners	0.2	1.7
Water Dispenser	0.5	na
Total Category 2	18.3	61.6

Category 3	average per household	
	(items)	(kg)
Fax Machines	0.0	0.1
Landline Phones	1.0	1.0
Mobile Phones	4.3	2.2
Laptops	1.2	4.0
PCs	0.5	5.3
Monitors (CRTs)	0.2	3.0
Monitor (flat panels)	0.4	1.8
Modems	0.4	0.1
Printers	0.4	2.8
Scanners	0.2	1.5
Copy Machines	0.2	11.8
UPS	0.5	5.3
Inverters	0.2	0.9
Total Category 3	9.6	39.8

Category 4	average per household	
	(items)	(kg)
Alarm Clocks	1.2	0.4
Cameras	0.9	0.6
DVD players	1.8	8.9
Electr. Instruments	0.7	4.8
Game Consoles	0.6	6.9
MP3 players	0.8	1.7
Radios	1.4	2.9
Stereos	0.8	8.1
TVs (CRT)	1.2	38.8
TVs (flat panel)	0.9	13.5
Sewing Machines	0.5	4.7
Total Category 4	10.8	91.3

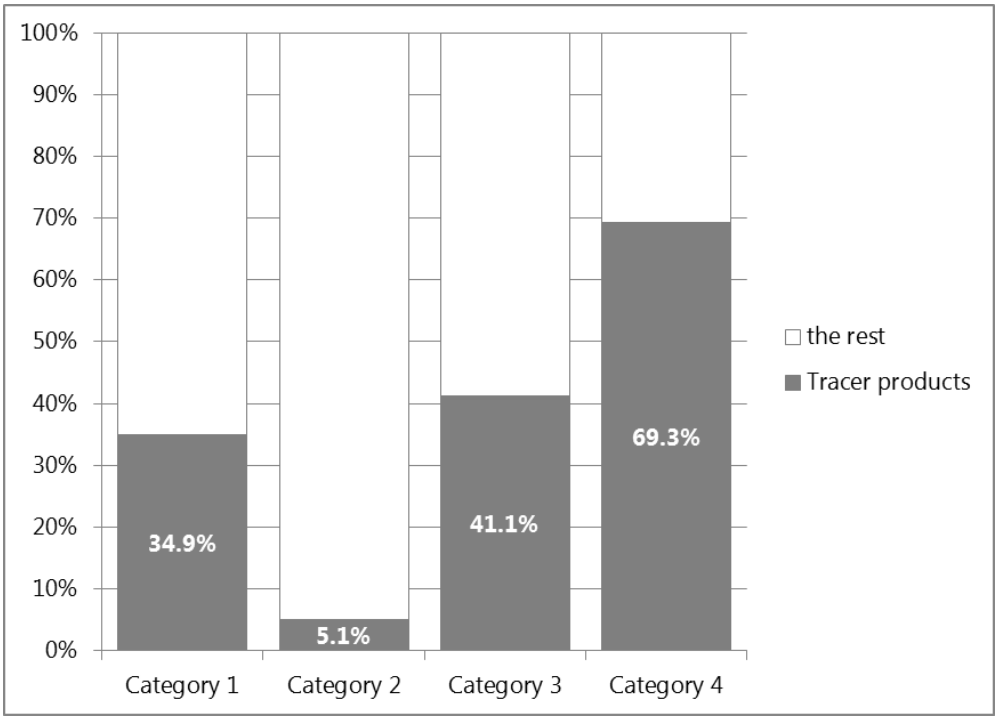
Table 6.3: Average amount of tracer products installed in households by income class

Tracer	Units installed per household by income class (Naira/year, 2010)				
	A (<20,000)	B (20,000 - 60,000)	C (60,000 - 100,000)	D (100,000 - 200,000)	E (>200,000)
Fridges	1.2	1.23	1.9	2	2.5
Air Conditioners	1.0	0.86	1.24	2	3.47
Irons	1.0	1.28	1.93	1.82	2.42
Kettles	0.7	1.17	1.73	1.47	1.86
PCs	0.8	0.27	0.42	0.62	0.91
Laptops	0.4	0.66	1.18	1.19	2.11
Mobile Phones	4.8	2.77	4.1	4.6	7.33
TVs (CRT)	0.9	1.1	1.4	1.16	1.56
TVs (flat panel)	1.4	0.41	1.03	0.91	1.66
Radios	2.1	1.21	1.37	1.41	2.06
Stereos	0.8	0.7	0.88	0.57	1.38

In order to extrapolate the survey results to the whole country, the numbers in Table 6.3 were used in conjunction with statistical data for the distribution of households by income class in Nigeria (Table 3.3, page 24), the population number for Nigeria (Table 3.2, page 24) and the likelihood estimations for rural areas. The number of units was converted by using the average weight per appliance as presented in (Amoyaw-Osei et al. 2011). Table 6.4 summarizes the results for the tracer products. Figure 6.5 indicates the share of the tracer products from all installed appliances (see Table 6.2) in Nigerian households. The total amount of installed EEE in Nigerian households, related to EU WEEE Directive category 1-4 appliances is listed in Table 6.5.

Table 6.4: Installed base of EEE tracer products in Nigeria

Appliance	per household (urban)	per household (rural)	total amount (Mio units)	Penetration rate (per 1000)	total amount (tonnes)
Fridges	1.27	0.23	24.0	155	840,000
Air Conditioners	1.02	0.09	17.8	115	330,000
Irons	1.16	0.21	22.0	142	22,000
Kettles	0.89	0.17	16.9	109	17,000
PCs	0.64	0.06	11.2	72	200,000
Laptops	0.55	0.05	9.6	62	34,000
Mobile Phones	4.28	1.58	92.6	599	46,000
TVs (CRT)	1.00	0.18	18.8	122	595,000
TVs (flat panel)	1.10	0.10	19.2	124	288,000
Radios	1.81	0.67	39.1	253	78,000
Stereos	0.78	0.29	16.9	109	169,000



Tracer products: Category 1: Fridges, Air Conditioners
Category 2: Irons, Kettles
Category 3: PCs, Laptops, Mobile Phones
Category 4: TVs (CRT and flat panel), radios, stereos

Figure 6.5: Weight based share of tracer products from all installed appliances in Nigerian households.

Table 6.5: Total amount of installed EEE in Nigerian households

	Tracer products (tonnes)	all of Category 1-4 (tonnes)	share
Category 1	1,170,000	3,355,000	52.15%
Category 2	39,000	765,000	11.90%
Category 3	280,000	681,000	10.59%
Category 4	1,130,000	1,632,000	25.36%
Grand Total	2,619,000	6,433,000	100.00%
	40.71%	100.00%	

6.3.2 Institutional and corporate consumers

In this survey it was assumed that institutional and corporate consumers correspond to the industry and services sector according to Table 6.6, while the agricultural sector is covered as private consumer. In total 90 interviews were performed, 25 in the industry sector and 65 in the services sector, of which 41 was with corporate consumers and 24 with institutional consumers.

Table 6.6: Economic sectors related to workforce, consumer type, business type and interviews performed for the survey.

Sector	Workforce (CIA 2009)		Consumer type	Business type	# of interviews
	(%)	(people)			
Agriculture	70%	35.7 Mio	Private		
Industry	10%	5.1 Mio	Corporate	Manufacturing	25
Services	20%	10.2 Mio	Corporate	Consulting Finance ICT Media Tourism	5 13 11 3 9
			Institutional	Education Health Ministries / Agencies	13 7 4
Total	100%	51.1 Mio			90

Awareness and disposal practice

70% of the government institutions interviewed indicated to be aware about the environmental hazards caused by discarded electronic equipment such as computers and that some parts need special treatment in order to be disposed of in an eco friendly way . However, despite being aware of the environmental hazards, 44.4% of them indicated the lack of procedures for handling e-waste while 11.1% of them indicated having plans for introducing an internal policy for handling e-waste.

The current practice of end-of life management varies, about 80% stores and 20% donates. 66% of the government Ministries and Institutions store obsolete computers within their premises for about 2 years before disposing them through auctioning or donation, depending on the decision of the top management. The remaining 34% stores them for an unspecified period of time.

In terms of awareness and purchasing behavior corporate consumers are similar to institutional consumers. Large, small and medium enterprises purchase new equipment and most of them are aware about the environmental hazards caused by discard of e-waste.

Installed base of EEE

The survey revealed that most institutional and corporate consumers purchase their equipment via retail shops or general distributors. Only a few purchases are done directly from the producer. Purchases from the second-hand markets were not mentioned in any of the interviews; hence it can be assumed that all EEE is purchased as a new product.

Penetration rates for the six tracer products in corporate and institutional consumers are listed in Table 6.7. Results demonstrate that the dominant EEE installed is IT equipment with an average penetration rate at corporate consumer of almost 80% and 20% at institutional consumers. This is followed by air conditioners, where differences between corporate and institutional consumers are not as big with 20% and 14% respectively. Results also suggest that refrigerators are installed for approx. every 25th employee. It is assumed that category 2 equipment are not relevant for corporate and institutional consumers, with kettles probably being almost the only appliances in use. Category 4 equipment (TVs and radios) can also be found, but to a lesser extent.

By applying these penetration rates on the workforce numbers the total amount of installed tracer products can be calculated. In order to extrapolate the amount of tracer products to the total amount of WEEE, a few assumption were made: i) for categories 1, 2 and 4 appliances only the tracer products (refrigerators, air conditioners, kettles, TVs and radios) are relevant for corporate and institutional consumers; ii) for category 3

appliances it is assumed that per personal computer (average weight 13.5 kg as a mix of desktop, CRT, LCD and Laptop) another 13.8 kg of category 3 appliances (fax machines, landline phones, modems, printers, scanners, copy machines, uninterruptable power supplies (UPS), inverters) are installed. The second assumption is based on the quantitative observations made from the household survey. It is further assumed that mobile phones used for business account towards the installed base of the private consumer.

Results are presented in Table 6.8. In support of what can be observed with the penetration rates, it can be seen that IT and communication equipment is the most relevant category (73 weight-%), followed by refrigerators and air conditioners (19 weight-%) and some TVs and radios (7.5 weight-%). Category 2 equipment is not relevant for corporate and institutional consumers.

Table 6.7: Penetration rate for 6 tracer products according to the survey results in corporate and institutional organizations (numbers in percentage of appliances per employee)

	Fridges	Air Conditioners	Kettles	Personal Computers	TVs	Radios
Corporate	**4.00%**	**20.17%**	**1.40%**	**79.14%**	**7.71%**	**3.06%**
Consulting	6.13%	33.13%	3.68%	54.60%	4.91%	1.84%
Finance	3.34%	21.26%	1.22%	84.35%	7.28%	3.32%
ICT	5.24%	27.07%	1.75%	30.57%	9.83%	1.09%
Manufacturing	6.04%	7.64%	1.45%	53.94%	7.91%	1.00%
Media	10.68%	37.52%	6.21%	62.61%	14.53%	6.34%
Tourism	41.82%	66.67%	11.52%	6.06%	56.36%	3.03%
Institutional	**3.27%**	**14.37%**	**1.48%**	**20.33%**	**3.14%**	**1.06%**
Education	1.68%	12.91%	0.33%	21.18%	2.22%	0.09%
Health	10.72%	22.23%	7.57%	9.69%	6.06%	4.85%
Ministries / Agencies	9.54%	14.71%	3.00%	28.07%	11.72%	8.72%
others	3.33%	16.67%	1.33%	66.67%	6.67%	0.00%
Grand Total	**3.85%**	**18.93%**	**1.42%**	**66.55%**	**6.73%**	**2.63%**

Table 6.8: Total amount of installed EEE in the Nigerian industry and services sector

	Industry (tonnes)	Services (tonnes)	Total (tonnes)	Share
Category 1	18,000	51,000	69,000	19.08%
Category 2	100	100	200	0.06%
Category 3	75,000	190,000	265,000	73.34%
Category 4	10,000	17,000	27,000	7.52%
Total	103,100	258,000	361,000	100.00%
	28.62%	71.38%	100.00%	

6.3.3 E-Waste generation

The survey resulted in an unclear picture regarding the life span of certain appliances. The household survey suggests that the average life span of category 1 appliances (e.g. refrigerators) is below ten years. Experiences from other studies (e.g. (Amoyaw-Osei et al. 2011)) however demonstrate that these appliances have a longer life span. On the other side the assessed life span for the categories 2-4 seem to be in line with other assessment studies. Hence an average lifespan for the different WEEE categories for all consumers were as-

sumed as presented in Table 6.9, presenting the life span for category 1 as an assumption and the life span for category 2-4 based on the analysis of the surveys.

According to the survey households are holding almost 95% of installed EEE (Figure 6.6) and are responsible for approx. 90% of WEEE arising. Altogether with corporate and institutional consumers WEEE generated in Nigeria sums up to 1.1 Mio tonnes for 2010, which is around 7 kg per capita. This is in a similar range as has been found in e.g. Ghana (Amoyaw-Osei et al. 2011).

Figure 6.6: Weight distribution of the installed base by WEEE category for private and institutional/corporate consumers in Nigeria

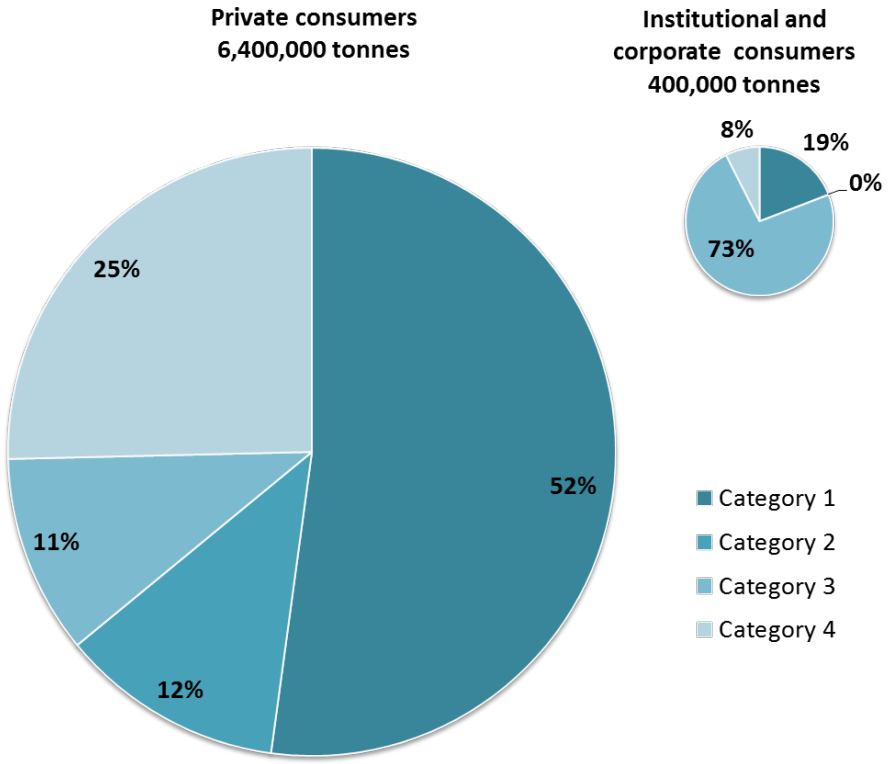


Table 6.9: Overview of installed base of EEE and WEEE generated in Nigeria for 2010.

Category	Installed base				WEEE generated		
	Households (tonnes)	Institutional (tonnes)	Total (tonnes)	Lifespan (years)	WEEE (tonnes)	WEEE (kg/capita)	Share (%)
1	3,355,000	69,000	3,424,000	10	342,400	2.2	31.07%
2	765,000	200	765,200	4	191,300	1.2	17.36%
3	681,000	265,000	946,000	4	236,500	1.5	21.46%
4	1,632,000	27,000	1,659,000	5	331,800	2.1	30.11%
Total	6,433,000	361,000	6,794,000		1,102,000	7.1	

6.4 Collectors

Collection of e-waste is through the formal and informal organisations. The informal sector is the major collector through waste pickers and scrap dealers agents scattered in the state and across the state. The waste pickers collect all recyclable waste generally from the household at a price or pick from those dumped with domestic waste. The waste-pickers are mostly found in the market and street picking e-waste and selling it at

some designated place to some brokers who dismantle it to extract the materials identified with most economic value.

The informal sector is dominated by young persons who go around the cities with push carts collecting discarded goods and buying EoL/stored products.

Figure 6.7: Mode of collection in wheel barrow by waste pickers or in a truck.

Between 144kg/wk and 1985kg/wk of e-waste mixed with other metal scraps is collected by a scavenger. The collected e-waste is co-mingled with other metal scrap. Up to 80,000 persons (34,000-80,000) are involved in this sector in Nigeria. The main sources of collected materials are homes/dump sites, refurbishers, streets, importers. Most collectors interviewed have not heard of 'take back or EPR'. Most did not understand the principle even when explained to them. Most collectors dispose e-waste which general waste. Most collectors believe the lack of infrastructure, cost, and absence of legislation to be the major challenges to effective e-waste management in Nigeria. Most collectors complained that the cost of transportation and undue "extortion of money by the police" are the greatest obstacles of their business. Collectors observed that collected EEE are bought by recyclers, by individual for reuse, and by repairer for repair and sale or for the reuse of components. They observed that virtually all brand are collected. However, Samsung, sharp, Sony, Panasonic, Toshiba, and LG are the most commonly in demand. Some collectors observed that "necklace" and "ring" or jewelries in general could be made from materials recovered from e-waste. This is of importance and may be the last step before establishing crude material recovered from e-waste. They observed that the e-waste components of interest are transformer, armature, cables, compressor, metal housing unit, and PWB.

Collectors indicate that the destinations of e-waste are Onitsha, Lagos, Warri and Kano and that the buyers are the downstream vendor listed under downstream vendor. Collectors pay for about 60-83% of collected EEE whereas about 17-40% are collected free from the street and dumpsites.

Figure 6.8: (a) Metal scrap collectors at work and (b) Scrap metals collected by scavengers (c) other wastes such as waste batteries and metal scraps are collected with e-waste.

Figure 6.9: Scrap metal collectors shop

The formal organisations involved in e-waste collection in Lagos are the LAWMA and recently LASEPA through a consultant under a public private partnership arrangement. LAWMA also has a public private partnership arrangement for the overall collection of municipal and industrial waste and collect waste from households and commercial/ industrial facilities across the state by a door to door collection with organised pick up days. They also collect waste dumped in dino bins in selected communities where door to door pick up is impracticable operationally. Currently the e-wastes collected are kept apart in a section of the dump site managed by the LAWMA.

The e-waste collected by the consultant working with LASEPA, MSC (Maintenance System Consultancy) are kept in a warehouse in anticipation of a recycling activity. Currently no money is being charged for the evacuation by the LASEPA consultant, thus creating an incentive for the corporate organisation to declare their e-waste stockpile and get them ready for evacuation. The formal collection system thus accounts for about 20% while 80 % is done by the informal sector.

6.5 Refurbishers

The refurbishers group comprises of all the repair units, service centres, etc., that extends the life time of equipment and feed the second hand market. Most of the manufacturer representatives and importers provide services centre. These are located at Ikeja Computer Village, Alaba Markets and some designated centre where EEE can be repaired.

Figure 6.10: Refurbished second-hand computers on display for sale at France Road Sabon-gari, Kano

6.5.1 Organisation of the sector

The group of refurbishers are organised into associations in both markets (Alaba and the Ikeja computer village) visited and across the country. Some work within neighbourhoods and some go to corporate organisations to repair faulty EEE.

Refurbishers in Nigeria operate with certain categories of EEE: mobile phone/MP3; TV/Radio/fan/DVD/CD player; photocopier; and computer/printer/laptop. Refurbishers active in repairs of refrigerators would not be involved in the repair of printer/computers and photocopies. The refurbishers repair all brands of electronics in the category of interest.

The survey revealed that most refurbishers are involved in the refurbishing of household consumer electronic goods (TV, radio, DVD, CD players etc) which makes up 62.5% of all refurbishers; followed by refurbishers of mobile phones (25%) and refurbishers of computers/printers/scanners and related computer accessories (12.5%).

They have associations that regulate their activities e.g. Nigeria Association of Refrigerator and Air-condition Practitioners (NARAP), and National Electronics Technician Association of Nigeria (NETAN). These associations are registered in Lagos State and some other cities and they pay their taxes to the state accordingly.

In the course of this study, it was observed that the market potential for refurbishers/ repairers is very large since a sizeable number of the second product brought into the country are not in good working condition. The importer after sorting the good functional ones from the faulty ones, they are then sold as non-tested which the customer, after purchase, give to a refurbisher /repairer. Among the non-tested, those found to be unserviceable are dismantled and the good components are removed to serve as spare parts.

Figure 6.11: TV/DVD repairer at work in Sabon-gari Market, Kano and Gwagwalada Abuja respectively.

Figure 6.12: a) Repairer at Ikeja Computer Village; b) Fridge repairer at Nyanya, near Abuja

6.5.2 Lifespan of Refurbished Equipment and waste handling

EEE taken to repair shops varies. Some new ones- that got damaged by high voltage - have longer extension life than the old, obsolete ones. The extension after repairs depends on usage and based on the survey is between 2-5 years on the average depending on the product. A mobile phone after repairs last between 6months – 2years maximum while the large and small households equipment could last up to 5 years with other forms of minor repairs in between.

Revenue per refurbished EEE is between N1000 - N3000 depending on the nature of the fault. On some occasions when faulty components or modules are to be replaced the charge may be higher. An estimated 52,000 persons are engaged in the refurbishing business in Nigeria.

However a typical repair shop receives between 20-50 appliances daily and equipment beyond repairs are dismantled and some useful parts used to fix other equipment. The e-waste produced in standard repair shop is about 300-500 kg/year. The repair shops sometimes serve as a dumping ground for used and broken equipments before final disposal.

Approximately 66-68% of EEE brought to repairers and refurbishers shops are effectively repaired. Unrepairable EEE that are abandoned in the repairer's shops are disposed /sold of between 6 months to 3 years (mean 1 and a half years) of storage in the repairers shop. 12-25% of the refurbishers dispose all e-waste generated in their operations with general waste. Others estimated at 66% store and sell the waste to collectors while the useless wastes are disposed with general waste. Overtime, un-repairable EEE abandoned at the refurbishers shops are cannibalized and used in repair activities. Generated wastes are sold to scrap dealers.

Some burn wastes generated during the refurbishers activities within their business operation area. Others dump the waste around the business premises and at open dumps. An average of 6kg waste/ week is generated by a standard electronics repair/ refurbishing shop.

All refurbishers indicated cost, lack of infrastructure and absence of recycling facilities as the most important obstacles to proper recycling of e-waste. Others indicated that the government has the solution to the e-waste problem.

Figure 6.13: Refurbisher/repairers shops. (a) a refurbisher/repairer at work (b) un-repairable electronics are abandoned in a refurbishers shop (c) PWB recovered from un-repairable EEEs displayed for sale. (Field survey Lagos, Aba and Kano)

Most repairers at the market visited do not use personal protective wears while working. From the survey results, 67.6 % were unaware of the environmental hazards caused by discarded electronic equipment and as such were unaware that some hazardous fractions in e-waste need a special treatment in order to be safely disposed off.

6.6 Recyclers

Recyclers are any organization dismantling, separating fractions and recovering material from e-waste. There is no formal recycler of e-waste for now in the country. Those who are engaged in it are in the informal sector. The recycling process takes the form of dismantling and separating of fractions which are sold to brokers who supplier them to manufacturing industries as secondary raw materials.

This sector comprises of mainly individuals with only few registered operators. In most of the cities, the scenario in such that some individual pay the recyclers to collect/supply the certain components of e-waste e.g. aluminium's parts, copper wires, steel parts. Depending on the material of interest, the recyclers go out scavenging for e-wastes or engage scavengers to collect for them. For recyclers interested in copper wire, waste cables are collected and burned in the open using waste tires to retrieve the copper wire. Other recyclers who are interested in the copper wires specialize in collecting transformer of EEE and compressors of fridge cut then open and collect the copper wires.

Figure 6.14: Material recovery from e-scrap (a) a recycler's shop (b) material recovery in progress; (c) recovered materials: copper wires.

Figure 6.15: Open burning of waste cables to recover metals

During the survey, a small scale recycler by name ADEBAS Company, located at Central Business District, Alausa Ikeja Lagos was met. The company recycles used condensers of fridges and compressors of refrigerators to make cast which is supplied to local aluminum pot companies for the manufacture of big local pots (Ikoko Irin).

Figure 6.16: Recyclers display of products cast from compressor of refrigerators for local pots (Ikoko Irin) and other furniture

The informal recyclers are spread all over the country. The major ones in Lagos are located in Alaba rago, Olusosun dumpsite and Odo Iya alaro at Ojota while Sabongari serves as the hub for those in Kano. The recycling is done in a crude way. The fractions of interest are Aluminum and copper and steel fractions. There is no interest in the glass fractions. Consequently the interest is in the cables, compressor, PWB, steels. Factions disposed include glass, plastics, certain PWB, and CRTs. Other fractions which are produced are gold, iron, brass, cathode ray tube, plastic etc.

Figure 6.17: Dismantling of EEE to recover valuable parts at Odo –Iya Alaro- Lagos

Figure 6.18: Aluminum foil ready for sale at Odo Iya alaro- Lagos.

Most of them are not aware of proper disposal methods. The non- valuable fraction (hazardous/non-hazardous) including the ash from the burning activities are either disposed with MSW or burn off in the dark hours/ after government officials close work or abandoned on site.

Yearly volume handled by the recyclers varies. It is on the basis of demand and market dynamics. Most of them do not document their operations or keep any periodic records of their activities.

Recyclers at the Alausa business district claim to use up to 100 tonnes per year while the others could not quantify the total tonnes per company/year.

From the estimates derived from the interviews of recyclers in the course of the survey, between 46,276tons and 1,347,840tons of scrap metals are handled annually in the country. The major buyers of scrap are companies in Onitsha, Lagos, Kano and Ajaokuta Steel Company.

Employment generated also varies, for instance in Odo Iya Alaro there are 20 major brokers that have in employment each between 50-100 boys who go about for waste picking, and 5- 10 workers who have skills in the dismantling, grinding or processing of the material fractions. In Alaba, a scrap dealer claims he has 200 waste pickers in his employment.

An estimate of the national average on the basis of interview in the cities assessed indicates the sector employs an estimated 72,000 to 100,800 persons throughout the country.

Quantification of by product/ ton of e waste by recyclers have not been done but it was observed litres of acid from circuit boards are just disposed onto the ground haphazardly.

6.6.1 Other recycling activities

There are other recycling activities than WEEE recycling as shown in Table 6.10.

Table 6.10: Other recycling activities related to WEEE recycling

Name of Business	Location	Items recycled
Genuss investment limited	Lagos	Metals
National Electronics Technician Association of Nigeria	Lagos	Metals
Samtexh Systems	Lagos	Metals
Panasonic Electronics	Lagos	Television sets
Gee-Marks Communications	Lagos	Metals

6.7 Downstream vendors

Downstream Vendors are the industries buying the fractions (e.g. copper, plastics, metals, gold, etc.) produced by the recyclers. They can be national or international, and vary from Jewelers to smelters, etc. In the course of the survey; most collectors observed that the major destinations of collected, recycled materials are Onitsha, Lagos, Warri and Kano.

The category of collected/recycled e-waste depends on the demands of the buyers in Lagos, Onitsha and Kano. Interest is mostly in printed wiring board (PWB), steel, aluminum, copper cables, etc. Most downstream vendors are in the formal sector of the economy. Consequently at this point, the e-waste re-enters the formal sector of the economy. There are indications that certain categories of e-waste are exported especially PWB and copper wires. The collectors indicated that they are exported to China and other Asian countries.

The copper, gold, brass and silver are bought by traders mostly from northern parts of Nigeria who supply same to dealers in Mali through the land borders and these are then exported to china. They are often exported without any form of processing.

Some of the identified companies involved in the e-waste and metals recycling are:

- Metalphic Lagos
- Sunflag, Lagos
- African Steel, Lagos
- Aladja Steel Warri
- Ajaokuta Steel Company
- Other marketers in Onitsha

The iron parts are sold to local iron smelters (Universal Steel in Ikorodu Lagos, Nigerian Spanish Metal in Kano and other steel companies in the country. Aluminium fractions are sold to Tower Aluminium Company in Lagos. Plastic parts are claimed to have limited value. One company who demands for it occasionally is Monaplex in Lagos for the manufacture of car spare parts. The majority of the plastic fractions are dumped anywhere after removal of the other valuables.

Revenue per weight of different fractions sold as obtained from the scrap dealer in the entire sites visited in Lagos is given in Table 6.11. It was interesting to note that the prices were same irrespective of the location.

In Abuja it was observed that most of the scavengers don't know what the scraps collected are used for and a typical vendor gets N3000-N5000/week when he sells his scraps; 1kg of copper from the scrap is sold for N200 while other metals cost N10/kg. Those buying the fractions of e-waste and other waste come from the cities of Lagos and Kano.

Table 6.11: Revenue per weight of different fractions sold from recycling activities

Fraction	Price (NGN per kg)
Copper	600
Brass	400
Aluminium	100
Plastic	50
Iron	150
Cathode ray	50
Printed wiring boards (PWB)	500
Compressor	200
Monitor	500
UPS	700 - 1000
Modem board	100
Printer	1000

(Exchange rate at N150 to a US1$)

6.8 Final Disposers

The organization in charge of the final disposal of waste land filling in Lagos State is the Lagos Waste Management Authority (LAWMA). In Kano State it is the REMASAB as stipulated in the Refuse Management and Sanitation Law No. 7 of 2003. Across the country are state waste management authorities who are not only involved in regulatory function but serve as service providers in disposal of both municipal and industrial wastes. E-waste disposal is often disposed with municipal waste or dumped at undesignated areas.

Figure 6.19: E-waste disposal at open dumps (a) waste cathode ray tube going to the open dump; (b) the disposal at an open dump

Figure 6.20: Dumping of e-waste at undesignated places

Figure 6.21: A LAWMA truck by the entrance of Olushosun dump site

In Lagos State, there are three officially designated dumpsites managed by LAWMA. These sites are located at Abule – Egba, Olushosun and Solous, with their ages ranging between 12 - 25years and a combined capacity of 63.67 hectares.

In the last decade (1997 – 2007) the estimated tonnes of waste deposited in the 3 landfill sites were about 27 Mio tonnes. The State Government recently granted approval for the construction of a new landfill site at Epe (South East of Lagos), while 2 other sites are being proposed at Ikorodu (NE) and Badagry (SW). There are also 2 waste conversion plants in the State, the Compost Plant at Odogiyan, Ikorodu and the Plastic Recycling Plant at Ojo Local Government Area.

The organisation (LAWMA) intends to commence the construction of 20 Transfer Loading Stations throughout the State in a period of 7years (2008 –2015) and construction of additional 3 IWMF (integrated waste management facilities) in the metropolitan Lagos. This is towards the attainment of 35% compliance in zero waste initiative within the next 4 years.

LAWMA doesn't separate e-waste from domestic waste. Everything is taken to the dump site where waste pickers are waiting to remove the waste with economic value and they have an association at the dump sites.

Figure 6.22: Sorted waste at Olushosun dump site awaiting buyer.

LASEPA- Lagos State Environmental Protection Agency also recently got involved in the disposals of waste and particularly e-waste. They through the consultant (MSC) go to companies and Government agencies to evacuate WEEE. The remaining waste is dumped and land filled formally in a controlled landfill. Energy recovery system is not in place though there are gas pipes in some areas of the dump site and there are plans for such methane gas recovery for the Olushosun site in particular.

Other than the official designated dumpsites there are some illegal waste dumpsite scattered within Lagos where open burning takes place in the metropolis.

The issue of waste management is done in partnership between government and private companies. Currently the dumpsites are owned and managed by the government without private involvement.

6.9 Most affected communities

From the survey carried out in Lagos, the most affected communities are those in the environ of the Alaba International market, Ikeja Computer Village, Odo iya Alaro and Olushosun dump sites with area of influence of pollution spreading to the Ojota, Ikeja and Alaba axis.

In the other cities surveyed e-waste is burnt along with municipal waste at dump sites.

Most e-waste activities take place within inhabited areas. The collectors, refurbishes and even recyclers usually have their site within residential area. E-waste management activities impacted negatively on the resident, by affecting the air, water and soil.

Figure 6.23: Most affected communities are those residing within e-waste generation and management site.

Figure 6.24: Wastes generated in material recovery from waste cables are usually abandoned and or burnt within the recovery sites

Health risk to community

Unusable e–waste are carelessly dumped around these communities and occasionally burnt to reduce growing piles. Furthermore the discharges from the dismantling and breaking operations are spilled onto the surrounding soils. These contaminate the soil and nearby water bodies through storm water flow.

The survey indicate that most surface materials found at e-waste recycling sites are ash and cinder left after waste burning activities. Soil samples collected from the upper 0-100cm of soil at e-waste recovery sites indicates that at some points the upper 100cm profile composed of ash and cinder mixed with soil. These impacts negatively on storm run off which washes the toxins of the ash to contaminate surface waters used for domestic purposes and farmlands. The burning activities also release highly toxic fumes. These activities also

impact on the aesthetics of the neighbourhood. Consequently the sector poses serious health and environmental risk to immediate and neighbouring communities with the attendant air, water and soil contamination.

The health impact among the workers could not be quantified, although some are ignorant of this situation but based on the survey some complain of dizziness and general weakness. Both the scavengers and informal recyclers suffer from health consequences of their occupation considering that the waste dumpsites are breeding grounds for mosquitoes, flies and other disease pathogens. As they seldom work with personal protective devices, waste pickers clearly face many serious occupational health risks. The main complaints of the scavengers concerned are bites from mosquitoes, cuts and bruises, body aches, general weakness, and frequent fever. The pickers are often unaware of the dangers they face but are economically tied to continuing the occupation. There was visible soil, water and air contamination in the neighbourhood of sites visited.

Employment creation

The sector also impacts positively economically on the nearby communities. The sector creates jobs for nearby residents as they supply / sell food and water to the operators. Nearby residents may also be engaged as security for collected scraps etc. Scrap dealers also pay rent for open spaces used for storage points. Nearby resident may be engaged in loading of e-scraps into trucks for transport to recyclers.

The quality of jobs compared to local alternatives at the same level of education is fair. The number of jobs provided by the e-waste sector both formal and informal is substantial considering the level of unemployment in the each of the state inventorised.

Working registered population at the dump sites at Olusosun, Odo iya alaro, Alaba rago is between 600-4000. These are low skilled workers, though few of them are educated but the level of education is low with about 10% being graduate especially the second hand dealer, while the formal sector should be between 10,000 -20,000 at most.

Figure 6.25: Waste pickers including women at work on Olushosun dump site.

6.10 Civil society and other stakeholders

The institutions having the capacity to support the implementation of an e-waste management system within the country are the Federal Ministry of Environment, their counterpart at the State level, the State Government Waste Management Board/Authority, the NPA, Nigerian Customs and the NESREA. In Lagos state it is the LAWMA, LASEPA and the Lagos State Ministry of Environment.

In Lagos State however, the organisations active in solid waste management is LAWMA and LASEPA. The other states of the federation are just at the planning stages for development of e-waste management system.

Non-governmental organisations (NGOs) are yet another set of participants in the waste management field. NGOs often have a mission of improving the environment or the quality of life for poor or marginalized groups; as part of this mission, they may stimulate small-scale enterprises and other projects. Since waste materials represent, in many cases, the only growing resource stream, these organisations frequently base their efforts on extraction of certain materials not currently being recovered and processing them to add value and generate revenue. In Latin America, a number of composting projects were started this way. This form of organizational setting is still very weak in Nigeria.

The registered NGOs involved in advocacy on the e-waste issues include the Waste management Society of Nigeria (WAMASON), Friends of the Environment (FOTE), and the Nigeria Environmental Society (NES).

7 Massflows

Figure 7.1 presents a simplified massflow system chart for Nigeria for the year 2010. In 2010 import statistics indicate that the share between new and used EEE was about 50%/50%, i.e. 600,000 of new EEE and 600,000 of used EEE imported into Nigeria. From the survey it was found that private households were by far the biggest consumers with an installed base of 6,400,000 tonnes category 1-4 appliances (breakdown of appliances according to Table 6.2 / page 60 and Figure 6.6 / page 65). The installed base for institutional and corporate consumers was estimated at 400,000 tonnes, mainly constituting of category 3 (IT and telecommunication) equipment. Consequently also most of the new imported EEE (approx. 450,000 tonnes) was sold to private consumers, while institutional and corporate consumers received around 150,000 tonnes.

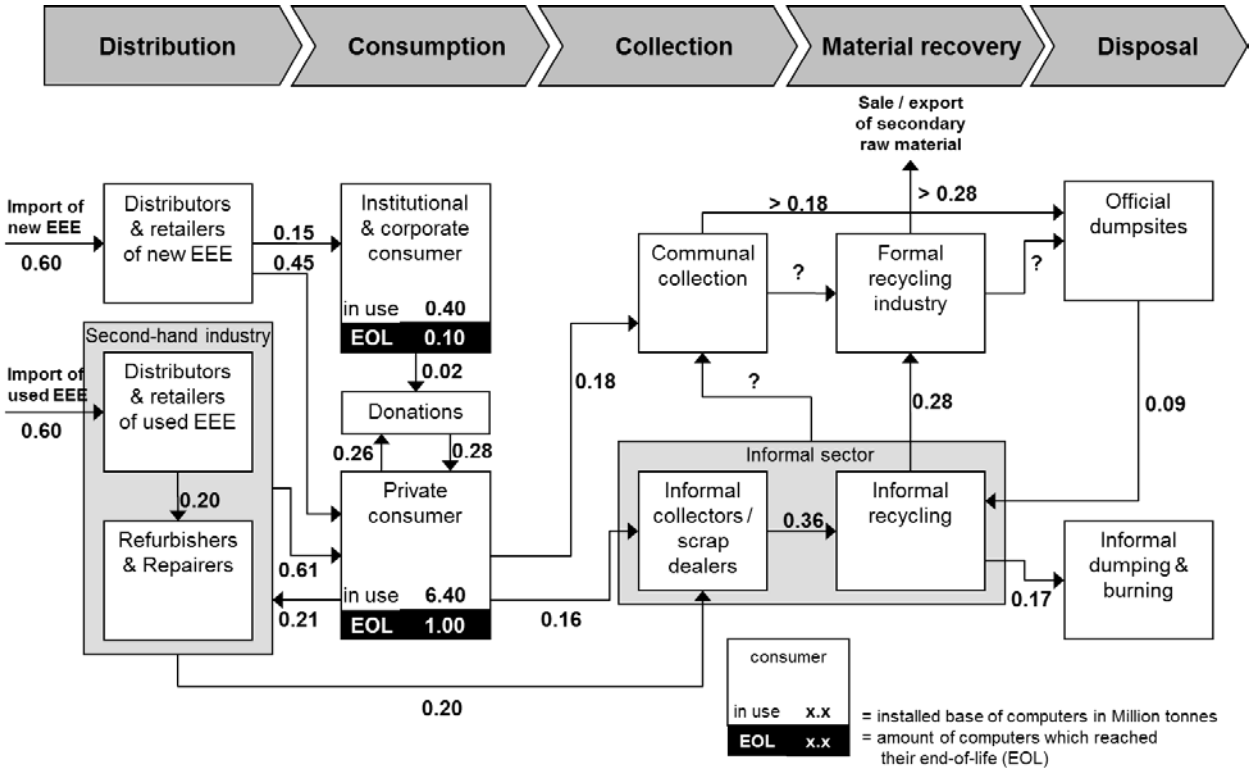


Figure 7.1: Massflows for (W)EEE in Nigeria in million tonnes per year for 2010

The survey also indicated that institutional and corporate consumers do not purchase used EEE from the second-hand industry in relevant amounts. Hence it was assumed that all imported used EEE are bought by private consumers. This is around 500,000 tonnes; 400,000 tonnes of used EEE which was imported in working conditions and 100'000 tonnes of used EEE which was imported in a non-working condition but repaired / refurbished and resold through the second-hand market. Another 110,000 tonnes originated from domestic second-hand appliances. This adds up to 610,000 tonnes of used EEE altogether, which were bought by private consumers in 2010.

The second-hand industry generated around 200'000 tonnes of e-waste in 2010. About half of the amount originated from the (illegal) import of used EEE in a non-working and non-repairable state. The other half came from repair and refurbishment businesses out of appliances from domestic consumers. The origin of this portion were private consumers, who sold around 21% or 210,000 tonnes of their end-of-life appliances to the second-hand industry, which in turn refurbished around 50% of the volume and consequently discarded another 100,000 tonnes.

Private consumers generated around 1,000,000 tonnes of end-of-life EEE. According to the disposal behaviour as depicted in Figure 6.4 (page 59), only around 34% of these appliances ended up as waste. Out of these 34% around 160,000 tonnes were directly sold to scrap dealers, hence entering the informal recycling sector. The remaining 180,000 tonnes were disposed of via household waste, which is assumed to have been picked up by communal collection. This fraction most probably directly ended up on official dumpsites, where waste pickers might separate valuable materials (mainly metals) from the rest.

According to the survey institutional and corporate consumers generated around 100,000 tonnes of end-of-life appliances – mainly ICT equipment, but did not discard them as waste. They either gave their appliances away as donations for re-use (20'000 tonnes) or stored them on their premises for an indefinite time (80,000 tonnes).

Table 7.1: Material recovery efficiency by the informal recycling sector

Material fraction	Material content	WEEE going to recycling	Material recovered		Downstream process
	(% in cat 1-4)	(tonnes)	(%)	(tonnes)	
Ferrous metal	37.9%	200,000	95%	190,000	local market / export (?)
Aluminium	8.5%	46,000	85%	40,000	local market / export (?)
Copper	8.7%	47,000	70%	33,000	export
Lead	0.7%	4,000	0%	0	dumped
Cadmium	1.51E-02%	80	0%	0	dumped
Mercury	5.14E-05%	0.3	0%	0	dumped
Gold	1.25E-04%	0.7	30%	0.2	export / burned / dumped
Silver	6.28E-04%	3.4	Na	Na	
Palladium	3.13E-05%	0.2	Na	Na	
Indium	2.60E-04%	1.4	0%	0	dumped
Brominated plastics	9.6%	52,000	0%	0	burnt
Other plastics	18.4%	100,000	20%	20,000	Local market, burnt
CRT glass	10.1%	54,000	0%	0	dumped
Other	7.2%	39,000	0%	0	dumped
Total	100%	540,000		283,000	(52% recovery rate)

All together it is estimated that the informal recycling sector collected and processed around 360,000 tonnes of WEEE. Another 180,000 tonnes of WEEE was collected through communal collection via household waste, which sums up to 540,000 tonnes of e-waste being collected in one or the other way. This indicates a combined informal and formal collection efficiency of 75% for end-of-life equipment destined to be disposed of as waste, the remaining 25% being in storage at the consumer. It is further assumed that the informal sector was recovering around 52% of the materials. This equals to approx. 280,000 tonnes, which were channelled further to the formal recycling industry and subsequently were sold to the inland or export market as secondary raw material. From the field visits and interviews it was apparent that while ferrous metals, aluminium and copper have high recovery rates, precious metals and plastics are only recovered to some extent, and other materials are mostly lost through burning and dumping. Table 7.1 summarizes quantitative estimations for the informal recycling sector channels.

In 2010 also some formalized collection and recycling activities specifically destined for WEEE were identified in Lagos. However since these initiatives were in their initial state, it was unclear how much waste was entering those channels.

8 Impacts

8.1 Overview

The e-waste sector provides thousands of people with jobs, in spite of the health and environmental risks the operations pose. Figure 8.1 identifies the various stages of the process, indicating hotspots which are sources of concern and requiring attention.

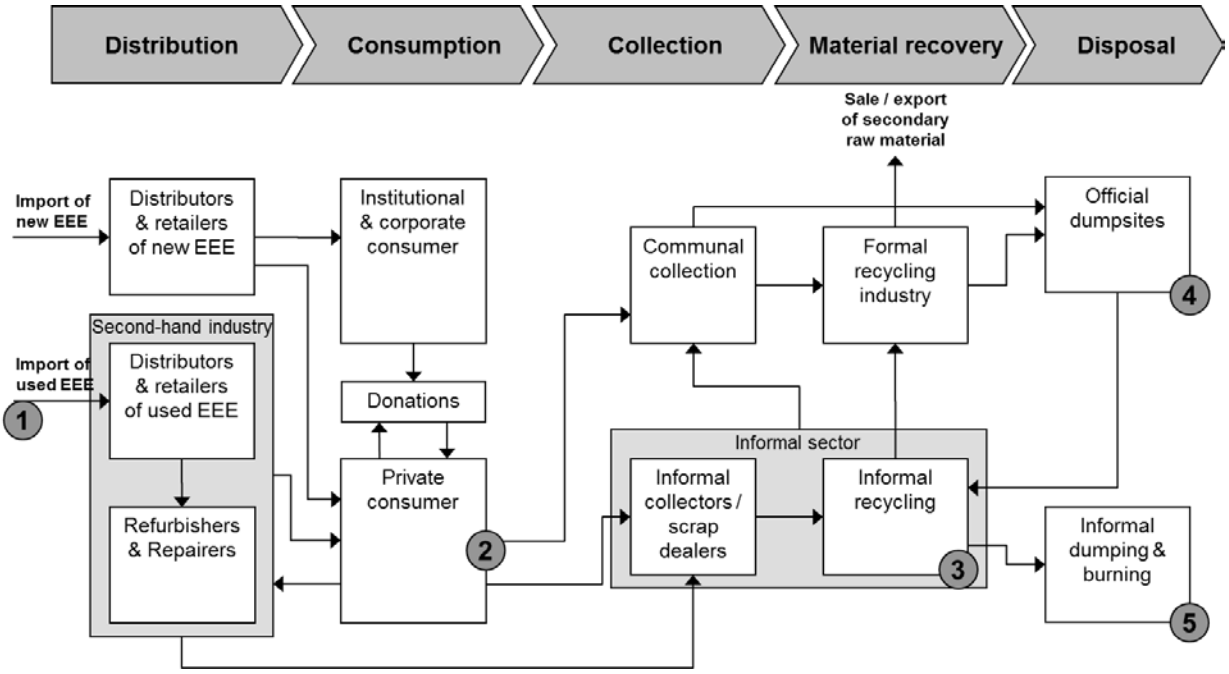


Figure 8.1: Massflow chart indicating hotspots in the Nigerian recycling chain

1) Importers of used EEE

About one third of the imported used EEE was non-functional and has to be defined as illegal imports. Although half of these illegal imports are repaired and reused locally, illegal imports add at least 100,000 tonnes to the internally generated e-waste. For the other approx. 100,000 tonnes of imported non-functional EEE, but which is repaired and refurbished after arrival, it can be assumed that these devices on average have a shorter lifespan compared to new equipment or second hand equipment arriving in working condition, and therefore contribute at a higher cadence to e-waste volumes.

2) Private consumer

Results indicate that private consumer dispose of approx. 18% of their e-waste or 180'000 tonnes with general household waste. This potentially results in more emissions of hazardous substances, when this fraction reaches its final disposal destination on dumpsites. In addition secondary resources contained in this fraction and its associated socio-economic opportunities are mostly lost.

3) Informal recycling

Informal recyclers apply practices with adverse effects on human health and the environment. This includes burning of cables to recover copper and possibly also acid leaching of gold from printed circuit boards.

4) Official dumpsites

A considerable amount of e-waste generated ends up on official dumpsites, which are not equipped with measures to avoid emissions of hazardous substances to the environment.

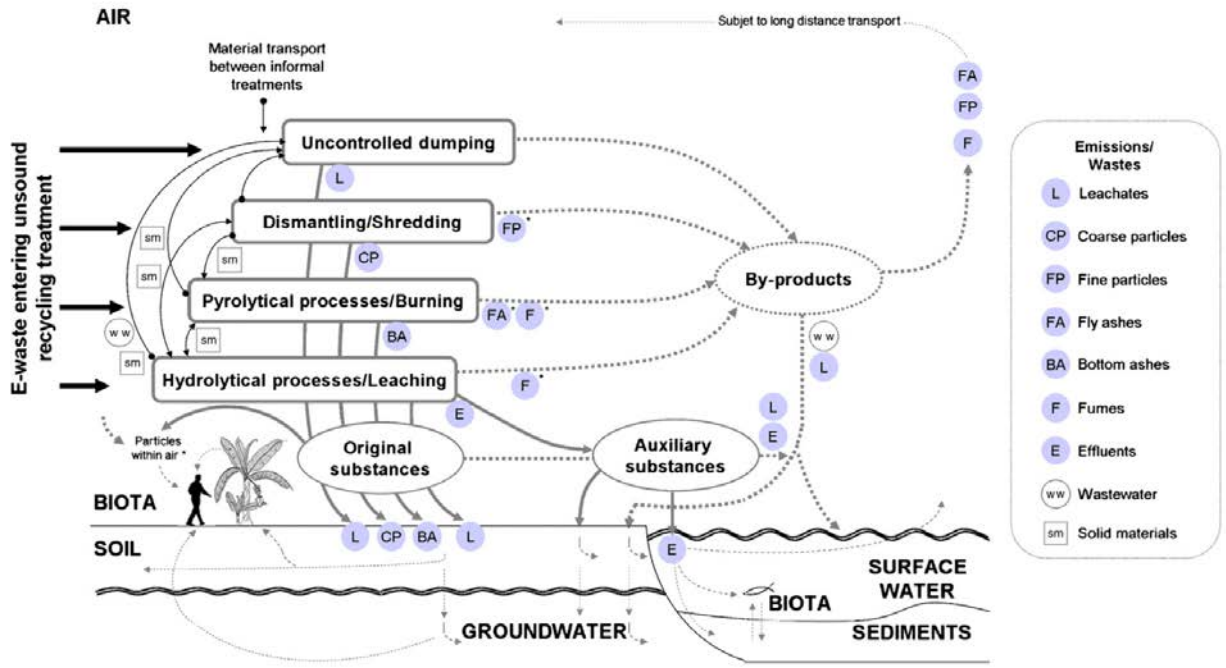
5) Informal dumping and burning

The remaining fractions after salvaging the valuable components in the informal recycling sector are dumped and/or burnt on informal dumpsite. The dumping and open burning of hazardous fraction is a threat to the environment and to public health.

8.2 Environmental & health impacts

Environmental impacts

Environmental impacts are discussed in a qualitative way and are not based on quantitative field investigations. Emissions from informal recycling activities have already been assessed in many studies (Sepúlveda et al. 2010). Figure 8.2 gives an overview on principal e-waste recycling activities, types of produced emissions/discharges and general environmental pathways.



Ovals: types of substances contained within emissions. Continuous bold lines: fate of original and auxiliary substances. Dotted bold lines: fate of by-products such as dioxins and furans. Black arrows with a bold dot: material transport fluxes between treatments. Fine dashed arrows: general environmental pathways

Figure 8.2: Principal WEEE recycling activities in China and India, types of produced emissions and general environmental pathways

E-waste recycling activities in Nigeria include mainly dismantling, uncontrolled dumping as well as pyrolytical processes. There are indications, but no proofs, for hydrolytical processes, such as leaching of precious metals from printed wiring boards. During collection as well as refurbishment or repair of EEE, negative impacts can partly occur, but are generally at a significantly lower level. Recycling activities often take place on unfortified ground where harmful substances released during dismantling are directly discharged to the soil. Burning copper cables and wires, as well as monitor and TV casings, creates an accumulation of ash and partially burned materials at the burning sites. Insulating foam from dismantled refrigerators, primarily CFC-containing polyurethane, or old car tyres are often used as the main fuels for the fires (Amoyaw-Osei et al.

2011), contributing to acute chemical hazards and long-term contamination at the burning sites, as well as emitting ozone depleting substances and greenhouse gases into the atmosphere.

As the practice of burning of cables is seen as one of the most direct severe impacts on human health and the environment, a small survey was conducted in the project partner country Ghana in the Greater Accra Region, in order to estimate the resulting dioxin emissions (Amoyaw-Osei et al. 2011). It was estimated that approximately 625 tonnes of cables were burnt per year. About 10-20 % of these cables were associated with e-waste, while the rest originated mainly from old vehicles. The estimation of dioxin emissions to air from open burning of cables resulted in source strength of ~3 g / year. Compared with the European dioxin air emission inventory for 2005 (Quass, Fermann, and Broeker 2004), this equals to 0.15 – 0.3 % of total dioxin emissions, 1.5 – 3 % of dioxin emissions from municipal waste incineration or 7.5 – 15 % of dioxin emissions from industrial waste incineration. Bearing in mind the much larger size of the Nigerian informal recycling sector compared to Ghana, dioxin emissions occurring from open burning of cables in Nigeria can be assumed to be a few factors higher. Hence this should be considered as a major source of dioxin emissions for Nigeria.

Occupational health and safety issues

According to the respondents in the assessment survey across the country, workers of the e-waste recycling chain are exposed to the hazardous substances in two ways, namely through absorption from skin contact, and inhalation through burning of cables for the recovery of copper. There is also indication that people are exposed to toxic fumes through the acid leaching of precious metals. Various workers involved in the collection of the scraps complained of aches, general weakness/ fatigue and irritation of the digestive system. A number of them sustain cuts and spinal injuries as a result of the rigorous working conditions, particularly those who carry the scraps on their back rather than those who push the barrows.

Workers involved in the dismantling and the repair/ refurbishing aspects complain of incessant cough that keeps coming and going, general weakness and irritation of eyes and skin. Also observed were some having hands that looked like it has run through a grater. Some of the workers attribute their physical health conditions to the dirty nature of their environment rather than the e-waste as they equated their work to that of auto mechanics.

The collectors and informal recyclers suffer from health consequences of their occupation considering that the waste dumpsites are breeding grounds for mosquitoes, flies and other disease pathogens. Moreover they seldom work with personal protective devices, and clearly face many serious occupational health risks.

The next step is to see to what extent quantitatively this is harming the environment and creating a health hazard for both the workers, and people living in the path of the emissions from the e-waste activities -- either through inhalation, or exposure to the skin. Literature review also implicated that some of these chemical compounds in e-waste may be carcinogens; others may be just as harmful because they can act as 'environmental disruptors' and may affect body processes from reproduction to endocrine function.

8.3 Socio - economic impacts

The socio economic impacts of the second-hand EEE and e-waste recycling formal and informal sector in Lagos were assessed in a separate study and detailed results can be retrieved from (Manhart et al. 2011). The discussion below contains partially a summary of this study and some additional observations from Lagos and Kano.

Formal operators as well as informal operators and individuals of the (second-hand) EEE sector are partially organized in associations, which are available in the big cities like Lagos and Kano. These associations are often used to resist pressure from government agencies to pay taxes or conform to set out rules.

From the survey there is no indication of prerequisite formal education for the collecting and sorting of e wastes, but a sizeable number of graduates are in the business of repairing and refurbishing while the recyclers also have no formal education. In spite of their limited formal education, all of the waste collector and recyclers interviewed had very good 'knowledge' of the kind of wastes they were interested in collecting and recycling.

At all the cities assessed over 70 percent of the waste collectors were male, women are often involved as brokers paying the cash. All the collectors interviewed were single and 80 % are of the northern extraction from the rural areas up north. There is a community in Kano that has prides itself to be experts in scrap business.

The wage structure is according to the waste volumes collected or treated hence the motivation for most individuals is the economic returns/benefits, rather than environmental is their main motivation. There is no additional benefit to wages given in return for volume/ weight of e-waste collected or treated.

Informal recycling also provides jobs and livelihood to mostly recent rural migrants who, possessing no special skills come to the city in search of the nonexistent greener pastures. Between 144kg/wk and 1985kg/week of e-waste mixed with other metal scraps is collected by a waste picker. The collected e-waste is co-mingled with other metal scrap. Up to 80000 persons (34000-80000) are involved in this sector in Nigeria. The main sources of collected materials are homes/dump sites, refurbishers, streets, importers. The waste picker sells to scrap dealers or vendors.

A typical vendor gets N3000-N5000/week approximately (US$ 20-30) when he sells his scraps. Mobile phone repairers often require the customers to register by paying a certain fee before the phones are investigated for the faulty. This charge is usually not part of the repair charge. Revenue per refurbished EEE is between N1000 - N3000 depending on the nature of the fault. On some occasions when faulty components or modules are to be replaced the charge may be higher. An estimated 52000 persons are engaged in the refurbishing business in Nigeria.

Approximately 66-68% of EEE brought to repairers and refurbishers shops are effectively repaired. Unrepairable EEE that are abandoned in the repairer's shops are disposed /sold of between 6months to 3 years (mean 1 and a half years) of storage in the repairers shop.

12-25% of the refurbishers dispose all e-waste generated in their operations with general waste. Others estimated at 66% store and sell the waste to collectors while the useless wastes are disposed with general waste.

The metal /steel sector and the plastic sectors of the country have been the main beneficiary of the informal collection of scraps and recyclable items. The e-waste aspect is also becoming a profitable venture for those into exporting of the printed circuit board through the various informal channels of the downstream vendors across the land border.

9 Conclusion

The baseline findings point towards several challenges for Nigeria to manage e-waste. Challenges are especially related to the control of used EEE imports, collection strategies and sound technological recycling solutions, as well as support through policy, economic instruments, and legislation.

9.1 Imports

The studies suggest that 50% to 70% of all imports are used EEE, with 30% of the used EEE imported determined to be non-functioning (hence should have been defined as e-waste): half of this amount was repaired locally and sold to consumers and the other half was un-repairable. It is unclear how much of the remaining imported used EEE functioned for a reasonable time after it was sold. This so called "near-end-of-life" equipment can be another major source of e-waste which was imported into Nigeria as equipment but turned into waste in a relatively short time. Compared to the neighbouring countries in West Africa, Nigeria dominates the region in the total amount of used and new EEE imports, total number of EEE in use and the subsequent total amount of e-waste generated. Altogether it is roughly estimated that in the past years a total of at least 100,000 tonnes of e-waste per annum was "illegally" entering Nigeria. This number is comparable to the total amount of e-waste generated in a small European country like Switzerland.

In addressing this, one major challenge for Nigeria is to avoid the import of e-waste and near-end-of-life equipment without hampering the meaningful and socio - economically valuable trade of used EEE of good quality. Refurbishing of EEE and the sales of used EEE is an important economic sector (e.g. Alaba market in Lagos). It is a well-organized and a dynamic sector that holds the potential for further industrial development. Indirectly, the sector has another important economic role, as it supplies low and middle income households with affordable ICT equipment and other EEE. In the view of the sector's positive socio-economic performance, all policy measures aiming to improve e-waste management in Nigeria should refrain from undifferentiated banning of second-hand imports and refurbishing activities and strive for a co-operative approach by including the market and sector associations.

The data compiled in this document is important for national decision-makers to take informed policy and economic decisions in relation to e-waste. Therefore efforts to keep and update data relative to EEE imports and e-waste should be continued.

9.2 Collection and recycling

Even if the trade of used EEE is controlled, Nigeria will still face major challenges related to properly managing domestically generated e-waste. It can be assumed that at least 50% of e-waste is generated out of the consumption of new or used EEE of good quality with a reasonable life-span. In addition up to 30% of waste originates from the consumption of EEE which was imported as used EEE of unclear quality. This is between 550,000 and 880,000 tonnes of domestic e-waste generated per annum. Although not all of this is reaching the waste stream (due to e.g. storage), it needs to be managed at a certain point.

This strongly demands for a functioning take-back and recycling systems. Challenges on the collection side include appropriate strategies, ensuring that high volumes of valuable and non-valuable waste fractions are collected equally and that those fractions reach appropriate treating and disposal facilities. In addition, connecting informal collectors to a formal recycling structure is pivotal, along with appropriate capacity building and training. The informal sector activities can provide a basis to develop a more advanced recycling industry, and important income opportunities for poor people. Any strategy addressing e-waste management should therefore carefully consider the possible roles of informal collection and dismantling before establishing a parallel system in competition to these structures. In particular, it is recommended that those people that are currently engaged in informal e-waste collection and pre-processing become officially acknowl-

edged as the players in the recycling chain. To ensure that these operations are done in the environmentally sound manner, it is vital to include health and safety measures into informal practices, as well as offer opportunities for the informal sector to gradually transform themselves into formal structures.

Recycling activities with adverse impacts on human health and the environment, such as open burning of cables, need immediate attention of the governments. As specialized recycling companies only exist on a very small-scale in Nigeria, another challenge is to attract investments for sound and locally adapted recycling technologies. Taking the socio-economic conditions into account, locally adapted recycling technologies for Nigeria should make use of the abundant labor force instead of deploying expensive shredding and sorting machinery. In addition treatment possibilities for hazardous fractions need to be identified. Further refining processes – especially those for precious metals – need to be carried out in state-of-the-art facilities that are only available in very few countries globally. To ensure a maximum yield of valuable recycling fractions, Nigerian recyclers are encouraged to interlink with international recycling companies and networks for developing market outlets for their pre-processed e-waste fractions for a maximized return of value for secondary raw materials. This also requires that government bodies guarantee a smooth, reliable and timely handling of export licenses and other administrative procedures to facilitate exports of certain e-waste fractions that can be hazardous.

Activities further investigating options and arrangements for sound recycling of e-waste need to be carried out in the form of pilot initiatives and specific studies on viable business models applicable to Nigeria.

9.3 Policy and legislation

It is an encouraging sign, that Nigeria has adopted specific regulations for the management of e-waste. However, with the implementation and enforcement of those regulations still ahead the main challenges are yet to be faced. It will be key to ensure that all actors will play under the same rules, in order to avoid ''cherry picking''. In addition to existing policies and legal frameworks especially related to environment, general waste management, as well as health and safety need to be enforced likewise posing challenges to the coordination between different regulatory bodies.

A sustainable e-waste management system will demand for a financing scheme, a level playing field and appropriate market incentives. It is thought that similar to policies in OECD countries, e-waste recycling systems in Nigeria should be developed under the principle of Extended Producer Responsibility (EPR). Producers and importers should be given an appropriate role to manage the waste generated out of their products. While the regulatory framework needs to be clear and precise in defining the obligations for the main actors, it should give producers and importers some flexibility in choosing their preferred way and mechanisms of implementing a sustainable system.

When designing national EPR policies in Nigeria, such issues as to how to deal with illegally imported e-waste and counterfeit goods and who can be responsible for its recycling costs should be carefully considered. Also establishing recycling facilities in Nigeria which operate in accordance with the international standards and practices and which could partner with producers will be vital when developing EPR systems. In this regard further projects and initiatives supporting the Nigerian government to draft and adopt policies and legislation addressing e-waste challenges and taking into account important aspects of e-waste management as referred to above will be necessary.

An increase in inter-Sub-Saharan trade of EEE indicates that the port of entry is not necessarily identical with the final destination. Used EEE is often refurbished in specialized clusters and then sold to traders from neighbouring countries or beyond. Cooperation with other African countries and the adoption of a regional approach (with involvement of sub-regional economic blocks such as the Economic Cooperation of West African Countries (ECOWAS)) supporting environmentally sound management of e-waste as well as control of illegal traffic in West and Central Africa appears to be important in pursuing the solution to e-waste in Nigeria and Africa in general.

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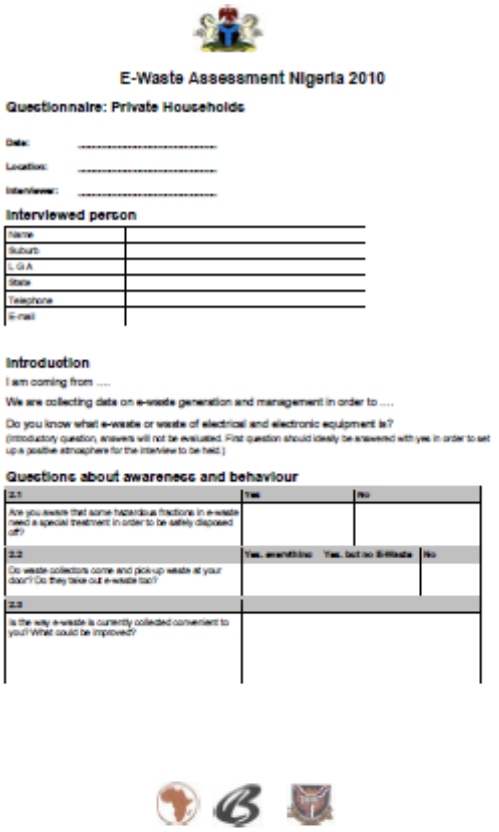
11 Annexes

Figure 11.1: Questionnaire private consumer



E-Waste Assessment Nigeria 2010

Questionnaire: Private Households

Date: .....

Location: .....

Interviewer: .....

Interviewed person

Name	
Suburb	
L.G.A	
State	
Telephone	
E-mail	

Introduction

I am coming from ....

We are collecting data on e-waste generation and management in order to ....

Do you know what e-waste or waste of electrical and electronic equipment is?

(Introductory question, answers will not be evaluated. First question should ideally be answered with yes in order to set up a positive atmosphere for the interview to be held.)

Questions about awareness and behaviour

2.1	Yes	No	
Are you aware that some hazardous fractions in e-waste need a special treatment in order to be safely disposed off?			
2.2	Yes, everything	Yes, but no E-Waste	No
Do waste collectors come and pick-up waste at your door? Do they take out e-waste too?			
2.3			
Is the way e-waste is currently collected convenient to you? What could be improved?			

Detailed information about tracing products

Product	Where was it bought? / In what condition? (new/ used & working/ broken)	If years used	If years stored before disposal	In what condition was the product at the end of life? working –W broken – B broken but fixable – F
Fridge				
Washing Machine				
Toaster				
Microwave				
PC(Desktop)				
Laptop				
Phones				
Tv (CRT)				
Tv (Flat panel)				
Radio				
Cameras				
DVD Players				
Electric Instruments				
Game Consoles				
MP3 Players				
Stereos				
Water dispenser				
Fluorescent Tubes				
Light Bulbs				
Long Life Light Bulbs (Energy saving)				
Rechargeable lamps				
Car Batteries				
One-Way Batteries				
Blenders				
Sewing machine				

questionnaires: households

Numbers of Electrical and Electronic Equipment in the Household (in use)

Large Household Appliances

Product	No of Products
Air Conditioners	
Dish Washers	
Dryers	
Electric Heaters	
Fridges	
Grillers	
Hobs(burner)	
(Steam-) Ovens	
Stoves	
Washing Machines	

Small Household Appliances

Product	# Products
Blenders	
Cables	
Extension Boxes	
Electric boiler	
Electric Lawn-mowers	
Fans	
Hair Dryers	
Irons	
Kettles	
Microwaves	
Mixers	
Popcorn Makers	
Rice cooker	
Soldering Iron	
Toasters	
Vacuum Cleaners	
Water dispenser	

IT and Telecommunication Equipment

Product	# Products
Fax Machines	

Product	# Products
Phones	
Mobile phones	
Laptops	
PCs	
LCD monitor	
CRT's (monitor)	
Modems	
Printers	
Scanners	
Copy machines	
UPS	
Inverters	

Consumer Equipment

Product	# Products
Alarm Clocks	
Cameras	
DVD Players	
Electric Instruments	
Game Consoles	
MP3 Players	
Radios	
Stereos	
TVs (CRT)	
TV (Flat panel)	
Sewing machine	

Lightning Equipment

Product	# Products
Fluorescent Tubes	
Light Bulbs	
Long Life Light Bulbs (Energy saving)	
Rechargeable lamps	

Batteries

Product	# Products
Accumulators	
Car Batteries	
One-Way Batteries	

Questionnaires: households

Disposal of Equipment (please tick)

Product	Donation	Sold to second hand dealers	Sold to scrap dealer	Disposed with household waste	Put on the street	Stored at home(for how many years)	Other
Fridge							
Washing Machine							
Toaster							
Microwave							
PC(Desktop)							
Laptop							
Phones							
TV (CRT)							
TV (Flat panel)							
Radio							
Cameras							
DVD Players							
Electric Instruments							
Game Consoles							
MP3 Players							
Stereos							
Water dispenser							
Fluorescent Tubes							
Light Bulbs							
Long Life Light Bulbs (Energy saving)							
Rechargeable lamps							
Car Batteries							
One-Way Batteries							
Blenders							
Sewing machine							

Number of persons in the household

1	2	3-4	5-6	more than 6

Salary per Month in the Household (Naira)

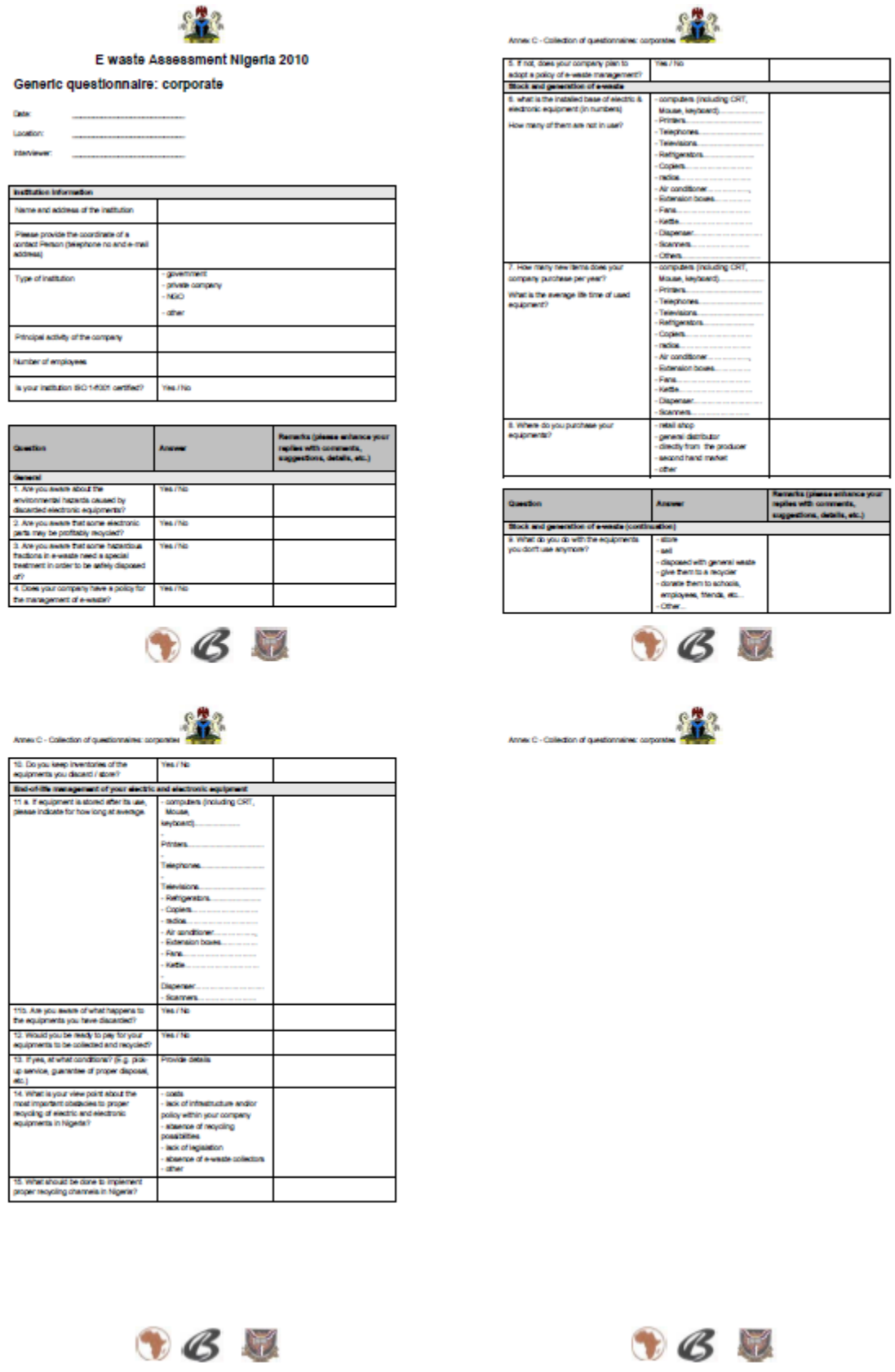
under 20'000	20'000 - 60'000	60'000 - 100'000	100'000 - 200'000	Over 200'000

Additional information and socio economic data

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.....

Figure 11.2: Questionnaire institutional and corporate consumer



E waste Assessment Nigeria 2010

Generic questionnaire: corporate

Date: .....

Location: .....

Interviewer: .....

Institution information	
Name and address of the institution	
Please provide the coordinate of a contact Person (telephone no and e-mail address)	
Type of institution	- government - private company - NGO - other
Principal activity of the company	
Number of employees	
Is your institution ISO 14001 certified?	Yes / No

Question	Answer	Remarks (please enhance your replies with comments, suggestions, details, etc.)
General		
1. Are you aware about the environmental hazards caused by discarded electronic equipments?	Yes / No	
2. Are you aware that some electronic parts may be profitably recycled?	Yes / No	
3. Are you aware that some hazardous fractions in e-waste need a special treatment in order to be safely disposed off?	Yes / No	
4. Does your company have a policy for the management of e-waste?	Yes / No	

Annex C - Collection of questionnaires: corporates

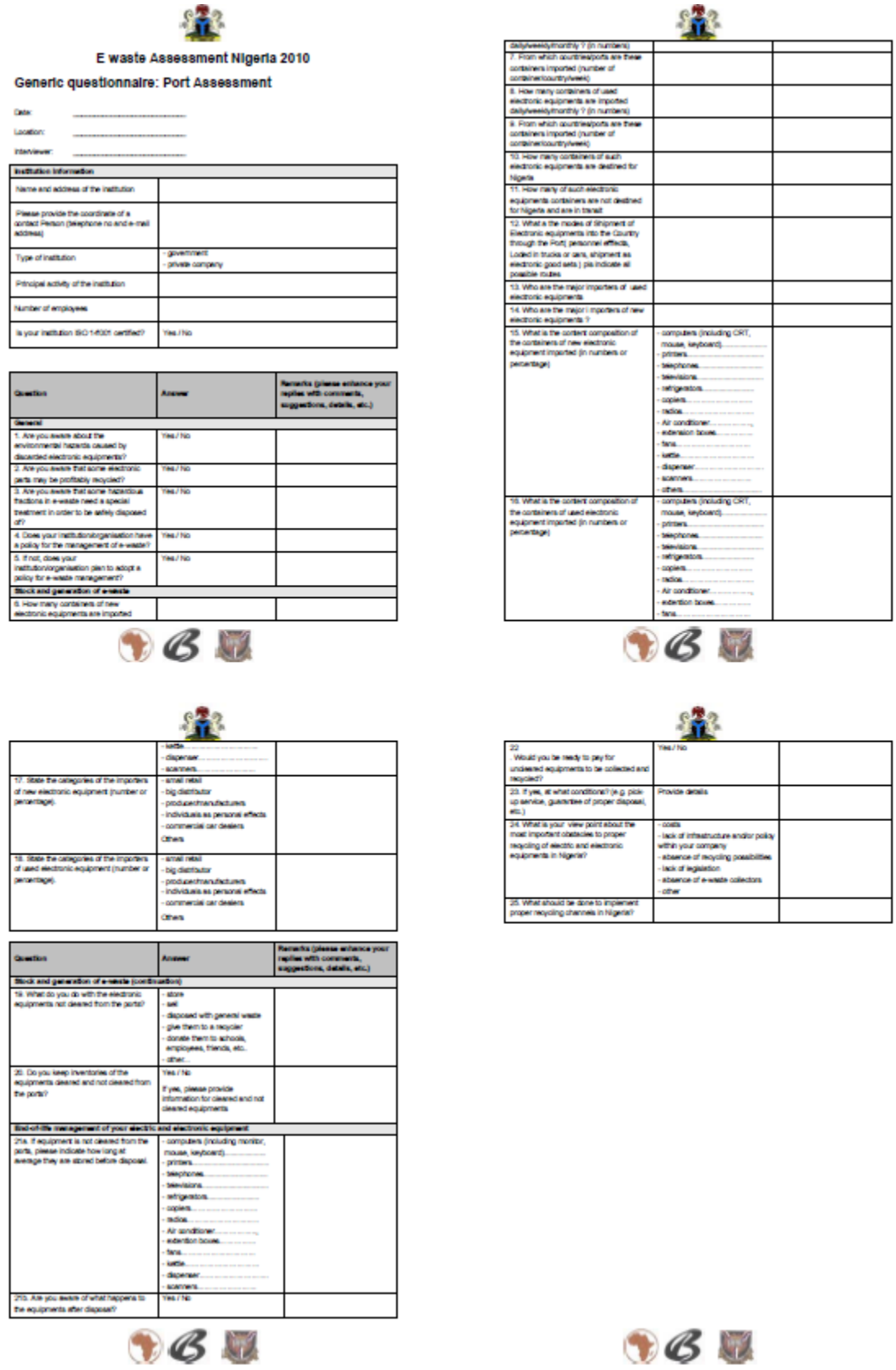
5. If not, does your company plan to adopt a policy of e-waste management?	Yes / No	
Stock and generation of e-waste		
6. what is the installed base of electric & electronic equipment (in numbers) How many of them are not in use?	- computers (including CRT, Mouse, keyboard)..... - Printers..... - Telephones..... - Televisions..... - Refrigerators..... - Copiers..... - radios..... - Air conditioner..... - Extension boxes..... - Fans..... - Kettle..... - Dispenser..... - Scanners..... - Others.....	
7. How many new items does your company purchase per year? What is the average life time of used equipment?	- computers (including CRT, Mouse, keyboard)..... - Printers..... - Telephones..... - Televisions..... - Refrigerators..... - Copiers..... - radios..... - Air conditioner..... - Extension boxes..... - Fans..... - Kettle..... - Dispenser..... - Scanners.....	
8. Where do you purchase your equipments?	- retail shop - general distributor - directly from the producer - second hand market - other	

Question	Answer	Remarks (please enhance your replies with comments, suggestions, details, etc.)
Stock and generation of e-waste (continuation)		
9. What do you do with the equipments you don't use anymore?	- store - sell - disposed with general waste - give them to a recycler - donate them to schools, employees, friends, etc... - Other...	

Annex C - Collection of questionnaires: corporates

10. Do you keep inventories of the equipments you discard / store?	Yes / No	
End-of-life management of your electric and electronic equipment		
11 a. If equipment is stored after its use, please indicate for how long at average.	- computers (including CRT, Mouse, keyboard)..... - Printers..... - Telephones..... - Televisions..... - Refrigerators..... - Copiers..... - radios..... - Air conditioner..... - Extension boxes..... - Fans..... - Kettle..... - Dispenser..... - Scanners.....	
11b. Are you aware of what happens to the equipments you have discarded?	Yes / No	
12. Would you be ready to pay for your equipments to be collected and recycled?	Yes / No	
13. If yes, at what conditions? (e.g. pick-up service, guarantee of proper disposal, etc.)	Provide details	
14. What is your view point about the most important obstacles to proper recycling of electric and electronic equipments in Nigeria?	- costs - lack of infrastructure and/or policy within your company - absence of recycling possibilities - lack of legislation - absence of e-waste collectors - other	
15. What should be done to implement proper recycling channels in Nigeria?		

Figure 11.3: Questionnaire port authority / customs



E waste Assessment Nigeria 2010

Generic questionnaire: Port Assessment

Date: .....

Location: .....

Interviewer: .....

Institution information	
Name and address of the institution	
Please provide the coordinate of a contact Person (telephone no and e-mail address)	
Type of institution	- government - private company
Principal activity of the institution	
Number of employees	
Is your institution ISO 14001 certified?	Yes / No

Question	Answer	Remarks (please enhance your replies with comments, suggestions, details, etc.)
General		
1. Are you aware about the environmental hazards caused by discarded electronic equipments?	Yes / No	
2. Are you aware that some electronic parts may be profitably recycled?	Yes / No	
3. Are you aware that some hazardous fractions in e-waste need a special treatment in order to be safely disposed off?	Yes / No	
4. Does your institution/organisation have a policy for the management of e-waste?	Yes / No	
5. If not, does your institution/organisation plan to adopt a policy for e-waste management?	Yes / No	
Stock and generation of e-waste		
6. How many containers of new electronic equipments are imported		

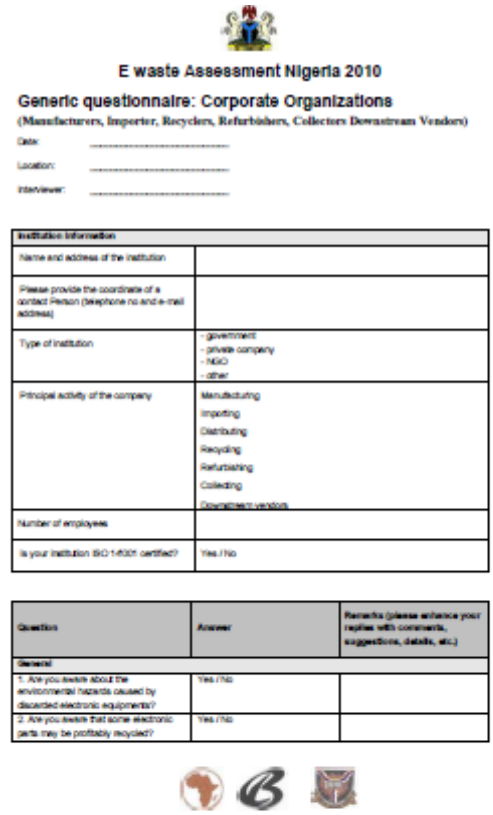
daily/weekly/monthly ? (in numbers)		
7. From which countries/ports are these containers imported (number of containers/country/week)		
8. How many containers of used electronic equipments are imported daily/weekly/monthly ? (in numbers)		
9. From which countries/ports are these containers imported (number of containers/country/week)		
10. How many containers of such electronic equipments are destined for Nigeria		
11. How many of such electronic equipments containers are not destined for Nigeria and are in transit		
12. What is the modes of Shipment of Electronic equipments into the Country through the Port(personnel effects, Loaded in trucks or cars, shipment as electronic good sets) pls indicate all possible routes		
13. Who are the major importers of used electronic equipments		
14. Who are the major i mporters of new electronic equipments ?		
15. What is the content composition of the containers of new electronic equipment imported (in numbers or percentage)	- computers (including CRT, mouse, keyboard)..... - printers..... - telephones..... - televisions..... - refrigerators..... - copiers..... - radios..... - Air conditioner..... - extension boxes..... - fans..... - kettle..... - dispenser..... - scanners..... - others.....	
16. What is the content composition of the containers of used electronic equipment imported (in numbers or percentage)	- computers (including CRT, mouse, keyboard)..... - printers..... - telephones..... - televisions..... - refrigerators..... - copiers..... - radios..... - Air conditioner..... - extention boxes..... - fans.....	

	- kettle..... - dispenser..... - scanners.....	
17. State the categories of the importers of new electronic equipment (number or percentage).	- small retail - big distributor - producer/manufacturers - individuals as personal effects - commercial car dealers Others	
18. State the categories of the importers of used electronic equipment (number or percentage).	- small retail - big distributor - producer/manufacturers - individuals as personal effects - commercial car dealers Others	

Question	Answer	Remarks (please enhance your replies with comments, suggestions, details, etc.)
Stock and generation of e-waste (continuation)		
19. What do you do with the electronic equipments not cleared from the ports?	- store - sell - disposed with general waste - give them to a recycler - donate them to schools, employees, friends, etc.. - other...	
20. Do you keep inventories of the equipments cleared and not cleared from the ports?	Yes / No If yes, please provide information for cleared and not cleared equipments	
End-of-life management of your electric and electronic equipment		
21a. If equipment is not cleared from the ports, please indicate how long at average they are stored before disposal.	- computers (including monitor, mouse, keyboard)..... - printers..... - telephones..... - televisions..... - refrigerators..... - copiers..... - radios..... - Air conditioner..... - extention boxes..... - fans..... - kettle..... - dispenser..... - scanners.....	
21b. Are you aware of what happens to the equipments after disposal?	Yes / No	

22 Would you be ready to pay for undesired equipments to be collected and recycled?	Yes / No	
23. If yes, at what conditions? (e.g. pick-up service, guarantee of proper disposal, etc.)	Provide details	
24. What is your view point about the most important obstacles to proper recycling of electric and electronic equipments in Nigeria?	- costs - lack of infrastructure and/or policy within your company - absence of recycling possibilities - lack of legislation - absence of e-waste collectors - other	
25. What should be done to implement proper recycling channels in Nigeria?		

Figure 11.4: Questionnaire businesses of the e-waste treatment chain



E waste Assessment Nigeria 2010

Generic questionnaire: Corporate Organizations

(Manufacturers, Importer, Recyclers, Refurbishers, Collectors Downstream Vendors)

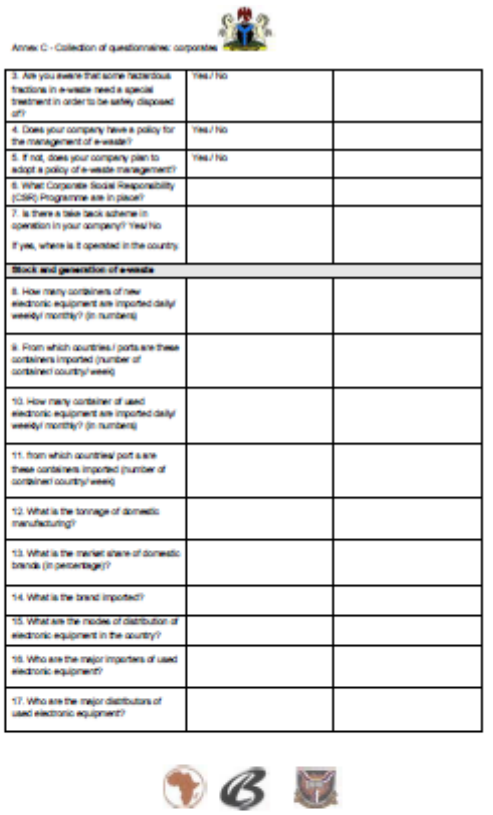
Date: .....

Location: .....

Interviewer: .....

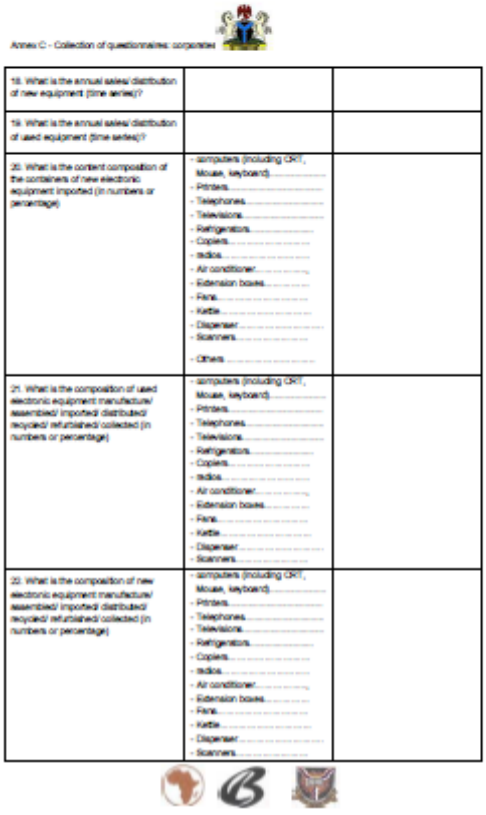
Institution information	
Name and address of the institution	
Please provide the coordinate of a contact Person (telephone no and e-mail address)	
Type of institution	- government - private company - NGO - other
Principal activity of the company	Manufacturing Importing Distributing Recycling Refurbishing Collecting Downstream vendors
Number of employees	
Is your institution ISO 14001 certified?	Yes / No

Question	Answer	Remarks (please enhance your replies with comments, suggestions, details, etc.)
General		
1. Are you aware about the environmental hazards caused by discarded electronic equipments?	Yes / No	
2. Are you aware that some electronic parts may be profitably recycled?	Yes / No	



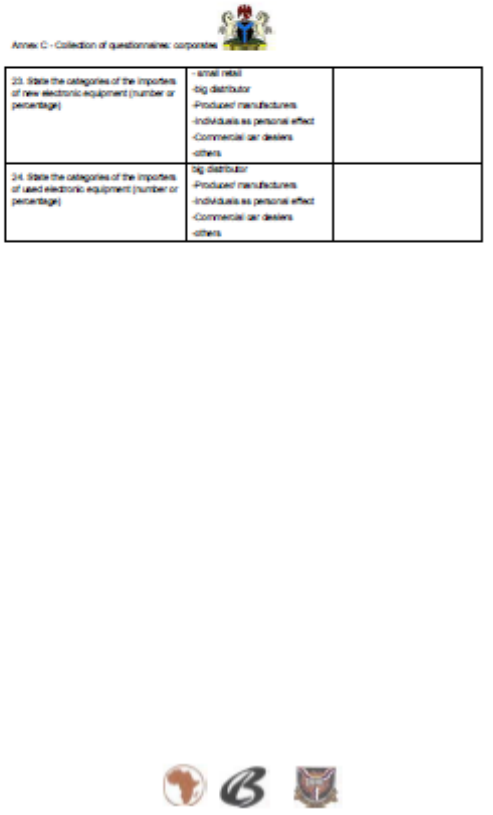
Annex C - Collection of questionnaires: corporates

3. Are you aware that some hazardous fractions in e-waste need a special treatment in order to be safely disposed off?	Yes / No	
4. Does your company have a policy for the management of e-waste?	Yes / No	
5. If not, does your company plan to adopt a policy of e-waste management?	Yes / No	
6. What Corporate Social Responsibility (CSR) Programme are in place?		
7. Is there a take back scheme in operation in your company? Yes/ No If yes, where is it operated in the country		
Stock and generation of e-waste		
8. How many containers of new electronic equipment are imported daily/ weekly/ monthly? (in numbers)		
9. From which countries / ports are these containers imported (number of contained country/ week)		
10. How many container of used electronic equipment are imported daily/ weekly/ monthly? (in numbers)		
11. from which countries/ port s are these containers imported (number of contained country/ week)		
12. What is the tonnage of domestic manufacturing?		
13. What is the market share of domestic brands (in percentage)?		
14. What is the brand imported?		
15. What are the modes of distribution of electronic equipment in the country?		
16. Who are the major importers of used electronic equipment?		
17. Who are the major distributors of used electronic equipment?		



Annex C - Collection of questionnaires: corporates

18. What is the annual sales/ distribution of new equipment (time series)?		
19. What is the annual sales/ distribution of used equipment (time series)?		
20. What is the content composition of the containers of new electronic equipment imported (in numbers or percentage)	- computers (including CRT, Mouse, keyboard) - Printers - Telephones - Televisions - Refrigerators - Copiers - radios - Air conditioner - Extension boxes - Fans - Kettle - Dispenser - Scanners - Others	
21. What is the composition of used electronic equipment manufacture/ assembled/ imported/ distributed/ recycled/ refurbished/ collected (in numbers or percentage)	- computers (including CRT, Mouse, keyboard) - Printers - Telephones - Televisions - Refrigerators - Copiers - radios - Air conditioner - Extension boxes - Fans - Kettle - Dispenser - Scanners	
22. What is the composition of new electronic equipment manufacture/ assembled/ imported/ distributed/ recycled/ refurbished/ collected (in numbers or percentage)	- computers (including CRT, Mouse, keyboard) - Printers - Telephones - Televisions - Refrigerators - Copiers - radios - Air conditioner - Extension boxes - Fans - Kettle - Dispenser - Scanners	



Annex C - Collection of questionnaires: corporates

23. State the categories of the importers of new electronic equipment (number or percentage)	- small retail -big distributor -Produced/ manufacturers -Individuals as personal effect -Commercial car dealers -others	
24. State the categories of the importers of used electronic equipment (number or percentage)	big distributor -Produced/ manufacturers -Individuals as personal effect -Commercial car dealers -others	

Table 11.1: Detailed listing of import statistics for Nigeria according to UN Comtrade database (in kg)

Commodity Code	2000	2001	2002	2003	2006	2007	2008	2009	2010
Category 1	50,525,208	51,219,955	38,860,766	87,454,034	329,823,481	51,787,856	42,679,203	631,943,709	220,445,555
8414	12,101,614	19,498,281	21,344,823	41,605,714	69,315,879			247,510,871	
8415	2,109,861	3,410,005	4,036,772	8,385,659	3,977,583	12,952,775	11,890,253	58,174,563	16,115,595
8418	31,068,450	21,087,546	6,847,227	16,979,651	3,501,053	27,850,457	22,848,941	115,802,726	166,219,708
8450	450,074	486,364	573,240	619,399	15,783,363	2,015,154	1,809,747	44,851,112	5,406,206
8509	454,376	739,425	884,742	967,173	14,215,810	2,311,284		28,737,477	
842112	239,892	24,256	15,500	1	6,670	23,325	75,063	146,499	116,334
842211	19,658	37,101	35,509	57,093	45,030	25,167	46,343	211,280	42,639
851610	1,737,334	1,951,987	1,475,779	1,854,521	7,273,445	1,931,846	1,090,931	4,516,144	1,989,433
851621	3,127	2,375	120,022	1,655	7,763	9,002	88,127	47,223	3,930
851629	69,446	25,365	16,379	24,135	104,428	99,925	42,410	294,951	108,453
851633	14,868	16,827	18,105	10,702	16,681	7,463	1,544	67,802	2,940
851650	23,469	254,300	552,411	1,105,067	111,581,849	1,760,685	2,823,678	93,641,807	4,176,819
851660	1,177,038	2,307,058	1,859,318	14,924,602	6,073,254	2,102,775	1,140,300	7,989,043	14,663,170
851679	804,367	1,343,104	1,048,566	867,471	97,728,569	678,532	821,866	28,404,684	11,600,328
851680	251,634	35,961	32,373	51,191	192,104	19,466		182,349	
851981								1,365,178	
Category 2	12,027,172	15,892,612	15,425,733	15,333,270	87,894,594	2,966,025	3,629,866	52,612,562	4,868,342
8508	324,198	284,564	449,563	426,360				376,815	143,417
8510	163,502	102,779	203,520	218,951	115,212	93,577	28,937	725,161	773,178
9101	0	0	0	0	24,567			303,000	
9102	0	0	0	0	504,733			398,827	
842310	138,958	238,361	466,668	288,502	100,207	75,826	85,442	1,601,548	470,574
845210	9,623,293	13,419,546	11,624,641	11,788,790	8,749,586	839,437	948,301	6,886,633	1,198,862
851631	137,813	180,402	270,605	294,605	18,259	50,112	30,488	875,445	193,254
851632	57,935	40,884	16,206	41,464	6,968	16,306	2,916	214,079	1,784
851640	1,240,819	1,349,036	2,020,786	1,847,186	59,550,046	724,929	1,060,671	20,178,803	1,276,953
851671	192,943	113,750	164,721	111,861	9,364,611	106,676	264,267	503,731	10,260
851672	147,711	163,290	209,023	315,551	5,366,887	283,645	596,309	18,391,113	332,116
910310	0	0	0	0	3,448			37,372	
910511	0	0	0	0	80,267	21	9,482	33,823	3,508
910521	0	0	0	0	3,970,367	775,496	603,053	2,077,274	464,436
910591	0			0	4,296			4,918	
910811									
910812			0	0					
910819									
910911	0		0		11,540			4,000	
910919	0	0	0		23,600			20	
Category 3	5,304,440	6,252,887	8,999,262	23,077,857	409,301,643	44,591	25,098	644,098,028	41,889,241
8469	203,650	301,467	221,631	161,692	120,755			41,162	
8470	890,209	627,518	601,545	1,996,729	470,776			1,520,295	
8471	2,054,858	3,551,478	6,149,423	7,571,074	399,765,133			264,983,754	
8473	645,164	1,060,569	1,361,939	1,593,724	4,800,746			170,548,260	40,383,346
8517	1,335,869	616,962	552,683	11,703,306	4,081,365			82,225,821	
8534	160,093	52,507	46,611	25,756	26,542			464,507	290,658
844331								1,054,383	155,489

Commodity Code	2000	2001	2002	2003	2006	2007	2008	2009	2010
844332								38,434,291	786,566
844339								26,679,478	
844391								54,504,617	101,153
844399								2,616,357	170,910
847210	14,597	42,386	65,430	25,576	36,326	44,591	25,098	1,020,968	1,119
851950								4,135	
Category 4	44,435,117	48,811,170	68,906,033	58,886,553	1,967,350,834	2,170,349	363,865	1,482,342,119	135,898,311
8518	2,811,750	3,887,478	4,732,765	5,021,820	17,288,101			71,565,995	
8521	14,184,054	9,923,433	16,730,842	10,927,094	124,568,773			81,281,329	
8522	316,603	256,425	252,182	254,827	139,314			2,799,995	135,689,955
8525	246,701	1,014,734	2,373,828	4,722,135	79,654,017	2,114,452		19,834,543	
8527	13,337,479	16,472,682	24,073,855	19,381,722	128,120,393			42,241,105	
8528	13,413,604	17,136,279	20,247,754	18,150,943	1,617,009,744			1,258,992,631	
8540	12,650	28,421	43,895	18,836	67,697			155,560	
9207	112,276	91,718	450,912	409,176	502,795	55,897	363,865	2,973,942	208,356
851920								3,000	
851930								387,716	
851981								1,365,178	
851989								741,125	
Grand Total	112,291,937	122,176,624	132,191,794	184,751,714	2,794,370,552	56,968,821	46,698,032	2,810,996,418	403,101,449