Investigation of the implementation and effectiveness of electronic waste management in Nigeria

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Abstract The BASEL Convention, adopted on March 22, 1989 and entered into force on May 5, 1992, was aimed at protecting countries from the dumping of hazardous wastes by controlling their trans-border transportation. Participation has grown over the years to 181 countries (as of April 2016). Transboundary wastes were first introduced into Nigeria following a negotiation worth \$100 per month in the 1980s partly as a result of environmental awareness in developed nations. This led the country to be a party to the Convention. External sources of electronic wastes include the increasing numbers of such wastes that continue to get into the country as a result the “digital divide”; these reach their end of life, sometimes more quickly than expected, and the average consumer eventually dumps them alongside municipal wastes. The municipal wastes are usually burnt and toxic pollutants are released into the environment.

Keywords Hazardous wastes · International convention · Illegal traffic · End-of-life equipment · Recycling facilities

Introduction

The Basel Convention on the control and transboundary movements of hazardous wastes and their disposal has been said to be the most comprehensive global environmental treaty on hazardous and other wastes (Basel Convention 1992). It was adopted on March 22, 1989, entered into

force on May 5, 1992 and was aimed at protecting countries from the dumping of hazardous wastes by controlling its trans-border transportation (Blowers and Glasbergen 1996). Participation to the convention grew over the years from 134 (as of March 2000) to 181 (as of August 2014) (United Nations 2014) considering that a number of net importers and exporters of waste (including the EU) were initially not party to the Convention (Blowers and Glasbergen 1996). Parties to the Convention are entitled to prohibit the import of hazardous wastes and are bound to prohibit its export if the importing country does not consent in writing to the specific import (Blowers and Glasbergen 1996). It is also prohibited to trade in hazardous wastes with non-parties and exports are allowed only if the exporting country itself does not possess technical means of disposing of the waste. The Convention makes clear that hazardous wastes should be disposed of in its country of origin (Blowers and Glasbergen 1996).

The Basel Convention was formulated expressly with an aim (among others) of regulating the international trade in hazardous wastes (Blowers and Glasbergen 1996). Environmental non-governmental organizations (NGOs) were extremely influential in the initial negotiation of the Basel Convention treaty in the late 1980s (Clapp 2005). By the early 1990s the direction of the Convention shifted toward adoption of an amendment that would ban the trade in waste between rich and poor countries (Clapp 2005).

Historical background

Beginning from the early 80s, concern for cleaner environment took greater momentum in the developed countries. A continuous stream of environmental regulations started pouring in from all levels of governments that greatly reduced the flexibility in disposing of waste earlier

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enjoyed by private businesses (Sundram 1997). A routine matter of waste disposal thus became an enormous and expensive one.

As increased regulatory controls became common place, the cost of disposal of generated waste, particularly hazardous waste, grew beyond leaps and bounds within a few years; thus prompting these private businesses as well as elected governments to look for cheaper means of getting rid of the wastes that were no longer welcome in their own countries (Sundram 1997).

Cash-starved developing countries, with concern for the protection of the environment not being on top of their economic order or social agenda, became ready and willing to accept the wastes of the West, a saga of international trade in hazardous wastes was thus silently born (Sundram 1997). This international trade happened because the cost of disposal of hazardous wastes was found to be cheaper in Africa (between US\$2.5 and US\$50) as opposed to exporting countries especially the members of the Organization for Economic Co-operation and Development (OECD) where the cost ranges from US\$100 to US\$2000 (Krueger 2001). Table 1 shows the percentage of exported OECD wastes from 1990 to 1995.

The trade in hazardous wastes began to intensify over the years resulting in transboundary pollution, amid numerous treaties and multilateral international conventions that deal with the protection of the global environment, with horrific tales of victims from recipient countries surfacing (Sundram 1997). Thus transboundary movement of hazardous wastes took global proportions requiring close coordination and genuine cooperation at international levels for its resolution. The Basel Convention came into life under this backdrop (Sundram 1997).

History of Nigeria's involvement

In an attempt to escape the stringent legal means of protecting the environment in the European Economic Community, on September 24, 1987, an Italian businessman acting on behalf of Messer S.I. Ecomar, an Italian waste

disposal company residing in Nigeria, was alleged to have illegally exported 4000 t of waste consisting of 150 t of polychlorinated biphenyls (PCBs) from Italy to Nigeria over an 18-month period (Okaru 2011). Thereupon, he made a profit of \$4.3 million. The wastes were brought into the country as industrial chemicals for a Nigerian building construction company, Irukepen. Mislabeling the garbage as fertilizers, the Italian company deceived a retired/illiterate timber worker into agreeing to store the poison in his backyard at the Nigerian river port of Koko for as little as \$100 per month.

These toxic chemicals were exposed to the hot sun and the children playing nearby (Okaru 2011). They leaked into the Koko water system, resulting in the death of 19 villagers who ate contaminated rice from a nearby farm (Okaru 2011). In reacting to the toxic waste export, the Nigerian government severed diplomatic relations with Italy and ordered the seizure of the Danish ship, *Danix*, which transported the poisonous chemicals into the country. Moreover, the Italian merchant ship, *M. V. Piave*, was detained though it was not involved in the alleged illegal shipment. Subsequently, diplomatic relations were renewed when the Italian government agreed to re-import the wastes in return for the release of the *Piave* (Okaru 2011).

Apart from this major incident, Nigeria (and Ghana) has unknowingly imported toxic products including beef contaminated by the Chernobyl nuclear accident in the Soviet Union in 1986 (Okaru 2011).

Reasons for the legal and illegal traffic of wastes to Nigeria and other African countries include the following:

- Lack of available sites for the installation of toxic waste facilities in industrialized countries.
- Increased environmental awareness in industrialized countries resulting primarily in local opposition to toxic waste dump sites in their neighborhoods.
- Financial inducement, particularly for those African countries faced with heavy debt and in need of foreign exchange.

Table 1 OECD exports of hazardous wastes, 1990–1995

	1990	1991	1992	1993	1994	1995
Hazardous waste exports (t)	1,801,108	1,941,317	1,425,962	1,396,470	1,299,315	No precise data
Average share going to final disposal (%)	53.1	51.3	49.8	41.6	32	22
Average share going to recovery (%)	46.9	48.7	50.2	58.4	68	78

In Table 1 the export data submitted to the OECD by member countries is *supposed* to include export to other OECD countries and non-OECD countries. However, not all OECD countries submit data regarding exports to non-OECD countries so the data is aggregated such that it is not clear what portion consists of exports to OECD countries (and exported by which countries) and non-OECD countries (Krueger 2001)

Source: OECD (1998) Paris: OECD, COM/ENV/TD (97)41/FINAL; OECD (1998), Paris: OECD, ENV/EPOC/WMP/WD (98)6, 7–9 (draft only)

- Lack of technical and regulatory means of reducing and preventing the production of toxic waste.
- Economic incentives for foreign companies faced with costly means of disposal in industrialized countries as opposed to cheap disposal costs in African countries (Okaru 2011).

According to the Basel Convention country fact sheet, Nigeria became party to the Convention and ratified it on March 13, 1991, with the competent authority being the Federal Ministry of Environment (Basel Convention 2011).

The focus of this article will be streamlined to Nigeria's involvement with the Waste Electrical and Electronic Equipment (WEEE) or Electronic waste (E-waste), within its borders; focusing on its treatment of the WEEE/E-waste especially in relation to the E-Waste Inventory Assessment Manual compiled by the United Nations Environmental Programme as well as within the framework of the Basel Convention.

The reason for this focus is because as of 2007, WEEE/E-waste became one of the fastest growing waste streams in the world, equaling 1 % of total solid waste on average (United Nations Environment Programme 2007).

In addition, Nigeria has had a large involvement with E-waste owing partly to the fact that the country is an importer of electronic devices from more industrialized and developed nations around the world.

Literature review

Definition of WEEE/E-waste

The most widely accepted definition of WEEE/E-waste is as per an EU directive named the WEEE Directive (EU 2002a; United Nations Environment Programme 2007):

“Electrical or electronic equipment which is waste including all components, sub-assemblies and consumables, which are part of the product at the time of discarding.” Directive 75/442/EEC, Article 1(a) defines “waste” as “any substance or object which the holder disposes of or is required to dispose of, pursuant to the provisions of national law in force.”

Electrical and electronic equipment (EEE) means equipment which is dependent on electrical currents or electromagnetic fields in order to work properly and equipment for the generation, transfer and measurement of such current and fields falling under the categories set out in Annex IA to Directive 2002/96/EC (WEEE) and designed for use with a voltage rating not exceeding 1000 volts for alternating current and 1500 volts for direct current (United Nations Environment Programme 2007).

The Directive categorizes electrical and electronic equipment in ten different ways as in Table 2.

In addition to the definition of WEEE/E-waste given above, the Basel Action Network also defines E-waste as a broad and growing range of electronic devices ranging from large household devices such as refrigerators, air conditioners, cell phones, personal stereos and consumer electronics to computers which have been discarded by their users (United Nations Environment Programme 2007).

Also, the Organization for Economic Development (OECD) in 2001 defined WEEE/E-waste as “any appliance using an electric power supply that has reached its end-of-life” (United Nations Environment Programme 2007).

These definitions were given by the United Nations Environment Programme (UNEP) in order to assist policymakers/other stakeholders to assess whether WEEE/E-waste is addressed in the existing environmental/related legislation of the country (United Nations Environment Programme 2007).

Hazardousness of WEEE/E-waste

Electrical and electronic equipment are made of components such as metal, plastic, insulation, glass, motor/compressor, magnetron, textile, circuit board, heating elements, thermostat, etc. These components are very diverse and may contain more than 1000 different substances which fall under “hazardous” and “non-hazardous” categories (United Nations Environment Programme 2007).

Broadly, the composition consists of ferrous and non-ferrous metals, plastics, glass, wood and plywood, printed circuit boards, concrete and ceramics, rubber and other items. Iron and steel constitutes about 50 % of WEEE/E-waste followed by plastics (21 %) and non-ferrous metals (13 %) and other constituents. Non-ferrous metals include copper, aluminum and precious metals like silver, gold, palladium etc.

The presence of elements like mercury, lead, arsenic, cadmium, selenium, hexavalent chromium and flame retardants in WEEE/E-waste and their components beyond threshold quantities as mentioned in Material Safety Data Sheet (MSDS) and regulations related to hazardous waste of different countries classify them as hazardous wastes (United Nations Environment Programme 2007).

In a paper released by the World Health Organization, effects of arsenic intake at a dangerous level include abdominal pain, diarrhea, muscle cramping among other things. Mercury poisoning could lead to impaired neurological development in infants and even fetuses. Lead poisoning could pose huge risk to brain development, damage to kidneys or cause seizures (Public Health and Environment 2010). These are some of the health effects of

Table 2 WEEE categories done according to the EU directive on WEEE

Number	Category	Label	Example
1	Large Household appliances	Large HH	Refrigerators, freezers
2	Small household appliances	Small HH	Vacuum cleaners, carpet sweepers
3	IT and telecommunications equipment	ICT	Printer units, minicomputers
4	Consumer equipment	CE	Video cameras, television sets
5	Lighting equipment	Lighting	Low pressure sodium lamps, straight fluorescent lamps
6	Electrical and electronic tools (with the exception of large-scale stationary industrial tools)	E & E tools	Sewing machines, drills, saws
7	Toys, leisure and sports equipment	Toys	Video games, coin slot machines
8	Medical devices (with the exception of all implanted and infected products)	Medical equipment	Dialysis, cardiology
9	Monitoring and control instruments	M & C	Thermostats, smoke detectors
10	Automatic dispensers	Dispensers	Automatic dispensers for money, solid products

Source UNEP 2007

these substances that classify them as hazardous to the environment and health.

The major environmental and human health impacts from recycling practices in West Africa result mainly from the processes of dismantling, material recovery and final disposal. During the collection, refurbishment and repair of EEE, negative impacts are present, but are generally at a significantly lower level. The burning of cables is seen as one practice with the most direct severe impact on human health and the environment. Bearing in mind that cable burning from EEE disassembly most probably occurs in all West African countries, this is a major source of dioxin emissions (Schluep et al. 2011).

Additionally, a sampling campaign carried out by the Greenpeace Research Laboratories in Accra, Ghana at the main informal recycling sites (Agbogbloshie and Korforidua) revealed that copper, lead, tin and zinc concentrations in soil and ash samples are over one hundred times higher than typical background levels. Increased levels of polychlorinated biphenyls (PCBs) and polybrominated diphenyl ethers (PBDEs) found in breast milk samples in Accra, Ghana, were also linked to informal e-waste recycling activities (Schluep et al. 2011).

Electronic waste and Nigeria

According to a presentation given in 2012 by the Deputy Director in charge of Industrial Compliance Monitoring Division in the National Environmental Standards and Regulations Enforcement Agency (NESREA), Nigeria is faced with huge challenges in the management of WEEE;

these E-wastes are either internally generated or exported (Amachree 2012).

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 (Ogungbuyi et al. 2012). 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. There is a co-disposal of all wastes in open dumpsites across the country, susceptible to spontaneous burning and release of unintended persistent organic pollutants which are injurious to the environment and human health (Ogungbuyi et al. 2012).

External sources of electronic wastes include the increasing numbers of WEEE that gets to be imported to the country and eventually dumped alongside general municipal waste, and then burnt with them, thus releasing toxic pollutants into the environment (Ogungbuyi et al. 2012).

In an attempt to bridge the digital divide between Nigeria and the technologically developed nations, large quantities of electronic equipment are imported from developed countries. With these equipment, there is no full guaranty of functionality, there is no distinction between items for reuse and items for recycling, most items that function upon arrival only have a short second life as they were old, obsolete and/or damaged in transit (Ogungbuyi et al. 2012).

Nigeria thus resolved to enforce the provisions of the laws prohibiting illegal shipment and dumping of hazardous wastes, while promulgating new ones to reflect

current realities. The government thus promulgated the National Environmental (Electrical Electronic Sector) Regulations S.I. No 23 of 2011 (Amachree 2012) among other regulations.

It was studied that E-waste recycling activities in Nigeria include mainly dismantling, uncontrolled dumping as well as pyrolytic processes. There are indications, but no proofs, for hydrolytic 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 low level. Recycling activities often take place on unfortified grounds where harmful substances released during dismantling are directly discharged to the soil. Burning copper cables and wires, as well as monitor and television 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 tires are often used as the main fuels for the fires, contributing to acute chemical hazard and longtime chemical hazard at the burning sites as well as emitting ozone-depleting substances and greenhouse gases into the atmosphere (Ogunbuyi et al. 2012).

According to respondents in an 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 the burning of cables for the recovery of copper. There is also indication that people are exposed to toxic fumes through the toxic leaching of precious metals. Workers involved in the dismantling and repair aspects complain of incessant cough, irritation of eyes and skin, general weakness/fatigue (Ogunbuyi et al. 2012).

National policies to control WEEE in Nigeria

Known national policies to control WEEE are highlighted below.

1. The Harmful Waste (Special Criminal Provisions) Act CAP H1, LFN 2004—this prohibits without the harmful carrying, dumping and depositing of harmful wastes in the air, land or waters of Nigeria without lawful authority. Notable sections include:
 - Section 6: provides for a punishment of life imprisonment for offenders as well as the forfeiture of land or anything used to commit the offense.
 - Section 12: defines the civil liability of any offender. He would be liable to persons who have suffered injury as a result of his offensive act.
2. The National Environmental (Electrical/Electronic Sector) Regulations S.I. No 23 of 2011 to address the

E-waste problem. The regulation is based on life-cycle approach and it covers both new and used electrical and electronic equipment. Notable highlights include:

- Use of basic management tools such as Environmental Impact Assessment (EIA), Environmental Audit Report (EAR), and Environmental Management Plan (EMP).
- Adoption of the principle of reduce, repair, recover, recycle and reuse (also known as the 5Rs principle) and the Polluter Pays Principle.
- Guidelines for importation of used electrical and electronic equipment.
- Provisions for collection and recycling facilities.
- Offences and penalties (Amachree 2012).

The National Environmental Regulations also have some specific provisions such as requiring all importers, exporters, manufacturers, assemblers, distributors and retailers of various brands of electrical and electronic products to be committed to an Extended Producers Responsibility (EPR) Program (Amachree 2012). Importers/distributors for all electrical and electronic equipment (EEE) traded or donated to individuals, educational institutions, religious organizations, communities or corporate bodies shall also subscribe to an EPR program and partner with NESREA (Amachree 2012).

Manufacturers, importers, distributors or retailers are to take back the end-of-life EEE and set up collection points or centers. These manufacturers and producers of EEE are to ensure environmentally sound management of e-waste from these collection points. Consumers are to return the end-of-life EEE to the collection points. Additionally, all importers of new and/or used EEE are to pay an administrative cost to NESREA to promote environmentally sound management of WEEE (Amachree 2012).

The Basel Action Network (BAN) in conjunction with the Basel Convention Coordinating Center, Nigeria (BCCC- Nigeria) in 2005 concluded, after a study, that 500,000 used computers are imported annually through the Lagos port alone. The study further stated that about 25 % of the imports are functional used electronics while the remaining 75 % are either unserviceable or junk, causing them to be eventually burnt or dumped carelessly (Amachree 2012).

As of 2012, the WEEE status showed that WEEE collection was not organized and that there were no collection centers, resulting in the WEEE being dumped alongside other wastes. A lot of WEEE were also stockpiled in offices and homes a trait of the culture of attachment to materials of memory. Some states however have been documented to have started stockpiling WEEE pending establishment of state-of-the-art recycling facilities (Amachree 2012).

In a report presented at the annual meeting of the Global Management Network (GEM₃) by the Deputy Director in charge of Industrial Compliance Monitoring Division (ICM) in National Environmental Standards and Regulations Enforcement Agency (NESREA), Mrs. Miranda Amachree, as at July 2013, NESREA has been able to identify and give certification to credible importers of used EEE (UEEE) while sanctioning uncertified importers.

During the period of 1 year, the agency has also repatriated 14 containers and 12 trucks of E-waste while intercepting 17 unregistered importers and imposing necessary punitive charges on them (Amachree 2013).

The aim of the thesis is to investigate the implementation and effectiveness of the regulations mentioned above as well as other existing ones in dealing with these WEEE/ E-wastes in Nigeria.

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