Chapter- V

Comparative Analysis

5.1. Flow of e-waste across the globe

The foremost finding by the researcher is the cross-border movements of e-waste across the globe. Bulk amount of e-waste has been dumped from developed nations to the developing nations. And to find out the answer for the quest that cross-border movement of e-waste is major factor responsible for increased menace of e-waste in developing nation or not, the researcher further investigated in to the global movement of e-waste and collected data to show that trade-in e-waste is the major contributor as compared to the generated domestic e-waste in any developing nation.

5.1.1. E-waste map tracks e-waste generated across the globe

Amount of e-waste from redundant computers, tablets, cell phones and toys, which can threaten health and the environment, is growing at a staggering rate. A latest e-waste map reveals that Canadians generate a staggering amount of e-waste 860,000 tonnes of it in 2012 alone. That works out to regarding 24 kilograms per person in one year.¹⁹³

It has been called the ‘dirty underbelly’ of electronics. The normal Canadian, for instance, generated regarding 24 kilograms of e-waste in 2012. That is more than 860,000 tonnes for the entire India. This is roughly equivalent to the weight of regarding 1,700 fully loaded Boeing 747s at take off. But the biggest manufacturer of e-waste is the United States, with an astonishing 9.36 metric tonnes produced in 2012, regarding 29 kilograms per person. According to the

¹⁹³ Raveena, Aulakh Environment, Published on (Dec. 15, 2013)
map, which was created by a number of agencies in the course of their ‘solving e-
waste problem’ (StEP) initiative. The main purpose of the map is to give a sense
how much electronic waste is present in any nation. It also allows a comparison
between purchasing power in diverse nations, which is a measure of wealth. The
richer the nation, the superfluous e-waste it generally generates.

By 2017, the volume of redundant e-goods globally, is expected to be 33
percent higher than in 2012 and weigh the equivalent of eight of the Great
Pyramids of Egypt. Haiti is among the lowest manufacturers of e-waste in the
world, with less than 8,000 tonnes produced in 2012 or less than one kilogram per
person. Afghanistan, too, was among the lowest in the world, with less than
19,000 tonnes of e-waste or 0.58 kilograms per person. The map is surprising in
parts. Singapore is much wealthier than Canada. Josh Lepawsky rightly said:

“When you look at e-waste generated. In Singapore, a tiny nation, the
normal person generated regarding 36 kilograms in 2012. The globe is
changing quite quickly.”

Miriam Daimond also highlighted on the issue of e-waste in U.S.A. and said:

"The U.S. is the heftiest end-user in absolute terms except it is behind
Luxembourg in per capita terms. It has a much smaller population than
the U.S., 520,000, compared to more than 314 million, except more new
electrical and electronic equipment comes to the market in Luxembourg
per capita. It is a disheartening number. It represents throwing away a
tremendous amount of energy that went into making it in the first place.
Used electronics often make their way to the emerging world, where a few
are re-used. In a lot of the remanufacturing segment, they are dismantled
by hand. That is a stern threat to health and the environment. Innovation
is a trademark in the world of electronics, predominantly in the world of

194 Josh Lepawsky, a professor at Memorial University in St. John’s, N.L., and a member of StEP
(Solving the E-waste Problem, a UN initiative)
cell phones, laptops and computers, where engineers come up with distinct, sleek styles to lure people to buy extra. Why won’t these same smart people also find a way that electronics can be used longer or reused in the best way, too? The outlay of mining new resources is also staggering. These minerals that we mine are scarce. Is it worth it? Mining, too, has negative impact on people and places.”

Josh Lepawsky also suggested:

“The solution to the tonnes of e-waste is relatively simple. Stop buying latest electronics; use what you have for longer. Repair should always be an option.”

5.1.2. Dumping of toxic e-waste in poor nations

A glance of UN Report “Millions of tonnes of old electronic goods illegally exported to emerging nations, as people dump luxury items i.e., i-Pads, Tablets and other electronic goods bought this Christmas are destined to create a flood of e-waste that is being dumped illegally in emerging nations”.

The world-wide volume of electronic waste is expected to grow by 35 percent in the next four years, when it will weigh the equivalent of eight of the great Egyptian pyramids, according to the UN’s StEP initiative, which was set up to tackle the world's growing e-waste crisis. In 2014, nearly 50 million tonnes of e-waste was generated world-wide or regarding 7 kilograms for every person on the planet. These are electronic goods made up of hundreds of diverse resources and containing noxious compounds such as lead, mercury, cadmium,

195 Miriam Diamond, a professor in the department of earth sciences at the University of Toronto, referring to the e-waste that emanates from Canada
196 Josh Lepawsky, a professor at Memorial University in St. John’s, N.L., and a member of StEP (Solving the E-waste Problem, a UN initiative)
197 UN report
arsenic and flame retardants. An old-style CRT computer screen can contain up to 3 kilograms of lead, for instance.

Once in landfill, these noxious resources seep out into the environment, contaminating land, water and the air. In addition, devices are often dismantled in primitive conditions. Those who work at these sites suffer frequent bouts of illness. An indication of the phase of e-waste being shipped to the emerging nations had already revealed by Interpol.\textsuperscript{199} As per Interpol report, almost one in three containers leaving the European Union (EU) that were checked by its agents contained unlawful e-waste. Criminal investigations had already launched against 40 companies. Ruediger Kuehr, executive secretary of StEP has said:

"Christmas will see a surge in sales and waste around the globe. The explosion is happening because there's so much technical innovation. TVs, mobile phones and computers are all being replaced more and more quickly. The lifetime of goods is also shortening."\textsuperscript{200}

E-waste, which extends from old refrigerators to toys and even motorized toothbrushes, is now the world’s best ever growing waste stream. China generated 11.1 million tonnes of e-waste in 2014, followed by the United States of America with 10 million tonnes, even if there was significant difference per capita. For instance, on normal each American generated 29.5 kilograms, compared to less than 5 kilograms per person in China.\textsuperscript{201} So the effective method to compare e-waste generation amongst different nations is to compare net e-waste generation per person. In USA, e-waste generation per person is more than in China. So we should not assume that more populous courtiers generate more e-waste.

By 2017, the volume of end-of-life TVs, phones, computers, monitors, e-toys and other goods to be enough to fill a 15,000 mile line of 40 tonnes Lorries. In Europe, Germany discards more e-waste in total and Norway and Liechtenstein

\textsuperscript{199} International Police
\textsuperscript{200} Ruediger Kuehr, executive secretary of StEP
\textsuperscript{201} According to the StEP report
throw away more per person. Britain is now the world’s seventh chief prolific manufacturer, discarding 1.37 million tonnes or regarding 21 kilograms per person. No figures are available from government or industry on how much is exported.  

Even it is legal to trade-out redundant goods to poor nations if they can be re-used or refurbished, much is being sent to Africa or Asia under false pretences. Much is falsely classified as ‘used goods’ even if in reality it is non-functional. It is often diverted to the black market and disguised as used goods to avoid the outlay associated with legitimate remanufacturing. A substantial proportion of e-waste exports go to nations outside Europe, together with West African nations. Treatment in these nations usually occurs in the informal segment, causing significant ecological pollution and health risks for local populations.

Few nations understand the extent of the problem, because no track is kept of all e-waste. Approximately, 1.3 million tonnes of used electrical goods are shipped out of the European Union (EU) every year, mostly to West Africa and Asia. These goods may subsequently be processed in perilous and inefficient conditions, harming the health of local people and damaging the environment.

A latest study by the Massachusetts Institute of Technology suggests that the United States of America discards 258.2 million computers, monitors, TVs and mobile phones in 2010, of which only 66 percent was recycled. Nearly 120 million mobile phones were collected, mainly which were shipped to Hong Kong, Latin America and the Caribbean. The shelf life of a mobile phone is now less than two years. Except the European Union (EU), United States of America and Japanese governments, various hundreds of millions are thrown away each year or are left in drawers. In the United States of America, only 12 million mobile

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202 Ruediger Kuehr, executive secretary of the U.N.’s Solving the E-Waste Problem (StEP) Initiative conducted the study
203 Interpol report
204 As per report by the European Environment Agency

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phones were collected for remanufacturing in 2011 even if 120 million were bought. Meanwhile, latest phone models are on the race in the market leaving old ones probably to end up in landfills. Most phones contain expensive metals. The circuit board can contain copper, gold, zinc, beryllium and tantalum. The coatings are typically made of lead and phone makers are now increasingly using lithium batteries. Yet less than 10 percent of mobile phones are dismantled and re-used. Major part of the problem is that computers, phones and other devices are becoming increasingly complex and made of smaller and smaller elements.

The failure to recycle is also leading to shortages of rare earth minerals to make future generations of electronic equipments.

5.1.3. E-waste and organized crimes across the globe

Instances of illegal shipments of e-waste across international borders have been increased, because it is win-win situation for both the stakeholders. For instance, remanufacturing of e-waste in formal sector is costly even trade-out of e-waste is profitable in developed countries. Vice-a-versa, trade-in of e-waste in poor countries and extraction of precious metals from e-waste is a profitable industry in poor countries. Lacunae in laws and lack of custom security have paved way for organized crimes like illegal shipments or smuggling.

5.1.3.1. Waste clearance and trade-out routes

5.1.3.1.1. in United Kingdom

The six broad categories of unlawful e-waste clearance in the UK context are as follows:

1. Direct unlawful clearance- For instance, fly tipping.
2. Use of unlicensed waste management sites- The deliberate clearance of e-waste at UK waste management sites which are not licensed to accept it.
3. Use of unlicensed carriers, brokers or waste tourists- It includes use of or sale of equipment to unregulated recipients such as contractors, brokers or
waste tourists. Waste tourists are individuals or groups who temporarily travel to the UK from Asia and West Africa to buy up e-waste for trade-out or sale and then involved in its unlawful clearance.

4. **Shipping infringements** - These include, for instance, the provision of false shipment details to Her Majesty’s Revenue and Customs (HMRC), the UK customs authority. The experience in Holland is that e-waste is shipped under various false headings (for instance, Personal effects, used goods etc.) as well as being mixed in with End-of-Life Vehicles (ELVs). The UK’s Environment Agency has observed that, from an enforcement perspective, it is difficult for regulators to prove that a consignment labeled for a resurgence market is actually waste, except goods are manually tested for functionality. The Environment Agency’s experience from the TFS Ports study has established that waste is often exported to a broker’s industry address or to a fictitious address, and thus not to a reputable contractor or clearance site. This breaks the continuity of the waste stream, and presents impending for prearranged criminality and unlawful practices.

5. **Mis-description of waste** - Illegal actions associated with the mis-description of waste span all types of unlawful waste trade-out. The extent and nature of this unlawful and unregulated remanufacturing or other clearance actions need to be better understood.

6. **Unregulated remanufacturing and other clearance actions** - It includes actions such as burning, unregulated dismantling or smelting to extract metals, fly tipping etc. Experience from the UK Environment Agency and the Dutch Inspectorate of Housing, Spatial Planning and the Environment

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205 VROM Inspectorate officer; personal communication
206 Transfrontier Shipment of Waste, The TFS cluster was set up in 1992 as an informal network in order to harmonize the enforcement European regulations on transfrontier shipments of waste.
indicates that the foremost of e-waste exported is disposed off in such a way once the working tool has been salvaged.207

5.1.3.1.2. In United States of America

Exporters of broken CRTs in the United States are required to report not only the volumes exported except also the mode of transport used the type of container and departure and entry ports. Most remanufacturers report multiple modes, containers and ports. The following tables facilitate a count of the number of times various modes of transport and ports were mentioned in the 23 notifications. To the extent that legal exports overlap with unlawful exports, this information may direct enforcement agents to precise locations and containers to search.

Most exporters reported using multiple modes to transport e-waste out of the United States of America. Because the heftiest number of exporters ship e-waste to Canada, road and rail are the commonly reported modes of transport. Because of the frequent use of Canadian remanufacturing services, Michigan and New York are the commonly cited points of departure and Canadian ports are the commonly cited points of entry. Even if China no longer accepts e-waste for remanufacturing, it was cited as a transit India for exports designated for Malaysia.

Some remanufacturers use multiple modes of transport for broken CRTs. Thus, these numbers add up to a total that is greater than the number of notifications to the EPA. Some remanufacturers use multiple ports of departure. Thus, these numbers add up to a total that is greater than the number of notifications to the EPA.

207 A recent BBC news report from Nigeria projected around 75 percent of IT exports destined for the used market to be unsalvageable, http://news.bbc.co.uk (Visited on Jul. 1, 2014)
5.1.3.1.3. Global Exporters

These businesses are structured in a variety of ways. Even, these appear to be small independent businesses that specialize in remanufacturing. A few electronic remanufacturers are part of heftier United States of America based corporate structures of varying magnitude. For instance, one United States of America based company appears to consist of a ‘corporate headquarters’ and one facility while another company owns at least seven electronics remanufacturers together with three that trade-out e-waste.

In these huge economy level, a few services send e-waste to other services owned by the same parent company for the actual trade-out. Other United States of America exporting services are owned by parent companies headquartered outside of the United States. In a few cases, a hefty international parent company owned both the United States of America exporter and the foreign e-waste importing facility for a few period of time.

Specifically, before selling its United States of America services to the Sims Group, an Australian based company; Xstrata, a Swiss based mining company owned not only one United States of America remanufacturing facility in Tennessee and another in California, except also an importing recycler in Canada. Similarly one United States of America Company, RMG Remanufacturing owns both a recycler in the United States of America and an importer in Canada. In such cases the company is actually exporting to itself.

There is no apparent correlation between industry structure and the volume of e-waste exported. Some of the heftiest exporters in terms of volume are small businesses, while others are part of heftier corporate structures. Yet variation in industry structure still raises several questions for further exploration.

Does the nature of the e-waste industry vary between small businesses and those embedded in heftier corporate structures? For instance, are small businesses

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208 Because it is difficult to obtain information on businesses that are not part of hefty, publicly traded corporations, precise numbers for various industry structures and strategies have not been provided at this time. General descriptions are offered based on publicly available data sources.
more probably to collect e-waste from the general public and other businesses? And why do companies move CRT glass from United States of America remanufacturing operations to foreign ones? Do services vary in capacity or know-how or is it less expensive even inside the same company to recycle CRT glass in foreign nations? Do these differences in the nature of the activity have any bearing on whether exports are legally recycled or illegally disposed off? These are certain major questions pertaining to e-waste management industry and presence of above quest clearly indicates the illegal cross-border movement of e-waste across the globe is the major cause behind its mis-management.

For instance, non-diversified businesses or companies may have incentive to make sure that exports are appropriately recycled, as international scandals could do significant harm to their main line of industry. Recyclers that are part of a hefty corporate structure, even, have other lines of industry to rely on in the face of public pressure regarding e-waste that is disposed off illegally. This may mean that they are less interested to closely monitor the ultimate destination of international shipments.

Never the less, small businesses may have fewer resources than hefty companies to make sure of compliance of e-waste management rules. In this scenario, being part of a hefty corporate structure may make exports less risky because hefty companies have extra resources to expand. These industry structures may also have implications for possible unintentional and intentional organized crime connections. For instance, remanufacturing services exporting to other services owned by the same company do not have to rely as extensively on third parties to transport and recycle e-waste. E-waste exported from small businesses may change hands several times, creating more opportunity for unlawful practices.

Facilities that specialize in remanufacturing may have extra knowledge of legitimate e-waste handlers and may consequently be better equipped to make sure safe clearance. Moving to the question of intentional criminal activity, small
businesses may have extra incentive than hefty companies to rely on questionable shippers or remanufacturers in order to reduce outlay.

As noted in the organized crime literature reviewed by MSU\textsuperscript{209}, various forms of industry crime have occurred in conjunction with perilous waste violations. MSU has been unable to gather any concrete information on violations in the trade-out of United States of America e-waste, except it did examine exporter’s record of compliance with United States of America and state RCRA regulations using the EPA Enforcement and Compliance History Online (ECHO) database. It searched by EPA identifier, when provided, name and address. Of the 21 unique services that had notified the EPA of exports, seven services could not be found on the enforcement database together with three services that provided EPA identifiers.

It is unclear whether businesses absent from the EPA databases or without a RCRA\textsuperscript{210} permit are in violation of United States of America regulations. Because of the patchwork nature of United States of America federal and state as well as international regulations, it is unclear whether businesses that collect e-waste for the purposes of remanufacturing have to obtain a United States of America RCRA permit. Specifically, it is unclear whether businesses that collect e-waste strictly for trade-out without doing remanufacturing themselves, must still obtain a permit. Of the remaining 14 services that could be found in EPA enforcement data, around two-thirds had never been inspected. Of the five services that had been inspected, three had been inspected only once in the past few years. Two services, even if, had clearly received closer attention from the authorities.

One facility had been found to be in violation of United States of America regulations during six quarters of the past three years and had been inspected twice in the previous five years. Another facility had been inspected eight times in

\textsuperscript{209} Michigan State University
\textsuperscript{210} Resource Conservation and Recovery Act
the past five years and had received fines total 7,560 US dollars. It also received four written informal enforcement actions in a period of past five years.

5.1.3.1.4. Global Importers

MSU was unable to explore the ownership structures of importers as extensively as those of exporters because of the limited availability of public data on non-United States of America companies. It did verify that Falconbridge is owned by a Swiss mining company named Xstrata and believes that RMG Canada is owned by a United States of America company (RMG Enterprises). Because of the well-known names of the remaining importers (For instance, Samsung Corning, LG, Philips), it is believed that a few are part of hefty corporate structures.

Less was learned less regarding the three Korean importers, except there is indications of connections. For instance, United Remanufacturing Industries exports to Sam Bu Inc, except also lists Korea China Enterprises as a secondary recycler. There are several other patterns in the data that merit additional exploration. First, a number of services were sold several times. In other comparable industries, companies have been known to sell problematic services rather than improving ecological technologies. Thus, services that have been sold multiple times may have more ecological violations.

Several businesses had connections to China that go beyond using it as a transport nation and may merit further investigation. For instance, a United States of America company that claims to be one of the few to be licensed by China’s Administration of Quality Supervision, Inspection and Quarantine (AQSIQ) is not recorded on any EPA database.

5.1.3.2. E-waste and organized crime

Criminality, by its very nature, is a secretive industry. It is difficult to identify the criminals involved in unlawful e-waste clearance. It is interesting,
even, to note the findings of a recent study undertaken by the Inspectorate of Housing, Spatial Planning and the Environment in the Netherlands. This concluded that almost all companies are somehow involved in unlawful exports of e-waste, whether they are aware of it or not.\textsuperscript{211}

In 2006, the Interpol Pollution Crime Working Group (PCWG) completed a study of the links between organized crime and pollution crimes using information on 36 closed court cases from Sweden, Canada, Italy, the United States, Mexico, Japan, Germany and the UK. Based on the numbers of individuals and organizations involved and the period and nature of criminal activity, i.e., much of it involved smuggling and fraud, the PCWG concluded that prearranged crime groups are actively involved in pollution crimes.

Rather than exhibiting the traditional hierarchial, centralized structure of prearranged crime, the involvement of prearranged criminality in pollution crimes is more loosely structured. Small groups organize for a period of time to commit crime to obtain financial or other benefit, except disperse under pressure to form new groups.

5.1.3.2.1. Organized crime in e-waste management in UK

The opportunities for criminal involvement in UK e-waste clearance are multiple and varied. Criminals exploit any lacunae in the system, predominantly where e-waste can be disguised or mislabeled so that it has the appearance of legitimacy. It has been claimed\textsuperscript{212} that various fishermen in China, unable to make a living from fishing, have reverted to ferrying cargoes of unlawful e-waste from Hong Kong to the Chinese mainland, where it is disposed off illegally.

‘Waste tourists’ is a term used to describe those individuals who visit the UK as tourists with the intention of organizing the purchase and trade-out of waste. While in the UK they will get a container filled and arrange for trade-out,

\textsuperscript{211} Representative, VROM Inspectorate of Housing, Spatial Planning and the Environment
\textsuperscript{212} Representative, VROM, personal communication
except due to their tourist status and their lack of links to customs they can avoid detection.

Some criminals exploit the need of local authorities to meet remanufacturing targets by buying e-waste directly from municipal sites for remanufacturing. It is alleged that often the equipment they buy is exported directly to non-OECD nations with minimal remanufacturing of key elements. This can be a highly profitable industry. Televisions and monitors, for instance, can be bought for 2-3 UK pounds each and sold on for twice that. Because of the volume of waste involved, the trade is projected to have an annual turnover of approximately 2 million UK pounds.²¹³

In various cases the exporters will change the means of shipment in the event of an enforcement clampdown. If customs officials decide to intercept 40 feet containers at a particular port, for instance, the waste shippers will switch to smaller containers or alternative forms of transport such as open sided Lorries or temporarily use a diverse port. This suggests a combination of premeditation and organization as well as indicating the perpetrator’s awareness that the waste shipment is unlawful i.e., organized criminal activity.

5.1.3.2.2. Organized crime in e-waste management in USA

Very few academic studies have examined organized criminal involvement in pollution crimes. Much of the literature is regionally limited and somewhat contradictory. But general patterns can still be inferred. Overall, it seems that traditional crime families had a few phase of involvement in the perilous waste industry, except this type of organization is far less common than loosely structured networks.

It is common knowledge that traditional prearranged crime groups were involved in the solid waste industry in New York and New Jersey in the 1970s.²¹⁴

²¹³ Environment Agency, England and Wales representative, personal communication
²¹⁴ Lyman and Potter (2004); Szasz (1986)
Under the guise of legitimate industry, prearranged crime groups used property rights, predatory pricing and threats of violence to dominate the solid waste industry. Waste hauling contracts were illegally shared out between affiliated haulers. Non-affiliated firms were pressured with threats and violence to either join the infrastructure or exit the industry, creating a system of territorial monopolies with non-competitive pricing.215

Even, the extent of prearranged crime involvement in perilous waste clearance is unknown, evidence suggests that a few prearranged crime groups used the existing garbage hauling organizational infrastructure to begin transporting and disposing of perilous waste in New York and New Jersey after the passage of the Resource Conservation and Recovery Act.216

Congressional investigations revealed that prearranged crime groups used several diverse methods to illegally dispose off perilous waste. Because of prior involvement in the garbage industry, a few mob affiliated individuals already owned municipal waste landfill sites. These owners simply accepted perilous waste labeled as municipal waste. In a few instances, landfill owners not directly associated with prearranged crime could be bribed to sign manifests for shipments never received or to accept perilous waste that was manifested elsewhere.

Organized crime figures also purchased licensed perilous waste handling services and illegally stockpiled or dumped the perilous waste rather than treating it. In a few extreme cases, prearranged crime figures filed false manifests for non-existent clearance sites.

Rebovich in 1992 also found evidence of traditional prearranged crime involvement in his analysis of perilous waste offences and offenders in 71 case studies and interviews with law enforcement personnel in Maine, Maryland, New Jersey and Pennsylvania. Even if, the involvement of traditional prearranged

215 Szasz (1986)
216 Block and Scarpitti (1985); Lyman and Potter (2004); Szasz (1986)
crime was limited. Organized crime links were detected in only three of the 72 cases, all in New Jersey.

In these cases individuals charged with perilous waste violations were identified as associates of traditional criminal organizations. Most perilous waste offences in the Rebovich study did not result from industry takeovers by traditional prearranged crime groups. These offences more closely resembled the model detected by Interpol. The criminal units involved were not as hefty or as centralized as traditional syndicate crime, they were ‘prearranged’ on an extra basic level.217 Perilous waste violations were committed by multiple offenders operating in independent or semi-independent units.

Many of these violations were in the context of legitimate industry. For instance, in a few cases multiple perilous waste industry entities participated in perilous waste violations together via criminal agreements. Generators, haulers, and handling, storage and clearance (TSD) operators agreed to illegally dispose off waste to either save money or generate profits.

Based on this kind of evidence, Rebovich argues that the term ‘prearranged crime’ is inappropriate to describe these perilous waste violations. He uses the term ‘group crime’ to refer to crime committed by two or more people, as opposed to members of a highly structured organization, for unlawful profits and power, advanced by racketeering actions and intricate financial manipulations. This is consistent with other descriptions of current forms of prearranged crime.

Today prearranged crime in the United States is a multi-ethnic enterprise, mainly it involving small groups who emerge to exploit criminal opportunities. According to Albanese in 2005, several of these groups are short lived and are comprised of ‘career criminals’ who form temporary networks of individuals with

217 Rebovich (1992)
desired skills to exploit a criminal opportunity. Some of these flexible, network-based forms of organization have global reach.\textsuperscript{218}

Even if the studies are limited in scope and number, this study is useful for anticipating the nature of and possible methods for unlawful clearance of e-waste. Given the similarity in industry structure in each industry, a few of the precise methods used to illegally dispose of perilous waste may also be used in e-waste violations.

\textbf{5.1.3.2.3. United States of America e-waste clearance incentives and disincentives}

Michigan State University has added to the information provided by its literature review by conducting a range of interviews to build up a picture of the e-waste clearance segment in the United States and how manufacturers of waste engage with it. An interview with one commercial manufacturer of e-waste revealed how a pattern of influences and events can shape clearance practices. First, the efforts of NGOs during the late 1990s and the early part of the 21st century served to highlight the impending risks posed by e-waste to human health and the environment. This led to this particular manufacturer reassessing the practice of sending computers, monitors, circuit boards and other e-waste ‘straight to the dumpster’. Instead the company’s waste was sent to a prison industry programme, at no outlay to the manufacturer.

Concerns then arose regarding the health effects that prisoners might suffer from e-waste toxins. Simultaneously, the manufacturer became concerned regarding the impending for those acquiring computers to get access to sensitive information. A combination of these concerns, regarding the risks associated with exports, prison industry remanufacturing and privacy of confidential data, resulted in the manufacturer looking for remanufacturing services that would properly certify the elimination of confidential information and the appropriate clearance of the resources. The company eventually selected for the job was not the

\textsuperscript{218} Galeotti (2004); Naim (2005); Wood and Shearing (2006)
cheapest, except the one that appeared to offer the best value professional service delivering guarantees of data elimination and the avoidance of shipping waste overseas. The manufacturer now pays approximately 12,000 US dollars per year for this service to dispose off approximately 8,000 monitors and establishes this as a basic industry outlay.

The two remanufacturers that MSU\textsuperscript{219} interviewed represent the types of companies that accept e-waste from manufacturers concerned regarding information security and trade-out. The companies interviewed operate in diverse states in diverse regions of the United States of America. These companies took pride in being ‘zero waste streams’ remanufacturers that erase all memory inside computers and electronics, prevent perilous waste from moving to landfill, do not trade-out and do not use prison labour. Both work primarily with commercial manufacturers except would accept e-waste from individuals. One specializes in all types of electronic waste and the other is a company that has long been involved in remanufacturing expensive metals from manufacturing methods except has added precise capacity for remanufacturing e-waste.

Both companies described services that involved picking up e-waste from manufacturers and then initiating a method of separating resources that could be re-conditioned for re-use from resources that were no longer useable. For the non-useable resources, both employ methods whereby the resources are broken down, perilous wastes separated, expensive metals or other resources of value separated for resale and non-noxious waste minimised and then disposed off. For perilous resources, both companies relied on third-party contractors for clearance.

Both identified the high outlay associated with processing and clearance as the reason why they had to charge manufacturers and individual citizens to take their e-waste from them. They projected that it outlay approximately 18 US dollars to properly remove the lead from a computer monitor or television screen. Even if the remanufacturers were able to recoup revenue in the course of the sale

\textsuperscript{219} Michigan State University
of expensive metals and other recycled resources, this was not sufficient to offset all the outlay associated with picking up and transporting e-waste, shredding information and mainly, retrieving and disposing off toxins. This is predominantly the case for computer monitors that have little value except that do have significant outlay associated with lead removal.

The outlay for remanufacturing vary, with heftier commercial enterprises receiving discounts based on volume and individual end-users paying a premium due to the inefficiencies of remanufacturing one machine at a time. For commercial manufacturers, there is value in having information destroyed except beyond this the only incentive for paying for the clearance of e-waste is from a ‘good corporate citizen’ standpoint. Otherwise, the financial incentive is to find a recycler who will accept the resources for free or purchase them cheaply and then not worry regarding what happens to them.

For individuals, the disincentives for appropriate remanufacturing are even highly pronounced. Except one unit in a state that has prohibited individuals from disposing in landfill, the end-user is probably to incur significant outlay for remanufacturing. For instance, one company charges a 50 US dollars fee to take-back a computer and monitor from individuals. This obviously represents a significant barrier to appropriate clearance and is one of the reasons why a number of states are working with computer manufacturers on ‘take-back’ campaigns that reduce direct remanufacturing outlay to the end-user.

The remanufacturers interviewed by MSU said they believed that their counterparts in the industry who accept resources for free or who purchase used e-waste, must be involved in the trade-out of these resources. This is because the outlay associated with zero waste streams remanufacturing make it essential to charge for this service. They said they did not believe that the outlay associated with international shipping and appropriate separation and clearance of perilous wastes could generate a profit without charging an up-front fee. They felt that where e-waste is being shipped overseas without a fee being paid by the
commercial manufacturer, it is probable that the waste will be broken down for retrieval of resources with value except also that it will then be redundant without appropriate clearance of noxious resources.

The zero waste stream remanufacturers said it was probable that a few functional used electronics were being shipped for re-use. But they did not believe this constituted a hefty proportion of the trade-out market. They argued that if a review of United States of America remanufacturers could be carried out to distinguish those who charge a fee from those who accept material for free or purchase used e-waste, then this could serve as an indicator of legitimate versus illegitimate remanufacturing.

Assuming that it is effective to make a key distinction between fee charging remanufacturers and those who either do not charge or purchase e-waste, a risk based picture for investigating and regulating e-waste remanufacturing emerges. There are related except distinct markets for individual end-users versus commercial manufacturers of e-waste. The fee based versus free or purchase distinction is the next key criterion. After that an idea of whether or not the recycler plans to trade-out provides an additional indication of risk.\(^{220}\) This should be considered preliminary and should be subject to testing except it does look as if a risk based approach can be productively applied to analyze the e-waste remanufacturing market. This does not mean that fee charging remanufacturers are not exposed to the risk of dumping e-waste abroad if they are involved in e-waste trade-out as well as remanufacturing in the United States of America. Even if, it is more probable that the fees charged reflect United States of America based remanufacturing capacity.

The importance of such an approach is also suggested by the preliminary finding by MSU that well over 2,000 businesses are involved in the assortment of

\(^{220}\) Even if yet to be determined, information on industry structure, method, and diversification may further develop this risk-based model.
e-waste. With this number of businesses, targeted rather than random inspections are likely to be a highly productive strategy for reducing unlawful clearance. Even if the remanufacturers both claimed that there was wide knowledge inside the e-waste remanufacturing industry of ‘shady operators’, neither was aware of prearranged crime involvement or of international ‘tourists’ coming to the United States of America to purchase used e-waste, as has been reported in Europe. Even if, both said that they simply did not have adequate knowledge of how international shipping of e-waste occurs.

Consistent with the description from remanufacturers, the regulators and enforcement personnel that were interviewed noted that the primary aim of buyers of e-waste in emerging nations is to retrieve expensive metals. But provision for worker safety and the appropriate clearance of noxious resources and other wastes would incur significant outlay that rapidly eat away or eliminate the profit from selling expensive metals. This suggests and this is a view that is reinforced by evidence from NGOs such as the Basel Action Network that the importers and remanufacturers of e-waste are not handling it properly because it is uneconomic to do so.

Regulators and enforcement personnel note that much of the world-wide distribution of e-waste appears to be conducted over the internet. Like the remanufacturers, the regulators also note that there are ‘high probability violators’ or high-risk companies and networks of companies that are mainly likely to be involved in the cross-border transport of e-waste.

5.2. Analysis of international laws on cross-border e-waste trade

The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Clearance was adopted in 1989 as a multilateral response to a series of noxious trade scandals in which various developed global

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221 This is based on websites that identify e-waste remanufacturing locations in communities across the United States of America. Undoubtedly it is an underestimate of the number of such locations.
industries were found to be dumping perilous wastes in emerging nations and Eastern Europe. Under international ecological justice concerns, nations entered into the negotiation of a multilateral treaty aimed at suppressing ecologically and socially detrimental perilous waste trading patterns. The resulting agreement is entitled the Basel Convention, which came into force in 1992. It regulates international transfers of perilous compounds as a means of addressing the rising threat to human health and ecological quality that is posed by the “increased generation, complexity, and cross-border movement of perilous wastes”.

With 180 Parties to date, the Basel Convention constitutes one of the widely ratified ecological treaties and is the primary legal instrument regulating the world-wide trade of perilous wastes.

The Convention affirms that in order to protect human health and the environment, perilous wastes should not be traded freely, similar to ordinary commercial goods, and thus, it establishes a written notification and approval method, procedure of Prior Informed Consent [PIC] for all cross-border movements of perilous wastes. The PIC is essentially a human health and ecological protection measure based on the principles of precaution, prevention and transparency. Under this system, Parties to the Convention are prohibited from exporting perilous wastes except the State of trade-in has already consented to the shipment in writing. Furthermore, the State of trade-out cannot approve a perilous waste transfer except it has received prior confirmation of the existence of a contract between the exporter and disposer from the State of trade-in, ensuring the Environmentally Sound Management (ESM) of the wastes in question.

The strictly controlled trading regime established by the Convention applies to perilous wastes, which are defined as those wastes listed in Annexure I,

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223 Ibid.
VIII of the Convention, except they do not exhibit one of the characteristics listed in Annexure III. Wastes that do not appear in these Annexures except are defined as perilous wastes under the domestic law of an exporting, importing or transit nation. A contracting Party to the Basel Convention has also recognized with these parameters.

In addition to imposing a higher level of ecological legal liability on exporters, importers, transit nation waste dealers and government authorities with respect to transfers of perilous wastes, the Basel Convention establishes precise circumstances under which Parties are authorized to engage in perilous waste transfers. The Convention clearly discourages the trade-out of perilous waste for clearance, limiting such transfers to when a contracting Party is incapable of handling the waste in question in an ecologically effective manner inside its own territory. Even, the trading regime allows perilous waste transfers between contracting Parties for the purposes of remanufacturing and resurgence. While a 1995 amendment to the Convention, the Basel Ban Amendment prohibits the movement of perilous wastes for the purpose of remanufacturing and resurgence from OECD nations under the Basel Convention to non-OECD nations. It has yet to come into force. In all cases that perilous waste transfers are permitted, the Convention requires that they must be managed in an ecologically effective manner. This method must be clearly established before the release of a shipment from the exporting State. Of course, the Basel Convention’s restrictions apply only to definitions of perilous waste contained in or recognized by the treaty. As such, any control over cross-border movements of EEE or e-wastes depends on whether or not these material categories are recognized as perilous waste under the Convention. As discussed below, the extent to which EEE and e-wastes are controlled under the Basel Convention remains a legally contentious aspect of the treaty.

224 The Basel Ban Amendment has been implemented in certain regional and national legal instruments, except has yet to enter into force at the international level.
225 Article 6(3)(b), Basel Convention
E-wastes listed in Annexure VIII of the Basel Convention are considered perilous waste. Annexure IX of the Convention makes a further clarification regarding e-waste, listing those material categories that are not controlled as perilous wastes. The last paragraph of Entry B-1110 in Annexure IX introduces an important regulatory exemption with respect to EEE, stipulating that when destined for direct re-use, electrical and electronic assemblies and their elements do not fall under the definition of perilous waste. Hence, when destined for clearance or remanufacturing, EEE assemblies and elements constitute perilous waste and they are subject to cross-border movement restrictions outlined in the Basel Convention as the PIC procedure. Even if, when intended for re-use, these resources are not recognized as perilous waste in a few cases, they may even qualify as regular commercial goods. Thus, they remain exempt from all perilous waste controls. The broad definition of re-use which is provided inside Annexure IX furthermore suggests that material for ‘direct re-use’ does not only include functioning equipment, except it may very well include electrical and electronic assemblies and elements in need of repair, refurbishment or upgrading except not foremost reassembly. Annexure IX additionally states, “In few nations these wastes destined for direct re-use are not considered wastes”. These under acknowledged footnotes of Annexure IX can be pinpointed as the source of the Convention’s obscurity regarding the distinction between goods and wastes. Even if Annexure IX clearly represents the attempt of Member States to uphold the social, financial and ecological benefits of EEE (Electrical and Electronic Equipment) re-use and also to recognize the important role of access to affordable know-how for international development. The terminology of the Annexure IX ultimately creates an incomplete regulatory framework, which provides little safeguard against cross-border e-waste pollution.226

226 Sabaa A. Khan, McGill University, “Differentiating EEE (Electrical and Electronic Equipment) Goods and Wastes: Recent Developments and future possibilities under the Basel Convention”
5.2.1. The Technical Guidelines

In order to facilitate further clarity on the distinction between UEEE (Used Electrical and Electronic Equipment) and e-waste, the Basel Convention Open Ended Working Group (OEWG) has been working on the adoption of Technical Guidelines on cross-border movements of e-waste and used electrical and electronic equipment, in particular regarding the distinction between waste and non-waste under the Basel Convention.

Technical guidelines are meant to advise Basel Parties on the basic standards for ESM as they are understood within the Convention. The main objectives of the UEEE Guidelines are to facilitate guidance on the provisions of the Convention that are relevant to cross-border movements of e-waste and clarify the distinction between waste and non-waste in the context of EEE (Electrical and Electronic Equipment) moved across borders. The UEEE Guidelines also aim to offer general guidance on the cross-border movements of e-waste, on international transfers of used equipment and on the enforcement of control mechanisms established by the Convention. Even, that Technical Guidelines have no legal authority.

5.2.2. Distinction between waste and non-waste

The governance framework proposed by the UEEE Guidelines, which attempts to prevent international regulatory exemptions on cross-border flows of UEEE for re-use from continuing to facilitate opportunities for illicit e-waste trading, rests on the mandatory functionality testing of all UEEE destined for cross-border movement. The Guidelines recommend that a number of documents accompany all shipments of UEEE intended for direct re-use in order to prove claimed intent and that these documents be provided by the holder of UEEE to any authorities upon request.227 The UEEE Guidelines also facilitate material,

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227 Article 24, Basel Convention
physical, pricing and EEE (Electrical and Electronic Equipment) market criteria under which a shipment should be considered waste as opposed to UEEE.228

In introducing a governance framework whereby the re-use ability of UEEE must be proven in the course of mandatory functionality testing before trade-in. The UEEE Guidelines respond directly to the definitional ambiguity of Annexure IX of the Basel Convention. Functionality is presented as the key variable in determining whether an international shipment of UEEE should be subject to the waste control mechanisms. The problem that has been signaled with such an approach is the implications it entails for return to manufacturer industry systems that engage a world-wide repair and refurbishment segment. It is argued that if shipments of non-functioning objects sent back to the manufacturer for repair or refurbishment were controlled as waste, this could prompt complex, costly and lengthy notification and consent controls that may deeply affect the solvability of these systems.229 The UEEE Guidelines facilitate an exception for cross-border movements of end-user goods under warranty, as well as for warrantee and non-warrantee objects for professional use.230 Even, the exception does not apply to a vast range of non-warranty EEE (Electrical and Electronic Equipment), namely any object designed for both private household and office use. The Researcher strongly feels that such transfers, while intended for the purposes of re-use, would be treated as ‘waste’ transfers and the objects in question would have to comply with the strict procedural controls of the Basel Convention if it met the perilous waste definition as prescribed by the Convention.

228 Article 25, Basel Convention
229 Phillips estimates the proposed guidelines would engender an added outlay of 500 million Euros annually to health care providers, and disrupt medical equipment servicing world-wide. See Philips, Philips comments on (Sept. 28, 2012) draft Technical Guidelines on Transboundary Movements of Electronic and Electrical waste.
230 The UEEE Guidelines define equipment for professional use as only encompassing equipment that is designed solely for professional or commercial use (medical equipment, hefty copying machines). This does not include equipment that would also likely be used in private households (personal computers and mobile phones, small copying machines).
In this respect, the prospective technical guidelines risk imposing latest administrative and financial requirements on current EEE (Electrical and Electronic Equipment) production, utilization and servicing models that involve world-wide distributed repair and refurbishment networks. Institutional and individual end-users would be required to label their objects intended for repair and re-use as ‘waste’ and repair or refurbishment services receiving the object. These services would have to hold waste handling licenses or special permits in order to receive the equipment. Furthermore, repair and refurbishment services operating in non-OECD nations would be prohibited from receiving objects from OECD nations, as various international and regional agreements and national laws prohibit cross-border waste shipments from OECD to non-OECD nations. The viability of the international repair and refurbishment segment, an essential element to sustainable digital development, would be put at risk. Ultimately, EEE (Electrical and Electronic Equipment) industry models that encourage repair and refurbishment over the production of brand new objects would be rendered economically inefficient, with waste minimization and resource conservation goals severely undermined.

While the fulfillment of world-wide climate protection and resource efficiency objectives, as well as the attainment of the Millennium Development goals, rely on the instilment of a digital culture in which re-use, repair and refurbishment are encouraged, prioritized and optimized, stricter measures are urgently needed to combat e-waste trafficking. Governance frameworks intended to protect human and ecological health need to be designed in a way that does not mischaracterize sustainable, world-wide distributed industry networks as sites of unlawful activity by sheer virtue of their geography. As such, it has been suggested that the cross-border movements of a strictly limited stream of non-functioning EEE (Electrical and Electronic Equipment) may be transferred as non-waste under the UEEE Guidelines. Basel Parties and other relevant
stakeholders have proposed exceptions to the proof-of-functionality documentation requisite under Article 24.

5.2.3. Non-functioning EEE (Electrical and Electronic Equipment) as non-waste

The range of equipment and the scope of geographical restrictions are the two main aspects in debate regarding allowable exceptions to proof-of-functionality documentation requisite under Article 24 of the UEEE Guidelines. In their current wording, the UEEE Guidelines facilitate that all objects under warranty and all objects for professional use that is transported across borders within an industry-to-industry framework to the manufacturer or a third party acting on their behalf should not be controlled as waste. So long as the object is appropriately packaged and a declaration from the holder states that the object is not considered waste in any of the nations involved in the transaction.

5.2.3.1. Objects under warranty

With respect to objects under warranty, the European Union (EU) has proposed that exceptions should only apply inside the context of industry-to-industry transfers. A disputed aspect of this approach is that individual end-users shipping their objects under warranty directly to manufacturers for repair and refurbishment would have to declare the object as waste. This requirement could inhibit end-users from extending the lifecycle of their UEEE. This could significantly disrupt currently world-wide infrastructures of return-to-manufacturer systems. The researcher suggests for the elimination of the industry-to-industry criterion, such as the widely supported joint proposition by BAN and the United States, under which shipments by individual customers of their own defective object under warranty for repair or refurbishment would not be subject to cross-border waste controls. Similar guidance documents on the cross-border movement of mobile phones and of computing equipment also developed in the
context of the Mobile Phone Partnership Initiative (MPPI) and Partnership for Action on Computing Equipment (PACE), both exclude objects under warranty from the Basel Convention’s scope of application.

5.2.3.2. Non-warranty equipments

Stakeholders involved in the development of the Guidelines have also taken various positions on which streams of non-warranty objects intended for re-use should be allowed to cross borders as non-waste. Article 26(b)(ii) of the UEEE Guidelines is meant to facilitate clarification in this regard. According to one approach, only transfers of non-warranty equipment for professional use sent to the manufacturer or a third party acting on their behalf would be categorized as non-waste. Hence, a massive range of objects that is used in both individual end-user and industry environments will be excluded. The European Union (EU), in supporting this approach, has also proposed a geographical restriction consistent with the Basel Ban Amendment, according to which shipments of non-warranty UEEE for professional use from Annexure VII to non-Annexure VII nations would be prohibited. In contrast, Japan has proposed that both these limitations be lifted. The proposal by the Information Technology Industry (ITI) and European Coordination Committee of the Radiological, Electro medical and Healthcare IT Industry (COCIR) groups reflects a middle ground between the two extremes, creating an exception for all manufacturer related used objects flows without imposing geographical restrictions, except maintaining a prohibition on Annexure VII to non-Annexure VII transfers to independent third party services.

The vital point here is whether the text that is eventually adopted refers to ‘used equipment for professional use’ or to the much broader category of ‘used equipment’. If only a narrow exception for equipment solely designed for

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231 PACE Guidelines and MPPI Guideline
professional use is agreed upon, massive quantities of non-warranty office automation and end-user electronics will have to be labeled as waste when exported for repair or refurbishment.

Several Basel Parties and other stakeholders have expressed concern over the industry-to-industry requirement, predominantly over the implications of a Geographical restriction.\textsuperscript{233} Singapore, for instance, has expressed its view that all UEEE sent to manufacturers or third parties acting on their behalf, for repair or refurbishment under a valid contract for re-use do not qualify as waste.\textsuperscript{234} The Government has also emphasized its position on geographical restrictions, stating that all nations with appropriate legal infrastructure, technological skill and resources should not be prohibited from importing or exporting UEEE for repair and refurbishment.\textsuperscript{235} Similarly, Malaysia has expressed opposition to geographical limitations.\textsuperscript{236}

Companies and industry associations in the IT and medical devices sectors have indicated their apprehension over the important financial and social consequences that a narrow range of exceptions under Article 26(b) is likely to entail for currently established manufacturer related, world-wide repair and refurbishment networks.

In particular, Digital Europe, which represents more than 10,000 companies in the European digital know-how segment has drawn attention to impending impacts on the world-wide IT and communications industry. There it estimates that approximately 15 to 20 million repairs and refurbishments are performed each year, often implicating cross-border transfers to specialized repair and refurbishment centers in non-OECD nations. These impending impacts

\textsuperscript{233} In addition to the exceptions being proposed on warranty and professional non-warranty equipment, the UEEE Guidelines also include exceptions on defective medical equipment sent to the manufacturer for root cause analysis under a valid contract (26(b)(iii)) and off-lease equipment shipped by the lessor or third party acting on their behalf with the intention of re-use (26 (b)iii). No geographic limitations have been attached to these exceptions.

\textsuperscript{234} Comments from Singapore submitted on (Feb. 28, 2013)

\textsuperscript{235} Ibid.

\textsuperscript{236} Comments from Malaysia submitted on (Nov. 9, 2012)
include increased e-waste generation in the course of shortened artifact lifecycles, the impending closure of centralized repair services in non-OECD nations. Also, a marked decrease in manufacturer’s abilities to meet increasing world-wide require for affordable used IT tool, medical devices and service parts. From an artifact lifecycle perspective, the problem is that because institutional and individual end-users may be unwilling to assume time consuming notification procedures related to the shipping of waste. This may lead to replacement of UEEE by new goods at a heightened pace, causing an increase in raw resources extraction for the purposes of manufacturing.

Evidently, obligations of Parties to Basel are to make sure the minimization of perilous wastes would be undermined by any mechanism that expedites the designation of UEEE as waste without due consideration to impending value for re-use, either direct or based on ecologically effective repair and refurbishment operations. In this respect, it is important that the guiding principles of the Strategic Framework for the Implementation of the Basel Convention for 2012-2021, which includes the recognition of a waste management hierarchy that takes into account lifecycle thinking. Furthermore, the promotion of guiding principle tools which encourage “the recognition of wastes as a resource as appropriate”, as well as “sustainable utilization and production”.

The challenge, from a sustainable development perspective, is to support legitimate, transparent and ecologically effective international trade flows for re-use. Even closing the regulatory lacunae contained in Annexure IX of the Basel Convention and ensuring the ESM of all wastes generated in any cross-border movement of UEEE. An effective trade strategy would recognize the sustainability interests in allowing ecologically liable and accountable entities to maintain their world-wide repair and refurbishment networks. While simultaneously targeting high risk, unlawful cross-border movements of e-waste masked as UEEE. The ITI or COCIR proposal implements such an approach by focusing geographical restrictions onto the precise actors known to be involved in
unlawful cross-border movements.\textsuperscript{237} Even, such a strategy also contradicts the interests of independent third party services located in non-Annexure VII nations who may view themselves apart from the world-wide repair and refurbishment segment, without any consideration as to their ESM capacity. Indeed, this is the general argument made against the Basel Ban amendment and the dichotomous grouping of nations under the Convention, which does not take into account the particularities of their domestic resource resurgence and waste management industries.\textsuperscript{238}

While numerous Basel Parties, both Annexure VII and non-Annexure VII and private segment stakeholders affirm the need to allow certain exemptions on functionality testing, concern has been raised over the legality of any cross-border movement of non-functional or untested equipment as non-waste. The NGO, Basel Action Network (BAN), for instance, argues the Convention provides no legal basis for exceptions to its definitions of waste.\textsuperscript{239} Even, the framework of the Convention may be too ambiguous to reach at this conclusion with clarity. The UN Convention on the Law of Treaties provides that treaties should be interpreted by their preamble, text, annexes and subsequent agreements between the Parties and the subsequent practice of the Parties to the Convention.\textsuperscript{240}

The adoption of technical guidelines is a necessary practical measure for the effective execution of the Basel Convention and it is meant to orient the practice of States in regards their obligations under the treaty. If the Basel Convention were definitely clear on the waste status of non-functional EEE (Electrical and Electronic Equipment), there would be no need for technical guidelines on the distinction between waste and non-waste EEE (Electrical and Electronic Equipment). It is precisely because the Convention is not explicit in

\begin{itemize}
\item \textsuperscript{237} Interpol (2009); Bisschop (2012); UNODC (2013)
\item \textsuperscript{238} Kreuger (1998)
\item \textsuperscript{239} BAN, “Preventing the Digital Dump: Ending Re-use abuse”, http://www.ban.org (Visited on Sept. 10, 2014)
\item \textsuperscript{240} Article 31, UN Convention on Law of Treaties
\end{itemize}
this respect and that important definitional parameters were not originally set inside Annexure IX, that technical guidelines are required.

Another aspect which further complicates the issue of legal clarity is that the Convention defines wastes in relation to ‘clearance’, which in turn, is defined as any operation specified in Annexure IV of the Convention. Notably, repair, refurbishment and upgrading are not listed as Annexure IV operations, even if they may well entail a few form of clearance. In essence, the Basel Convention does not facilitate a consistent or clear legal basis on which to differentiate cross-border movements of waste and non-waste, other than referring to national legal definitions. Even, national legal interpretations of the Basel Convention differ so widely, that achieving a common understanding with respect to the terminologies used in the Convention and predominantly on the distinction between waste and non-waste, has been identified as the leading objective of the latest 2012-2021 Strategic Framework for the execution of the Convention.

Many Basel Parties have already developed or are in the method of emerging, objective criteria which would determine when UEEE for re-use is to be regulated under the Basel Convention. Even, other Basel Parties have adopted a much stricter approach. Colombia, for instance, unanimously treats all cross-border movements of used and end-of-life electronic objects as movements of perilous waste subject to Basel control procedures.\(^{241}\) Ultimately, Parties to the Convention have exclusive competence to decide which resources should be designated as perilous waste inside their jurisdictions. Even, the relevant authorities of exporting States are not always familiar with the importing nation’s perilous waste classification lists. A State of trade-out, in which a certain material is not considered perilous, might not control a shipment as perilous waste, even if the material may well be destined for a State where it is defined as perilous.

On the other hand, Annexure IX of the Convention makes way for national differences regarding re-use, the terminology used is too wide, resulting

in a regulatory lacunae that facilitates e-waste trafficking. It is clear that effective execution of the Convention rests significantly on the further clarification of reuse, in part in the course of the development of the UEEE Guidelines. In the course of drafting these technical guidelines, Parties to the Convention are not bound by the Conventions original definitional limitations. Rather, they are presented with an opportunity to clarify execution of the treaty to enhance its relevance to contemporary social, financial and ecological realities. The worldwide agenda to promote lifecycle thinking is to establish systems of extended manufacturer liability and encourage sustainable international linkages in the UEEE chain.

This could mean regulating wastes not exclusively by their nature, except also with respect to the phase of transparency and accountability of the contractual relations to which they are attached. Trade restrictions are unlikely to offer a real remedy to the problem of e-waste pollution currently faced by emerging nations, predominantly if they are not based on empirical knowledge of real global UEEE markets and transnational trading networks.

5.2.4. Effectiveness of the UEEE Guidelines

Current knowledge of unlawful cross-border movements of e-waste indicates that success in eliminating traffic depends mainly on the inspection and enforcement capacity of customs authorities and the extent of their collaboration with ecological protection agencies, police authorities and other relevant national and international stakeholders. This knowledge is reflected in Article 25 of the UEEE Guidelines, which provides the vital investigative points for enforcement authorities to detect waste shipments. Evidently, the suppression of e-waste trafficking will require strengthened institutional commitment on behalf of all contracting States in inspection and enforcement capacity building.

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242 Interpol (2009); EEA (2009); IMPEL (2006)
Even if the UEEE Guidelines clearly stipulate their non-application to objects collected from take-back programmes, it is nevertheless important to note how the technical guidelines synergize with world-wide efforts in the area of extended manufacturer liability. Across the globe, various jurisdictions have adopted extended manufacturer liability law in an effort to curb the ecological impacts of EEE (Electrical and Electronic Equipment). One of the main challenges to manufacturers in this respect has been the leakage of both UEEE and e-waste to independent third party entities, which are not legally obliged to finance the assortment or handling of used goods.

As per the UEEE Guidelines, this has the impending to contribute significantly to reducing waste leakage into unaccountable trading networks by effectively eliminating the possibility for non manufacturer entities to move non-functional UEEE across borders. Providing exceptions that favour manufacturers or manufacturer related entities exclusively reveal impending trade discrimination issues. From an ecological perspective, there appears to be no clear justification for allowing manufacturers or entities contracting on their behalf to engage in cross-border movements of UEEE without requiring them to facilitate documented proof that wastes generated from their operations will be managed via ecologically effective methods. The imposition of such a requirement may further foster a phase playing field between manufacturers, raising the base-line standard for downstream corporate social liability. In essence, any prospective international governance framework should support cross-border movements of UEEE for re-use taking place inside closed loop and ecologically effective industrial systems, be they world-widely distributed or not.

While the UEEE Guidelines were considered at the 11th Conference of the Parties 11 (COP 11) in Geneva, Parties to the Convention ultimately failed to reach consensus on Article 26(b). Among the salient issues raised at COP 11 with regard to e-waste and UEEE regulation was the pressing need for linkage between
the governance framework in adoption and ‘real-global’ contexts.\footnote{243} Evidently, a lifecycle approach to e-waste management at the international phase, which prioritizes repair and re-use over remanufacturing. This cannot be elaborated without further knowledge on the characteristics of existing local markets for UEEE and further enhancing traceability, transparency, accountability and international cooperation along the reverse supply chain. Even if the contact group established at COP 11 to address technical matters prioritized the issue of the UEEE guidelines, the only consensus reached pertains to the method for ongoing work. By virtue of decision United Nations Environment Program,\footnote{244} Basel Parties have included development of the e-waste guidelines in the work programme of the OEWG for 2014-2015 and requested information from all relevant stakeholders, specifically on the current practices and issues related to Article 26(b), that is, to situations where UEEE should normally be considered waste or not. The decision also calls for the publication of a revised draft of the technical guidelines.

After citing international legal framework, the researcher strongly feels that Basel Ban amendment and UEEE guidelines must be adopted by every nation unanimously so as to curb problem of cross-border movement of e-waste. Regarding question of UEEE, Product Identification System for labeling and strict penal provisions and effective customs in developing nations especially China, India and South Asian countries, is recommended. Furthermore, the researcher supports the international conventions and holds that effective implementation of guidelines prescribed by international conventions must be effected in national laws of every nation. Without the global awakening, unanimous standards on e-waste, stringent policy and punishment, control of e-waste pollution is difficult.

\footnote{243}{IISD (2013)}
\footnote{244}{(UNEP)/CHW.11/CRP.22}
5.3. Positive impacts of RoHS (Restriction of Hazardous Substances) Directives

Restrictions on hazardous substances or perilous substances have been proved to be a vital and effective measurer to control problem of growing e-waste pollution across the world.

5.3.1. Direct impact of RoHS Directives on environment

Four ecological and human health effects due to the execution of the RoHS Directive were identified:\textsuperscript{245}

1. RoHS means restriction of hazardous compounds in the production stage of EEE (Electrical and Electronic Equipment). According to Arcadis, the use of hefty amounts of lead, cadmium and hexavalent chromium for manufacturing was avoided, for instance due to modifications of the composition of TVs, PCs and refrigerators. This implies a decrease in the need for restricted compounds and of emissions in the supply chain and consequently of the impacts of manufacturing on environment and health.

2. Decrease in human toxicity impending and eco-toxicity impending of EEE (Electrical and Electronic Equipment) in the course of the diverse ecological compartments similar to air, fresh water and terrestrial. For cadmium and hexavalent chromium, it seems that the RoHS Directive impact has been the heftiest on the human toxicity impending via the air compartment. For lead and mercury, the impacts on the human toxicity impending via the soil and fresh water compartment are also relevant.

3. Reduction of the Octa BDE volatilization losses. Brominated flame retardants (BFR) such as Deca BDE and Octa BDE tend to volatilize from goods during service life,\textsuperscript{246} which may impact the environment and

\textsuperscript{245} Arcadis (2008), Perrine Chancerel, Karsten Schischke, “Nationwide Impacts of Substance Restrictions of ICT Equipment”, StEP(Solving the E-waste Problem)
\textsuperscript{246} JRC (2002)
human health. The RoHS Directive has a positive effect on the Octa BDE volatilization losses.

4. Decrease of the waste emissions being disposed to the environment. It is projected that the yearly amount of waste avoided being disposed to the environment will be 89,800 tonnes of lead, 4,300 tonnes of cadmium, 537 tonnes of hexavalent chromium, 22 tonnes of mercury and 12,600 tonnes of Octa BDE, as a consequence of the substance restrictions in the latest goods. Even if, these numbers have to be considered with caution for the following reasons:

- They are time dependant, there is a time delay between bringing on the market of RoHS compliant goods and waste generation,
- They depend on the remanufacturing methods applied to treat the waste material, and
- They also do not take into account the substitution resources, which is similar to the restricted resources require adequate remanufacturing to limit the negative direct and indirect ecological impacts.

The elimination of lead in the course of the introduction of the lead-free solders has a small effect on the ecological impact of the metal production system as a whole.\(^\text{247}\) The reason is that solder for electronics before the execution of the RoHS Directive accounted for only 1.5 percent of the lead production. The assortment of data on the impacts of the RoHS Directive is challenging, due to the following reasons:\(^\text{248}\)

1. There is little information regarding the quantities of perilous compounds used in EEE (Electrical and Electronic Equipment) before RoHS and it is

\(^{247}\) Reuter & Verhoef (2004)  
\(^{248}\) COM (2008)
not possible to elaborate a realistic scenario on what the current situation would have been if RoHS had never existed.

2. There are uncertainties regarding the quantities of restricted compounds contained in EEE (Electrical and Electronic Equipment) currently placed on the market. Manufacturers point out that it is very difficult to know exactly the artifact composition in particular when it incorporates thousands of elements from a long supply chain stretching around the globe.

3. There are uncertainties regarding the quantities of EEE (Electrical and Electronic Equipment) placed on the European Union (EU) market.

4. It is not always easy to determine to which extent the reduction of the perilous compounds in EEE (Electrical and Electronic Equipment) can be attributed to RoHS or is due to other factors as well, such as technology changes. For instance, shift from cathode ray tube TVs to flat screen TVs, end-user preferences or other European Union (EU) legal acts.

The ecological impacts of the RoHS Directive do not only affect the European Union primarily because a hefty proportion of the EEE (Electrical and Electronic Equipment) sold in the European Union is produced outside Europe and the non-European manufacturers had to adapt their manufacturing. This possibly reduced the amounts of restricted compounds emitted locally during manufacturing to the environment, for instance the composition of production waste. Furthermore, a few manufacturers modified the artifact plan and the production systems not only for the goods intended to be sold in the European Union, except for their whole production. So that RoHS compliant elements or goods are placed on markets outside the European Union as well. This is also confirmed by the claims made by several brand name end-user electronics and IT manufacturers, as compiled by Greenpeace for their ‘Greener Electronics’ ranking of companies. Finally, the handling of WEEE by European Union (EU) Member
States partly takes place outside Europe. The execution of the RoHS Directive may reduce the hazardousness of WEEE and consequently, the hazardousness of the emissions related to remanufacturing and clearance of WEEE. Unfortunately, no data is available on the international impacts of the execution of the RoHS Directive.

5.3.2. Substance substitutions is the result of RoHS Directives

The execution of the RoHS Directive resulted in the substitution of the restricted compounds by non-restricted compounds. RoHS Directives can be coined as an approach which is aimed at solving e-waste problem at root-cause level. It provides for use substitute non hazardous elements in production of EEE and prohibits use of hazardous elements.

5.3.2.1. Lead-free solders

To meet the requirements of RoHS, the printed circuit board industry had to move away from lead containing solders and surface finishes, on printed circuit boards and element’s contacts, to alternative resources. Even, the electronics industry did not adopt a universal alternative. The alternatives for surface finishes include organic solder ability preservatives i.e., electro less nickel or immersion gold, immersion silver and immersion tin.\textsuperscript{249} In 2004, lead containing soldering retained 55 percent market share of the final finishes used in manufacturing of printed circuit boards and this world-wide market share was projected to have decreased to 37 percent in 2008. According to a recycler of production waste of the electronics industry in Malaysia, the use of substitution resources during production is continuously evolving, the recycler first observed a decrease of the lead content in the production waste associated with an increase of the content of expensive metals, predominantly palladium and after a few months a decrease of

\textsuperscript{249} Vander Pas (2007)
the expensive metals content due to the use of extra resource efficient manufacturing methods.

The ecological impacts related to the use of substitutions to replace the restricted compounds have not been extensively investigated. Some studies looked into the effects of lead substitution.\textsuperscript{250} Besides the positive ecological effects of lead substitution in solders, predominantly on its toxicity, the use of alternative resources similar to tin, copper and silver to substitute lead in solders also has negative ecological effects over the artifact life cycle. For instance, on energy utilization, resource depletion, photochemical smog and air particulates are the possible consequences. As the discussion on the ecological impact of lead-free soldering is very complex, ambiguous and still ongoing, no definitive conclusion can be drawn on this topic.

The execution of the lead restriction hardly changed or did not change at all, the production volumes of the bulk metals similar to lead, zinc or copper. In contrast, the lead substitution drastically increased the need for and production of metals similar to bismuth and tin, which production volumes are much smaller.\textsuperscript{251} The variations of the use of metals replacing lead containing solders can be investigated based on the example of silver. The world-wide use of silver for fabrication of EEE (Electrical and Electronic Equipment) has strongly increased in the years 2001 to 2007.

A comparison to the world-wide trade statistics, for instance, the semiconductor market shows parallel trends i.e., increase in the years 2001 to 2007 and decrease in 2008 and 2009.

The variation of the use of silver to manufacture electrical and electronic equipment is consequently explained by financial fluctuations. Even if, the replacement of the lead free solders possibly played a role, since a strong increased use of silver in the years around the adoption of the RoHS Directive

\textsuperscript{250} Arcadis (2008); Deubzer (2007); Reuter & Verhoef (2004); United States of America EPA (2005)  
\textsuperscript{251} Reuter & Verhoef (2004)
from 2004 to 2007. The increase of the silver use was predominantly strong in Japan in 2004, which was 26 percent more as compared to 2003. This is probably a consequence of the voluntary agreement of manufacturers, called Japanese Electronics Information Technology Industries Association's (JEITA) lead free roadmap. The JEITA lead free roadmap required the complete supplying of lead free elements by 1 January 2005 and the complete lead elimination in IT equipment by 1 January 2006.

5.3.2.2. Flame retardants

The ecological impacts of substitution options for brominated flame retardants are currently being investigated in the frame of the ENFIRO project.²⁵² A practical approach is followed in which the alternative flame retardants are evaluated regarding their flame retardant properties, their influence on the function of goods once incorporated and their ecological and toxicological properties. The outcomes of the project will be a comprehensive dataset on viability of production and application, ecological and human safety and a complete life cycle assessment.

Three flame retardant (FR) artifact combinations were selected for case studies i.e., metal based FRs, phosphorous based FRs and nano clay based FRs in printed circuit boards, paints and foam. The case studies will facilitate recommendations for industrial and governmental stakeholders and will be useful for similar substitution studies, for instance, under the REACH Directive.²⁵³ So in total, impact RoHS Directives is positive but it has not yet measured and it is difficult also. Following table shows the substituted elements by RoHS Directive.

²⁵² ENFIRO, a European Commission-funded project offers a prototypical case study on substitution options for precise brominated flame retardants (BFRs). The project delivers a comprehensive dataset on viability of production and application, ecological safety, and a life cycle assessment of the alternative flame retardants (FRs).
²⁵³ Registration, Evaluation and Authorization of Chemicals, EC 1907/2006
**Table XII- Substitutions of the hazardous compounds restricted by the RoHS Directives**

<table>
<thead>
<tr>
<th>Restricted compounds</th>
<th>Application</th>
<th>Substituting Resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lead</td>
<td>Solders</td>
<td>Mixtures containing tin, silver, copper, bismuth, zinc, organic solder ability preservatives, nickel, antimony, gold or palladium</td>
</tr>
<tr>
<td>Cadmium</td>
<td>Plastic colouring</td>
<td>Other colouring resources</td>
</tr>
<tr>
<td></td>
<td>Contacts</td>
<td>Silver-Nickel (AgNi), Silver-Tin-Oxide (AgSnO2)</td>
</tr>
<tr>
<td>Mercury</td>
<td>Switch</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sensor</td>
<td>Other metals or metal alloys (e.g. gallium alloy)</td>
</tr>
<tr>
<td></td>
<td>Contacts</td>
<td></td>
</tr>
<tr>
<td>Hexavalent Chromium</td>
<td>Pigment</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Anti-corrosion</td>
<td>Trivalent chromium, tungsten carbide</td>
</tr>
<tr>
<td></td>
<td>agent</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Plating</td>
<td></td>
</tr>
</tbody>
</table>
| Flame retardants,    | Flame retardants  | Changes of the combination of polymers to reduce the inflammability. Bis (penta-bromo-phenyl) ethane, ethylene bis (tetra-bromo-phthalimide), other halogenated and halogen free flame retardants similar to the phosphorous based FR resorcinol Bis (di-phenyl-phosphate) and bisphenol A
<p>| Polybrominated       | (FR) in general   |                                                                                                                                                       |
| biphenyls and        |                   |                                                                                                                                                       |
| Polybrominated       |                   |                                                                                                                                                       |
| diphenyl ether       |                   |                                                                                                                                                       |</p>
<table>
<thead>
<tr>
<th>Category</th>
<th>Flame Retardants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wire and cables</td>
<td>Aluminium-tri-hyroxide, magnesium-dihyroxide, boehmite, phosphorus flame retardants, zinc borate, phosphate esters, melamine cyanurate, melamine phosphate, red phosphorus, in tumescent goods based on ammonium polyphosphate, aluminium phosphinates, aryl phosphates (pinfa 2010)</td>
</tr>
<tr>
<td>Electronic enclosures</td>
<td>Triphenyl phosphate, resorcinol bis-(diphenyl phosphate), bisphenol A bis-(diphenyl phosphate), resorcinol bis(2,6-dixylenyl phosphate) (pinfa 2010)</td>
</tr>
<tr>
<td>Electrical installations</td>
<td>Metal phosphinates (often combined with N-nynergists), Inorganic Metal phosphinates, Melamine Polyphosphate, Melamine cyanurate, Red phosphorus, Aryl phosphates and phosphonates, Magnesium hydroxide, Ammonium polyphosphate in combination with nitrogen synergists (pinfa 2010)</td>
</tr>
<tr>
<td>Printed wiring boards</td>
<td>Aluminium Trihydroxide, Aluminium monohydrate, metal phosphinates and polyphosphates, DOPO (Dihydrooxaphosphaphenantrene), Poly(1,3-phenylene methylphosphonate) (pinfa 2010)</td>
</tr>
</tbody>
</table>

### 5.3.3. Effects of substitution on remanufacturing

Following two changes in artifact compositions caused by the execution of the RoHS Directive are reported:

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254 Danish EPA (2006); Rossi & Heine (2007)
1. Modification of the material composition of electronic as a consequence of the replacement of lead containing solders by lead free solders, for instance tin and silver.

2. Use of other flame retardants to replace polybrominated biphenyls and polybrominated diphenyl ether.

The elimination of lead from electronics goods may have increased their remanufacturing value, because lead substitutes such as silver have considerable value.\textsuperscript{255} The higher financial value of the lead-free solders can facilitate an incentive for increased remanufacturing of the electric and electronic scrap and a reduction in remanufacturing outlay.\textsuperscript{256}

European remanufacturers reported changes of the lead and tin ratio in end-of-life electronic resources over the past years, i.e. an increase in the tin content in the end-of-life printed circuit boards. Tin does not pose a problem in copper smelters where printed circuit boards are primarily recycled. Even if, an increased content of bismuth in lead-free solders may lead to challenges for the remanufacturing of electronic scrap in copper processing. Some of the bismuth in the feed of copper smelters may follow the copper smelt and contaminate the cathodes. Some smelters currently are not able to separate this bismuth from the cathodes. Other methods can separate the bismuth after the copper furnace. For instance, Umicore, a smelting facility in Belgium can improve copper, tin, antimony, bismuth and other lead-free solder elements.\textsuperscript{257}

The consequences of the use of non restricted flame retardants for the printed circuit boards and the other plastic parts of the goods on the remanufacturing methods were not investigated. An adaptation of the remanufacturing methods may be necessary to consider the changes in the material composition.

\textsuperscript{255} Turbini et al. (2000)
\textsuperscript{256} Reuter & Verhoef (2004)
\textsuperscript{257} Hagelukan (2008)
To conclude, research gaps remain to better and more comprehensively understand the consequences of the material substitutions on e-waste remanufacturing. Because the lifetime of electronic goods often exceeds five years, e-waste remanufacturers are mainly treating end-of-life goods that were manufactured before the execution of the RoHS Directive, and consequently that are not RoHS compliant. The massive arrival of ‘RoHS compliant e-waste’ to the remanufacturing services is expected in the next years.²⁵⁸

5.3.4. Economic impacts of RoHS Directives

According to a stakeholder consultation conducted by Arcadis in 2008, the total outlay incurred by the companies to comply with the RoHS Directive amount to a maximum of 59.6 million UK pounds, with a normal of 10 million UK pounds and a weighted normal of 21 million UK pounds. These figures include following outlay:

- Administrative outlay on training and information measures, assortment, organization and review of information or material declarations, exemption procedures and organizational implications causing monetary losses.
- Technical outlay related to RoHS compliance on capital expenditure, operating expenditure, research and development for all restricted compounds.

Companies are expecting an annual outlay in the future amounting to a maximum of 4.7 million UK pounds. Even, the RoHS law has also a number of positive financial impacts. For instance, the communication across the supply chain was massively increased, which is also necessary to comply with other

requirements similar to REACH\textsuperscript{259}. The equipment development and method control required for RoHS led to an increasing knowledge of solders, interfaces, processing and reliability. This resulted in an overall reduced number of defects, an increased production efficiency and functionality to end-users\textsuperscript{260}.

The restriction of metals stipulated by RoHS affects the configuration of the metal production system.\textsuperscript{261} For instance, Reuter & Verhoef in 2004 projected that switching from lead solders to silver solders may consume 6 to 9 percent of the world’s total output of silver, putting pressure on silver supplies and affecting the metal prices. Despite the higher outlay of the lead-free alternatives, an increase in the outlay of printed wiring boards was not expected, because solder accounts for such a marginal percentage of total outlay.

### 5.3.5. Other secondary effects of RoHS Directives

The question whether or not the RoHS Directive has inspired or hindered innovation is strongly contested. The main arguments of the stakeholders regarding RoHS enabled innovation are:

- Manufacturers of EEE (Electrical and Electronic Equipment) and element suppliers have been forced to develop and implement a range of innovations and technologies in order to make sure that goods are in compliance with the substance restrictions. Trankell & Sandahl in 2010 reported that the yields in printed circuit board production were improved during the introduction method of low halogen printed board resources. Another positive effect was an extra uniform specification of low halogen resources, which resulted in more robust plan. Also a better understanding of solder behaviour and properties has been put on.

\textsuperscript{259} Registration, Evaluation and Authorization of Chemicals, EC 1907/2006
\textsuperscript{260} Arcadis (2008)
\textsuperscript{261} Reuter & Verhoef (2004)
In the years around the entry into force of the Directive, significant increases in applications for patents in RoHS compliance related areas in the United States of America, Japan and Europe were observed.

Even if, the antagonists argue that:

- The innovative efforts undertaken to comply with the RoHS may have been at the expense of other broader R&D actions for artifact development.
- The avoidance of the restricted compounds may hinder the development of latest technology, as fewer resources are considered.

RoHS also supported the development of monitoring and knowledge tools to support RoHS and the pining for electronics with more benign compounds. For instance, the Clean Production Action delivers solutions to enterprises for green chemicals, sustainable resources and ecologically preferable goods. Among others, the Clean Production Action made the free screening tool ‘Green Screen for safer Chemicals’ publicly accessible. The companies similar to Hewlett Packard use such equipments not only directly for a safer management of compounds, except also to plan extra innovative goods, to improve the competitiveness and to implement marketing strategies.

5.4. Analysis of e-waste Take-Back System Design and Policy Approaches

End-of-life electronics have garnered significant interest among policymakers because they are a waste stream with a unique combination of characteristics. First, stages of end-of-life electronics or ‘e-waste’ have been increasing and are expected to continue on this path. Second, e-waste contains

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resources that are considered noxious, such as lead, mercury and cadmium, which have led to increased ecological concern regarding improper clearance of these goods. Third, there are valuable resources in e-waste and resurgence of these resources can alleviate mining of virgin resources. For instance, a metric tonne of end-of-life personal computers contains more gold than that recovered from 17 tonnes of gold ore.\textsuperscript{263}

Finally, in various cases the outlay of remanufacturing e-waste exceeds the revenues generated from the recovered resources. This is primarily due to the difficulty of separating highly commingled resources in complex goods. These concerns have led policymakers across the globe to create systems to collect and process e-waste, also known as ‘take-back systems’. The many Asian nations including Japan, Taiwan and South Korea have developed mandatory e-waste assortment laws. Furthermore, the Member States of the European Union (European Union (EU)) have recently completed transposing the Waste Electrical and Electronic Equipment (WEEE) Directive, which requires Original Equipment Manufacturers (OEMs) to be liable for the assortment of end-of-life electronics. The European Member States join other European nations, such as Norway and Switzerland that have similar programmes. North America has experienced a rapid increase in e-waste legislative activity in the past five years. As of September 2008, seventeen United States of America states and four Canadian provinces had already implemented systems or approved law creating electronics remanufacturing systems.\textsuperscript{264} Legislative activity in the United States of America is rapidly increasing. 79 pieces of e-waste law were introduced in 33 states in 2007, compared with 54 bills introduced in 27 states in 2006.

Even it is laudable that policymakers should resolve to address e-waste issues, they often lack the knowledge and practical experience required to create efficient latest take-back systems for end-of-life electronics. The current systems


\textsuperscript{264} Gast, J., “Making a Mark”, \textit{E-Scrap News} (2008) p. 24-28
are nascent and many laws were developed concurrently without the benefit of learning from existing systems. This leaves policymakers and system architects in the unenviable position of creating systems that are essentially experimental in nature. They must use guiding principle instruments that are latest and have not been well tested. A tangential result is that there is a patchwork of diverse implementations of e-waste take-back systems in various nations and regions. There is a need for a consolidated source of information on end-of-life electronics take-back system plan that would summarize plan alternatives and highlight their strengths and weaknesses. The primary objective of above findings is to address this need by providing guidance to policymakers and system architects on the guiding principle tools, configuration alternatives, financing schemes and management alternatives that may be used to operate such systems. It describes the generic structure of a take-back system, followed by details on the alternatives available to fulfill each element of the system and strengths and weaknesses of various alternatives.

5.4.1. Structure of Take-Back System

A take-back system has three main functions i.e., assortment, processing and system management. These designations refer to precise goals of the programmes and all viable systems comprehend all of these functions. The financing scheme encompasses all of the functions and enables the system to be executed. A system architect must define execution modes for these four elements, which will depend on the goals of the system. Some common goals for e-waste systems include:

- Motivate OEMs (Original Equipment Manufacturers) to improve artifact recyclability, reduce the use of noxious resources and integrate these concepts into artifact plan.
- Prevent noxious resources from entering landfills or being incinerated.
• Recover scrap resources from the goods, thereby avoiding the ecological burdens associated with producing virgin resources.
• Ensure that e-waste is processed in an ecologically and socially liable manner.
• Share liability among stakeholders.
• Motivate end-users to co-operate in collection of e-waste.
• Create an efficient and sustainable system.

A fundamental challenge in creating any system is balancing potentially conflicting goals to try and create an optimal system configuration. The technical aspects of processing e-waste are covered extensively and system architects do not typically make decisions related to these aspects, aside from generic processing requirements such as trade-out bans or ecological, health and safety guidelines. The modes described for assortment, system management and financing schemes are modular. They could be used individually or in combinations.

5.5. Criminal liability on noncompliance to e-waste laws in USA

Vigilantly, a federal grand jury in the District of Colorado indicted an ecological waste remanufacturing company, its chief executive officer, and its former vice president of operations on charges of wire and mail fraud and various ecological crimes for the company’s improper handling of e-waste in 2010. This was the first instance of indicting criminal charges against an e-waste exporter in the United States.

The indictments against Colorado based Executive Remanufacturing Inc. and two of its executives were announced by EPA’s Criminal Investigation Division and the Homeland Security Investigations unit of U.S. Immigration and Customs Enforcement. Executive Remanufacturing, an e-waste remanufacturing industry located in Englewood, Colorado with affiliated locations in Utah and
Nebraska, collects e-waste from private households, businesses, and government entities and was registered with the Colorado Department of Public Health and Environment as a “Large Extent Handler of Universal Waste”. The company was featured in an e-waste expose on CBS’s 60 Minutes News channel.  

5.5.1. Summary of the Indictment in Colorado based company’s case

The indictment includes charges for wire and mail fraud, failure to file a Notice of Intent to Export with EPA in violation of the Resource Conservation and Recovery Act (RCRA), smuggling of goods from the United States and destruction of records. Executive Remanufacturing was the exporter of record in more than 300 exports from the United States between 2005 and 2008, together with the trade-out of over 100,000 cathode ray tubes (CRTs). CRTs are glass video display elements of an electronic device, usually a computer monitor or a television and contain a hefty amount of lead.

The company and its officers were charged with defrauding industry and government entities that sought to properly dispose off their e-waste. The defendants allegedly represented falsely to customers that they would dispose off e-waste in an ecologically friendly manner, in the United States rather than overseas and in compliance with all local, state and federal laws and regulations. Contrary to such representations, the company allegedly sold e-waste to brokers for trade-out overseas to China and other nations. The ongoing 30 months investigation included cooperation from law enforcement agencies in the United States, Hong-Kong and Canada.

Penalties for a violation of the RCRA charge alone include imprisonment for up to two years and fines of up to 500,000 US dollars or 50,000 US dollars per day of the offence. A conviction for destruction of records during the course of EPA’s administrative method carries a penalty of up to 20 years in prison and a fine of up to 250,000 US dollars.

5.5.2. Significance of penal provisions in USA

The federal government’s willingness to bring criminal charges against an e-waste processor signals an escalation in the government’s ecological enforcement actions in the area of e-waste management and this change may be indicative of future criminal enforcement actions. The case certainly indicates that e-waste exports area is receiving increasing nation’s attention, consistent with USEPA’s (United States Environment Protection Agency) acknowledged guiding principle priorities. States have also begun to step up enforcement of improper clearance of e-waste. In March 2012, the Target Corporation agreed to pay 22.5 million US dollars in penalties to settle a case brought against the company by many California law enforcement agencies alleging that for years the company improperly disposed off perilous waste, together with electronics and batteries. On the international front, Canada, many European Union (EU) member states and other nations have also intensified enforcement of laws governing the trade-out of e-waste.

The prime significant e-waste litigation involving a challenge to sweep New York City artifact take-back law passed in 2008, over the objection of Mayor Michael Bloomberg. The law seeks manufacturers of end-user electronics to directly manage and pay for the assortment and remanufacturing of certain types of e-waste throughout the city, together with pickup of e-waste at end-user’s homes. Beveridge & Diamond, P.C. filed suit on behalf of a number of affected parties, together with the Consumer Electronics Association and the Information Technology Industry Council. Drawing significantly on industry expertise, the lawsuit established the burdensome nature of the latest law and highlighted its constitutional, statutory and administrative defects. The City’s law was ultimately preempted by a state law before arguments could be heard.

The New York City law is one predominantly onerous instance of a growing class of artifact take-back laws across the nation focused on end-of-life electronic goods, batteries, used carpet, paint and other end-user goods. The
Obama Administration formed the ‘Interagency Task Force on Electronics Stewardship’ in November 2010, and the task force released its report ‘National Strategy for Electronics Stewardship’ in July 2011. Legislation is also pending in Congress to further restrict the trade-out of e-waste from the U.S. to emerging nations.266

In light of the finely tuned concern regarding e-waste issues, companies managing used and end-of-life end-user electronics and IT tool would be wise to review their clearance practices, together with the practices of any entities retained to handle the remanufacturing of e-waste. In the above cited Executive Remanufacturing case, there is evidence that the recycler’s clients were affirmatively misled. Under diverse circumstances, companies doing industry with an errant clearance contractor could potentially face civil or criminal liability for conspiracy to engage in unlawful clearance practices. Electronics remanufacturers should be careful to identify and comply with applicable federal waste trade-out laws. Similar requirements in many states as well as the requirements of importing nations, many of which impose highly stringent regulation on cross-border movements of e-waste for remanufacturing than the United States has been detected.

5.5.3. Upcoming strategy of USA for e-waste management system

To embark on need of e-waste policy in USA, it is helpful to cite the following words from Abigali Barnes reports:

“Ameria’s redundant laptops and smart phones continue to wreak ecological havoc in emerging nations. Could a trade-out ban make a difference? Visit the website of Chicago based Intercon Solutions and you may think you’ve stumbled upon a paragon of the remanufacturing industry. The company claims to process electronic waste domestically,

266 The Responsible Electronic Remanufacturing Act of 2011 (HR 2284 / S1270)
adhere to strict ethical and ecological codes of conduct and emphasize transparency and accountability.”

Recent instances in USA speak, even, a diverse tale. In July 2011, this electronics waste remanufacturing centre in USA was denied to have e-Steward certification, a designation awarded to companies in the segment that demonstrate ethical, ecological and social liability, after evidence revealed the company had been shipping electronic waste overseas. It was an instance of a practice that is linked to heavy metal pollution in emerging nations and often violates the trade in laws of target nations.

China, the world’s leading rare earths manufacturer, has recently extend-back its exports of these resources. This a negative move that could push their prices up and negatively affect budding green and clean tech companies that depend heavily on rare earth imports. China, one of the heftiest recipients of e-waste, announced highly stringent regulations in June, 2011 that ban the dumping and handling of solid waste from overseas and the transfer of perilous solid waste via China. According to a 2005 United States of America industry report, remanufacturers trade-out 74 percent of used electronics for re-use, refurbishing and remanufacturing and much of this ends up in China. While China forbidden the trade-in of e-waste back in 2000. The industry has gone underground, creating a lucrative industry that profits from the dismantling of electronics and reselling of reclaimable resources.

Lead, mercury, chromium, PCBs, dioxins and polybrominated diphenyl ethers are all elements of the e-waste stream, and the dismantling of these electronics is known to pose tremendous risks to public health and the environment. Sarah Westervelt has rightly remarked on that:

“The heavy metals in e-waste are ‘immortal’, and never disappear after being dumped into rivers, air, and soil, causing endocrine disruption, and reproductive and neurological damage for various generations.”

Having electronics dismantled in places without the know-how or resources to dispose off the resources safely is one of the biggest problems with exporting waste to the emerging nations. She added further:

“Not only it is unlawful for mainly emerging nations to receive perilous electronic waste from the United States of America, except the primitive dismantling and material resurgence techniques in use are resulting in profound and permanent poisoning of human health and entire regions and water tables.”

That electronic waste continues to move in the course of grey channels has been linked to the complicit role of various United States of America electronics remanufacturing centers. This is proved as notorious for accepting waste under the pretence of liable remanufacturing and then quietly shipping it to China, India, Africa and other parts of the world, without appropriate oversight. Currently, cathode ray tubes (CRTs), found in computer screens and televisions are the only e-waste material specifically forbidden from trade-out under United States of America law, allowing for the unrestricted and legal trade-out of mainly other electronics. Glimpse of a latest headline by Sarah Westervelt:

“We’ve tracked over 200 containers, and regarding 80 percent of them is going to Hong Kong.”

James Kao explained the key concept of Business Model in context of e-waste management:

268 Sarah Westervelt, e-waste project coordinator at the Basel Action Network, an ecological advocacy group
“The standard industry model puts profit first and the environment second and it is important for the remanufacturing industry to follow a model that puts the environment first. As more people begin to embrace a western lifestyle, require for electronics will continue to grow and nations will have one of two options: to continue to dig and improve a limited supply of raw resources or to use resources recovered in the course of remanufacturing.”

James Kao’s operation emphasizes the re-use impending of electronics and offers a tracking service for clients to make sure that the electronics do not leave the United States. Kao believes passage of a uniform ban on trade out will ‘make places similar to Green Citizen a requirement rather than an option’.

Several foremost tech companies together with Dell, Hewlett Packard (HP), Samsung, Apple and Best Buy have already given formal support to the bill. Steve Rockhold has also added:

“HP does not allow the trade-out of e-waste from developed nations to emerging nations and we encourage other companies to join the effort in promoting liable remanufacturing. By making it unlawful to ship e-waste abroad, the United States of America will be joining the world-wide society in its efforts to prevent the trade-out of perilous waste to the emerging world.”

The bill is designed to accomplish the same goal as if the United States ratified the Basel Convention, a treaty designed to control the international flow of perilous waste. All other industrial nations, together with China, have ratified the Basel Convention. Except the United States of America, in spite of

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269 James Kao, founder and chief executive of San Francisco based e-waste remanufacturing company “Green Citizen”
270 Steve Rockhold, HP’s global programme manager for artifact re-use and remanufacturing
international pressure has not ratified the same. One of the supporters of the bill, Barbara Kyle has also emphasized the ethical and economical benefits:

“This is the prime important step, which our federal government can take to solve the e-waste problem to close the door on e-waste dumping on emerging nations. The law will bring remanufacturing jobs back to the United States of America.”

Critics of the bill suggested that a ban would drive the method underground and hurt affordable technology and remanufacturing in other parts of the world. In the words of Robin Ingenthorn:

“If used computer exports are outlawed, only outlaws will trade-out used computers.”

Ingenthorn argued that if both supplier and buyer are held to high standards, liable remanufacturing and electronics trade-out can go simultaneously. WR3A’s guiding principle openly acknowledges that electronics are shipped overseas and the organization provides photos and films of the conditions where remanufacturing is carried out in several emerging markets. Ingenthorn believes the answer lies not in a ban, except in fair trade policies, he added:

“A ban on exports of used computers will not help students, doctors or internet cafe owners overseas. Fair-trade guiding principle is a better approach.”

Local governments have created initiatives in the absence of federal laws. In June, 2011 the United States of America state of California collected around

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271 Barbara Kyle, Indian coordinator of the Electronics Take-Back Coalition, an ecological advocacy group
272 Robin Ingenthorn, former remanufacturing programme director for the Massachusetts Department of ecological Protection and president of the World Re-use, Repair and Remanufacturing Association (WR3A), a United States of America nonprofit
273 Global Re-use, Repair and Remanufacturing Association Policy
450 kilograms of e-waste in the course of the state’s e-waste remanufacturing programme. What happens to this waste after it is collected, even if, is unclear. A report released in July, 2011 by the White House Interagency Task Force on Electronics Stewardship acknowledged that:

“Very little is known regarding the trade flows of used electronics, together with amounts exported or trade-in and called for greater oversight, partnerships with emerging nations and ratification of the Basel Convention.”

Since the regulation of trade-out falls outside the realm of state jurisdiction, it is for the Congress to decide whether the United States of America legislates a federal ban on e-waste trade-out. Whatever the solution, it is clear from above arguments that a latest strategy is needed to manage the United State’s e-waste stream. With available space dwindling and end-users buying up gadgets in ever greater numbers, the clearance of electronic waste has become a vital issue for the environment, ethics and the economy.

A latest report from the United Nations found that global electronic waste could grow by 33 percent by 2017. In just five years, all of the world’s refrigerators, televisions, cell phones, computers and electronic devices destined for clearance or remanufacturing will grow by 33 percent.274

The mountain of used electrical and electronic devices, known as ‘e-waste’, has grown up to 48.9 million tonnes world-wide in 2012 and expected to grow up to 65.4 million tonnes in 2017. This weight is equivalent of 200 Empire State Buildings or 11 Great Pyramids of Giza.275 Ruediger Kuehr has rightly remarked that:

“Even if there is ample information regarding the negative ecological and health impacts of primitive e-waste remanufacturing methods, the lack of

275 Ibid.
comprehensive data has made it hard to grasp the full magnitude of the problem.\textsuperscript{276}

E-waste is detrimental to the environment because those goods can contain noxious compounds. When those electronic goods are burned or put in a landfill, those noxious compounds, such as mercury, cadmium and lead can seep out and contaminate ground water. The United States topped the list of the 184 nations analyzed for the total volume of e-waste generated each year at 9.4 million tonnes in 2012 followed by China, with 7.2 million tonnes. The United States might have had such a higher volume because there have been extra electronic goods put on the market in the past and consequently high, are now ready to be retired. In 2012, for instance, the United States put regarding 10 million tonnes of electrical and electronic objects on the market, compared with regarding 1 million tonnes in Canada.

Additionally, the amount of e-waste generated per person in the United States was much higher than other nations. In 2012, each person generated regarding 30,000 kilograms of e-waste in the United States, compared with 5.4 kilograms in China.\textsuperscript{277} The study conducted by the Massachusetts Institute of Technology and the U.S. National Center for Electronics Remanufacturing, found cell phones accounted for the heftiest extent of used electronics in the United States. The study’s authors recommend creating trade codes that can be used to track electronic goods. Joel Clark opined that:

“We cannot possibly manage complex, cross-border e-waste flows until we have a better understanding of the quantities involved and the destinations. This research is an important first step in that direction.”\textsuperscript{278}

\textsuperscript{276} Ruediger Kuehr, executive secretary of the U.N.’s Solving the E-Waste Problem (StEP) Initiative conducted the study
\textsuperscript{277} A separate study published in tandem with the U.N. report tracked the flow of electronic clearance and assortment across borders.
\textsuperscript{278} Joel Clark, an MIT professor
5.6. Judicial Trends on e-waste management in UK

To give effect to WEEE Directives and RoHS Directives, Legal machinery in UK has dealt stringently with violations of e-waste management laws. Some of the instances are as follows.

5.6.1. Imprisonment of exporters for perilous shipments of e-waste

Repeat waste crime offender Joe Benson was sentenced to 16 months in prison at Snaresbrook Crown Court for illegally exporting 46 tonnes of perilous electrical waste to Nigeria, Ghana, the Ivory Coast and the Congo. Broken cathode ray tube televisions and ozone depleting refrigerator freezers were found in four containers intercepted at ports by Environment Agency investigators between September 2012 and April 2013. This was the first time a defendant has been sentenced to a custodial sentence for illegally exporting waste.

Mr. Benson was previously convicted of exporting similar perilous electrical waste to Nigeria in 2011 during one of the Environment Agency’s biggest trade-out cases, Operation Boron. Even he persistent to illegally trade-out televisions and freezers to West Africa while appealing, unsuccessfully, against his previous convictions.

It was thought that Mr. Benson stood to make around 32,000 UK pounds from the trade-out of the intercepted containers. He collected the electrical waste from civic amenity sites in London and the Home Counties and took it to his licensed waste site in Walthamstow where it should have been tested for functionality and safety before being exported. He made money by collecting the waste and selling it on at regarding 8,000 UK pounds a container as well as avoiding the outlay incurred in dealing with the waste safely. Andrew Higham has rightly remarked:

“These are not victimless crimes. The rules governing the exportation of waste electrical equipment are in place for good reason, to protect human life and the environment. It is unlawful to send perilous waste to these
nations. Mr. Benson has seen fit to flaunt the rules for his own personal benefit. The Environment Agency has a specialist crime unit to track and prosecute criminals who trade out waste illegally.”

Harvey Bradshaw has also opined:

“This sentence is a landmark ruling because it’s the first time anyone has been sent to prison for unlawful waste exports as a result of our investigations. We take a zero tolerance approach to those commit waste crime, and cracking down on unlawful waste exports will continue to be a priority for the Environment Agency. We urge anyone in the waste industry to help us protect their legitimate industry and report any suspicious activity to Crime stoppers anonymously.”

Working electronics can be exported for resale and there is a legitimate market for used goods. But the law is clear it is always unlawful to send perilous electronic waste from the UK to emerging nations where it could be dumped and burnt to extract expensive metals, posing stern risks to people’s health and damage to the environment. They can contain perilous resources such as lead, phosphors and ozone depleting compounds.

Environment Agency prosecutors showed that Mr. Benson’s containers gave the impression that relevant guidelines were being met. Independent testing showed this was not the case and that the exports were unlawful. Mr. Benson entered a guilty plea at an earlier hearing. Dawson J. said:

“In my view this is a stern offence that you have committed before. The public and the global need protecting from this sort of offence.”

Andrew Higham, who leads the Environment Agency’s National Ecological Crime Team
Harvey Bradshaw, Director of regulated industry
Judge Dawson while sentencing said
To conclude this, this instance of judicial vigilance and implementation of e-waste laws in its true sense is recommended to be applied in other nations also. The problem of dumping of e-waste across the globe can be solved by such type of stringent policy and effective judicial system.

5.6.2. Fine on e-waste clearance companies for exporting dumped electronics

In another landmark instance of e-waste laws implementation, In UK, eight people were found to have been at the heart of a lucrative trade which sends tonnes of waste computers and other end-user durables to West Africa and Asia. Owners and employees of a string of waste clearance companies have been fined more than 200,000 UK pounds following Britain's heftiest investigation into the unlawful trade-out of noxious dumped electronics to the emerging world.

The eight people, whose firm’s operated across the UK, were found to have been at the heart of a lucrative trade which sends tonnes of waste computers and other end-user durables to West Africa and Asia every year to be stripped of valuable metals in grim conditions, often by children.

Thus, after citing effective legal provisions and instances of implementation of e-waste laws in UK, the researcher concludes that, though the production of e-waste per annum in UK is not so high as compared to USA, the principle e-waste generator across the globe, the e-waste legal frame work is more effective in UK as compared to USA. In USA, states are free to enact their national laws and uniformity in e-waste management law is one of the major causes of this problem. Comparatively, UK laws on e-waste are competent, effective and dynamic laws. Other nations should adopt e-waste laws in parlance with laws in UK. Secondly, the researcher feels that a lot of research and development on substitute substances used in EEE is yet to be done. There are lot of new innovative researches are going on to find out the effective substitute substances, which can replace use of perilous substances in EEE. Substitute substances can solve the problem of e-waste from the root level. It will reduce the
future expenditure on recycling of e-waste. The concept of ‘greener goods’ is the contemporary issue in this quest. The production of more ‘greener goods’ and distribution across the globe can be proved to be the ultimate step in curbing the menace of e-waste.

5.7. E-waste management in China by Baidu Partners with UN

Baidu\textsuperscript{282} and the United Nations Development Programme are hoping to streamline the remanufacturing of e-waste in China with a latest app that can help users easily sell their old electronics for cash. The Web based app called ‘Baidu Recycle Station’ was launched as part of a latest joint lab established by the Chinese company and the U.N. group. The lab will use Baidu’s Internet services and data analytics to develop programmes targeted at helping the environment, health care, education and more. Baidu has already been working to analyze data from the Internet for applications as various as forecasting flu outbreaks and predicting the outcome of the Global Cup.

In emerging remanufacturing app, Baidu is tackling China’s considerable e-waste problem. China is the second hefty manufacturer of electronic trash, creating over 3.6 million tonnes of it each year.\textsuperscript{283}

The company hopes the app will help in promoting legitimate remanufacturing factories that can offer users accurate pricing for old electronics. Many Chinese still rely on local street peddlers who buy old electronics for their valuable metals. But this often leads to the improper clearance of e-waste, resulting in ground and water pollution.\textsuperscript{284}

To create the app, Baidu and the U.N. group partnered with Chinese electronics vendor TCL to handle the remanufacturing. Users can upload a photo of their old electronics, receive a projected price and then arrange for pick-up from TCL. The app is already available for users in Beijing and Tianjin, except

\textsuperscript{282} Chinese Search Engine
\textsuperscript{283} According to a U.N. study
\textsuperscript{284} Baidu spokesperson
Baidu will roll out the service to other Chinese cities in the future. The joint lab is also inviting other groups such as the Chinese government, academics and companies to partner with it to develop future projects.

The researcher strongly feels that, with the advent of Information Technology, menace of information technology can be controlled more effectively with the help of information technology. Developing mobile app (application, software) to manage or locate e-waste is the progressive step in the direction to establish an effective co-ordination between the stake-holders of e-waste recycling industry. This can be proved to be an effective tool to spread awareness and we can link other stakeholders in other countries and in total it will be helpful in estimation or data collection of e-waste also.

5.8. E-waste management in Japan by increasing recycling

No matter, Japan produces less amount of e-waste as compared to large stake holders, still Japan is considered to be the tech-savvy in developing new technologies, innovating new systems for recycling. Japan has showed a strong concern on the rising problem of e-waste across the world. In the words of Mary Shufelt:

“We must really be swimming in electronic waste, what with all i-Phones and other devices that are so common. How is this all being dealt with?”

To inquire further in the extent of the problem, we must realize that with electronic tool and gadgets the best ever growing waste stream in various nations, how to deal with so called ‘e-waste’ may in fact be one of the mainly pressing ecological problems of the 21st century. According to BCC Research, end-users around the world purchased 238.5 million TVs, 444.4 million computers and tablets and a whopping 1.75 billion mobile phones in 2012 alone. Most of us

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285 Mary Shufelt, New Bern, North Carolina
discard such items inside three years of purchase and this is driving the world-
wide expansion in e-waste by a few eight percent a year.

Meanwhile, a recent study conducted by researchers from the
Massachusetts Institute of Technology on behalf of the United Nations found that
the expansion in require for and manufacturing of latest electronics will result in a
33 percent increase in e-waste across the world between 2012 and 2017.286

But why is e-waste any more of a problem than old fashioned garbage?
Some of the resources in personal electronics, such as lead, mercury and cadmium
are perilous and can release perilous toxins into our air and water when burned or
deposited in landfills improperly and throwing away metal elements, such as the
copper, gold, silver and palladium in cell phones and other electronics leads to
needless mining for latest metals.287

Today, around 80 percent of discarded electronics are disposed off
improperly. E-waste is either redundant or exported to emerging nations, where
open air burning and acid baths are used to reclaim expensive metals and other
elements. The lack of appropriate controls in such nations has led to elevated lead
stages in children and heavy metals pollution of soil and water. As a result, we
now stand at the forefront of a growing ecological catastrophe.288

The good news is that various nations have enacted effective laws to hold
manufacturers liable for the future e-waste created by their goods. The European
Union has led the way with its Waste Electrical and Electronic Equipment
Directive, which calls on electronics makers to ‘take-back’ their goods for
remanufacturing when end-users upgrade to something latest and restricts
European nations from exporting or importing e-waste. Japan and China are
among other nations that have passed similar laws.

The U.S. government has yet to follow suit, except the Electronics Take-
back Coalition reports that 21 U.S. states have implemented their own ‘take-back’

287 Reports of the non-profit Natural Resources Defense Council
288 Maureen O’Donnel, EHS Journal
laws and several other states are considering similar law. Meanwhile, environmentalists continue to pressure Congress to consider similar law at the national level, given predominantly that Americans are the global leaders in generating e-waste.

Additionally, various manufacturers are adopting voluntary e-waste remanufacturing certification standards. One is the e-Stewards programme, which helps those looking to dispose off obsolete electronics identify remanufacturing options that adhere to high standards of ecological liability and worker protection. Another programme, R2 Certification, run by the nonprofit SERI, is supported by several hefty manufacturers, together with DirecTV and Microsoft. Consumers can do their parts by choosing manufacturers that embrace so called ‘manufacturer pays’ electronics remanufacturing in the course of participation in one of these programmes.

5.9. Corporate Social Responsibility to manage e-waste

Corporate Social Responsibility (CSR) or liability of the Corporate Houses towards environment conservation is the contemporary concept of 21st century. It is the extension of Extended Producer Responsibility (EPR), which assigns liability to every corporate body to contribute in ecological perspectives as well as in other social welfare aspects.

5.9.1. E-waste remanufacturing under CSR Law in India

The key aspect of the CSR law is that it makes it mandatory for corporations to spend 2 percent approximately of the net profits on their CSR commitments towards society. With the official nod to the Companies Bill from the Upper House, India has become the first nation to mandate CSR spending in the course of statutory provision. As a nation reeling under overwhelming pressure from e-waste, it has proved to be quite an effective push for ecologically sustainable e-waste management in India.
The Delhi-NCR region alone receives 85 percent of the e-waste generated in developed nations.\textsuperscript{289} The Companies Act provides to spend on CSR actions could very well boost more effective e-waste management. The key highlights of the Act are as follows:

- The Companies Act seeks to enhance corporate governance and increase transparency, accountability and conformity with international industry standards.
- The concept behind the Act is to promote equitable and sustainable expansion in the nation.
- Under the Act, organizations meeting a particular set of criteria must spend a minimum of 2 percent of their profits over the last three years towards CSR actions.
- The Act has defined nine actions that meet the CSR requirements. One of these nine is ‘ensuring ecological sustainability’. One of the ways companies can work toward ecological sustainability is in the course of ecologically liable e-waste remanufacturing by ensuring that they recycle and dispose their old computers and other broken down or outdated electronics and objects with registered remanufacturers who have the sufficient technology to process e-waste responsibly.

5.9.1.1. The Criteria established by CSR Law

Clause 135 or the CSR Clause of the Companies Bill mentions the criteria for the companies that need to spend on CSR actions. The criteria based on their capital are as follows:

- Companies worth over 50 billion rupees or more
- Companies with a turnover of 100 billion rupees or more
- Companies with a net profit of 50 million rupees or more in a given financial year

\textsuperscript{289} According to the latest ASSOCHAM study, “E-waste in India by 2015”
It is mandatory for companies that meet any one of these criteria must spend 2 percent of their normal profits over the last three years on CSR actions. The companies are required to be audited every year for these actions and will face penalties in the event of non-compliance.

5.9.1.2. Penalty for non-compliance of CSR Law

As the CSR spend is a mandatory, the companies that fail to conform to the CSR rule will have to explain why they failed in the annual board to report in order to prevent being penalized. Even if, failing to facilitate an explanation will result in the company being penalized with a fine of not less than 50,000 rupees or 900 US dollars and up to 2.5 million rupees or 46,000 US dollars. Also, officials who default on the reporting provision could be subject to imprisonment of up to 3 years or a fine of not less than 50,000 rupees and not more than 0.5 million rupees or 9,200 US dollars.

Other key highlights of the amended law include rules pertaining to board members auditors. These rules include mandate for the set up of a CSR committee in each organization. The committee will be liable for formulating CSR policies and actions that are to be undertaken by the organization and to monitor the policies periodically. The rules pertaining to auditors limit the number of companies an auditor can serve. Also, organizations need to rotate auditors every five years and an audit firm cannot serve for over two terms of five consecutive years. The aim is to bring extra clarity on criminal liability of auditors if they recklessly or knowingly ignore certain information in their reports.

According to the study, 8,500 mobile handsets, 3,000 PCs and 5,500 televisions are trashed every day. The Delhi-NCR region is all set to become the e-waste dumping capital, generating a projected 50,000 metric tonnes of e-waste by 2015. According to another report by world-wide management consulting firm, Tech-Sci Research, only 5 percent of the total electronic waste in India is recycled. The remaining e-waste ends up in landfills and pollutes the
environment. The problem lies in the fact that e-waste contains noxious elements that need to be recycled and disposed off in an ecologically liable and safe manner to render them harmless to the environment.

The introduction of the CSR provisions in Companies Act can help in curbing the hazards posed by e-waste. Organizations and companies who deploy or regularly upgrade their computer systems and electronic equipments as well as manufacturers in the CDIT industry can now aim their CSR actions under the Companies Act towards e-waste remanufacturing. Companies in the IT segment and manufacturers of end-user durable electronics can play a foremost role, as they are the heftiest manufacturers of electronic waste and as part of the mandatory CSR actions. These companies can make sure that any form of e-waste emanating from their organizations is recycled in an appropriate and safe manner. Remanufacturing electronic e-waste in an ecologically safe manner would make sure that all noxious electronic elements are treated carefully and recycled and reused without causing any harm to the environment.

While the earlier E-waste (Handling and Management) Rules 2011 had made a few advancement in this respect, the introduction of the CSR law can give e-waste remanufacturing in India a much needed boost in the course of its mandatory CSR provision.

There are various aspects that organizations and companies looking to recycle their e-waste as part of their CSR initiative to comply with the Companies Act, need to take into consideration. Remanufacturing e-waste with just regarding any recycler doesn’t solve the purpose. The e-waste remanufacturing segment in India is divided into two categories, the organized and the unorganized segment. The problem lies in the fact that 95 percent of the e-waste is handled by the informal remanufacturing segment, which lacks the expertise to process e-waste in a liable manner and ends up polluting the environment. In order to make sure that an organization’s e-waste remanufacturing initiative complies with its CSR objectives, it must make sure that they recycle their e-waste with authorized and
registered e-waste remanufacturers who are equipped with the technology to process and handle e-waste in an ecologically friendly manner.

One of the pioneers of e-waste remanufacturing solutions and NASA recognized know-how innovator, Attero\(^\text{290}\) has developed patent pending technology for remanufacturing and processing e-waste in an eco-friendly manner. As India’s heftiest electronic asset management company, Attero offers end-to-end integrated remanufacturing of e-waste and provides customized solutions for data security and electronic asset management and is the only company with the capability to extract pure metals from e-waste by processing it in an environment friendly manner. As part of its e-waste remanufacturing solutions, the recycler offers end-to-end real time online tracking of e-waste right from the source to its state of the art remanufacturing facility in Roorkee.

Attero is also the only company to be registered with the United Nations Framework Convention on Climate Change (UNFCCC) and award Carbon Credits to organizations for remanufacturing their e-waste with Attero. Attero has also launched the Clean E-India Initiative in collaboration with the International Finance Corporation (IFC), a Global Bank entity, to help raise public awareness regarding the hazards of e-waste and set up an efficient e-waste take-back model by working together with all stakeholders involved in the electronics life cycle, together with the unorganized segment. Attero has also tied up with over 21 of the world’s top electronics brands and OEMs (Original Equipment Manufacturers) together with Wipro, Samsung, HCL and Acer to make sure eco-friendly e-waste remanufacturing.

**5.9.2. E-waste management firm Attero raised 10,000 million rupees in India**

Existing investors Draper Fisher Jurvetson (DFJ), Granite Hill India Opportunity Ventures, Kalaari Capitals also participated in this round of fund.

\(^{290}\) Attero, the Noida-based e-waste management company, announced a 15 million US dollars Series C round of investment in a round led by private equity firm Forum Synergies (India).
Attero\textsuperscript{291} has raised 2 earlier rounds of funding from existing investors and debt funding from International Finance Corporation.

Attero is the only company in India with the capability to extract pure metals from end-of-life electronics. To deal with the problem of electronic assets, Attero offers various services together with customized end-to-end solutions for e-waste management, electronics asset resurgence, data security and along with repair, refurbishment and retailing of electronics.

Commenting on the just concluded deal, Samir Inamdar, Co-founder, Managing Director and CEO, Forum Synergies, India said:

"Attero addresses a growing ecological concern in India in a safe and efficient manner. We are confident of helping Attero management create a world-wide company out of India. What attracted us to Attero was the innovative know-how, the passionate and high energy management team and their vision for growing the industry."\textsuperscript{292}

Nitin Gupta, CEO, Attero added:

"The funding will enable us to expand geographically, grow our client base and help more businesses, manage e-waste in the India and world-widely."

According to recent studies, e-waste in India is set to reach 1.72 million metric tonnes by 2020. To complement its efforts towards a sustainable e-waste management solution, Attero has also been working to formalize the informal segment, which handles a foremost portion of e-waste in India. The idea is to train informal segment workers and establish an end-user e-waste assortment channel, which will divert e-waste to the formal segment for liable remanufacturing.

\textsuperscript{291} NASA recognized know-how innovator in India
\textsuperscript{292} “e-waste management firm Attero raises 10 million rupees”, \textit{Business-Standard} (Aug. 28, 2014)
Forum Synergies is a private equity fund manager headquartered in Bangalore. It focuses on investing expansion capital in SMEs and mid-market businesses in engineering, healthcare, clean technology and information and communication know-how.

5.9.3. E-waste management by Ultrust in India

Under CSR initiative, taking liability to take-back the packaging and goods has been found not only to yield scrap and salvage value, except is increasingly being looked upon as corporate liability and part of corporate governance and good practice adopted by liable companies. Ultrust used to combine its corporate social liability and e-waste management by giving away old machines to poor students and educational institutions. While doing so, it just needs to make sure of one thing that the machines are in usable condition so that the maintenance outlay is minimal. Further, it is proactively involved in managing its customer’s e-waste. It has implemented a world-wide artifact returns programme that recycles, reclaims and re-uses elements or entire systems. End-users can return their end-of-life objects for recycling and re-use or appropriate clearance.

5.9.4. E-waste management by DELL

Dell, under CSR initiative, made the announcement with a pledge to phase-out the use of two key groups of chemicals known to be perilous to the environment namely, all types of brominated flame retardants (BFRs) and the plastic polyvinyl chloride (PVC) by 2009. This success follows just months after its success in pressuring its big rival Hewlett Packard (HP) to change its guiding principle in March 2006. HP, LG, Nokia, Samsung, Sony and Sony Ericsson have already made commitments to eliminate the use of BFR’s and PVC in the near future. Even if, a number of other companies together with Acer, Apple, Fujitsu-Siemens, IBM, Lenovo, Panasonic, Siemens and Toshiba have so far
failed to commit to similar measures. Motorola recently broke its promise to clean up.

But despite these small steps in the right direction by a few companies it is clear that electronics users expect more. A survey conducted by Ipsos-MORI\textsuperscript{293} for DELL reveals that mainly people across nine nations say they would pay extra for a highly ecological friendly computer and that companies should be held liable for dealing with their perilous waste from PCs. The extra amounts paid by end-user ranged from approximately 59 US dollars in Germany, 118 US dollars in UK, 199 US dollars in China and a whopping 229 US dollars in Mexico.

Every year, hundreds of thousands of old computers and mobile phones containing noxious chemicals are dumped in landfills or burned in smelters. Thousands extra are exported, often illegally, from the Europe, United States of America, Japan and other industrialized nations to Asia. There, workers at scrap yards, a few of whom are children are exposed to a cocktail of noxious chemicals and poisons. This is the dark side of a trend for cheaper and added disposable electronics. By removing the noxious chemicals, companies make it cleaner and easier to recycle their goods. Companies that take liability for the whole lifecycle of their goods from cradle to grave make sure that their goods last longer and cause less pollution. As per RoHS (Restrictions of Hazardous Substances) Directive also envisage use of substitute elements to produce ‘greener goods’. Our vision for the industry is one that produces cleaner, longer lasting, extra sustainable goods that don't contribute to the growing tide of noxious, short lived goods currently being dumped in Asia.

5.10. Common understanding to Re-use goods across the globe

The following findings are aimed to facilitate StEP (Solving the E-waste Problem, a UN Initiative) definitions for terms associated with ‘Re-use’ of EEE (Electrical and Electronic Equipment) or its elements. It has been developed

\textsuperscript{293} Ipsos-MORI, a leading market research company in the UK and Ireland
within the task force of StEP regarding ‘Re-Use’ and discussed with other task forces. Thus it is an agreement among the StEP members to adopt a common understanding or standards on re-use of goods.

The term ‘re-use’ and its associated terminology has several definitions in international legislations, norms and re-use practice, all embracing diverse contexts and not following a global common standard for communication. The StEP Initiative discovered early on that mixed definitions of key terms became barriers for solutions as well as creating confusion among academia, government, industry and end-users, eventually hindering an efficient re-use market. The purpose of this study is to present re-use terminology based on a holistic approach and create one ‘dictionary’ of key terms, their definitions and underlying concepts for establishing a global standard for communication. It does not raise the claim to discuss in depth the variety of existing definitions, except it is intended to be a basis for recommendations to foster re-use and to evaluate policies and standardize concepts against these definitions.

5.10.1. Stages of Re-use of goods

Re-use of EEE (Electrical and Electronic Equipment) or its elements is to be seen in the context of the waste hierarchy, wherein the avoidance of waste generation is seen preferential to actions of waste processing, namely resurgence of resources and energy and ultimately clearance. By extending the use phase of EEE (Electrical and Electronic Equipment) or its elements with an impending for re-use and, thus, substitute for the use of latently produced EEE (Electrical and Electronic Equipment) or its elements, re-use is seen as a form of avoidance of waste generation. The common standards for re-use of used-goods must be adopted by every nation in their national laws. The following essentials must be applied in formulating common standards for re-use of used goods.
5.10.1.1. Standard re-use policy model

Potential for re-use is defined as the ability and advantageousness of electrical and electronic tool or its elements to be re-used. In general, the impending for re-use is composed of five dimensions:

1. Technologic
2. Economic
3. Ecologic
4. Social and cultural
5. Legal aspects

A detailed artifact precise analysis considering the involvement of the private segment as well as charity organizations takes into account of the background and all influencing factors to determine whether re-use is advantageous to resurgence alternatives.

**Flow Chart V- Proposed activity oriented model on fixing re-use policy**

![Flow Chart V](image-url)
The above flow chart shows an activity-oriented model on the context of re-use of EEE (Electrical and Electronic Equipment) or its elements. It does neither include any actors involved nor any transfer methods between actors involved. At the end of a use phase, EEE (Electrical and Electronic Equipment) is returned from the place of use.

This logistic method involves assortment, identification and sorting of EEE (Electrical and Electronic Equipment). EEE (Electrical and Electronic Equipment) with an impending for re-use is passed on to a preparation for re-use. Such qualified EEE (Electrical and Electronic Equipment) or its elements is either re-marketed or redeployed for a re-use. EEE (Electrical and Electronic Equipment) may be remarketed or redeployed for a persistent use without any further preparation for re-use. EEE (Electrical and Electronic Equipment) or its elements without the impending for re-use is passed on to waste processing actions.

5.10.1.2. Life-span of re-use

Re-use of electrical and electronic tool or its elements is to continue the use of it for the same purpose for which it was conceived beyond the point at which its specifications fail to meet the requirements of the current owner and the owner has ceased use of the artifact.

Thereby, it is an activity to prevent EEE (Electrical and Electronic Equipment) from being put into storage and not used anymore or from being deposited into the waste stream. Another owner thus begins use of the EEE (Electrical and Electronic Equipment) or its elements and this persistent use then substitutes the use of a latest artifact. Re-use can be applied either on the whole artifact phase or on the element phase. While evaluating re-uses options, a first consideration should be to determine whether the whole artifact specifications still meet the perceived needs of another impending user.
If the whole artifact specifications do not meet the perceived needs of another user, then it should be determined if any of its elements can still be harvested for re-use.

5.10.1.3. Standard preparations before Re-use

Preparation for re-use comprises any operation performed to bring used electrical and electronic tool or its elements into a condition to meet the requirements of a next impending owner. In general, this activity may contain the following steps of:

- Dis-assembly
- Cleaning (together with data erasure)
- Inspection
- Component exchange
- Component retrieval
- Component reprocessing
- Mechanical such as by manufacturing operations
- Electronic such as SMD mounting
- With IT methods such as bios flash-in
- Re-assembly, together with recombination of parts from diverse cores
- Testing

The goods must be declared fit for re-use only after due certification policy followed by above methods of preparation for reuse of goods.

5.10.1.4. Re-manufacture after re-use

Remanufacturing comprises any action necessary to build up as latest goods using elements taken from previously used electrical and electronic objects as well as latest elements, if applicable. The output artifact meets the OEM (Original Equipment Manufacturer) functionality and reliability specifications. To remanufacture an artifact requires the complete disassembly of the unit, thorough
testing and replacement or reprocessing of all elements not meeting these specifications. Depending on the applied elements this method may significantly change the unit’s composition and plan.

5.10.1.5. Refurbish after re-use
Refurbishment comprises any action necessary to restore a unit up to a defined condition in function and form that may be inferior to a latest unit. The output artifact meets the original functionality specifications. To refurbish an artifact requires disassembling the unit only to the extent that is required to make sure the testing and re-processing of all elements not meeting these specifications. The unit’s composition and plan is not changed significantly. The term recondition is understood synonymously for refurbish.

5.10.1.6. Repair before re-use
Repair comprises any action necessary to correct any faults in a unit preventing its specified operation. The output artifact is in functioning condition. To repair a unit requires only method steps necessary to restore the specified operation. The unit’s composition and plan is not changed significantly.

5.10.1.7. Upgrade and disposal of rejected objects
Upgrade describes any action with hardware or software on electrical and electronic objects to improve or increase its performance or functionality. The unit’s composition and plan is changed significantly by this method. Due to emergence of changing technology concepts, the pace of upcoming technology is very fast and to pop-up with the pace, upgrading is suggested for optimum utilization of resources. Discarding existing goods and purchasing new goods will result in to generation of e-waste. In spite of this upgrading of exiting goods by replacing latest part or an element is favourable. Upgrading reduces cost and
amount of e-waste also. The following table summarizes the differences of the four alternative actions of preparation for re-use.

Table XIII- Different actions to prepare goods for re-use

<table>
<thead>
<tr>
<th></th>
<th>Disassembly Depth</th>
<th>Output specification</th>
<th>Degree of change in unit’s composition and plan</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Remanufacture</strong></td>
<td>Complete disassembly</td>
<td>Original functionality and reliability</td>
<td>May be changed significantly</td>
</tr>
<tr>
<td><strong>Refurbish</strong></td>
<td>Not complete, only to make sure requisite specification</td>
<td>Original functionality</td>
<td>Not changed significantly</td>
</tr>
<tr>
<td><strong>Repair</strong></td>
<td>Only to exchange or reprocess defective element</td>
<td>Functioning condition</td>
<td>Not changed significantly</td>
</tr>
<tr>
<td><strong>Upgrade</strong></td>
<td>Dependent on upgrade operation</td>
<td>Upgraded performance and /or functionality</td>
<td>Significantly changed</td>
</tr>
</tbody>
</table>

Warranty and liability issues of EEE (Electrical and Electronic Equipment) or their elements for re-use are influenced by the degree of change in a unit’s composition and plan. Furthermore, these aspects are affected by the brand under which an actor is remarketing or donating EEE (Electrical and Electronic Equipment) or their elements for re-use.
5.10.1.8. Reselling of goods for re-use

Reselling of goods or Remarketing comprises any action, together with marketing actions, necessary to customers or sell previously used electrical and electronic object or its elements directly to indirectly via channels. Proper tracking of artifacts and its disposal must be regulated by the inspecting authorities so as implementing re-use policy across the globe.

5.10.1.9. Redeploy of goods within the premises

Redeployment comprises any action of renewed deployment of previously used electrical and electronic tool or its elements inside the organization of the owner. A particular form of either returning EEE (Electrical and Electronic Equipment) or its elements at the end-of-use phase or remarketing or redeploying it is to donate EEE (Electrical and Electronic Equipment) or its elements.

5.10.1.10. Donation of used goods to weaker section of society

Donation comprises any action to transfer electrical and electronic objects or its elements for charity to another owner without any reward in return.

After citing stages present in the concept of re-use policy, the researcher strongly feels that re-use of existing goods must be favoured by law so that we can utilize existing resources at optimum level. Another aspect in re-use policy is that this policy must be standardized and applied uniformly across the globe. This policy on re-use will substantially reduce the amount of e-waste.

To conclude, after citing comparative analysis of e-waste management laws and models adopted across the globe, the researcher holds that Basel Convention, Basel Ban amendment, WEEE Directives and RoHS Directives, CSR concept, principle of EPR and re-use policy are the most effective sources of e-waste management legal regime. Uniform policies across the globe and strict implementation by judiciary are required to control the problem of e-waste.
Furthermore, global uniform policy on e-waste is the primary requisite for solving the e-waste problem.

United States of America, a leading contributor to entire e-waste problem has not adopted Basel Ban Amendment has been proved as outlaw. Without the contribution of USA in to the global e-waste management policy, curbing of the menace of e-waste is impossible. Even some states have been ratified to global policy on e-waste still many states have not. The researcher strongly holds that as leader of the global economy, USA must come forward to adopt and to participate in the global forum and must take actions to help developing nations to control the problem of e-waste.