solving the e-waste problem

Effect of Waste Legislation on TBM of EEE Destined for Reuse

Impact of E-waste Regulations on Reuse Organizations and Possible Future Direction

Solving the E-Waste Problem | Step Green Paper | 13.01.2016

ISSN: 2219-6579 (Online) | ISSN: 2219-6560 (Print)

Step Green Paper Series

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Effect of Waste Legislation on Transboundary Movements of EEE Destined for Reuse:

Impact of E-waste Regulations on Reuse Organizations and Possible Future Direction

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Acknowledgements

The project group would like to thank all survey respondents, interviewees and reviewers for their valuable input:

- John Dickenson (AER Worldwide)
- Thomas Holberg (Dataserv)
- Edwin Koolwijk (Flection)
- Daniel Kramer (Datec Technologies)
- Stephen Rodgers (Ericsson)
- Joep Van Loop (Flection)
- Peter Manderick (Close the Gap)
- Rajan Venkatesh (Sims)
- Christian Winkler (EGR Recycling)
- Marie Zide (Ericsson)
- Colton Bangs (Umicore)
- Christina Meskers (Umicore)
- Josh Lepawsky (Memorial University of Newfoundland)
- Kris Pollet (Cisco)

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1 Abstract

This report evaluates current transboundary shipment legislation and its influence on the movement of used electrical and electronic equipment (UEEE) destined for reuse and/or refurbishment, specifically addressing the electronic refurbishment industry's point of view. The report is particularly concerned with the increased costs, and resultant reduction, of reusing UEEE that occurs as a result of such legislation. The report examines (i) current international legislation regarding transboundary shipment of e-waste; (ii) case study experiences from stakeholders in the electronics industry collected from survey and interviews; and (iii) various models and practices adopted by reuse organizations to handle the proliferation of electrical and electronic equipment (EEE). The report identifies three priority areas obstructing reuse organizations' movement of UEEE across the globe: (i) discrepancies in legislation and enforcement between developed and developing countries; (ii) legislative limitations; and (iii) the valuation of UEEE. Based on these evaluations, the report proposes five key recommendations to resolve such issues:

1. The identification of specific policy amendments for the current transboundary shipment legislation;
2. The establishment of national e-waste and reuse policies within developed and developing nations;
3. The development of a comprehensive database to harmonise legislation between developed and developing countries;
4. The expansion of recycling and dismantling facilities in developed and developing nations using the informal recycling sector as a valuable element; and
5. The introduction of a regulated green, international e-waste transboundary channel.

For the sake of expediency, these recommendations may be considered on either a regional or sub-regional level.

2 Introduction

The past two decades have seen explosive global growth in waste electronic and electrical equipment (WEEE), or e-waste, as electrical and electronic product consumption and technological advancement accelerate, which renders electronic equipment obsolete in a shorter timeframe (Mien et al., 2005). In response to this growing waste stream, governments, environmental non-government organizations (ENGOs), academic and research institutions, industry, media and the general public have become increasingly concerned over the environmental consequences that result from the improper treatment and handling of waste. This concern has resulted in the creation of international electronics-related policy focusing on the take-back and recycling systems and managing the trade of hazardous material. Two examples of this are the WEEE and Waste Shipment Regulation by the European Union (EU) and the Basel Convention (Kahhat and Williams, 2009).

Additionally, interest and concern over the transboundary movement of hazardous, problematic and non-hazardous wastes and

illegal shipments of discarded electronic waste have also received increased attention through numerous media and academic reports (Wuttke, 2007). These reports convey a narrative in which e-waste exports from the global north intensify the negative social and environmental conditions in the global south. The reports generate awareness of the e-waste problem and of the uneven wealth and pollution patterns associated with the digital expansion (Salehabadi, 2012). However, this narrative offers a limited representation of the problem, implying discarded e-waste travels in a straight line from north to south, signifying that all developed countries are exporters, and that developing and transition countries are importers (Salehabadi, 2012).

There are also assumptions that all industrialized countries export the same amount and types of e-waste, causing uniform social and economic problems across the importing developing countries (Salehabadi, 2012). While most academic and media reports focus on the discarded electrical and electronic equipment (EEE) as toxic waste objects of no value, they neglect to mention that e-waste can be a commodity of value. E-waste can be a highly valuable resource that can lead to the creation of several industries, such as waste management, materials recovery and reuse and refurbishment (Salehabadi, 2012). These industries drive the transboundary movement of EEE and indicate that a total ban on exporting and importing e-waste will not work; it will only result in damages to these important and legitimate industries, while illegal actors will continue to be unconfined, adapting and capitalizing on such regulations (Salehabadi, 2012).

These reuse and refurbishment organizations already face numerous difficulties when moving EEE between developed and developing countries, as the variations in cross-border shipment regulations can cause obstruction, hindering the movement. This causes confusion and creates barriers that result in either substantial time delays, as the complications are resolved, or excessive charges that render the activity unprofitable. The collective impact of this has seriously impeded reuse and refurbishment organizations, and material is regularly brought to a domestic recycler instead of a foreign reuse centre.
Despite the increased attention and concern surrounding cross-boundary movement of e-waste, there is still a notable shortage of coherent data on used electronics and their movements (Miller et al., 2012). This dearth in data makes it difficult to monitor and evaluate the economic and environmental impacts of these shipments (Salehabadi, 2012).

Additionally, there are a number of challenges in obtaining accurate information from the existing multitude of cross-boundary movement data sources due to the inconsistent categorizing and labelling of used electronics and their components and inadequate data collection systems (Miller et al., 2012). These barriers, in addition to regulatory oversights, allow illicit actors to operate within the system (Miller et al., 2012), while the legitimate reuse industry struggles to perform. To accurately inform the numerous strategic decision makers, such as governments, policymakers and electronic industry stakeholders involved in the current transboundary movement and reuse situation, a comprehensible account of the flows of used electronics is necessary (Miller et al., 2012).

2 Objectives

The first objective of this report is to evaluate international crossboundary shipment and e-waste legislation. It aims to:

- Identify the current legislation influencing cross-border movements and examine their notification procedure, information requirements and waste categorization; and
- Examine the gaps between the legislative frameworks and detect the bottlenecks that allow for ineffective and inefficient enforcement.

The second objective is to examine the benefits of the reuse and refurbishment industries, focusing on four operating models by examining both academic reports and commercial websites.

The third objective is to collect a selection of case studies from electronic industry stakeholders to examine the EEE reuse and refurbishment industries' experiences with shipping electronic products for reuse and/or refurbishment. It aims to:

- Characterize and highlight the barriers to the movement of UEEE as a result of regulations;
- Identify complications concerning the movement of EEE with reference to both developing and developed countries; and
- Identify and assess any other variables that influence the movement of EEE.

Based on the knowledge accumulated from the three objectives above, the fourth objective aims to propose solutions to the current issues regarding the cross-border shipment framework while promoting the practices of reuse and refurbishment. It aims to:

- Recommend legislation amendments and possible policy options to provide an improved e-waste shipment channel; and
- Recommend probable proposals to help monitor the e-waste from its origin to its destination aimed at global e-waste shipment issues and reuse organizations.

3 Background

3.1 Reuse and refurbishment

The Step Initiative supports reuse, as it is considered both an important means of alleviating or moderating the e-waste problem and a significant step towards achieving more sustainable consumption of EEE (O'Connell and Fitzpatrick, 2012). Though it is not a permanent solution to the e-waste problem, the case for developing and expanding a reuse sector are strong on many levels.

Reuse can offer a number of economic, social and environmental benefits. It can provide an opportunity to conserve energy and water that would have been used to manufacture new equipment (Fitzpatrick et al., 2012). It is also the most efficient use of scarce materials, as lifetime extension through reuse (Fitzpatrick et al., 2012) ensures that non-renewable minerals and material resources are sustained instead of dissipated or rendered unusable (Sepúlveda et al., 2010, Hagelüken and Meskers, 2008 cited within Fitzpatrick et al., 2012). Furthermore, reuse can make a significant contribution to social and economic growth

by creating employment for disadvantaged people (Hines, 2008) and creating secondary markets that ensure sustainable economic growth while minimizing environmental pollution (O'Connell and Fitzpatrick, 2012). These secondary markets provide essential appliances and access to education for low-income and disadvantaged families in both the developing and developed world (Fitzpatrick et al., 2012, O'Connel et al., 2010), while allowing organizations to demonstrate a commitment to corporate social responsibility to their customers and stakeholders (Fitzpatrick et al., 2012). Therefore, the increase of reuse practices globally can decrease the amount of e-waste transferred to the underdeveloped recycling infrastructure (Sepúlveda et al., 2010), which benefits the social and environmental infrastructure of the developing world.

3.1.1 Current reuse business models

In recent decades, the EEE reuse sector has grown substantially with many organizations having successfully developed in both the profit and non-profit sectors despite facing several different challenges (Kissling, et al., 2012). The four established basic operating models (Networking Equipment Recovery, Information Technology [IT] Asset Management, Bridge the Digital Divide and Social Enterprise) offer a number of reuse practices to extend the useful life of certain EEE and components, offering collection, preparation for reuse, refurbishment, remarketing and redistribution of UEEE.

Networking Equipment Recovery
This is a for-profit model that processes both used and excess new durable IT networking equipment, such as rack servers, routers and switches. Organizations that use this model receive equipment from third-party service providers to customers of original equipment manufacturers and also collect directly from corporate users. The majority of reuse is distributed in components from the received products. The reuse rate ranges between 10 and 50 per cent.

IT Asset Management
This is also a for-profit model that specializes in the refurbishment and remarketing of desktop and notebook computers for resale to distributors and retailers (Kissling, et al., 2012). This model offers asset recovery services and receives much of its input from commercial corporate users or leasing companies who offer take-back service to their customers. Due to the corporate users' more frequent equipment replacement, the reuse rate for this model is greater and ranges between 25 and 95 per cent.

Bridge the Digital Divide
This is a not-for-profit model that provides used desktop and laptop computers to beneficiaries in developing countries, such as educational and medical institutions or local not-for-profit organizations. The majority of equipment is received via donations from corporate and public users. In exchange, this model's practitioners offer equipment collection, data sanitation and appropriate compliance certification.

Social Enterprise
This is another not-for-profit model in which organizations acquire and prepare equipment, including computers, peripherals and large household appliances, for reuse and resale to individual users with the objective of creating social benefits (i.e., employment or training for disadvantaged individuals). Normally, social enterprises focus either on computers received through donation or large household appliances from various

providers. Refurbished equipment is sold to eligible recipients.

Waste Management Licence
What a reuse company can and cannot do depends on the licence they hold. These are summarized in Table 1.

	Can Import		
Type of Company	UEEE	Green WEEE	Amber WEEE
Reuse company with no recycling licence			
Reuse company with recycling licence			
Recycling company with recycling licence			

Table 1: Summary of import capabilities based on licencing

While it may appear that a waste management licence expands the possibilities for a reuse organization, it may come with a number of responsibilities that lead some to avoid recycling altogether. For example, if one has a waste management licence, they come under environmental regulation and must record the weight of all material handled, ensure all downstream vendors have the necessary licence and are treating the material appropriately. It is also necessary to hire trained staff and undergo regular inspection from environmental regulators.

3.2 Legislation overview

In response to the expanding growth in the exporting and importing trade of both EEE and e-waste, a number of e-waste regulations at the local, national, regional and international levels have evolved. This section provides an overview of the regulations in place surrounding the movement of EEE, UEEE and WEEE. All pieces of legislation mentioned are only enforceable once they have been transposed into national law.

3.2.1 The Basel Convention

The Basel Convention on the Control of Transboundary Movement of Hazardous Wastes and their Disposal is an international treaty of the utmost relevance. The treaty was introduced on March 22, 1989 in response to public protest following the discovery of imported toxic wastes in the developing world in the 1980s, and it entered into force on May 5, 1992 (UNEP, 2011). The aim of the treaty is to protect human health and the environment from the adverse effects of hazardous wastes and other wastes by restricting the movement of hazardous waste between countries, specifically from developed to developing countries (UNEP, 2011). In addition, the treaty aspires to minimize the production of hazardous waste and to encourage local handling of such wastes (UNEP, 2011). E-waste is seen as one of the priority waste streams.

The Convention also provides standardized definitions for hazardous waste and includes a list of hazardous and non-hazardous wastes covering toxic, poisonous, explosive, corrosive, flammable, eco-toxic and infectious wastes that each Party can individually build on (UNEP, 2011). Thus, it allows the Parties to define waste at a national level when the definitions given by its annexes are insufficient (Espejo, 2010).

The requirements placed on importing and exporting countries aim to ensure that inter-

national trade is conducted and is waste handled in accordance with the principles of Environmentally Sound Management (Andrews, 2009). Shipments between Parties without prior notification and consent are illegal (UNEP, 2011) along with shipments from Parties to non-Parties, unless there is a bilateral or multilateral agreement between them. Under the Convention, there are clear restrictions on the export of WEEE intended for disposal, and upon arrival in the importing country, verification by competent authorities must be received indicating that the waste will be handled in an environmentally-safe manner (UNEP, 2011). Currently, the Basel Convention does not consider used electronics intended for direct reuse to be a hazardous waste (Khan, 2009).

The Basel Convention Regional Centres (BCRCs)

The BCRCs are an important instrument in implementing the Basel Convention in developing countries, as they assist parties in the management of hazardous wastes, such as e-waste, through training, technology transfer, information exchange, consulting and awareness raising (Secretariat of the Basel Convention, 2007). Centres are located in Argentina, China, Egypt, El Salvador, Indonesia, Islamic Republic of Iran, Nigeria, Russian Federation, Senegal, Slovak Republic, South Pacific Regional Environment Programme (Samoa), South Africa, Trinidad and Tobago and Uruguay (Secretariat of the Basel Convention, 2007). Each centre services several countries in its respective region (Secretariat of the Basel Convention, 2007). However in recent times, these centres have encountered numerous problems due to deficiencies in funding and insufficient human resources and cooperation among member countries (Secretariat of the Basel Convention, 2007). The BCRCs require further support if they are to continue to implement projects in developing countries that help manage hazardous waste and trade in electronics.

The Ban Amendment

The Ban Amendment was adopted in 1995 by the third meeting of the Conference of the Parties (COP) as a means to address the problems within the Basel Convention (UNEP, 2011). The parties adopted a decision to ban trade in hazardous waste destined for disposal, between all Annex VII Parties (Organisation for Economic Co-operation and Development [OECD] and European Union [EU] countries and Lichtenstein) developed and developing countries non-Annex VII countries (all countries not defined in Annex VII, whether or not they are Basel Convention members) (UNEP 2011). As of October 2013, the total number only 75 member states have ratified it (Internet Reference 1), which means that it has not entered into force, as it requires ratification by 75 per cent of the member states to the convention.

As overseer of the most relevant international e-waste trade policy, the Secretariat of the Basel Convention is taking steps to help Parties who have difficulty enforcing national legislation in order to fully enforce all provisions of the Basel Convention. The Draft Technical Guidelines on transboundary Movement of Electrical and Electronic Waste, in particular the section regarding the distinction between waste and non-waste, was developed by a small inter-sessional working group including leading industry stakeholders, including members of the Step Initiative. However, these draft guidelines were not adopted at the last Conference of the Parties to the Basel Convention in 2013 in Geneva.

3.2.2 The OECD Council Decision

In March 1992, the Organisation for Economic Co-operation and Development (OECD) introduced their own regulation OECD Decision C (92)39/FINAL to supervise the movement of wastes destined for recovery operations between member countries (OECD, 2009). The regulation deviates from the previously-mentioned Basel Convention in that it seeks to control resources secured from wastes and minimize hazardous waste shipments (OECD, 2009). It also offers more detailed guidelines that allow countries that are not signatories of the Basel Convention to continue to trade waste with OECD member countries. The OECD decision differs slightly from the Basel Convention on the definition of waste, especially as a result of the developments of two new detailed lists of wastes in Annexes VIII and IX that were adopted by the Basel Convention in November 1998 (OECD, 2009). These new lists motivated the revision of OECD Decision C (92)39/FINAL in order to harmonise procedures and requirements and to avoid duplicate activities with the Basel Convention (OECD, 2009).

This revision resulted in the adoption of Council Decision C (2001)107/FINAL in May 2002 (OECD, 2009). As a result, all cross-border movements are now supervised under a specific OECD Control System based on two types of risk categories and procedures: Green and Amber. Centred on the two waste lists from the Basel Convention, the “Green Procedure" applies to the wastes listed in Annex VIII of the Basel Convention (Sander and Schilling, 2010). The Green Control Procedure relates to wastes that present a low risk to human health and the environment; the wastes are not subject to any waste-law control (OECD, 2009). Whereas the “Amber Control Procedure” applies to wastes that present sufficient risk, and it requires two forms for notification, and its movement is dependent on the consent of the applicable authorities. Prior to any movement of Amber Control waste, the OECD Decision requires legally-binding contracts from the legally responsible parties involved (the exporter, the importer or the chain of contracts), starting with the exporter and terminating at the recovery facility (OECD, 2009).

The control of waste shipments is carried out by national competent authorities and customs offices, as appropriate. Wastes subject to the control procedures are listed in Appendices 3 and 4 to Decision C (2001)107/FINAL; the level of control applied to the wastes listed has been agreed upon by all OECD member countries (OECD, 2009). However, depending on certain countries’ domestic legislation, it should be noted that some member countries may impose specific requirements for the transboundary movement of wastes, subject to the Green and Amber control procedures (OECD, 2009). There are a number of similarities between the Basel Convention the OECD Council Decision, most notably their waste lists and their classification of hazardous wastes by the substances they contain, instead of defining specific types of e-wastes (OECD, 2009). Additionally, both regulations specify that exported hazardous waste must be treated and handled in an environmentally and socially sound manner in the receiving country (OECD, 2009).

3.2.3 The European Waste Shipment Regulation (WSR)

The European Waste Shipment Regulation (EC) No 1013/2006 was adopted on June 14, 2006 by the EU (Internet Reference 2). The

regulation transposes the Basel Convention and OECD Council Decision into European law, making it legally binding in all EU member states.

Under the regulation's guidelines, the shipment of waste depends on a number of factors: the intended destination, the purpose of export (reuse, recovery or disposal) and the type of waste being exported. The regulation permits the export of non-hazardous waste for the purpose of second-hand equipment and recovery, provided a test report is presented along with evidence of the potential market for the equipment (Van Earp and Huisman, 2010). The regulation applies to member states within the EU and to shipments of EU waste in transit through third countries or imported or exported to/from third countries and shipments of waste in transit through the EU, on the way from or to third countries (Internet Reference 9). The regulation concerns almost all types of waste shipped with the exception of a minor few, including radioactive waste. Similar to the two previous transboundary shipment regulations, the WSR divides waste into three primary categories: Prohibited Wastes, Amber Notification Control intended for waste disposal and recovery and Green Listed Controls. Non-hazardous wastes are listed in more detail in Table 2.

A contract between all involved is required for all waste shipments, and financial guarantees must also be provided when waste shipments are subject to a notification requirement.

Waste Type	Description	Notification Requirements	Notification Application	Outside EU and OECD
Green List (Annex III)	Non-hazardous and easily recyclable materials, such as paper and plastic. These are the lowest level of control and only ever apply to some (but not all) imports or exports of non-hazardous waste for recovery.	These wastes may move across international borders within the EU without having to request permission or advance notification.	Requirement that certain information, signed by the holder of wastes subject to the Green Control Procedure, accompanies each shipment of such waste in order to assist the tracking of these shipments.	Depends on the country of destination
Amber List (Annex IV)	Material that has some hazardous property or consists of a mixture of materials. For example, when Green List wastes are mixed (co-mingled), they become amber-listed wastes. As a waste becomes somewhat more difficult to recover or somewhat more hazardous, it goes onto the Amber List.	They require pre-notification and prior written consent before they can be exported. A fully completed "consignment note" (or a copy thereof) must be present during transport. This document consists of a notification form and a transport form. In case of prior written permission, the notification form must be stamped by the competent authorities from the destination country. They also must comply with a range of other requirements.	These apply to all permitted imports and exports of: (i) hazardous waste moving for recovery; (ii) any type of waste moving for disposal within EU; and (iii) to some imports and exports of non-hazardous wastes for recovery.	Prior notification and consent control are required for these.
Red List (Annex V) and wastes not included in any lists	Particularly dangerous and hazardous wastes	Controlled Movement, TFS Report work, pre-notification and prior written consent are all required before export. A fully completed "consignment note" (or a copy thereof) must be present during transport. This document consists of a notification form and a transport form. In case of prior written permission, the notification form must be stamped by the competent authorities from the destination country.	Applies to all waste under the red list.	Movement prohibited for: (i) exports for disposal; (ii) exports of hazardous waste to developing countries (non-EU and non-OECD), even if moving for recovery; (iii) exception made to European Free Trade Association (EFTA) countries that are party to the Basel Convention.

Table 2: Summary of control protocols and waste lists of the WSR

However, unlike the two previous regulations, WSR's classification of e-waste into the below categories depends on what components they contain, though the regulation neglects to list the entire WEEE or parts (Juan, 2009). It also differs in its application to shipments between EU member states only; shipments intended for disposal and/or recovery from EU member states to non-OECD countries are forbidden "with the exception of countries which are party to the Basel Convention; countries which have concluded a bilateral agreement with the EU or Member States; or other areas during situations of crisis". It is important to note that many of the key components of WEEE are not listed in any of the three transboundary shipment regulations, resulting in confusion related to the transboundary movement of certain e-waste.

3.2.4 The WEEE Directive

As the principal Directive to regulate disposal of EEE within the EU, the WEEE Directive 2002/96/EC was issued in 2003 with the objectives of preventing WEEE and promoting the reuse, recycling and recovery of such wastes (WEEE Forum, 2008), which allows producers to create collection schemes.
In December 2008, the European Commission proposed to revise the WEEE Directive with increased emphasis on reuse (in line with the Waste Directive 2008/98/EC and the Energy related products directives 2009/125/EC) in order to oblige member states to prioritize reuse at the earliest stages of WEEE take-back (O'Connell and Fitzpatrick, 2012).

In relation to the shipment of WEEE and UEEE, minimum inspection and monitoring requirements are included in Annex VI. These requirements oblige exporters to:

- Provide a copy of an invoice that states the equipment is destined for reuse;
- Provide evidence of testing and proof of functionality;
- Make a declaration that none of the material is waste; and
- Use appropriate protection against damage during transportation.

Another change is the harmonisation of national registration and reporting requirements by aligning the requirements by member states' registers for producers of e-waste more closely, reducing the administrative burdens. It is important to note there is no framework in place to promote and track reuse in the current take-back systems (Streichter-Porte et al., 2009) or any mention of this situation in the recast. Emanating from an EU Life Project co-ordinated by the WEEE Forum, WEEELABEX emerged as a set of normative standards with respect to the collection, sorting, storage, transportation, preparation for re-use, treatment, processing and disposal of all kinds of WEEE. These have since been translated into formal CENELEC EN standards EN 50574 on the "Collection, logistics & treatment requirements for end-of-life household appliances containing volatile fluorocarbons or volatile hydrocarbons" (Published 2012), EN 50625-1 on "Collection, logistics & treatment requirements for WEEE - Part 1: General treatment requirements" (Published March 2014) and EN 50614 on "Requirements for the preparation for re-use of waste electrical and electronic equipment" (In preparation with work starting in March 2014 and due for completion December 2015). WEEELABEX has also created a process of monitoring companies using internally trained auditors. Successful audits result in operators being listed on the publicly-accessible

WEEELABEX website. The WEEE Directive permits member states to employ minimum quality standards, and many are adopting these WEEELABEX-based standards for their collection and treatment systems.

3.2.5 National legislation

China

China, the largest known EEE exporter and WEEE importer, established the Regulations for the Administration of the Recovery and Disposal of Waste Electrical and Electronic Products (RAW), also known as "the China Directive", into law in January 2011 (Zhang, 2011). Since 2000, a number of waste policies had been developed in China, but none was comprehensive regarding WEEE-specific policies (Zhang, 2011). This set of regulations aims to standardize the recovery and disposal of WEEE and set out the responsibilities of various parties with respect to the manufacture, import, sale and repair and after-sales service of EEE (Zhang, 2011). The "Waste Electronic and Electric Equipment Disposal Catalogue" and the "Catalogue Drafting and Editing Rules", which were jointly announced in September 2010, are subject to RAW. In accordance with RAW, local governments will implement the WEEE regulations instead of the central administration (Yang et al, 2008 cited in Zhang 2011).

Under RAW, China has a compulsory government-administered recycling programme for five categories of WEEE: television sets, refrigerators, washing machines, computers and single room air conditioning units (Zhang, 2011). The scope of RAW categories is similar to Japan's Home Appliance Recycling Law (HARL), which was amended in 2008 to incorporate liquid crystal display (LCD), plasma televisions and clothes dryers (Aizawa et al., 2008). The funding mechanism of RAW requires the China WEEE administration to collect a tax levy per unit sold or imported to China on products in RAW's five categories (Zhang, 2011). This payment is made by the EEE manufacturers and consignees of imported EEE and their agents to fund the WEEE collection and treatment (Zhang, 2011). The tax revenue is then collected, administrated and allocated, mainly by the Ministry of Finance, with tax rebates awarded for companies per product unit recycled under RAW (Zhang, 2011). A sub-regulation will to be created with specific rules and directions to guide the funding mechanism in the future (Zhang, 2011).

However despite the presence of such legislation, there are still several significant gaps when comparing the EU and China's legal frameworks (Juan, 2009). Currently, there is no specific regulation enacted to deal with waste shipment in China; only importing waste lists detail which waste could be used as raw materials (Juan, 2009). So far, environmental awareness and responsibility are much less developed than in the EU, with the relevant pieces of legislation based around acquiring raw materials rather than combating illegal disposal (Juan, 2009). Another factor affecting the implementation of WEEE legislation in China is the overall responsibility for the WEEE management system (Juan, 2009). The related responsibilities of local governments are not clearly defined, and their administration and supervision systems are still too weak to fully enforce RAW and the WEEE management system (Zhang, 2011).

United States

In the United States, there is no singular comprehensive policy on e-waste. The U.S. congress introduced the Responsible Elec-

tronics Recycling Act, also known as HR 2284, on June 22, 2011 "to prohibit the export from the United States of certain electronic waste, and for other purposes". However, the law is yet to be passed. In the absence of federal legislation,, state governments have begun to address the e-waste issue by developing and adopting their own e-waste legislation and policy (Herat and Pariatamby, 2012). In relation to export of information and communications technology (ICT) products, there is only one piece of legislation relevant: the cathode ray tube (CRT) rule associated with the Resource Conservation and Recovery Act (RICRA). Under this rule, exporters must file a notification with the U.S. Environmental Protection Agency (EPA) to allow CRT monitors to be exported for reuse. However, as the United States has not yet implemented mechanisms for prior notification (Kahhat and Williams, 2009) as long as U.S. exporters abide by the CRT rule, export of UEEE is legal in the United States.

At present, the EPA is the principal authority actively working on the e-waste issue, aiding all exporters of e-waste in obtaining documentation from developing countries on the legal procedures of importing these exports. Currently, the EPA encourages consumers to recycle or donate their UEEE. Unfortunately, not all electronic recyclers follow environmentally sound practices to resolve this, though legitimate recyclers can be certified by demonstrating their ability to meet available standards on responsible recycling practices to an accredited, independent third party. There are currently two accredited certification standards in existence in the United States: the e-Stewards Standard and the Responsible Recycling Practices (R2).

The e-Stewards Standard for Responsible Recycling and Reuse of Electronic Equipment was published in 2009, and it set forth the requirements to become a certified e-Stewards Recycler. The certification was created by the Basel Action Network (BAN), a non-profit organization, and it is available to all electronics recyclers and refurbishers, providing they comply with the Standard and have a registered International Organization for Standardisation (ISO) 14001 environmental management system in place. R2 was established by a broad stakeholder group (EPA, state governments, manufacturers, recyclers, trade groups and NGOs) for the electronics recycling industry. It is the standard adopted by the industry to recognize strong and comprehensive environmental, health and safety management systems as well as high-quality and responsible recyclers.

3.2.6 Synopsis

The Basel Convention, OECD Council Decisions C (2001)107/FINAL and European WSR are the principal agreements regulating the transboundary movement of e-waste. The Basel Convention is the most comprehensive and significant of these agreements, as it introduces restrictions on the movement of hazardous waste between countries through controls and "hazardous waste" and "non-hazardous waste" lists (UNEP, 2011). The OECD Council and EU have then built on the convention, adapting and improving it to their own domestic positions through development of legislation with more detailed waste categories and control lists (Amber, Green and Prohibited) and stricter regulation on shipments intended for disposal/recovery to non OECD countries (EU).

These principal pieces of legislation have also been influential in shaping laws in other developed regions, for example a number of U.S. state governments and China. However, the governments have their own agendas and develop the legislation to meet their own requirements.

4 Data

This report analyses the qualitative data collected through an Internet survey and semi-structured telephone interviews. Participants were identified from Step members. The membership encompasses organizations engaged in reuse that represent all four operating models (Networking Equipment Recovery, IT Asset Management, Bridge the Digital Divide, and Social Enterprise). The invitation to participate in the online survey was sent to all members in June 2012, and follow-up solicitation was sent in July 2012. The majority of respondents reported on experiences involving transfers within and between Europe, the United States, Africa, Latin America and the Middle East. As there are no Asian case studies described, it should not be interpreted that the issues outlined do not occur in China, India or other Asian countries. For telephone interviews, all members were invited in January 2013 with a follow-up invitation sent in February 2013. E-mail reminders were sent to non-respondents.

The interviews were documented by audio recordings and subsequent transcription. Participants explained and discussed their reuse activities and their involvement in transboundary shipment of equipment. Participants were also asked, where applicable, to describe specific examples of issues they encountered during cross-border movements of their shipments. All surveys and interviews were conducted in English.

Twenty-three responses were collected: 14 complete surveys and nine telephone interviews. The semi-structured format of the telephone interviews allowed for respondents to discuss issues of particular interest to them, but this was also a limitation, as respondents may not have shared their perspectives on all potentially-relevant issues. Overall, the resultant sample represents variation of operating reuse models including all four of those described in Section 3.1.1.

The final dataset consists of nine case studies. The table in Appendix I overviews collected case studies. The survey's text is presented in Appendix II and a standardized guide for interviews is presented in Appendix III. An interview was also carried out through e-mail with the Dublin Transfrontier Office to provide the viewpoints of a competent authority (see Appendix IV). The survey and interviews covered UEEE, WEEE and EEE, but specifically focused on ICT products.

5 Methodology

A contextual analysis to identify the patterns of events or conditions and their relationships using case studies approach was performed. The multiple techniques utilized for gathering the data (surveys and interviews) contributed to the study method and helped to triangulate data (Yin, 1984).

The data were first evaluated for selecting cases based on typical problems in reuse activities raised by the participants by placing information into arrays. Next, within-case analysis was performed for each respondent to identify unique patterns within the data,

followed by the cross-case analysis to identify unique patterns within the cases. The analysis of interview data was supplemented with a literature review and content analysis of public documents.

6 Results

6.1 Barriers to obtaining transboundary shipment license

6.1.1 Differentiations in definitions and classification

Case Studies 1, 2, 3, 5 and 8 identify the differences in definitions and classifications resulting from the varied interpretation and transposition of the WSR, OECD Council Decision and Basel Convention, which serve as a principal obstruction to trade for reuse operators. This diversity in legislation increases the timeframe for completing and acquiring a shipment license, as each country's implementation reflects its national situation and its capacity for the appropriate management of e-waste (Khetriwal et al., 2011). The authority for the movement of waste in Ireland, the National Transfrontier Shipment Office (Appendix II), has also emphasized this by stating that the principal issues have to do with the appropriate classification of materials and the misinterpretation that waste material is not waste.

For example, Case Study 1 demonstrates how companies wishing to transport reuse equipment (mobile phones for repair and reuse) face up to two years' delay due to interpretation problems between local authorities in different countries. This lack of a clear, detailed and standardized definition for goods, e-waste, recyclable materials, reuse and second-hand materials complicates the completion of the universal forms and decisions on the protocol of trade between countries. Currently, depending on the destination of reuse equipment, some material may be considered waste by some but not by others (Sanders and Schilling, 2010), making it difficult to determine the legal scope of the Convention (Espejo, 2010). This causes significant delays; in Case Studies 2 and 3, it took 19 and 22 months to complete license acquisition for export from Hungary and Czech Republic to Scotland.

Legislators have attempted to rectify this issue through categorization of e-waste by its various uses (reuse, recycle or disposal). However, the categorization differs between the principal regulations; for example, the OECD Council Decision and the Basel Convention's waste lists are grouped according to the substances within the e-waste, while the European WSR is based on the equipment's components. In addition, the current legislation also has problems keeping pace with the ever changing IT and equipment. This can create loopholes in the export and import of e-waste, which allows a number of products to escape the classification as hazardous waste and creates an uneven playing field for the stakeholders (Khan 2009). This can result in problems for the reuse industry through both increased illegal activity and the restriction of equipment for reuse, refurbishment or recovery.

Many countries' governments, such as those of new EU members or some developing countries, are still unsure of the protocol for the movement of UEEE, as each country may have different definitions, provisions and agreements (Khetriwal et al., 2011). In Case Study 6, the Networking Equipment Recovery firm experienced time delays and communication difficulties while organizing the

shipment of equipment from Venezuela to a recycling centre in the United States. The Venezuelan regulators decided to change their information requirements on the invoice resulting in an additional four-week delay of shipment while the changes were coordinated between the three parties involved (reuse organization, recycler and export partner).

In Case Study 5, an IT asset management firm experienced the same issue while exporting equipment destined for repair from Costa Rica to their boarded Environmental Provider in the United States. As a result of misinterpretation of the Basel Convention regulation, export was denied by Costa Rica's government, which resulted in the halting of the export of parts for functional testing and proper refurbishment or reuse between non-OECD to OECD countries. The Costa Rican officials informed the IT asset management firm that the parts could no longer be exported back to the United States without permission from the US EPA, due to Basel Rules between the two countries. The US EPA contacted United Nations Environmental Programme (UNEP), requesting their intervention to assist with the issue, and its resolution took more than six months. This demonstrates the lack of clarity by non-OECD customs officials regarding Basel Convention Regulation and the lack of established processes for timely resolution.

In addition to the time factor in obtaining the appropriate papers, notifications and approvals can also vary between countries. For example, in Case Study 8, a Networking Equipment Recovery organization encountered problems when using rail or road freight, as they involve transit through several border points, with separate appropriate protocol required from each country before transit. This often increases the time necessary to obtain approval for the entire journey. Some countries can be quite straightforward from an administrative perspective, while others can be difficult due to misinterpretations and lack of funding for customs and police.

6.1.2 Valuation of UEEE

Case Studies 2, 3 and 7 identify how the type of e-waste being shipped can restrict reuse organizations or cause them financial difficulty. For example, the value, reusability and recyclability (Aoki-Suzuki et al., 2012) of certain equipment causes some countries to use confusion in definitions and interpretation of legislation to achieve goals other than the ones intended, which can result in a difficulty contacting certain countries for approval for export or import. The use of regulations to retain raw materials for a country's own purposes is demonstrated in Case Study 2. An environmental advisor in the Czech Republic attempted to persuade the customers of an IT asset management and a network equipment recovery firm that it is illegal to ship amber-listed waste to Scotland in order to retain the material for their own purposes.

To remedy this issue, both the Basel Convention and OECD Council require each country to inform the Secretariat of the Convention/OECD Council of their definitions of hazardous waste within their national legislation as well as any additional distinct trade restrictions (Aoki-Suzuki et al., 2012). However, not all countries have informed the Basel Convention, possibly because the lack of capability and human resources results in legal discrepancies in trade procedures between exporting and importing countries (Aoki-Suzuki et al., 2012). The discrepancies over the value of materials can also cause

inconsistencies with the cost of the bond between developed and developing countries. For example, Case Study 3 reports the total cost of the bond from Hungary to arrange a transboundary shipment was calculated at 662 Euros, while Hungarian authorities demanded 9,060 Euros, almost 14 times more. The cost computed by the receiving authority was 3,414 Euros, and only 59 Euros were assessed by German transition authority. This issue is also mirrored in Case Study 2 where it cost nothing to arrange the transhipment from the Czech Republic, but the bond required by Czech authorities amounted to 6,000 Euros.

Another issue identified in relation to the valuation of materials is variation depending on national circumstances and capabilities. In Case Study 7, a networking equipment recovery firm had a difficult and costly experience due to the misperception of material as valuable instead of its actual "scrap" value while shipping equipment from the Ukraine to Scotland.

6.1.3 Functionality testing

Case Study 8 identifies the absence of functionality testing framework within current legislation, which can restrict the movement of reuse equipment to reuse organizations and cause confusion for authorities when distinguishing between wastes and non-wastes. For example, when reuse operators define their reuse products/material for export, the national transposition of the Basel Convention requires the organization to provide proof that the equipment is working before it was defined as “products for potential reuse”. However, the Basel Convention does not suggest how to establish and verify the reusability of the UEEE and provides no additional provisions or frameworks to ensure the functionality of these products for reuse, repair or component part use. While the WSR provides guidelines for the functional testing of UEEE, it does not cover the parts and components that make up the used or repaired equipment. Therefore, the networking equipment recovery organization in Case Study 8, which only operates reuse on a spare or component parts, is restricted in its ability to trade.

6.2 Administration and enforcement issues

6.2.1 Administration

At each stage in the transboundary movement of waste, enforcement agencies should be able to track the information on the shipment’s activity from both the exporting and importing perspectives (Juan, 2009). However, this is not the situation in practice, as the variations in legal bases and classifications of e-waste between regions create incompatibility between monitoring and enforcement systems (Juan, 2009). Case Study 1, which regards an IT asset management and network equipment recovery organization in Scotland, is the case in point. The organization could not contact the responsible authority in Jordan and had to resort to asking the British Embassy Trade Department for their help and the Scottish Environmental Agency (SEPA) to get a response.

This scenario is a consequence of the number of individual enforcement agencies and monitoring systems with different organizational structures, strategies and procedures involved in addition to the deficiency in information exchanged between these authorities (Juan, 2009). This can cause great difficulties when tracing a single shipment from origin to destination, and it can also restrict

accurate data collection. The monitoring systems between the competent authorities need to be better integrated in order to allow countries to track and access information before and after a shipment.

6.2.2 Enforcement

Case Studies 1, 2, 3 and 4 illustrate how unscrupulous actors use variations in definitions, transpositions and translation to their advantage, which results in confusion when determining if something is exported for the actual purpose of reuse or if the items are being exported under the auspices of reuse. For example, in Case Study 4 in Germany, a reputable IT asset management agency stopped illegal exports to their recycling facilities on behalf of the authorities (customs). The illegal exporter was fined 10,000 Euros, but they shrugged off the fine and continued illegal activities using two containers to recover the loss. This demonstrates the enforcement agencies' inability to track down and appropriately persecute offenders.

Additionally, the illegal industry is flexible; when complications with authorities arise within one area, they can shift to one with more lax regulations (Williams et al., 2008), circumventing the legislation by shipping untested equipment with no documentation. For example, in Case Study 1, an IT asset management organization found that some recyclers and telecom operators were moving their material as product or direct resale without the necessary protocol, defeating the objective of the Basel Convention.

7 Possible future direction

The time delays and additional costs associated with acquiring a transboundary shipment licence can hurt reuse organizations commercially; organizations require a mechanism and cost structure that enable companies to work in a timely manner. These frustrations can result in companies' avoidance in attaining a transboundary shipment license if the length of time is too long, resulting in noncompliance of the Basel Convention and WSR. Based on these findings, this section outlines possible future directions, which, if explored in greater detail, could improve the movement of EEE, UEEE and WEEE and counteract the barriers identified in Section 6.

7.1 Policy amendments

There are already many existing laws that attempt to control transboundary movement of e-waste. Therefore, effective and smart amendments should simplify this process for reuse organizations, ensuring clear harmonised definitions and guidelines and an integrated approach between governing bodies. Developing these will require the involvement of all current stakeholders, including governments, policymakers, ENGOs, academics, research institutions and industry leaders. Key areas in the current legislation that need to be examined and improved upon by governing bodies include definitions, reporting and harmonisation, classification, and monitoring and enforcement.

Definitions, reporting and harmonisation

To develop clear, detailed and harmonised definitions, governing bodies must:

1. Improve their understanding of UEEE, EEE and WEEE and their knowledge of their international flows (Terazono, and Yoshida, 2012).
2. Improve and develop sharing, updating and reporting on national import regulations and e-waste definitions under Arti-

cles 3, 4 and 13 of the Basel Convention (Aoki-Suzuki et al., 2012). The EU has already made similar approaches in the recast of the WEEE Directive.

3. Develop new measures or enforce reporting requirements to ensure that permanent definitions and national regulation decisions are reported in a timely manner to the Secretariat of the Basel Convention/OECD Council/EU (Aoki-Suzuki et al., 2012), ensuring transparency for reuse organizations and preventing trade between countries that have the least strict regulations.
4. Ensure each country's input is included in the development of these definitions and future drafts of transboundary shipment legislation, such as The Basel Convention, creating harmonised definitions.
5. Expand the BCRCs to ensure this reporting does not create an administrative burden, and provide them greater financial and human resource support to develop trade information hubs in their regions under the Basel Convention (Aoki-Suzuki et al., 2012). Similar centres can also be organized within the EU.
6. Develop international integrated standard codes for export and import from the improved definitions and categorization for EEE, WEEE and UEEE.
7. Diversify and update categories of UEEE, WEEE and EEE regularly to reflect the current realities in trade and scope of ICT. The EU has plans to extend the scope of EEE after 2018.
8. Improve information exchange systems between the competent authorities and between the Basel Convention, OECD Council and EU.
9. Shorten the notification and approval timelines, which can be facilitated by electronic communications.

Classification

The development of an all-inclusive functionality-testing framework is necessary in order to classify whether equipment is destined for repair, reuse or disposal. Currently, the testing guidelines put into law are inadequate to determine if a product is "for potential reuse" or repair or if it should be classified as e-waste, especially when testing parts and components for reuse or equipment for repair. One possible option includes the use of the PAS 141, or a tool like it. PAS 141 is the Publicly Available Specification developed by the WEEE Advisory Body as a specification for the reuse of WEEE and UEEE (O'Connell and Fitzpatrick, 2012). The specification covers preparation of equipment and components for reuse, and it includes requirements for assigning WEEE and UEEE for recycling (O'Connell and Fitzpatrick, 2012). A framework could be developed that would ensure that all e-waste destined for repair or reuse had passed the PAS 141 standard. Similarly, the Code of Good Practice for Re-use of WEEE developed by the Public Waste Agency of Flanders (Ovam) offers good insight.

Monitoring and Enforcement

To aid struggling enforcement in developed and developing countries, the following could be accomplished:

1. Develop guidelines illustrating the integration of trade controls of WSR, the Basel Convention and the OECD Council Decision, and provide these to the competent authorities within each country;
2. Develop guidelines specifically for border control personnel to help distinguish between non-recyclables and non-reusable and recyclable and reusable e-waste, which cover all types of EEE sold in developed and developing markets to ensure accurate border control (Aoki-Suzuki et al., 2012).

3. Exporting developed countries assist importing countries in developing their regulatory capacity to handle such shipments.

7.2 National e-waste and reuse policies

Many developing and developed countries lack e-waste and/or reuse policies in their current legislation. The aim of such policies is to provide harmonisation with the current international agreements and EU member state legislation while developing a framework for e-waste collection, reuse, recycling and disposal in an environmentally safe manner. The establishment of such policies within countries' national legislation can be accomplished by:

1. Transposition of the relevant international or member state legislation into the national law (Basel Convention, European WEEE Directive and WSR, and OECD Council Decision);
2. Promotion and development of domestic collection, and if possible, recycling and dismantling centres;
3. Improvement and promotion of the current understanding of EEE, UEEE, and WEEE through the development of guidelines;
4. Development of guidelines for determining bond guarantees for specific UEEE, with the help of the Basel Convention and the EU;
5. Emphasis on social, environmental and economic implications and possible benefits of reuse within legislation (Kahhat and Williams, 2009);
6. Establishment and improvement of WEEE legislation to include reuse targets;
7. Provision of nationally-standardized EEE take-back schemes and frameworks with third-party access to this equipment for reuse organizations that can provide a reliable and consistent supply of suitable equipment;
8. Integration of ICT tools and reuse and recycling awareness into education and disadvantaged community programmes; and
9. Development of these national policies through involvement with economic development organizations, reuse/recycling firms, informal recyclers and the academic community (Aoki-Suzuki et al., 2012).

7.3 Establishment of comprehensive databases

It is important to clarify the legality of the transboundary movement of UEEE within developed and developing countries. This could possibly be achieved by creating a secure and comprehensive database between the EU, OECD and non-OECD countries. The OECD currently provides a user-friendly interactive database on its website to help guide individuals involved in a transboundary movement of waste destined for recovery within the OECD area. The database offers the information necessary to complete the forms for notification and movement of documents required by national competent authorities. A similar database designed for all countries involved in the transboundary movement of WEEE, UEEE and EEE would be highly beneficial. Such a database could provide information on all requirements, notifications and forms required for each country, explain the different legislation, legal basis and classification for e-waste and who to contact for bonds. It would be suitable to have the international Basel Convention, or possibly the EU, head such a database.

Further, another database could be created to store details of each country's transboundary movements. The regularly updated database would provide a system for tracking the UEEE and ensure accurate data collection regarding transboundary movements. This would provide greater transparency in the scale and nature of this trade and improve the information exchange between OECD, non-OECD and EU countries and competent authorities. Likewise, It would be suitable to have the Basel Convention or EU head such a database. The construction of the database would also have to be considerate of commercially-confidential information related to the businesses involved in the trades.

7.4 Expansion of reuse, recycling and dismantling centres

Given the dramatically growing population of the developing countries combined with the increasing sales of ICT, it is inevitable that the developing world will dominate the next generation of the e-waste stream (Williams, 2012). It is therefore essential that developing nations acquire the capacity and resources for proper e-waste handling and disposal (Williams, 2012). This creates an opportunity for suitable recycling, reuse and dismantling facilities in the key locations of transboundary trade in both developing and developed nations. For example, key areas in developing countries such as Ghana in West Africa or selective areas in Southern China. In developed nations, there are already several accredited recycling and reuse facilities, though there need to be more considering the growth of the waste stream and proliferation of technology and devices. For example, reuse organizations could develop specific reuse and/or recycling centres in strategic locations suitable to their and partners' requirements, establishing a network of recycling, reuse and recovery facilities worldwide.

Developing countries, need international support to develop the requisite technology. Possible options could include the exporting developed country funding the appropriate management of e-waste in the importing developing country (Aoki-Suzuki et al., 2012). For example, an extended exporter responsibility system could be developed in which exporters provide funds and resources through the Official Development Assistance to encourage environmentally sound practices within importing developing countries (Yoshino, 2008). An additional option could be to provide incentives for reuse organizations to set up additional centres in developing countries that would create a channel of state-of-the-art facilities connecting both sides of the chain. Possible incentives include tax breaks or economic subsidies, provided the centres create employment and social benefits within the local area.

For the success of these certified, reputable centres, it is important to consider a country's current social, environmental and economic boundaries (Herat, and Pariatamby, 2012). Therefore, when countries house existing successful informal e-waste recycling sectors, governments could develop innovative integration models whereby the informal sectors are still allowed to participate in safe recycling practices (collection and/or preprocessing), while hazardous operations (end-of-life processing and/or refurbishment) are transferred to state-of-the-art formal recyclers (Herat, and Pariatamby, 2012). This could be done through the introduction of national e-waste and reuse policy with additional technical assistance and staff training within the developing countries. In addition,

policymakers must examine these informal sectors and investigate the factors that provide the informal sector with the advantage. For instance, the informal sector generally pays consumers for their e-waste, while the reputable recycling facilities do not. Thus, incentives for both the customers and the informal sector workers may be necessary in order to develop a legitimate recycling and reuse sector (Yu et al., 2010). An extended producer responsibility (EPR) system that provides financial incentives for the informal recyclers through higher prices than those available from informal recyclers is another option (Bates et al., 2014).

7.5 Green e-waste transboundary channel

The development of a green regulated channel of export and import is a highly attractive option (Juan, 2009) to resolve the current issues obstructing the movement of equipment destined for reuse, refurbishment and repair. A regulated channel of reuse organizations' equipment destined for sites certified as operating under agreed normative standards for reuse, refurbishment, recycling, recovery and disposal would be authorized, managed and monitored by a regional or global collaborative system like the Basel Convention (Aoki- Suzuki et al., 2012) or by national governments. To allow this type of e-waste trade, a regulatory action might be needed by the Basel Convention or the EU to change certain procedures (Juan, 2009).

The main stakeholders in this channel would be those that handle discarded equipment (Anahide, 2007), including official reuse and refurbish organizations, recyclers, collection dismantling and recovery facilities, processors, final disposers and regulators. To aid the success of the channel, points to introduce and improve would be:

- Create a waste database (Anahide, 2007) that allows collection facilities (retailers, civic amenity sites, refurbishment centres) and competent authorities for transboundary shipment to record all e-waste processed (the origin and the destination of the parts, components or whole products). This waste database would also enable communication and information sharing between stakeholders.
- Increase the current quality and amount of WEEE, UEEE and EEE for reuse,
- Regarding refurbishment and recovery use a communication and marketing campaign (Anahide, 2007) to highlight the public and private collection facilities, specifying the type of equipment that can be recycled and reused in order to ensure material enters the formal channel and not the informal sector.
- Establish pick-up collection in built up areas once or twice per year. This could be developed through the waste database with persons registering the equipment and address for pick-up.
- Permit only official organizations with the appropriate licenses and certifications to operate within the channel.
- Launch a campaign to inform the public to purchase components and equipment that has PAS 141 demarcation or those from reputable refurbishers and to purchase second-hand equipment with the appropriate documentation indicating place of purchase to cut out informal competitors.

If it is enacted into legislation that a PAS 141 standard or something similar is required for reuse products, parts and components, movement will become easier for official reuse organizations and informal processes may be reduced through loss of market.

8 Conclusion

The case studies confirm that there is substantial e-waste trade in both developed and developing countries despite the dominant narrative told by ENGOs. This report identified a number of barriers obstructing the transboundary movement of e-waste for the purpose of reuse and/or refurbishment. The predominant obstructions were insufficient definitions for distinguishing between waste and non-waste and the discrepancies in transposition into national legislation. These barriers create time delays and confusion when exporters apply for transboundary licensing, and in some cases, they generate increased costs for reuse organizations, which renders their activities unprofitable. This regularly leads to high-quality equipment being recycled domestically rather than shipped abroad for refurbishment and reuse. Given the current situation, these barriers will likely continue to affect reuse organizations until a global standard for reuse is developed in conjunction with capacity improvements in developing countries. Despite these significant obstacles, change is possible through the support and development of a straightforward protocol for reuse organizations and through the review and creation of amendments to the current legislation.

The development and establishment of national e-waste and reuse policies and a comprehensive transboundary database has the potential to help resolve the barriers to reuse and refurbishment trade. Further, to tackle the ever-growing e-waste problem and support the growth of the reuse, refurbishment and recovery industries, the formation of state-of-the-art e-waste reuse, recycling, dismantling and recovery network and a regulated green transboundary channel are proposed for both developed and developing countries. The creation of independent certified processing centres with a focus on refurbishment will help prioritize EEE reuse. These recommendations aim to improve the transboundary movement of EEE, UEEE and WEEE and support environmentally sound practices worldwide. For the sake of expediency, these recommendations may initially be considered on a regional or sub-regional level.

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Annex 1: Overview of collected case studies from StEP members

Case Study	Reuse Model Type	Activity	Movement of equipment
1, 2, 3	IT Asset Management and Networking Equipment Recovery	Movement of mobile phones and parts from developing countries to developed for the purpose of licensed recycling and reuse practices.	Importing to Scotland licensed facility, from Jordan, Czech Republic and Hungary
4	IT Asset Management	Reuse of used IT equipment and mobile phones.	Globally exporting and importing to license facilities in UK, Germany, France, Italy, Spain, Sweden, South Africa, India and US. As well as exporting to facilities in West/East Europe, North Africa, South Africa, and the Middle East.
5	IT Asset Management	Parts being exported non-OECD to OECD for functional testing and proper refurbish/reuse.	Importing to USA licensed facility from Costa Rica
6, 7, 8	Networking Equipment Recovery	Reuse/Recycle	Importing to facilities in Chicago from Venezuela; from Ukraine to Scotland recycling facilities; and trade between European members.
9	Close the Gap	Refurbished computers sent to qualified organizations	Importing to developing countries

Annex 2: Survey structure

1. Step Member Organization
2. Re-Use Activities
3. Equipment being transferred
4. From (Place)
5. To (Place)
6. When
7. Simple description of how re-use was obstructed (one sentence)
8. More comprehensive description of the situation (paragraph)
9. How unscrupulous actors are circumventing this regulation (paragraph)

Annex 3: Interview guide with Step Members

Step Member:_____

The activities of reuse organizations operating to high standards are frequently frustrated by waste regulations, which add significant delays and costs to the shipping of appropriate materials to their refurbishment operation. We are interested in how your organization's re-use activities have been obstructed during trans-boundary shipments.

1. What kind of reuse activities are you involved in? [refurbishing of full devices; extracting parts or components; transport; resale; etc.]

2. What kind of equipment destined for reuse have you shipped and how are they sourced?

3. Can you give an example of a situation of how re-use activity was obstructed. Details:
    a. When
    b. Places (from _____ to_____)
    c. Clarify characterizations such as "tricky", "difficult", etc.
    d. How encountered problems were solved?

4. Have you encountered any problems with:
    a. Differences in equipment definitions and classification;
    b. Valuation of equipment shipped;
    c. Equipment functionality testing;
    d. Difficulties tracing a single shipment from origin to destination;
    e. Non co-operation of authorities;
    f. Having to deal with multiple authorities when shipping overland.

5. What do you want to be changed to improve the current situation?

Members and Associate Members of the Step Initiativ

(Jan 2016)

Full Members:

- Austrian Society for Systems Engineering and Automation (SAT)
- Basel Convention Coordinating Centre for Asia & the Pacific (BCRC China)
- Basel Convention Coordinating Centre for Training and Technology Transfer for the African Region (BCCC-Africa), University of Ibadan
- BIO Intelligence Service S.A.S.
- Center for Environment and Development for the Arab Region and Europe (CEDARE)
- Chiho-Tiande (HK) Limited
- Compliance and Risks
- Dataserv Group Holdings Ltd.
- Datec Technologies Ltd
- Delft University of Technology (TU Delft)
- Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH
- Dismantling and Recycling Centre Vienna (D.R.Z)
- Empa – Swiss Federal Laboratories for Materials Science and Technology
- Ericsson
- Ewaste de Guatemala
- FECACLUBS-UNESCO
- Fraunhofer Institute for Reliability and Microintegration (FHG-IZM)
- Griffith University
- Hewlett Packard (HP)
- Institute for Applied Ecology (Öko-Institut e.V.)
- International Telecommunication Union (ITU)
- Massachusetts Institute of Techno-logy (MIT) – Materials Systems Laboratory
- Memorial University
- MicroPro Computers
- Microsoft
- Ministry of the Environment Japan, Office Waste Disposal Management, Department of Waste Management and Recycling
- National Center for Electronics Recycling (NCER)
- Philips Consumer Lifestyle Sustainability Center
- Plataforma de Residuos Eléctricos y Electrónicos para Latinoamérica y el Caribe (Latin American WEEE Platform) (RELAC Platform)
- Reverse Logistics Group Americas (RLGA)
- Secretariat of the Basel Convention (SBC)
- Secretariat of the Pacific Regional Environment Program (SPREP)
- Sims Recycling Solutions
- Swiss State Secretariat of Economic Affairs (SECO)
- Technische Universität Berlin, Institut für Technischen Umweltschutz, Fachgebiet Abfallwirtschaft (Chair of Solid Waste Management)
- Technische Universität Braunschweig, Institute of Machine Tools and Production Technology
- The Sustainability Consortium
- UMICORE Precious Metal Refining
- United Nations Environment Programme/Division of Technology, Industry and Economics (UNEP/DTIE)
- United Nations Industrial Development Organization (UNIDO

- United Nations University (UNU)
- United States Environmental Protection Agency (US-EPA)
- University of Limerick
- University of Northampton (UoN), The Centre for Sustainable Wastes Management
- University of Southern Denmark, Department of Chemical Engineering, Biotechnology and Environmental Technology
- Vel Tech University
- WEEE Help
- WorldLOOP

Associate Members:

- Global e-Sustainability Initiative (GeSI)
- Vertmonde Cia. Ltd.

Step Green and White Paper Series

Number	Area	Title	Date
Green Paper #11	“Reuse”	Effect of Waste Legislation on TBM of EEE Destined for Reuse	13 January 2016
Green Paper #10	“Reuse”	Reuse Potential	07 January 2016
Green Paper #9	“Policy”	E-waste Prevention, Take-back System Design and Policy Approaches	13 February 2015
Green Paper #8	“Policy”	Differentiating EEE Products and Wastes	14 January 2014
Green Paper #7	“Reuse”	E-waste Country Study Ethiopia	10 April 2013
Green Paper #6	“Policy”	E-waste in China: A Country Report	05 April 2013
Green Paper #5	“Policy”	Transboundary Movements of Discarded Electrical and Electronic Equipment	25 March 2013
Green Paper #4	“Recycle”	Recommendations on Standards for Collection, Storage, Transport and Treatment of E-waste	22 June 2012
Green Paper #3	“Policy”	International Policy Response towards Potential Supply and Demand Distortions of Scarce Metals	01 February 2012
Green Paper #2	”Redesign”	Worldwide Impacts of Substance Restrictions of ICT Equipment	30 November 2011
Green Paper #1	“Policy”	E-waste Indicators	15 September 2011

Number	Area	Title	Date
White Paper #5	“Policy”	One Global Definition of E-waste	03 June 2014
White Paper #4	“Recycle”	Recommendations for Standards Development for Collection, Storage, Transport and Treatment of E-waste	02 June 2014
White Paper #3	“Policy”	On the Revision of EU’s WEEE Directive - COM(2008)810 final	1 October 2009, revised 22 March 2010
White Paper #2	“Reuse”	One Global Understanding of Re-use – Common Definitions	5 March 2009
White Paper #1	“Policy”	E-waste Take-back System Design and Policy Approaches	28 January 2009

All Step publications are online available at http://www.step-initiative.org/publications.html

About the Step Initiative:

"Step envisions tobe agents and stewards of change, uniquely leading global thinking, knowledge, awareness and innovation in the management and development of environmentally, economically and ethically-sound e-waste resource recovery, re-use and prevention."

Step is an international initiative comprised of manufacturers, recyclers, academics, governments and other organizations committed to solving the world's waste electrical and electronic-e-waste-problem. By providing a forum for discussion among stakeholders, Step is actively sharing information, seeking answers and implementing solutions.

Our prime objectives are:

- Research and Piloting
  - By conducting and sharing scientific research, Step is helping to shape effective policy-making
- Strategy and goad setting
  - A key strategic goal is to empower proactivity in the marketplace through expanded membership and to secure a robust funding base to support activity
- Training and Development
  - Step's global overview of e-waste issues makes it the obvious provider of training on e-waste issues
- Communication and branding
  - One of Step's priorities is to ensure that members, prospective members and legislators are all made aware of the nature and scale of the problem, its developmentop-portunities and how Step is contributing to solving the e-waste problem.

The Step initiative came about when several UN organizations, whowere increasingly aware of the growing global e-waste problem, saw the need for a neutral, international body to seek real, practical answers that would be supported by manufacturers, recyclers and legislators alike.

Step's core principles:

1. Step views the e-waste issue holistically, focusing on its social, environmental and economic impact – locally, regionally, globally.
2. Step follows the lifecycle of equipment and its component materials from sourcing natural resources, through distribution and usage, to disposal.
3. Step's research and pilot projects are "steps to e-waste solutions".
4. Step vigorously condemns the illegal activities that exacerbate e-waste issues, such as the illegal shipments, recycling practices and disposal methods that are hazardous to people and the environment.
5. Step encourages and supports best-practice reuse and recycling worldwide.

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