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Transboundary Movements of Discarded Electrical and Electronic Equipment

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SOLVING THE E-WASTE PROBLEM

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Executive Summary

The global "trade and traffic" (Lepawsky & McNabb, 2010) in used and end-of-life electronics has become a serious matter of concern in the past decade. Building on primary archival and ethnographic research, as well as secondary sources such as recent studies and reports on global flows, this green paper describes, quantifies and analyzes the global trajectory of discarded electrical and electronic equipment.[1] In addition, the paper reviews the key international, regional and national regulations and guidelines that govern the transboundary flows of this material stream. Finally, the paper describes and analyzes the drivers of export, as well as the various loopholes and leakages that facilitate the global flow of used and end-of-life electronics, frequently referred to as WEEE (waste electrical and electronic equipment) or "e-waste". Of particular significance in terms of understanding and addressing the drivers of export and the loopholes and leakages that facilitate transboundary flows of e-waste are the difficulty in clearly defining the boundary between waste and commodity,[2] the problems with monitoring flows and enforcing regulations, and the tension between national environmental policies and a globalized, profit-driven economy.

[1] Primary sources are understood to be reports, pamphlets and other documents published by government agencies, companies and NGOs concerning electric and electronic equipment, as well as interviews conducted by the author. Secondary sources are articles of a journalistic or academic nature that engage with the issue in a primarily analytical fashion.

[2] A discarded electrical and electronic item can be a commodity in multiple senses: as a functional or repairable technology, as a source of spare parts, or as a source of raw materials. The term commodity encompasses all these forms and emphasizes the potential value in discarded electrical and electronic items. There is quite a bit of debate over how to classify discarded items, since their status as commodity or waste varies considerably over time (for instance as the market price for raw materials fluctuate) and from place to place (for instance a used but still-functional computer is too old to be valuable in the US, but in Nigeria it is a valuable commodity). According to the StEP Initiative, "E-waste is a term used to cover almost all types of electrical and electronic equipment (EEE) that has or could enter the waste stream. Although e-waste is a general term, it can be considered to cover TVs, computers, mobile phones, white goods (e.g. fridges, washing machines, dryers etc), home entertainment and stereo systems, toys, toasters, kettles – almost any household or business item with circuitry or electrical components with power or battery supply" (www.StEP-initiative.org). The definitions of e-waste put forth by EU's Waste Directive, the OECD Waste Agreement and the Basel Convention definitions, as well as those of various national governments, contain nuanced differences. As I note below, the fluidity and complexity in terms of definition has implications for how e-waste can be regulated. This definitional fluidity also has implications for how discarded equipment is nequipment or when she refer to something as a used commodity, yet these terms often obscure the complexity she attempts to capture in her discussion. For a further nuanced definition, see: Secretariat of the Basel Convention (2011).

1 Introduction

The past ten years have seen increased concern over the problem of used and end-of-life electronics. Governments, multilateral organizations, environmental justice NGOs, the media, industry and the general public have become increasingly sensitized to this issue. In addition to concerns over this material stream's sheer volume and potential danger to human health and the environment through improper management, the theme that has evoked the most concern is the transboundary movement of discarded electrical and electronic equipment, which media and NGO reports repeatedly characterize as the newest form of toxic waste dumping from the rich to the poor. Provocative images of smouldering e-wastelands in China, India and West Africa, and titles such as "Exporting Harm" (Puckett 2002), suggest that once again that the poor and marginalized peoples of the global South—who lack the political and economic capacity to safely dispose of hazardous material— and their environments are paying the price for the affluent, high-tech lifestyles in the North (Bodeen, 2007a; Högens, 2009; Mayfield, 2003). Such reports echo the language used during the toxic waste export crises of the 1980s.

Equating the export of discarded equipment with toxic waste dumping brings much-needed attention to the uneven global patterns in the distributions of wealth and pollution associated with the digital revolution. However, it is becoming increasingly evident that such dumping narratives offer only a partial representation of the problem. They tend to oversimplify the global trajectory of used and end-of-life electronics. That is, they put forth a simple yet inaccurate story in which this equipment travels in a straight line from the global North to the South. In addition, they assume that the North and South are internally homogenous (Lepawsky & McNabb, 2010). Such representations perpetuate the false notion that all industrialized countries are exporters and developing and transition countries are importers. Furthermore, they presume that export countries export identical quantities and types of used and end-of-life electronics and that the environmental and social impact of imported used and end-of-life electronics is identical across all net importing countries. Finally, this representation of export assumes that once an electrical and electronic device is discarded, it is and remains a singularly toxic, valueless object (Lepawsky & McNabb, 2010).

Increasingly, environmental NGOs and the media have begun to recognize that dumping alone cannot entirely capture the complexity of the transboundary movements of used and end-of-life equipment. Careful studies reveal that e-waste flows most often take a regional, not a North-South trajectory (EEA, 2009; Fischer et al., 2008; Lepawsky & McNabb, 2010; Sander & Schilling, 2010; Secretariat of the Basel Convention, 2011; UNODC, 2009). Moreover, neither export countries nor import countries are homogenous. The quantity and type of e-waste exported and imported varies significantly, as does the ability of individual import countries to process e-waste in an environmentally-sound manner. Finally, while discarded equipment certainly contains toxic compounds, it is also a source of spare parts or components, as well as valuable materials that can be extracted and reintroduced into production. According to this consciously alternative narrative on used and end-of-life electronics, "the enormous resource impact of EEE… is widely overlooked" (Schluep et al., 2009, p. 2). As strategic metals in particular are becoming rare, more and more actors are seeing e-waste as urban ore. Far from dumping, formal and informal export of used and end-of-life electronics and their components represent billion-dollar industries (ABI Research, 2010; BCC Research, 2010; Cobbing, 2008; Hicks, 2005). Moreover, drivers for export are multiple and complex: West African countries appear to attract discarded items particularly for the re-use value of the equipment while other countries such as China, with their growing need for strategic raw materials, requires access to large quantities of certain minerals. Overall, what is becoming clear is that the potential value of discarded equipment—be it as a reusable technology, a spare part, a component or a source of raw materials—is a significant driver of export (Ayodeji, 2011; Espejo, 2010).[3]

Thus, used and end-of-life electronics is in fact not a simple story of North-South dumping, such as the waste crisis of the 1980s, but a complex, global division of labor, technology, value and ecology in which numerous actors have different, at times competing, priorities. However, as discussed in the following section, it can be challenging for some existing regulations, which were originally developed to address traditional waste streams, to address the complexity inherent in the transnational flow of used and end-of-life electronics. These regulations were put into place before non-traditional waste streams, such as construction and demolition debris, ship recycling and used and end-of-life electronics represented a significant problem. More recent guidelines, such as the WEEE Directive/Recast and the Basel Technical Guidelines, attempt to adapt environmental regulations to account for both used EEE (which, it can be argued, are still products and not waste) and end-of-life electronics in an effort to address the unique complexity of this waste stream, though effective regulation remains a considerable challenge.[4]

2 Regulatory Frameworks

In response to the exponential growth in the amount of e-waste generated worldwide and the international controversy over its export, the past decade has seen a burgeoning of used and end-of-life electronics regulations at the local, national, regional and international levels. These policies encompass provisions for the production of EEE, as well as the collection, treatment and export of discarded EEE. This section provides a brief overview of some of the key regulations and policies relating to discarded used and end-of-life electronics.

3 The Basel Convention

Of the international guidelines with the potential to address the management and transboundary movement of e-waste, the most significant are the technical guidelines on re-use, recycling and transboundary movement currently being devised under the auspices of the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal. The Basel Convention was adopted in 1989 and entered into force in May of 1992, with later addendums in 2006 (Nairobi Declaration) and 2011 (Cartagena Decisions).[5] The Convention, which has been signed by 179 countries, arose in response to the toxic waste scandals of the 1980s. The concept of environmentally-sound management (ESM) is the cornerstone of the Convention. It has three stated objectives: to minimize the production of hazardous waste, to encourage the local handling of hazardous waste, and to minimize

[3] What some call the “social dimensions” of transboundary e-waste flows - that is, consumer awareness and understanding of the problem, patterns of consumer behaviour, notions of responsibility and attitudes to alternative solutions such as equipment leasing - requires further research. Little is known about the role consumers play in the disposal process, what factors influence their attitudes and what implications these issues have for the transboundary movements of e-waste.

[4] For more information, see: http://ec.europa.eu/environment/waste/shipments/pdf/correspondents_guidelines_en.pdf.

[5] Note also that in 2012 the Basel Convention, in conjunction with a host of relevant partners, launched the Call for Action, a global survey on e-waste. For more on this, see: http://www.basel.int/DNNAdmin/AllNews/tabid/2290/ctl/ArticleView/mid/7518/articleId/474/Joint-Survey-on-E-Waste--Call-for-Action.aspx.

the export of hazardous waste from developed to developing countries.[6]

The Convention has evolved in terms of its definition of what constitutes hazardous waste and what constitutes non-hazardous waste. Initially, categories of hazardous wastes were developed by the Parties under Annex I. Wastes that belonged to any category in Annex I would be considered hazardous, unless they did not poses any of the hazardous characteristics outlined in Annex III of the Convention. Furthermore, wastes that belong to any category contained in Annex II of the Convention (wastes collected from households and residues arising from the incineration of household wastes) that are subject to transboundary movement are considered "other wastes" covered by the Convention. Subsequently, the parties developed Annex VIII and Annex IX that expressly list what is considered hazardous and non-hazardous, respectively, under the Convention. These lists are intended to codify and harmonize definitions of hazardous waste across countries. In theory, standardized definitions of hazardous wastes make it more challenging to justify export on the basis of the spatial contingency of hazardousness.

The Basel Convention does not ban the export of hazardous waste altogether. Instead, the Convention's stated purpose is to minimize the negative social and environmental impacts of hazardous waste export.[7] A number of provisions are put in place to attain this objective.

In addition to standardizing definitions of hazardous substances, the Convention was the first body to put together a hazardous waste import and export control system by developing prior informed consent (PIC) protocols for the import, transit and export process. Specifically, it states that exporters and importers of waste must notify and obtain written consent from the Basel Competent Authorities of importing countries, as well as transit countries, prior to any shipments. Exported waste must also be closely monitored during the transport process. According to the Convention, shipments of waste from developed to developing countries without notification and consent are illegal (for a specific list of countries see, Annex VII of the Basel Convention). Finally, the Basel Convention places clear restrictions on the export of hazardous waste intended for disposal (as opposed to export for recycling and recovery). Exporters of hazardous substances must demonstrate that the refuse will be handled in an environmentally-sound manner upon arrival in the importing country.

Importantly, the Basel Convention was developed to address traditional waste streams. It classifies hazardous waste in terms of the substances in the waste materials. That is, the Convention does not list, for instance, computers as hazardous and keyboards as non-hazardous. Instead, it classifies wastes as hazardous or non-hazardous depending on the waste's chemical properties. The Convention lists a threshold limit for each hazardous sub-

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[6] Importantly, the Basel Convention stipulates that in certain limited instances, when a country clearly lacks the technology to handle hazardous waste locally in an environmentally-sound manner, hazardous waste may exported to a country with the necessary technology/infrastructure for the purposes of disposal. For more about the history of the Basel Convention, see: http://untreaty.un.org/cod/avl/ha/bcctmhwd/bcctmhwd.html.

[7] The Basel Ban Amendment was introduced in 1994 as a means to address some of the problems with the Basel Convention. According to some developing countries and environmental groups, the Basel Convention was not strict enough. Critics of the Convention point out that the Secretariat has nearly no power to enforce the Convention. Furthermore, with notification and consent, nearly anything could, at least theoretically, still be exported. Unlike the Basel Convention, the Basel Ban places a total ban on any export of hazardous waste for any purpose, including re-use, from Annex VII countries to non-Annex VII countries. The Basel Ban has yet to be ratified, however. This is because some developing countries that specialize in waste handling see a total ban as a loss of revenue. Other critics of the Basel Ban, including industry representatives, argue that stopping all flows of hazardous waste would unnecessarily restrict access to recyclables and raw material. For more on the Basel Ban, see: Kellow (1999) and Lepawsky & McNabb (2010).

stance it identifies. For instance, waste that contains mercury above the official threshold is considered hazardous. Anything below this value is considered non-hazardous. This means that the Convention does not have a specific rule for all forms of used and end-of-life electronics.

It is worth noting that there are a number of initiatives under way within the Basel Convention that may impact the management and transboundary movement of used and end-of-life electronics. First, the public-private Partnership for Action on Computing Equipment (PACE) has developed technical guidelines addressing the re-use, recycling, and transboundary movement of used and end-of-life computing equipment. This public-private partnership of technical stakeholders succeeded the first Basel public-private partnership, the Mobile Phone Partnership Initiative (MPPI), which developed similar guidelines addressing mobile phones. PACE is also implementing pilot projects on used and end-of-life computing equipment in developing countries that are geared to the informal sector.[8] The Basel Convention Open-Ended Working Group (OEWG), which consists of the Basel Party and Signatory technical experts, is also developing a technical guideline on the transboundary movement of used and end-of-life electronics that is informed, in part, by the work of PACE. Finally, work is being undertaken by the Legal Clarity Workgroup launched by the recent "Country-Led Initiative" (CLI) on the Ban Amendment. This group is addressing terminology, particularly the lack of clear definitions for some wastes and ambiguous terms within the Convention. One particular focus of this group is clarifying definitions of re-use.

[8] For more on PACE, see: http://archive.basel.int/industry/compartnership/index.html

4 The OECD Council Decision

Article 11 of the Basel Convention provides for bilateral, multilateral and regional agreements regarding the transboundary movement of hazardous wastes or other wastes with Parties or non-Parties, provided that such agreements or arrangements do not detract from the environmentally-sound management of hazardous wastes and other wastes as required by the Convention. One such agreement is the 1992 Organization for Economic Co-operation and Development's (OECD) Waste Agreement, an among developed member countries that aims to control the transboundary movement of hazardous waste. Similar to the Basel Convention, the OECD Waste Agreement established a framework for OECD member countries to supervise and control transboundary movement of wastes within the OECD area.[9] However, it concentrates on wastes exported for the purpose of material recovery only. Thus, when compared to the Basel Convention, which aims to minimize hazardous waste shipment, regardless of intention, the OECD Council Decision seeks to control the trade of potential resources secured from waste. The OECD's regulation not only offers more specific guidelines than the Basel Convention regarding waste destined for recovery, but it also makes it possible for countries that are not signatories of the Basel Convention, such as the United States, to continue to trade waste with OECD member countries.

[9] Most of the basic terms and definitions used in the OECD Waste Agreement, such as the terms "waste" and "hazardous waste", were harmonized with those of the Basel Convention in the 2001 revised OECD Council Decision. However, for the sake of clarity, the terms "disposal" and "recovery" are distinct terms in the OECD Waste Agreement, whereas the term "disposal" covers both disposal and recovery operations in the Basel Convention. Furthermore, the OECD Waste Agreement retains certain procedural elements of the original OECD Decision C (92)39/FINAL that do not exist within the Basel Convention, such as time limits for approval process, tacit consent and pre-consent procedures.

The OECD system also diverges from the Basel Convention in its definition of waste, especially since the revision of the Council Decision in November 2003. The Council Decision differentiates between two types of waste: green listed and amber listed (see Appendix III and IV for the lists of wastes). Green listed wastes are defined as wastes that pose minimal or no risk to human and environmental health.[10] Exporters of green wastes follow the same protocols as exporters of any other commercial goods. In some instances, notification of shipment is required, but in general, green wastes can be exported without any additional controls.

Amber listed wastes are considered to pose a potential risk to human and environmental health.[11] The export of amber wastes is permitted. However, in this case PIC procedures similar to those outlined in the Basel Convention are used to control the flow of these potentially harmful wastes.

The OECD Waste Agreement was updated in 2001 (C (2001)107/Final) to harmonize with changes made to the Basel Convention as reflected in the Basel annexes. A few points about the OECD Council Decision warrant specific mention. During this revision, the OECD categories of Amber and Green were better integrated into the Basel Convention waste list, such that the Basel Convention's list of exempt wastes maps almost exactly onto the OECD green list. Annex VIII list of the Basel Convention overlaps with the OECD's Amber list. Second, like the Basel Convention, hazardous wastes are classified by the substances they contain. Specific types of waste, such as e-waste, are not defined as hazardous or non-hazardous in and of themselves. Third, like the Basel Convention, the OECD Council Decision stipulates that exported hazardous waste must be handled in an environmentally- and socially-sound manner in the receiving country.

5 The European Waste Shipment Regulation

In 2006 the European Union transposed the Basel Convention and the OECD Council Decision into European regulation with the European Waste Shipment Regulation (WSR).[12] The WSR implements the international obligations of the two regulations and includes the internationally agreed upon objective that wastes shall be disposed of in an environmentally-sound manner. How and what types of waste can be exported under the WSR is contingent on a number of factors: the intended destination, the purpose of export (re-use, recovery or disposal) and the type of waste being exported. Much like the two multilateral agreements it builds on, the WSR divides wastes into three primary categories: "Prohibited Waste", "Notification Control" and "Green Listed Controls". Unlike the Basel Convention, however, it classifies waste by components, meaning that used and end-of-life electronics fall into one of the three

[10] Annex III of the OECD Council Decision contains two categories of green-listed wastes. The first category represents the wastes listed in Annex IX of the Basel Convention. The second category of green wastes includes additional wastes that have been defined as non-hazardous by OECD Member Countries.

[11] Appendix IV of the Council Decision contains a list of these wastes. Again, the OECD classification consists of two categories. The first category includes the wastes listed in Annexes II and VIII of the Basel Convention. The second category consists of additional wastes that OECD Member Countries have agreed to classify as Amber wastes.

[12] The current regulation is the revised version of the Council Regulation (EEC) No 259/93 of 1 February 1993 on the supervision and control of shipments of waste within, into and out of the European Community. The European Waste Shipment Regulation was revised in 2007. As Juan explains, "The revised law aims to develop a simplified but stronger regime for waste movement, ban certain types of waste exports, establish greater enforcement actions and streamline existing procedures. It also seeks to incorporate into Community legislation the amendments to the lists of waste annexed to the Basel Convention as well as the revision adopted by the OECD in 2001" (Juan 2009). While the new law is clearer, the export process remains complicated and confusing.

categories mentioned above depending on what components they contain. Importantly, like the Basel Convention and the OECD Council Decision, many of the key components in used and end-of-life electronics are not listed in the WSR. The Regulation forbids the shipment of hazardous wastes in particular from EU to non-OECD countries.[13] It does, however, allow the shipment of non-hazardous waste to other countries, so long as that waste is exported for the purpose of recovery. Moreover, if items are taken apart in the country of origin, what remains will often be categorized as green list waste, thus exempting an exporter from having to notify the authorities (Fischer et al., 2008, p. 33). The export of functioning second-hand items is also permitted under this regulation, though the recent revision of the WEEE Directive lays more restrictions on the export of used equipment.[14] Importantly, the three regulations addressed above are enforceable once they have been transposed into national regulation. For more on relevant national regulations, see the following endnotes.[15] [16]

[13] See Annex V of the Regulation.

[14] For more details, see: http://ec.europa.eu/environment/waste/shipments/pdf/correspondents_guidelines_en.pdf.

[15] E-waste has become a priority issue for policy-makers across the globe (Yu, 2010). In 1991, the UNEP declared e-waste a priority waste stream. Since then, countries around the world have struggled to manage their e-waste. While the US does not yet have a comprehensive policy, President Obama called for a better national e-waste policy on 20 June 2011 and the US EPA is actively working on the e-waste issue. For more information on the US EPA's work on e-waste, see: http://www.epa.gov/osw/conserve/materials/ecycling/pubs.htm. The US Congress introduced HR 2284, otherwise known as the Responsible Electronics Recycling Act. This bill would prohibit the dumping of electronic waste to developing countries while simultaneously promoting recycling jobs at home. This bill was initially introduced to Congress two years ago, but has not yet been passed. See also: Gov Accountability Office Report, especially appendix 3, which is the US EPA's response to the report. Widmer et al. (2006) offer a comprehensive list of national e-waste regulations from around the world. The following proposed and existing e-waste legislation is not included in the above-mentioned article: 1) The Asia Partnership is a project funded by the Ministry of the Environment of Japan and the Secretariat of the Basel Convention. The goal of the partnership is to establish a public-private partnership for dealing with e-waste in seven countries in the Asia and Pacific region (Cambodia, Malaysia, Sri Lanka, Mongolia, Thailand, Philippines China). For more on this see, http://www.env.go.jp/en/recycle/asian_net/Project_N_Research/Asia_E-waste_Project.html. The UK has introduced the The Waste Electrical and Electronic Equipment Regulations 2006. Iceland RR-SKIL 2008. France, Decree n° 2005-829 of 20 July 2005 relating to the composition of electrical and electronic equipment and to the elimination of waste from this equipment. Italy, Legislative Decree 25th July, 2005 – no. 151. See also Alice Munyua's (2010) report on e-waste in East Africa for a general overview of e-waste policies and provisions in other laws that can apply to e-waste in African countries. For more on WEEE in China, see:http://www.usito.org/dev/policy-work/environmental-protection/china-weee.

[16] An additional question is whether regulations should place some responsibility on the consumer as well. Current formulations of e-waste policies place little, if any, requirements on product owners. As one industry representative points out this is problematic, as product owners, through the disposal channels they choose, greatly influence what happens to the items they discard. A critique of this perspective is that devolving the responsibility onto consumers who have little control over the production and disposal processes is not very realistic and could deflect attention away from the source of the problem. From this perspective it is more important to maintain the system in which producers are held responsible, and to also make importers responsible, than it is to place responsibility on consumers. As one industry representative explained: "Being an electronic or electrical product producer within the EU means that you are required to offer your customers a free-of-charge service to take back the products and recycle them in an environmental-friendly way when they reach end-of-life. There are no requirements on the product owner, though, to use the offered service. It is totally possible to just sell the product to the highest bidder on the second-hand market and gain some extra money on it instead. This generates a strange landscape where one party needs to set up and secure a take-back process, while the other party (the one having control of the product) has no commitments at all. It is more or less up to the product owner's common sense and good will to ensure that his/her product is actually processed in an acceptable way. The producer may have a stronger environmental profile than the legal owner of the product, which may lead to a brand issue/risk. As an external viewer it is easy to put

6 A Green Chanel

Given the potential value of used and end-of-life electronics, many observers contend that a total ban on export is unrealistic, economically disadvantageous, and potentially environmentally disastrous.[17] These actors challenge the Basel Convention's insistence on localized waste management of such electronics, and thus the minimization of export of used and end-of-life electronics on three grounds. First, they point out that most countries lack the technological sophistication to safely and efficiently handle materially complex waste streams. They also insist that developing state-of-the-art domestic recycling and recovery capacity is unrealistic in many countries given the high cost of the requisite technologies, such as integrated smelters used to handle discarded electrical and electronic goods. Second, the unique physical make-up of used and end-of-life electronics necessitates both manual and high-tech disassembly.[18] Finally, labor is significantly cheaper in the developing world than in the industrialized world, and established informal collection systems in the developing world are highly efficient. Advocates of export argue that formalized, regulated channels of export that adhere to strict environmental and health regulations are vastly superior to unregulated informal recycling networks that rely on "primitive" recycling techniques which are harmful to both human health and the environment and are grossly inefficient (Juan, 2009, pp. 11–12). They contend that the South gains employment and high-tech firms in the North can more easily recover critical raw materials. Moreover, the environment is protected because both informal, backyard recycling and the expansion of mining are avoided.

Such an arrangement, however, may perpetuate a global division of recycling (Juan, 2009, p. iv). Others dispute this, proposing that as mechanized recovery technology grows more sophisticated in Europe and if producers are more mindful of designing for the environment, constructing products with mineral recovery in mind, the entire process of disassembly may shift to Europe. Whether the latter claim proves to be accurate is yet to be seen. Nonetheless, it remains the case that, given the global distribution of technology, uneven wages and the various potential values embedded in discarded EEE, a global system of processing seems inevitable.

Whether one supports the arguments made by promoters of export—be it as a form of economic development or an efficient global recycling system—it is clear that the transboundary movements of used and end-of-life electronics cannot be interpreted as a simple tactic used to defray the costs of recycling in countries with strin-

responsibility on the producer of the product as long as the item carries the producer's brand and logo, while the owner's responsibility stops when he/she sells the item. Thus it doesn't matter that the producer doesn't have the legal responsibility for the item, he/she will be accountable for it as long as it carries the producer's name" Personal Communication with Marie Zide, Ericcsson, (4 October 2012).

[17] StEP holds that export should be allowed as long as it complies with the Basel Convention. For more information, see Wang et al. (2012).

[18] E-waste is materially complex. It consists of various types of plastic, metal and glass. This material complexity makes it such that it is easier to recover valuable metals when the equipment is initially manually separated. When equipment is manually disassembled, the glass, plastic and metal fractions are more easily kept apart. This means that a higher level of what environmental engineers refer to as "eco-efficiency" is achieved. While manual, relatively low-tech recycling techniques are favourable during the initial stage of the recycling process, it is argued that high tech facilities with integrated smelters are better capable of recovering trace precious metals and rare earth elements from e-waste. That is, these integrated smelters are exponentially more efficient at extracting valuable materials out of e-waste, while causing the least environmental damage. Thus, the most efficient recycling combines manual with high-tech facilities (Chancerel & Rotter, 2009; Schöps, 2010). As Otmar Deubzer (2011, p. 83) explains, "It is not sufficient to install a shredding and mechanical separation process and simply treat all kinds of e-waste with it in the same way. Good pre-processing requires a balanced application of manual labor and state-of-the art mechanical processing for each type of e-waste".

gent environmental and human health regulations (Espejo, 2010; Lepawsky & McNabb, 2010). The disposal of discarded used and end-of-life electronics is organized along a complex, non-linear, and interconnected division of labor, wealth, technology and ecology that transcends national borders. Discarded EEE–in the form of reusable goods, spare parts, e-scrap, precious metal-rich components and toxic materials—circulates and crisscrosses the globe as environmental and human health liabilities and valuable commodities. A close look at this complex system makes evident that the conceptual model underlying the dominant narrative of dumping—a model in which the world is cleanly divided into the wealthy, developed, high-tech global North that exports waste and the impoverished, technologically-primitive global South—is not only oversimplified, but may actually hinder a more productive understanding of the issue. Such a model overlooks too many important subtleties to capture the second-life of used and end-of-life electronics as well as the array of social, economic, political and material relationships they engender.

The StEP Initiative proposes that the oversimplified story of e-waste export frustrates attempts by policymakers to regulate and manage the transboundary flows of discarded equipment. A more nuanced understanding of drivers, mechanisms and the global trajectory of discarded equipment is a necessity if efforts to regulate and manage transboundary flows of e-waste are to be effective (Wang et al., 2012).

7 Exit Strategies and Flow Patterns

Despite this cluster of conventions and guidelines, e-waste continues to be exported. This section outlines the legal and illegal ways in which e-waste exits countries, using Germany as an example. E-waste is exported for three reasons: for re-use, for recovery and for disposal. Instead of following the "formal" and "informal" channels of export, which often overlap, this section examines the three primary sets of actors who do most of the exporting: development organizations, immigrants and waste processing firms. [19]

Development agencies collect used and end-of-life equipment and ship it to developing countries in an effort to bridge the digital divide. In exporting the equipment, the agency has to declare the goods—if, as is often the case, they are being shipped outside of the EU—using the Customs Office's IT system ATLAS, on paper documents, on data carriers or over the Internet (Wang et al., 2012). Interestingly, as Sander & Schilling have pointed out, "in the

[19] For reasons outlined in the body of this report, it remains challenging to find conclusive and reliable quantitative data on global transboundary e-waste flows. A number of studies offer limited insight into how much e-waste is produced and exported, how business-to-business e-waste differs from privately owned equipment, and the trajectory of trade flows. One example is a study conducted by Huisman et al. (2012), which concentrates on the Netherlands, though the authors hold that the results are applicable to a number of other European countries. It is important to acknowledge the numerous on-going research projects focused on the mechanisms of e-waste export. Many of these studies are also working on quantifying and describing transbourdary trade flows. The StEP Initiative is spearheading the research on global e-waste production and trade flows. For more information on this work, see pages 25-26 of the 2011 StEP Annual Report (2012). It is also worth noting that the United States Environmental Protection Agency (US EPA) funded a StEP study authored by The Massachusetts Institute of Technology (MIT) and The National Center for Electronics Recycling (NCER) examining trade flows. For more on this research project, see: http://msl.mit.edu/index.php?id=35. The Commission for Environmental Cooperation (CEC) – a NAFTA side agreement between US, Canada and Mexico—is also conducting a similar study, though with a focus on North America. For more information, see: http://www.cec.org/Page.asp?PageID=924&SiteNodeID=1026. Furthermore, the US Trade Representative Agency has commissioned a similar export study. See: http://escrapbeat.wordpress.com/2012/04/17/u-s-itc-to-conduct-bipartisan-survey-of-american-electronics-recycling-and-reuse-landscape. Finally, the Asian Recycling Network has also launched a study on e-waste flows, though no information is currently available on this new research project.

case of EEE, the goods codes do not distinguish between used and new equipment " (Sander & Schilling, 2010, p. 20). The shipments are then scanned upon leaving the harbour for export.

Export through development agencies represents only a fraction of used and end-of-life electronics that leaves Germany. A much larger amount of e-waste leaves Germany through individuals who are either settled immigrants or persons who have come to Germany for the intended purpose of collecting and exporting discarded EEE. The complexities of identifying who these people are, how they are organized, and the manifold ways in which they obtain EEE are too complex to be thoroughly engaged with in this report. In short, Africans, Middle Easterners, Asians and Eastern Europeans ship discarded goods to relatives, friends or acquaintances in their home countries, who then sell these goods for re-use or for parts. They may also sell the equipment directly on the global market through brokers. Before export, the goods are stored in depots in various clusters around the port city. For example, Billstrasse in Hamburg contains dozens of such warehouse depots, which are almost exclusively run by Afghanis. Their methods for exporting these goods include declaring the goods for re-use, packing containers so that a row of functional equipment hides a load of waste, and pasting money on the inside of container doors as a way to bribe customs inspectors.

The third channel of e-waste exportation is through firms. International brokers who trade in used equipment purchase discarded equipment from individuals, businesses and e-waste collection sites. By reselling items technically destined for recycling, these actors not only defray the cost of domestic government-mandated recycling, but actually turn a profit. Moreover, as these goods are classified as "reusable", they fall outside of existing waste regulations. That is, exports of any type of used products (whatever their nature) for the intention of re-use are also not considered to be waste. Donations of EEE from development aid projects and others that meet the criteria for non-waste equipment set forth in the guidelines are not considered waste. However, as noted below, these definitions are vague and it remains challenging to test whether items exported for re-use are, in fact, reusable. Thus, it becomes difficult to assess whether they are in fact products or waste.

What exactly happens to the used and end-of-life electronic equipment once it leaves countries such as Germany is difficult to quantify with any certainty. While this material flow is difficult to track with precision, it is clear that it does not follow a simple North-South trajectory. For example, as the author's primary research suggests, a significant portion of e-waste that leaves Germany ends up in former Soviet Bloc countries (Annonymous Interview, 2010). In the absence of official reports or relevant academic research, international brokers and their activities remain poorly understood. Moreover, while some brokerage firms are large and well established, the line between "individuals" and smaller or unregistered "businesses" can be gray, making these later two categories difficult to discern. There are also a variety of motives for firms in the business. A recent paper on business re-use of discarded EEE lists four primary models: 1) network equipment recovery; 2) IT asset management; 3) bridge the digital divide; and. 4) social enterprise. Moreover, this report claims that all firms complain of the difficulty of accessing discarded EEE suitable for re-use and rate it as their primary barrier to business expansion (Kissling et al., 2012). Such a reliable and consistent supply of suitable equipment often requires the transboundary movement of used electrical and electronic equipment in need of repair and/or refurbishment. However, waste legislation often impedes this supply for a number of reasons that will be outlined below.

All three actors – development organizations, individuals and firms – procure their goods in a variety of ways. They often procure equipment by soliciting donations either from individual consumers or from companies. In Berlin, this author found cases in which individual dealers and smaller, semi-legal brokerage firms also solicited "donations" to help bridge the digital divide. Such dealers also stand outside municipal waste and recycling centres or procure equipment by buying it from consumers. Larger brokerage firms generally purchase EEE from companies that wish to upgrade their IT equipment.

In concluding this section, two key observations need to make: First, the flow of used and end-of-life electronics is not simply a form of dumping. EEE moves because it has value, in terms of its materials, its components and its re-use potential. However, the regulations that apply to e-waste flows today arose in response to toxic waste crisis of 1980s and thus lack the nuance to properly address the complexity of e-waste. The fact that they fail to appreciate e-waste's ambiguity creates regulatory loopholes through which e-waste flows (more on this below). The legacy of the toxic waste dumping discourse of the 1980s also informs the framing of the issue by NGOs and the media. By equating e-waste export with toxic waste dumping, some of these groups see strict restrictions on export as the only solution.

Second, the flow of e-waste is far from linear. An e-waste handler with whom the author spoke illustrated this point vividly. As he and the author walked around his facility, the man pointed to a pile of shredded circuit boards and said, "This e-waste here has an incredible story—a story that's not too uncommon these days. I don't know where the actual equipment came from, but I know that the circuit boards originated somewhere on the East Coast of North America. A Taiwanese trader bought them and shipped them to Hong Kong. Someone in Mainland China then bought them and had the components manually removed. The circuit boards minus the components were then sold to another trader in California who sold the goods to yet another trader. This guy trucked the boards to the Midwest and had them shredded there. The man in the Midwest then sold it to our customer who shipped the shredded material to us in Belgium to have the precious metals recovered" (Interview, 2009).

The e-waste handler stressed to the author that this type of arrangement is quite common today. Used and end-of-life electronic equipment rarely stays in one country or region. Instead, e-waste traders and recyclers move the once-obsolete items from place to place. Along the way, informal and formal recyclers and re-users repeatedly transform these items, with varying economic, health, environmental and social repercussions. In contrast to certain forms of mechanical disassembly, such as the manual extraction of copper wires in Bangladesh, other types of informal e-waste recycling can be catastrophic for health and the environment. For instance, in Ghana, older teenagers and sometimes even children break apart equipment imported from Europe and North America and set the wires on fire to get at the copper wires. The rest of the material is then buried, burned or sold to brokers. At each stop along the formal and informal circuits travelled by used and end-of-life electronics, handlers focus on particular parts and use different techniques. In some places, e-waste processing causes significant environmental and health damage; in other locations, it causes nearly none at all. Some make a significant profit from handling e-waste, while others, such as the children at Agbogbloshie Market in Ghana, one of the world's e-waste informal processing cites, make just enough to survive.

8 Loopholes and Leakages

This section describes and analyzes some of the key loopholes and leakages that make export possible. There are two ways to think about the issue of unwanted export. The first way is to see export as the outcome of a series of technical/bureaucratic errors or shortcomings. In other words, from this perspective the overall system is fine, but a few leaks must be plugged. As discussed below, the sources of these leaks include the lack of consistency among and between national legislations and international bodies such as the Basel Secretariat, the OECD and the EU with regards to definitions of used and end-of-life equipment. An alternative way to conceive of the problem of transboundary flows, however, is as a manifestation or symptom of a larger problem. This larger problem is the tension between national formulations of environmental policies and an uneven, globalized, profit-driven economy. That is, laws formulated from the perspective of one country are often ill-fitted to the realities of a global economy. Before engaging with these broader issues of interpretation in the conclusion, however, a look at the key loopholes and gaps in the existing e-waste regulations and infrastructure is necessary.

9 Definitions, Classifications/Codes

The export of e-waste is facilitated in part by the lack of harmonization in existing guidelines, regulations and definitions of waste.[20] Scholars in the field of discard studies point out that the category of waste is spatially, culturally and temporally contingent (Gille, 2007). This fluidity of the category of waste poses a serious challenge for regulation makers, as regulations require a somewhat stable definition of something in order to regulate it. Moreover, unlike waste in general, e-waste's duality as a toxic bad and valuable good makes it even more difficult to regulate.

One way legislators have attempted to deal with this ambiguity is to categorize e-waste by its various uses: reuse, recovery or disposal. The Basel Convention, the OECD Council Decision and the European Waste Shipment Regulation, as well as many domestic regulations, permit the export of discarded EEE for the purpose of re-use.[21] Furthermore, some regulations permit the export of equipment for material recovery under particular conditions (Lepawsky & McNabb, 2010). In other words, in distinguishing between the various purposes of export, regulations attempt to be more precise in how they define e-waste.

However, it remains difficult to determine if equipment is really being exported for re-use or if it is being exported under the auspices of re-use, when in fact it is being sent abroad as a means to turn a profit, either by evading the cost of environmentally-sound domestic recycling or through the recovery of secondary materials by means of environmentally-unsound practices by the informal sector in the importing country. When the Basel Convention was first introduced, it banned the export of hazardous waste for disposal. However, the convention permitted export for recovery and

[20] Importantly, e-waste's complex materiality poses serious challenges for classificatory systems and definitions. E-waste is not a traditional waste stream. For instance, in the United States, regulations were developed to address more "traditional" materials such as sludge or slag. The Resource Conservation and Recovery Act (RCRA) places the burden on the generator to test the waste if it is not expressly listed in Subtitle C. To perform the Toxicity characteristic leaching procedure (TCLP) test, the generator must grind up the waste if it is solid and then test it for toxicity, corrosivity, leachability or pyoritic characteristics. However, if a laptop, for example, is ground it is already rendered waste before it can be tested. One solution would be to list laptops as hazardous, but depending on their design, they might not test as hazardous (and could thus be labelled as such by the manufacturer). Thus, these newer, non-traditional waste streams, such as ship recycling outputs, end-of-life electronics or construction and demolition debris pose a serious challenge to regulators.

[21] Annex 6 of the WEEE Recast states that it is incumbent on the exporter to prove that the items for export are functional. In the old formulation of the law it was the responsibility of the competent authority to test functionality. This should improve the situation somewhat, though it is unclear how this will work in practice. Some products are easier to test for functionality than others. For more information, see: http://ec.europa.eu/environment/waste/shipments/pdf/correspondents_guidelines_en.pdf.

re-use. The result was that the export of waste intended for disposal from OECD countries to non-OECD countries decreased by 31 per cent between 1990 and 1995, whereas exports for the purposes of refurbishment and re-use increased by 32 per cent over the same time period (Espejo, 2010). The suspicion here is that export of wastes for disposal to certain destinations continued; only the waste was labelled as reusable. [22] In other cases, in particular in West Africa, re-use seems to remain the driving factor.

The same thing is happening for used and end-of-life electronics. The re-use clause in existing regulations governing the transboundary movement of e-waste makes it such that a lot of the electrical and electronic goods that are still intact are exported under the auspices of re-use (Espejo, 2010). However, it would be very difficult to determine if these items are in fact being re-used (Beck, 2007 cited in Juan, 2009). In the case of West Africa, recent studies suggest that most imported e-waste is intended for re-use (Ayodeji, 2011). Only a small percentage of goods arrive in a non-working state and half of that is repaired locally and resold for re-use (Ayodeji, 2011, p. 78; Lubick, 2012; Secretariat of the Basel Convention, 2011).[23] As Fischer explains in the study of transboundary shipments of European waste, "The conditions under which a used electronic or electrical product is, or is not, regarded as 'waste' for regulatory purposes are a matter that appears repeatedly in any discussion about thetrade in these products. In the case of electronic and electrical items, the potential for direct reuse of a discarded but functional product complicates matters rather more than is the case for, say, waste paper." (Fischer et al., 2008, p. 54).

The question of re-use is further complicated when one considers the differences between re-use from consumer products and re-use from business products and, similarly, the re-use of whole technologies and of individual parts. A consumer product such as a laptop or a cell phone can easily be re-used by new users as long as the product is functioning. In these cases, the products are re-used as they are, and are normally used for the same purpose as they were produced. For instance, evidence suggests that there is a market for re-use of washing machines, refrigerators, cell phones and certain other IT equipment in the developed world. This is less so for CRT monitors that have little re-use value in developed countries, but might have re-use value in developing countries. The situation is a bit different when it comes to business products and larger infrastructures, however. An entire base station is not re-used, but each station consists of a number of boards, which in turn can be re-used. It is still a kind of re-use, though on a product level rather than on a part level. The board was a part of product when it entered the WEEE flow, but it leaves the flow as a separated reusable part. Indeed, even in the US and Europe, some companies reintegrate discarded EEE, such as parts of cell phone networks and other network infrastructure or medical devices, into their operations. This reintegration of discarded EEE is a form of asset recovery.

The ambiguous status of used and end-of-life electronics as waste or commodity partially explains why regulators have such a hard time defining e-waste and why definitions of e-waste remain so diverse (Huisman et al., 2012). Definitions of e-waste vary from place to place, from policy to policy, and sometimes even within different sections of a given regulation. Moreover, definitions can vary depending

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[22] The Partnership for Action on Computing Equipment (PACE)—an initiative launched at the ninth meeting of the Conference of the Parties to the Basel Convention—introduced a recommended test for functionality to counter this problem. However, because the recommended test has not been adopted by the *Conference of Parties* (COP) it is not legally binding. Consequently, there is little guarantee that the test is routinely enforced by member states. For more information on the test for functionality, see: http://archive.basel.int/industry/compartnership/index.html.

[23] For more studies on this, see: http://www.ewasteguide.info/Where-are-WEEE-in-Africa.

on whether one emphasizes the material composition of the product or tries to define its status as functional or waste. For instance, what is classified as e-waste in European countries is not considered to be e-waste in China. Whereas in Europe e-waste is classified according to its hazardousness, waste in China is classified according to the raw materials it contains. Thus, a form of e-waste that contains significant quantities of hazardous materials will be banned from being exported out of Europe, but if the waste is rich in raw materials the Chinese government will likely permit its import (Juan, 2009, p. 48). This means that it is very possible to have the same goods be legally imported to China but be illegally exported out of the EU. Not only do definitions of waste differ between countries such as Germany and China, but they also vary significantly between European countries. Theoretically, the European Waste Shipment Regulation provides the template for how member states should define e-waste. However, in practice, member states interpret the EU waste codes quite differently. As a result, countries across Europe operate with significantly different e-waste classifications (Grossman, 2007; Lepawsky & McNabb, 2010; Pellow, 2007). One can see this variation by examining countries' reporting on shipments. For instance, in 2003, the Netherlands reported that they had exported 1.3 million tonnes of household waste (the exact category was Y46) to Germany. Germany, however, reported only receiving 21,000 tonnes of household waste from the Netherlands (Fischer et al., 2008, pp. 22–23). While the example of household waste is used to illustrate the point here, this phenomenon extends to shipments of used and end-of-life electronic equipment as well (Juan, 2009, p. iii).[24]

There are inconsistencies and incompatibilities between multilateral agreements and national regulations, as well as among multilateral agreements,[25] in regards to definitions of e-waste. For instance, the Basel Convention's classifications of e-waste contradict the classifications of many signatory countries (Lepawsky & McNabb, 2010).[26] Furthermore, multilateral agreements operate with different definitions of e-waste. Contrary to the stated desire to harmonize the Basel, Rotterdam and RoHS Conventions, these three continue to use distinct and sometimes contradictory codes. Furthermore, the OECD Council Decision conflicts with the Basel Convention in terms of what types of e-waste it defines as hazardous.[27] The lack of agreement between these regulations on what parts of e-waste are considered hazardous is striking.

What is perhaps most problematic is that there are inconsistencies and contradictions

[24] A similar issue exists between the United States and the EU with regards to end-of-life automobiles. The U.S. exempts them from hazardous waste regulation as they are considered scrap metal. The Basel Convention and the EU regulate end-of-life autos as hazardous if the liquids have not been removed. The Port of Rotterdam frequently contacts the US competent authority to notify them of what they consider to be an illegal shipment. The US EPA has no legal authority, however, to compel an exporter to take back the shipment. Nevertheless, exporters often try to hasten their shipments' return as the ports charge large storage fees.

[25] At a recent extraordinary meeting of the Conference of Parties to the Basel, Rotterdam and Stockholm Conventions, one of the primary goals was to find ways to build synergies between the RoHS, Rotterdam and Stockholm Conventions. Despite these efforts, there continues to be a lack of harmonization between these conventions.

[26] Recall that the Basel Convention stipulates that its guidelines are applicable to all signatories. However, the Convention also gives member countries significant leeway in their definitions of hazardous waste.

[27] Council Decision C(2001)107/Final contains codes explicitly distinct from Basel codes. The OECD Decision cancels out Basel's classification of WEEE as hazardous; it says, "Basel entries A1180 and A2060 do not apply and OECD entries GC010, GC020 and GG040 in Appendix 3 Part II apply instead when appropriate." Basel code A1180 is the WEEE item on the hazardous list. OECD replaced the WEEE deemed hazardous in Basel under codes (GC010, GC020 and GG040) that are listed as "green control", which means that they are treated more as commercial products than as hazardous waste as long as they remain within the OECD.

even within a individuals policies in regards to how e-waste is defined. This is most clearly seen in the Basel Convention, which has mirror listings for certain wastes in both Annex VIII and Annex IX, depending on whether and to what extent they contain Annex I material and if this amount is sufficient to cause them to exhibit an Annex III characteristic. More specifically, Annex VIII of the Basel Convention encompasses a list of substances, including forms of e-waste that are considered to be hazardous. At the same time, Annex IX—which lists non-hazardous materials—exempts the very same forms of e-waste listed in Annex VIII, so long as these materials pass tests for hazards defined in Annex III. Annex III, however, states that there are no conclusive tests to measure flammability and toxicity (Lepawsky & McNabb, 2010, p. 5). Thus, as Lepawsky & McNabb aptly conclude, "the Convention remains highly ambiguous when it comes to common e-waste materials (and many others) and leaves a great deal of room for 'flexible' interpretation of its intentions to halt the transboundary movement of them (Young et al., 2000)" (Lepawsky & McNabb, 2010, p. 179). Finally, all the e-waste regulations discussed above ignore entire categories of e-waste altogether. For instance, the European Waste Shipment Regulation's list of e-waste remains relatively limited, despite recent revisions. This is true for the other e-waste regulations as well. Furthermore, until recently, the World Customs Organization's (WCO) harmonized shipping categories did not differentiate between commodities and waste.[28] The fact that many of the regulations exclude many types of e-waste can in part be explained by the fact that this waste stream is constantly changing and expanding. New devices are constantly being placed on the market and they often contain different concentrations of key materials than were contained in earlier models. For example, mercury was a key component in EEE when the Basel Convention was written, but it now represents a much less significant ingredient in products. In addition, more and more items are becoming electronic (Juan, 2009, p. 38). Still further compounding the problem of defining e-waste are the facts that every year sees many new electrical and electronic devices and that the line between electronic and non-electronic goods is increasingly becoming blurred. This means that even if regulation makers put all their resources into classifying e-waste, they would still have a hard time because the materials change so quickly. The classificatory systems simply cannot keep up. One government official speculates that laws are 15 years behind the realities of production (Willke, 2012).

To make matters worse, the challenges in defining e-waste listed above make it difficult to gather information on this waste stream. Without exception, every report on e-waste -be it about domestic generation or transboundary flows- includes the caveat that all data on used and end-of-life electronics is based on estimates.[29] This is beginning to change; however, as attempts to track flows have increased in recent years.[30] Still, the data on transboundary

[28] The WCO and Basel Convention have begun working together to address the issue of electronics, among some other materials, in the harmonized system. For more information on this, see: http://www.basel.int/Implementation/TechnicalMatters/WCOHarmonisedSystemCommittee/tabid/2390/Default.aspx.

[29] Reports on e-waste frequently attempt to quantify its existence. One commonly used method for quantification is using the number devices put on the market to estimate the amount of e-waste generated. Another common method involves looking at trade statistics for shipments of electrical and electronic devises and then using the price-to-weight ratio of containers to estimate whether the devices being shipped are new or used. Fischer et al. (2008) use this latter method, looking at the export value of shipped goods to determine whether they are new or used equipment, or even e-waste (Fischer et al., 2008, pp. 56–59; Juan, 2009).

[30] Previously, there were no mechanisms in place to track electronics flows, although now various groups are working on establishing mechanisms for future tracking. For instance, Valerie Thomas of Georgia Tech University is working on developing

flows remains largely inaccurate and potentially problematic, as no one can say with any certainty how much e-waste is being generated each year or where the waste is going. The lack of data is attributed to the vague codes and classifications in existing regulations, as well as to the existence of a well-organized and extensive, yet largely invisible, informal e-waste handling sector (Ayodeji, 2011).The lack of data makes it impossible to monitor and evaluate the economic and environmental impacts of these shipments, even though that is a primary goal of existing e-waste regulations. The facts that classifications vary and that many types of e-waste are simply not visible make it difficult to monitor e-waste shipments. Put simply: if you cannot see it, you cannot regulate it.

10 Monitoring and Enforcement

In addition to the difficulty in defining e-waste, there is also the problem of operationalizing existing regulations. Among the most significant challenges is the monitoring of the export of used and end-of-life electronics. A lot of e-waste is exported illegally and without record, making it administratively invisible and unable to be traced. Legal shipments are almost equally challenging to monitor. In a comparative study of e-waste management and export in the Netherlands and China, Juan writes, "Neither the Dutch nor the Chinese system is capable of tracking a single shipment from origin to destination" (Juan, 2009, p. 64). In other words, coordinating monitoring activities internationally is a logistical nightmare. A number of factors make it difficult to track the flows of used and end-of-life electronics across the globe. There is very little communication between responsible authorities in export, transit and importing countries. This lack of communication is due to a number of factors, including: language barriers; different classifications of e-waste; the fact that the agencies responsible for implementing and enforcing the regulations often lack resources to do their own jobs effectively, let alone coordinate with other agencies; and resistance to working and exchanging information with agencies in other countries because doing so is often perceived as a threat to national sovereignty. Not only is communication between international agencies challenging, but cooperation and communication between and among local, regional and national agencies is often also wanting (Fischer et al., 2008; Grossman, 2007; Hieronymi, Kahhat, & Williams, 2012; Pellow, 2008; Secretariat of the Basel Convention, 2011; Wang et al., 2012). [31] For instance, there is often minimal coordination between police and customs within individual countries.

The enforcement of e-waste regulations presents yet another challenge. A container full of discarded "broken" equipment, it could be argued, is not waste because it may have value in the import country. Nigeria, for example, has the know-how and the cheap labour to repair broken equipment. Thus, a Nigerian immigrant to Germany can legitimately argue that his shipments do not constitute waste (Espejo, 2010, p. 18). Indeed, a lot of "broken" equipment is repaired and resold at the Alaba Market in Lagos. The idea behind the provision permitting export of discarded items intended for re-use is to make sure that the developing world still has access to equipment. However, no provisions exist on how to test what is being sent to determine if it can be repaired or harvested for parts, or if it is, in fact, junk. In addition, there is no clear distinction between 'recyclable waste, hazardous waste and

a system in which Universal Product Codes (UPC) barcodes or RFID (radio frequency identification) are attached to every electronic item. Angie Leith of the US EPA is also working on this issue. For more information, see: http://www.isye.gatech.edu/news-events/news/release.php?nid=65615.

[31] For more on this, see the European Electronics Recyclers Association website at: www.eera-recyclers.com.

used good,' "which creates a gray area into which millions of tons of e-waste have disappeared" (Juan, 2009, p. ii).

A bigger problem still is that of testing. Items can be shipped abroad for re-use. In this case, the cargo is "outside of the waste regime" so to speak (Willke, 2012). That means that it is not subject to the laws outlined above that seek to stop illegal toxic dumping. Since anyone can say that they are exporting things for re-use and competent authorities simply do not have the resources to check every container, waste items are frequently exported as items for re-use.[32] What has recently changed, however, is that Annex 6 of the new WEEE Directive states that it is incumbent on the exporter to prove that the items for export are functional. In the old formulation of the law it was the responsibility of the competent authority to test functionality. This should improve the situation somewhat, though it is unclear how this will work in practice. Some products are easier to test for functionality than others. A cell phone, for example, is easier to test than a base station, which can only function as part of a larger system and cannot simply be plugged in and run on its own. To use Germany as an example, authorities are aware of this problem and have attempted to address it, for instance, by giving customs officers clear protocols. In practice, however, it remains difficult for customs officials and harbour police to legally distinguish between used goods and toxic trash when it comes to used and end-of-life electronics.

In cases where customs officials determine that items being exported are waste, exporters rarely face any consequences. If exporters are caught at one port, the only consequence is that they are faced with a minimal fine and are forced to take back their materials. Often, they simply try to ship the same materials from another port (Deubzer, 2011, p. 69; Espejo, 2010). Furthermore, it remains challenging, if not impossible, to prosecute illegal exporters. The few court cases involving illegal shipments of e-waste out of Germany have all been dismissed on the grounds that existing regulations make it difficult, or even impossible, to legally define the difference between waste and commodity. In addition, the difficulty in determining who 'owns' a given shipment of e-waste serves as a disincentive for local authorities charged with monitoring e-waste flows to actually enforce regulations. Shipments go from harbour to harbour and repeatedly change hands, increasingly obscuring the identity of the owner. This is particularly true if the materials pass through the Hong Kong port where shipments often vanish from administrative records without a trace. According to many national regulations, however, if the owner of the illegal shipment cannot be found, then the municipality in which the harbour is located must cover the costs of disposal, thus providing further disincentive for local authorities to enforce e-waste regulations. The inability to enforce existing regulations and to successfully sanction violators thus helps explain the high incidence of export of e-waste (Bodeen, 2007a, 2007b; Juan, 2009, p. 13).

The Basel Convention signatories (except for three countries, one of which is the US) are required to follow streamlined export and import procedures. However, the reality of implementing such procedures is complex and varies considerably from country to country, depending on available resources, priorities and knowledge. Multinational and regional regulations such as the Basel Convention and the Waste Shipment Regulation are only enforceable at the nation-state level and only by competent, well-funded and trained regulators or officials. This means that while the Basel Convention and the WSR provide guidelines for national regulations, each member

[32] The issue of whether discarded electrical and electronic equipment should be classified as waste or as resource is an on-going debate in the United States. Draft bills attempt to limit re-use flows as a means to curb illegal export of waste. However, the United States Trade Commission argues that discarded items are often products and waste laws should not apply to them.

state, as we have seen, has considerable discretion in how they implement and enforce the regulations. Consequently, some countries have stricter regulations and are better able to enforce these regulations than others, depending on their prioritization of the regulations and the availability of resources to enforce the regulations (Juan, 2009, p. 81; Widmer et al., 2006, p. 30). Similarly, companies or individuals seeking permission to ship discarded equipment out from or into a given country can wait anywhere from weeks to years for the proper paperwork to be processed, in which time the re-use value of the equipment can be dramatically reduced or eliminated altogether. This applies both to shipments of equipment from one developed country to another developed country and to shipments from developed countries to developing countries. Finally, export for re-use is further complicated by the fact that only a few sites worldwide possess the capacity necessary for refurbishment of discarded EEE. [33]

In addition to the lack of a clear definition of waste, there are relatively few controls at many ports (Espejo, 2010). Officials at various major European ports, for instance, complain that they simply do not have enough resources to check every container. In fact, while awareness of the negative social and environmental effects of e-waste export has grown in over the past few years, funding for harbour police and customs has been cut dramatically in many cases. This evidence seems to suggest that national and local governments devote very few resources to actually enforcing the regulations that prohibit unauthorized transboundary shipments of e-waste (BCRC, 2005; IMPEL-TFS, 2006; Juan, 2009). Adaptable exporters, especially informal ones, are able to capitalize on this regulatory unevenness. They look for countries and ports where regulations are less stringent or where regulations are not enforced as completely. When regulations tighten in one port, they quickly shift operations to another. In other words, Europe is not a level playing field. The tightening of controls in a country like Germany is thus only marginally effective because exporters can easily evade them by shifting their shipments to ports in more lenient countries (Juan, 2009, p. 61).

Additionally, it is equally difficult to ensure that domestic processors act according to e-waste regulations and handle e-waste locally and in the most environmentally-sound way possible. As Deubzer explains using Germany as an example, “the treatment operators are audited and certified annually by third party auditors in order to ensure that they have adequate technology, know-how and organization for a state-of-the-art treatment of e-waste. It is, however, difficult to prove whether treatment operators actually make use of their abilities in daily operation” (Deubzer, 2011). Economic factors play a large role in treatment operators’ decisions to employ the most environmentally-sound techniques, as it is often costly for operators to follow specified procedures and regulations. As Deubzer (2011, p. 62) continues, “It would be difficult to prove if a treatment operator shreds entire LCD displays, for example, instead of removing the mercury-containing backlights before. Such incompliance would save cost for expensive manual disassembly of the LCD displays, and the small amounts of mercury would evaporate and be diluted in the waste stream”.

Furthermore, consistently monitoring and enforcing regulations in importing countries remains nearly impossible. As mentioned above, the Basel Convention includes a caveat that allows for export of certain types of e-waste for disposal from one signatory country to another as long as the waste is handled in an environmentally-sound manner (see article 11, paragraph 1). The European Waste Shipment Rule has a similar provision to that of the Basel

[33] Personal Communication with Dr. Colin Fitzpatrick, Department of Electronic & Computer Engineering, University of Limerick, Ireland (4 January 2013).

Convention.[34] However, these regulations only vaguely define the criteria for "environmentally-sound management" (Lepawsky & McNabb, 2010, p. 3) and rarely, if ever, are disposal practices in non-OECD importing countries monitored.

Equally problematic with multilateral agreements and regional regulations is the obvious fact that the jurisdiction of the nation state only extends to its borders. For instance, as Juan (2009, p. 14) explains, "Europe's Waste Shipment Regulation only applies to companies registered in Europe, and their obligations are invalidated once their cargo is shipped out of the EU to China". This creates a regulatory no man's land or abyss for transboundary shipments of e-waste. In this space beyond the sovereignty of states, the market logic of profit maximization prevails, often trumping other considerations (Juan, 2009, p. 58).

Finally, the difference in the value of labour, the environment and discarded equipment across the globe poses a serious challenge to the success of any regulation that attempts to regulate transboundary shipments of e-waste. As Larry Summers observed two decades ago, labour costs and environmental regulations are lower in the developing world than they are in the developed world (Summers, 1991). In a liberalized economy, then, the 'natural' tendency is for waste to flow from developed to transition and developing countries as a means to maximize profit and reduce costs. Discarded electrical and electronic equipment also leaves Germany because items that are conceived of as a value-less waste in Germany are seen as a resource in countries such as China, Vietnam, Ghana or the Philippines. Whereas the German regulations focus on stopping the export of this waste certain actors in developing countries work hard to maximize access to the very same materials through import because they are seen as valuable goods.

11 Conclusion

Having examined the numerous technocratic problems with the existing regulatory and physical infrastructure governing the transboundary movement of discarded EEE, one may by extension ask if anything can be done to improve the situation. One possible approach is to address each problem listed above individually, as most institutions and individuals working on the issue of export recommend. Such an approach involves, among other steps, developing a clear definition of and classification system for e-waste that is agreed upon by all countries, creating clear protocols and increasing funding for enforcement agents, and improving coordination among competent authorities. While addressing the issues individually would likely incrementally improve the status quo, the author proposes that the shortcomings listed in the previous section are symptoms of a larger phenomenon. As such, addressing each symptom independently will yield limited results at best; at worst, it could prove counterproductive.[35]

[34] "According to the Waste Shipment Rule, it is required for importers to provide a certificate before any shipment that they have the capability to handle and reprocess hazardous waste in an environmentally sound matter; and that the importer has adequate facilities for treatment and disposal of wastes generated. However, on the one hand, as exporting countries, they do not have access to the information and data on what actually happens to the waste that is exported and when it reaches its destination. On the other hand, importing countries fail to complete the requirements of issuing a 'certificate of environmentally sound processing'. They currently do not have a reliable means to establish the extent of environmental harm caused by such exports in the destination state" (Juan, 2009, p. 63).

[35] There exist alternative proposals such as the Best of Two Worlds Project that acknowledge the complex global system. Other proposals include setting up a system that incentivizes the re-export of secondary raw materials to the global North and putting in place a 'buffer loan scheme' in which individuals from the informal sector in the developing world are immediately financially compensated as a means to bridge the gap towards the payment of the integrated metal smelters in the global North. These possible solutions represent an important step in the right direction, yet they continue to run the risk of capitalizing on and thus reinforcing global inequali-

The limited effectiveness of addressing individual symptoms can be seen in Germany's environmental waste regulations. The tightening of domestic environmental waste handling regulations, such as the introduction of the ElektroG and the German Landfill Ordinance (which is the national transposition of the European landfill directive, Council Directive 1999/31/EC of 26 April 2000), can result in the export of the problem to the global South. In other words, e-waste, like other unwanted by-products of Germans' affluent, high-tech lifestyles flows to places of least resistance. Export, in turn, often results in the net worsening of the global environmental impact since the importing countries often lack the capacity to handle these materials in an environmentally- and socially-sound manner intended by the regulations in Germany. Thus, an attempt to stem the ill effects of e-waste can in fact be said to have augmented them. With rises in the prices of critical materials, however, some businesses have an incentive to fully or partially process discarded equipment in Europe. While this trend is growing, it has not yet become widespread enough to stem the flow of export, for re-use, dumping or partial assembly to the global South.

The fundamental issues at hand—issues that the transboundary shipment of e-waste make evident—are the limits and effects of national formulations of environmental policy in a liberalized, uneven global economy. On the one hand, governments strive to implement policies that will render their countries more environmentally sustainable. On the other hand, however, these countries are embedded in a larger set of uneven global political, economic, cultural, and environmental relations. The cost of labour, regard for human life and the environment – or at least the technological and economic capacity to protect them – as well as the values of critical minerals, components and waste differ drastically from place to place. Consequently, the tightening of domestic environmental or social regulations in affluent countries often results in the materials deemed harmful or value-less, whether toxic waste or second-hand commodities, flowing out of the affluent countries to less affluent and more vulnerable areas.

Despite its limited explanatory power, some scholars and journalists sometimes favour the narrative that frames e-waste as an outcome of affluent residents of the global North externalizing the waste of their lifestyles, or as the result of legal ambiguity and lack of political will to stop export, though this is rapidly changing. While it is certainly true that European governments are keen to protect their own environments, this argument ignores a second key factor in the flow of used and end-of-life equipment developing and transition countries, namely its value.

Used and end-of-life equipment does not just exit export countries as a liability, but also as a valuable good. Export from North to South is thus not simply a story of the affluent dumping on the poor. Discarded EEE's value also drives its transboundary movements from North to South. As discussed in this report and elsewhere, discarded EEE represents an important source of value for numerous actors in the form of secondary materials, spare parts and reusable goods. For waste management firms and other companies that deal in minerals, technologies or their components, the material stream of discarded EEE is a source of revenue not only because it contains valuable materials, but because it is something that needs to be handled. And because certain steps of the waste treatment process costs less in developing countries–due to lower labour costs and often less stringent or less enforced environmental regulations–than it does in exporting countries, the profit margin is larger in developing countries, thus incentivizing the export of certain fractions that are costly to handle in OECD countries.

ties rather than offering a socially- and environmentally-just solution.

The same trend applies to e-waste as scrap. Because EU and German regulations mandate higher recycling rates, the European market has been flooded with secondary materials. “For example, the amount of recycled packaging waste increased from 27 million tonnes in 1997 to 36 million tonnes in 2003” (Fischer et al., 2008, p. 10). However, the value of these secondary materials is higher on the international market. In the case of as a source of metals, trade out of Germany is directed toward China, rather than African countries, because the preponderance of ICT manufacturing plants in the region creates a higher demand for raw materials. In addition, transportation costs (specifically shipping) to Asian countries are low. This is because many cargo ships that bring commodities from East Asia to Europe end up sailing back to Asia with empty containers.

When taking into consideration the potential value of discarded EEE, it becomes evident that a total ban on export will not work. There are simply too many disincentives to stopping export. While lack of political will and the advent of European environmental concerns are factors in the ongoing export of discarded EEE, the primary driver appears to be simple economics. Ultimately, write Fischer et al. (2008, p. 7), “the economic factors seem to be the most important driver behind the shipments”. More recent studies that engage with the problem of e-waste export have come to similar conclusions (Sander & Schilling, 2010; Secretariat of the Basel Convention, 2011).

The combination of the money saved from not processing the waste in affluent countries in an environmentally-sound way and the profit that is made from tapping into the secondary materials and reusable technology market in the global South are the drivers of export. As this report shows, there are three main loopholes and leakages that enable export: 1) definition/classification of used and end-of-life equipment; 2) monitoring and enforcement; and, 3) uneven political-economic landscape. But, as the term “loophole” implies, they do not explain the process fully. What pushes the e-waste through these holes and out of Europe is the drive to maximize profit, and herein rests the underlying problem. Solutions that seek to simply plug the holes through which discarded EEE flows out of Europe thus appear doomed to limited effectiveness, at best. So long as the profit potential of discarded equipment is constrained by strict environmental standards, taxes, and high labour costs in Europe, and so long as capital flows are able to escape the sovereign reach of nation-states, it will be difficult to stop the flow of discarded EEE – and the value it represents – to the global South.

12 Bibliography

ABI Research (2010). E-Waste Recovery and Recycling.

Anonymous (2009, September). Dissertation Interviews Conducted by Djahane Salehabadi.

Ayodeji, O. O. (2011, April 11). Assessment of the flow and driving forces of used electrical and electronic equipment into and within Nigeria. Brandenburg University of Technology-Cottbus, Cottbus, Germany.

BCC Research (2010) Electronic Waste Recovery: Global Markets.

BCRC (2005) Investigation on E-Waste Import and Soundly Environmental Management in China. Beijing.

Beck, M. (2007). Mission Impossible? Illegal E-Scrap Shipment and the Isssue of Enforcement. Recycling International.

Bodeen, C. (2007a). China's E-waste Nightmare Worsening. ABC News.

Bodeen, C. (2007b, November 18). In "E-waste" Heartland, a Toxic China. International Herald Tribune.

Chancerel, P., & Rotter, V. S. (2009). Assessing the management of small Waste Electrical and Electronic Equipment through Substance Flow Analysis-The example of gold in Germany and the USA. In Sustainable Systems and Technology, 2009. ISSST'09. IEEE International Symposium on (pp. 1–6).

Cobbing, M. (2008). Toxic Tech: Not in Our Backyard. Amsterdam: Greenpeace International.

Deubzer, O. (2011). E-waste Management in Germany. United Nations University.

EEA. (2009). Waste without borders in the EU? Trans-boundary shipments of waste. Copenhagen, Denmark: European Environment Agency.

Espejo, D. (2010, December). Assessment of the Flow and Driving Forces of Used Electrical and Electronic Equipment From Germany to Nigeria. Brandenburg University of Technology, Cottbus, Germany.

Fischer, C., Hedal, N., Carlsen, R., Doujak, K., Legg, D., Olivia, J., … Werge, M. (2008). Transboundary Shipments of Waste in the EU: Developments 1995-2005 and possible drivers. European Topic Centre on Resource and Waste Management.

Gille, Z. (2007). From the cult of waste to the trash heap of history : the politics of waste in socialist and postsocialist Hungary. Bloomington: Indiana University Press. Retrieved from http://www.loc.gov/catdir/toc/ecip0620/2006026312.html

Grossman, E. (2007). High Tech Trash: Digital Devices, Hidden Toxics, and Human Health (2nd ed.). Shearwater.

Hicks, C. (2005). The Recycling and Disposal Of Electrical and Electronic Waste in China--Legislative and Market Responses. Environmental Impact Assessment Review, 25, 459–471.

Hieronymi, K., Kahhat, R., & Williams, E. (Eds.). (2012). E-Waste Management: From Waste to Resource. Routledge.

Högens, C. (2009). Die Kinder von Sodom. Der Spiegel.

Huisman, J., Van der Maesen, M., Eijsbouts, R. J. J., Wang, F., Balde, C. P., & Wielenga, C. A. (2012). The Dutch WEEE Flows: Where do WEEE go from here? Bonn, Germany: United Nations University, ISP-SCYCLE.

IMPEL-TFS. (2006). International Cooperation in Enforcemen Hitting Illegal Waste Shipments.

Juan, W. (2009). Transboundary Shipments of E-Waste --A Global Problem (Masters Thesis). Delft University of Technology, Delft.

Kellow, A. (1999). Baptists and Bootleggers? The Basel Convention and Metals Recycling Trade. Agenda, 6(1), 29–38.

Kissling, R., Fitzpatrick, C., Boeni, H., Luepschen, C., Andrew, S., & Dickenson, J. (2012). Definition of generic re-use operating models for electrical and electronic equipment. Resources, Conservation and Recycling, 65, 85–99.

Lepawsky, J., & McNabb, C. (2010). Mapping international flows of electronic waste. The Canadian Geographer, 54(2).

Lubick, N. (2012). Shifting Mountains of Electronic Waste. Environmental Health Perspectives, 120(4).

Mayfield, K. (2003). E-Waste: Dark Side of Digital Age. Wired. Retrieved from http://www.wired.com/science/discoveries/news/2003/01/57151

Munyua, A. (2010). Regional Report: East AFrica. Kenya ICT Action Network.

Pellow. (2007). Resisting global toxics : transnational movements for environmental justice. Cambridge, Mass.: MIT Press. Retrieved from http://www.loc.gov/catdir/toc/ecip073/2006035516.html

Pellow. (2008). The Global Waste Trade and Environmental Justice. In K. Gallagher (Ed.), Handbook on Trade and the Environment. Northhampton, MA: Edward Elgar Publishing. Retrieved from internal- pdf://Pellow_2008-1379271936/Pellow_2008.pdf

Puckett, J. et al. (2002). Exporting Harm: The High-Tech Trashing of Asia. Basel Action Network (BAN) and Silicon Valley Toxics Coalition.

Sander, K., & Schilling, S. (2010). Optimierung der Steuerung und Kontrolle grenzüberschreitender Stoffströme bei Elektroaltgeräten/Elektroschrott. Ökopol.

Schluep, M., & Et al. (2009). From E-Waste to Resources. United Nations Environment Programme & United Nations University.

Schöps, D. (2010). Bilanzierung der Edelmetallverluste beim E-Schrottrecycling. TK Verlag - Fachverlag fuer Kreislaufwirtschaft Quelle: Recycling und Rohstoffe, 3.

Secretariat of the Basel Convention. (2011). Where are WEee in Africa? Findings from the Basel Convention E-waste Africa Programme.

Summers, L. (1991, December 12). GEP. Retrieved from http://www.whirledbank.org/ourwords/summers.html

UNODC. (2009). Transnational trafficking and the rule of law in West Africa: a threat assessment. Vienna: United Na-tions Office on Drugs and Crime.

Wang, F., Huisman, J., Meskers, C. E. M., Schluep, M., Stevels, A., & Hagelüken, C. (2012). The Best-of-2-Worlds philosophy: Developing local dismantling and global infrastructure network for sustainable e-waste treatment in emerging economies. Waste Management. Retrieved from http://www.sciencedirect.com/science/article/pii/S0956053X12001407

Widmer, R., Schluep, M., Eugster, M., Wang, X., Lombard, R., Ecroignard, L., & Sinha-Khetriwal, D. (2006). Legislating e-waste management: progress from various countries. elni Review, 1 2/06, 27–36.

Wilke, K. (2012, November 26).

Young, G., Garman, J., Tupper, S., & Suddards, H. (2000). A Long Way From Basel Clarity: Implications of the Basel Convention for the Consumer Electronics Sector. European Environmental Law Review, 9(3), 71–80.

Yu, J. (2010). Forecasting Global Generation of Obsolete Personal Computers. Environmental Science & Technology. doi:doi: 10.1021/es903350q

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About the StEP Initiative:

"StEP envisions a future in which societies have reduced to a sustainable level the e-waste-related burden on the ecosystem that results from the design, production, use and disposal of electrical and electronic equipment. These societies make prudent use of lifetime extension strategies in which products and components – and the resources contained in them – become raw materials for new products."

Our name is our programme: solving the e-waste problem is the focus of our attention. Our declared aim is to plan, initiate and facilitate the sustainable reduction and handling of e-waste at political, social, economic and ecological levels.

Our prime objectives are:

- Optimizing the life cycle of electric and electronic equipment by
  - improving supply chains
  - closing material loops
  - reducing contamination
- Increasing utilization of resources and re-use of equipment
- Exercising concern about disparities such as the digital divide between industrializing and industrialized countries
- Increasing public, scientific and business knowledge
- Developing clear policy recommendations

As a science-based initiative founded by various UN organizations we create and foster partnerships between companies, governmental and non-governmental organizations and academic institutions.

StEP is open to companies, governmental organizations, academic institutions, NGOs and NPOs and international organizations which commit to proactive and constructive participation in the work of StEP by signing StEP's Memorandum of Understanding (MoU). StEP members are expected to contribute monetarily and in kind to the existence and development of the Initiative.

StEP's core principles:

1. StEP's work is founded on scientific assessments and incorporates a comprehensive view of the social, environmental and economic aspects of e-waste.
2. StEP conducts research on the entire life cycle of electronic and electrical equipment and their corresponding global supply, process and material flows.
3. StEP's research and pilot projects are meant to contribute to the solution of e-waste problems.
4. StEP condemns all illegal activities related to e-waste including illegal shipments and re-use/ recycling practices that are harmful to the environment and human health.
5. StEP seeks to foster safe and eco/energy-efficient re-use and recycling practices around the globe in a socially responsible manner.

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