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Barriers to electronics reuse of transboundary e-waste shipment regulations: An evaluation based on industry experiences

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ABSTRACT

In our globalized economy, increasing volumes of used electronics are shipped across national borders. While global and regional regulations prioritize electronics reuse as a prudent approach for conserving resources and reducing environmental toxicity, their effect on cross-border shipping activities of the reuse industry is not well-known. This study analyzes data from nine cases collected in 2012–13 via interviews and a survey of reuse organizations to identify the effects of these regulations on transboundary reuse activities, which respondents perceive as barriers to electronics reuse. Overall, three broad areas were identified in which regulations may directly influence the reuse organizations that participated in this study: (i) definitions, classification, operating procedures, and enforcement; (ii) evaluation of shipments; and (iii) requirement for functionality testing. These findings suggest that, contrary to the goal of encouraging reuse of discarded electrical and electronic equipment, in some cases regulations may be contributing to raising barriers for reuse organizations' business. To help eliminate these barriers, policy recommendations proposed in this paper include: appropriate legislative amendments; inclusion of issues related to reuse in the development of relevant national policies; establishment of a comprehensive international legislative database; creation of refurbishment operations close to the install base and integration of informal recyclers in the reuse sector; and an introduction of a regulated green e-waste transboundary channel.

1. Introduction

Accelerated by technological advancements and growing economic prosperity, consumption of electrical and electronic equipment (EEE) has experienced an unprecedented growth in both low- and high-income countries in the last two decades. While demand for new EEE creates a boon for economies, known side effects of their rapid replacement include resource depletion and environmental pollution. For example, global annual production of cell phones requires approximately 44 tons of gold, 455 tons of silver and 16,381 tons of copper (Hagelüken and Corti, 2010; Statista, 2015). Moreover, improper disposal or crude processing of discarded EEE, known as electronic waste (e-waste), may cause hazardous materials to contaminate soil, water, and air through various processes identified by a growing body of evidence (see, for example, Townsend (2011) for relevant literature review). Grant et al. (2013) have extensively reviewed the literature on the health consequences from the improper treatment and handling of e-waste and concluded that evidence of causal relationship exists between such activities and adverse health impacts.

To various extents, many countries and regions across the world have adopted three main approaches to try to alleviate growing e-waste concerns: green engineering, improved collection and recycling, and increased reuse. While relevant laws and policies mandate the removal of certain materials from electronics manufacturing, this approach is far from universal. For example, the US, who is the biggest producer of e-waste in the world, lags other nations in restricting potentially toxic materials from the use in electronic components. National policies around the globe require increasing recycling, however the rates remain low and majority of consumers are still unaware of how to handle properly their obsolete electronics. Recent studies found that the majority of US households are unaware of safe e-waste disposal options and that

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only old televisions stored in US homes may contain over 91 thousand tons of potentially toxic materials, including lead and mercury (Milovantseva and Saphores, 2013a,b). Moreover, a UK study found that consumers are largely unconcerned about the environmental consequences of e-waste and tend to throw away working electronic devices in order to replace them with newer models (Cox et al., 2013).

Electronics reuse has been prioritized by a wide range of global policies and regulations as a prudent approach for conserving resources and reducing environmental toxicity. Majority of laws that regulate movement and disposal of equipment containing potentially hazardous materials urge reusing used equipment, e.g. the EU WEEE Directive (EC, 2012), EU ErP Directive (EC, 2009), EU Waste Framework Directive (EC, 2008), China Decree 551 (State Council, 2008), Illinois Electronic Products Recycling and Reuse (Illinois General Assembly, 2008). As an important step toward more sustainable consumption, reuse offers a number of economic, social, and environmental benefits. In addition to ensuring that the world's resources of non-renewable materials are sustained instead of being dissipated or rendered unusable, as still is widespread during recycling (Chancerel et al., 2009), it provides a social dividend by creating employment through refurbishing commerce and providing access to lower cost equipment (O'Connell et al., 2013; Sepúlveda et al., 2010; Williams et al., 2008). There are important studies that generate an awareness of the issues surrounding e-waste. Literature includes research on various e-waste management strategies in different countries and recycling approaches for specific types of equipment. Some of the recent examples of the former include an assessment of take-back policies in India (Dwivedy et al., 2015), an analysis of e-waste decision factors in Mexico (Estrada-Ayub and Kahhat, 2014), designs of e-waste system in Turkey (Kilic et al., 2015; Ozkir et al., 2015), Korean policy development review (Manomaivibool and Hong, 2014), and an examination of EU WEEE Directive's implementation in Finland (Yla-Mella et al., 2014). Examples of the latter comprise case studies of mobile phones (Paiano et al., 2013), laptop computers (Kasulaitis et al., 2015), and electronic displays (Ardente and Recchioni, 2014). However, the global movements of electronics for reuse have not received much attention in the literature. Reports focused on global shipments of obsolete electronics often offer narratives of discarded e-waste travel from the global North to the global South suggesting that all developed countries are exporters and developing and transition countries importers (for example, Puckett et al., 2002). Alternatively, Kahhat and Williams (2009) make the case that e-waste treatment is an important economic activity and provide evidence from Peru. While Duan et al. (2014) have attempted to quantify the flow of used electronics from the US to other countries using export trade data, to our knowledge the literature has not yet examined the on-the-ground impacts of e-waste regulations on the reuse of EEE. To begin addressing this gap, in this study we analyze data collected in 2012–13 through interviews and a survey of reuse organizations to examine how different countries' interpretations of e-waste regulations affected cross-border shipment activities.

We begin by summarizing operating models of reuse and refurbishment industries followed by an overview of international legislation related to transboundary movement of e-waste. Next, we examine respondents' experiences with shipping their electronic products to other countries for refurbishment and reuse to characterize and highlight perceived barriers to the movement of EEE reportedly raised by current regulations, highlight some complications in shipping EEE for reuse across both developing and developed countries identified in studied cases, and assess few other aspects that affected our respondents' activities in the movement of electronic goods destined for reuse. Finally, we conclude with several policy recommendations aimed at removing barriers to reuse identifies in the study.

2. Background

This section serves to set the scene for the international electronics reuse sector. It describes the industry's business models followed by an overview of the regulatory framework in which they operate.

2.1. Reuse business models

In recent decades, the reuse sector for EEE has developed through four generic operating models. While exploring the barriers and success factors for the reuse sector in general, Kissling et al. defined these operating models as: (i) Networking Equipment Recovery, (ii) IT Asset Management, (iii) Close the Digital Divide, and (iv) Social Enterprise (Kissling et al., 2013, 2012).

The Networking Equipment Recovery is a model that processes both used and excess new durable IT networking equipment such as rack servers, routers, or switches. The model receives much of its input as end-of-life third party service provider to customers of original equipment manufacturers with the remaining input collected from corporate users. The majority of equipment is distributed for reuse in parts and components from the received products. For this model, it is very often the case that only one or two sites globally can prepare such specialized equipment for reuse and, consequently, it is extremely dependent on trans-frontier shipments.

The IT Asset Management model specializes in offering asset recovery services for products such as desktop computers, notebook computers, tablets, and cell phones. The majority of equipment input for this model comes from commercial corporate users or leasing companies who offer take-back service to its customers. The speed at which such products can be returned to reuse market is paramount as product values sharply decline over time.

The Close the Digital Divide model provides used desktop and laptop computers to beneficiaries in developing countries, mainly educational and medical institutions or local non-government organizations. The majority of devices for reuse are received through corporate and public users' donations. In exchange, this model's practitioners offer equipment collection, data sanitation, and appropriate compliance certification.

The Social Enterprise model organizations acquire and prepare equipment including computers, peripherals, and large household appliances for reuse and retail to individual users with the objective of creating social benefits (for example, training and employment creation for disadvantaged individuals). Generally, Social Enterprises are focused either on desktop and notebook computers received through donations or on large household appliances from various providers. Refurbished devices are sold to eligible recipients and social markets are often prioritized.

2.2. Regulatory framework

In response to the expanding growth in the exporting and importing trade of both e-waste and EEE, a number of regulations at international, regional, national, and local levels have evolved. All international and regional legislation becomes enforceable on the ground once it has been transposed into national laws. The Basel Convention, The Organization for Economic Co-operation and Development (OECD) Council Decision (2001)107/FINAL, and European WSR are the principal agreements regulating the cross-border movement of e-waste.

The Basel Convention is the most comprehensive and significant of these three introducing restrictions on the movement