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Best of two worlds? Towards ethical electronics repair, reuse, repurposing and recycling

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ABSTRACT

International trade of discarded electronics (e-waste) has become a matter of concern over the last decade because of the actual and potential harms associated with their hazardous materials. An initiative under the aegis of the UN called the Best-of-Two-Worlds (Bo2W) philosophy is one solution to the e-waste problem that has gained some traction. Our dual purpose is to examine the ethical grounds of Bo2W and to propose an alternative program for action. We call this alternative ethical electronics repair, reuse, repurposing, and recycling (EER4). To explore the ethical grounds of Bo2W and to articulate EER4 as an alternative, we draw on notions of ethics, technology, and organization developed in science and technology studies (STS) and diverse economies literatures while empirically we explore a mixed methods case study of a small recycling firm in northern Mexico. Conceptually and empirically, our analysis points to a need for a richer imagination of the possibilities for economic action oriented toward managing discarded electronics. More broadly, our findings may act as a reminder that the space between use and discard proliferates the literal and figurative resources for enriching the imagination and enactment of diverse economic possibilities via the action of repair, reuse, repurposing, and recycling.

1. Introduction

In the last decade, discarded electronics (or 'e-waste') has become an international matter of concern (Latour, 2004) for environmental non-governmental organizations (ENGOs) (e.g., Basel Action Network, 2002; Toxic Link India, 2003; Greenpeace International, 2005), policy-makers (European Parliament, 2003; United Nations Environmental Programme, 2015), news media (e.g., Höges, 2009; Klein, 2009), and scholars in a variety of disciplines including geography (e.g., Lawhon, 2012, 2013; Herod et al., 2014; Pickren, 2014; Lepawsky, 2015a; Reddy, 2015, 2016). Over arching concerns in the literature are the actual and potential negative social, environmental, and economic impacts for people and places resulting from international flows of discarded electronics for materials recovery (recycling) and dumping (e.g., Wong et al., 2007; Nnorom and Osibanjo, 2009; Xu et al., 2015). Various solutions to the problem have been proposed and implemented ranging from enforcement of international treaties such as the Basel Convention to the passage of extended producer responsibility laws. Yet, such solutions sometimes result in unintended negative impacts including loss of livelihoods and enhanced precarity for economically marginalized populations, enhanced cost externalization from original equipment manufacturers for waste mitigation (Lepawsky, 2012), and loss of employment and resource conservation opportunities from repair, reuse, and repurposing (e.g., United States Environmental Protection Agency, 2000; Williams, 2005; Williams et al., 2008; Lepawsky, 2012; Hieronymi et al., 2013).

One particular solution put forward is the Best-of-Two-Worlds (Bo2W) philosophy advocated by Manhart (2010) and Wang et al. (2012) under the auspices of an United Nations initiative called Solve the E-waste Problem (StEP) (UN StEP, 2010). As we discuss in more detail below, the Bo2W philosophy attempts to institute a commodity chain between high-income and low-income countries to take advantage of low-cost labour in the latter for manual disassembly into high-quality material fractions that are then exported to high-technology refineries in the former. Such a commodity chain is, according to Bo2W, a 'win-win' scenario since workers at manual disassembly plants would accrue benefits such as higher wages and improved occupational health and safety while high-technology refining facilities would gain access to low-cost but high-quality feedstock that is superior in purity to that derived from automated shredding of discarded electronics.

Our purpose in this paper is twofold: to examine the ethical grounds on which the Bo2W philosophy is founded and, via an

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empirical case from our own fieldwork, articulate an alternative framework for organizing action geared toward what we call ethical electronics repair, reuse, repurposing, and recycling (EER4). To help us explore this state of affairs about economic action concerned with discarded electronics we draw on concepts of ethics, technology, and organization developed by key thinkers in science and technology studies (STS) and diverse economies literatures.

2. Best of two worlds?

Manhart (2010) and Wang et al. (2012) argue that there are three types of approaches to recovering metals from electronics. The first type of their typology is described as 'low-technology, low yield, and severely polluting'. It is typified by metal recovery practices in 'backyard', informal situations in which "metal recycling technologies and know-how are limited" (Manhart, 2010, 18). The second type is described as 'medium technology, medium yield, but severely polluting'. This scenario is typified by the use of wet chemical leaching of circuit boards to liberate precious metals such as gold and silver. The use of cyanide and aqua regia mixtures to extract gold and other precious metals entails severe health and pollution risks. The third type is described as 'high-tech, high yield, and low pollution'. This type entails mechanical separation (shredding) of discarded electronics and metallurgical refining in advanced refineries. To keep labour costs low, manual disassembly and sorting are kept to a minimum, but a consequence of this is less than pure metal fractions for the refining process.

To these three types Manhart (2010) and Wang et al. (2012) make a case for adding a fourth that they call the Best-of-Two-Worlds (Bo2W) philosophy. The Bo2W model entails inserting manual disassembly into the process under two scenarios. The first scenario entails collecting discarded electronics in "low income countries" (Manhart, 2010, 22), followed by manual disassembly in the low income locale and subsequent export of high purity metal fractions for refining in "high income countries" (Manhart, 2010, 22). The second scenario combines the first scenario with collection of discarded electronics in high income countries followed by export for manual disassembly in the low income locale with subsequent re-export of high quality metal fractions for refining in high income countries.

Given these scenarios, we suggest that in the Bo2W philosophy at least three ethical principles can be discerned (we elaborate our use of the term 'ethics' in a separate section below). First is a well founded concern to reduce the health and environmental impacts of low technology, low yield metals recovery. This is to be done through training for manual disassembly and instituting occupational health and safety (OH&S) practices that protect manual disassembly workers from harm. The OH&S strategies can be very simple and cheap as they entail basic protective gear such as safety glasses, gloves, and masks. A second principle is higher wages for the manual disassembly workers than they would receive in the 'backyard informal' sector so as to entice labour into the formal sector and, potentially at least, offer them a better income. While a third principle—though noticeably more muted or, at least, more axiomatic in the Bo2W philosophy—is generating high quality sources of valuable metals for refining in high income countries via relatively low cost labour for manual disassembly in low income countries. Paying attention to how these principles are formatted as 'good' in Bo2W enables us to understand them as potentially positive, but also non-exhaustive, and open to scrutiny—is it, for example, inherently 'good' that refineries in high income countries get access to high-quality feedstocks of valuable metals in exchange for safer working conditions and higher wages for workers in 'low-income' countries (Knapp, 2016)?

Other studies of pilot implementations of Bo2W have highlighted limitations to the model. These limitations include the need for public financing to support private for-profit e-waste recycling, an inability of the model to successfully compete against extant informal collection systems, and a tendency to dispossess people working in those informal systems of their livelihoods (Davis and Garb, 2015; Reddy, 2015, 2016; see also, Williams et al., 2013). To Reddy's (2015, 2016) concerns about the inequality generated by implementations of the Bo2W model, we would add our own: the Bo2W model offers little consideration of product repair, reuse and repurposing practices that would extend the useful life of electronic equipment or its parts (cf. King et al., 2006). Yet, extending product life-spans is crucial to capturing a number of environmental and socioeconomic gains (United States Environmental Protection Agency, 2000). As Williams (2005, 6) pointed out a decade ago, "nearly all effort thus far in the formal sector for recovering electronics focuses on recycling materials, the environmental 'payback' of which is relatively tiny". Williams (2004) and Deng et al. (2009) show, for example, that a 'typical' desktop and laptop computer respectively require 6400 and 3010–4340 MJ of primary energy to manufacture (see also Kasulaitis et al., 2015). An earlier study (Williams et al., 2002) showed that a 32 MB DRAM chip to be a highly material and energy intensive manufacture requiring 630 times its weight in fossil fuels to produce. Post-consumer recycling will not recoup the energy and materials already expended in manufacturing (see MacBride, 2012). While energy intensity (e.g., MJ per unit manufacture) for electronics production may have declined in the years since these foundational studies, aggregate demand for new IT manufactures has increased leading to uncertainty about whether any gains in energy or materials efficiencies made in electronics production chains have actually reduced total demand for energy and materials in that sector. For example, according to Ryen et al. (2015) the proliferation of electronic devices in American households has increased their net energy consumption, despite efficiency gains in the electronics industry.

We are also skeptical of the Bo2W claim that the low or even medium technology metal recovery types described by Manhart (2010) and Wang et al. (2012) can so easily be characterized as ones in which know how is limited and pollution high. Recent research has begun to document some of the rich ecology of practical knowledge for the repair, reuse, and repurposing of discarded electronics in low-income situations (Lepawsky and Billah, 2011; Jackson et al., 2012, 2014; Ahmed et al., 2015). Furthermore, given the recent findings on health risks from high technology electronics recycling (Ceballos et al., 2014; Julander et al., 2014; Ceballos et al., 2015) and from emissions from smelters known to process discarded electronics we think it is an unwarranted valorization of high technology refining to suggest it can so easily be considered 'low pollution'. While it is true that emissions of heavy metals from smelters have declined over time, historic emissions entail toxic legacies that continue to have toxicological consequences to this day. Even as emissions decline, they nevertheless remain significant in that they involve tens to hundreds of tons of heavy metals being deposited annually at the sites proximate to smelters and refineries (Bonham-Carter, 2005; Knight and Henderson, 2006; Savard et al., 2006b,a; British Columbia Ministry of Environment, 2009; Keeling and Sandlos, 2009; Meynen, 2009).

We agree that there are benefits to be gained from a Bo2W philosophy. However, we are also concerned that unless modified, the Bo2W philosophy exacerbates the problems identified by Williams (2005) in that adhering to the model will further entrench a collect-and-destroy approach to materials recovery (recycling) while bypassing opportunities to enhance infrastructure for repair, refurbishment, repurposing, and reuse of discarded electronics. As