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China's toxic informal e-waste recycling: local approaches to a global environmental problem

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ABSTRACT

Electronic waste or e-waste has been an increasingly severe problem over the last decade, and is the fastest growing waste stream in the world. China's inexpensive labour and manufacturing abilities have already made it "the world's factory" and for e-waste recycling it is no exception. Informal workers do the majority of e-waste collection and recycling in cities throughout China. E-waste recycling work provides livelihoods for migrant workers and the urban poor and has formed a well-established shadow economy. The improper dismantling and burning of e-waste for resource recovery exposes workers to toxins and heavy metals, and causes severe air, water, and soil contamination. The illegal global trade of e-waste makes it a transboundary environmental governance problem of local and global scales. This paper investigates informal workers' knowledge of the environmental impacts of e-waste, perceptions of their work and whether they would be receptive to government regulation of recycling work. It finds that informal recyclers interviewed lack environmental awareness of the dangers related to e-waste recycling and are unwilling to be regulated due to fear of losing jobs and profits through regulation. Weak e-waste legislation and social marginalization are also major barriers to protecting e-waste recyclers and the environment. Through a scalar analysis of environmental governance, this paper proposes strengthening the roles of small enterprises and inclusion of Non Governmental Organization (NGOs) and Government Organized NGOS (GONGOs) to work in the informal sector to find safer recycling solutions to fill the large gap between legislation and de facto practices.

1. Introduction

As our world moves towards fast technological advances, the world's capacity to deal with the huge amounts of waste electrical and electronic equipment (WEEE), or e-waste,[1] declines. E-waste can be defined as, "end-of-life electronic products including computers, printers, photocopy machines, television sets, mobile phones, and toys, which are made of sophisticated blends of plastics, metals, among other materials" (Wong et al., 2007:133). The EU WEEE directive defines it as, "electrical or electronic equipment which is waste (…) including all components, sub-assemblies and consumables" (Directive, 2002/96/ECArticle 3b), or any items which have a battery or a power cord (Perkins et al., 2014). In developing countries, widespread improper informal e-waste recycling has led to severe water and air pollution, soil contamination, and health effects since products contain high amounts of hazardous materials, including heavy metals and Persistent Organic Pollutants (POPs). The global flow and trade of e-waste presents transboundary environmental governance problems on both international and local levels. The U.S., U.K., and the EU are the major exporters of e-waste to developing countries such as China, India, and Nigeria (Chi et al., 2011) benefiting from low-cost labour and "disposal." Only 25% of all e-waste is accounted for and recycled safely by official means, the remaining 75% is lost in the illegal e-waste stream (Perkins et al., 2014).

Legislation such as the 1989 Basel Convention (ratified by 181 countries) has struggled to control illegal exportation of e-waste.

China is the largest producer, consumer and exporter of e-waste in the world (Chi et al., 2011). The global estimate of e-waste generation is 20–50 million tons annually (Ongondo et al., 2011:715), the UN predicts that by 2017, e-waste generation will increase to

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[1] In this paper the term "e-waste" is used as the same meaning as WEEE.

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65.4 million tons per year (Perkins et al., 2014:287). Moreover, 70%–80% of all e-waste is exported to Asian countries and 90% of that is received by China (Ongondo et al., 2011:719). In China, individual collectors and dealers[2] (收电子废品人) of e-waste are the key intermediaries between first disposal and recycling or material recovery of an EoL (end of life) product. In 2004, informal workers made up more than 50% of the work force in China (Kumar and Li, 2007). Informal workers engage in recycling for income but are left vulnerable to the dangers of informal recycling of toxic materials. The informal sector's lack of awareness on e-waste's adverse environmental and health impacts highlights the fact that marginalised workers do not receive needed education, and their work mainly serves survival income purposes. These workers comprise a complex informal network that is also integrated with formal channels, forming a shadow economy that operates outside regulation, making legislation difficult to enforce.

1.1. Aims & objectives

The overarching aim of this research is to provide insight from within the e-waste recycling system in Beijing by conducting ethnographic interviews with informal e-waste collectors and recyclers to give them a voice. Other studies on e-waste workers have not included workers' opinions. If the e-waste sector is to change, solutions must come from within the system, requiring first-hand knowledge from workers that can only be obtained through direct exchanges. This work suggests policies that protect and support informal workers. It also illustrates that China's informal system of e-waste management occurs very locally but it is a phenomenon spurred on and affected by the global e-waste market. The arenas of e-waste management and recycling operate on multiple scales and across various actors, state and non-state, formal and informal. Given that e-waste is a non-linear environmental issue permeating all levels, a socio-economic scalar approach is taken to analysing the current e-waste recycling situation in China. This research suggests that NGOs can help informal workers and small enterprises work with government to protect the environment and health of individuals who practice e-waste recycling without sacrificing their livelihoods. This research hopes to open up the arena for more specific studies on the needs of the informal sector to develop safe and implementable e-waste recycling practices.

2. Discourses on informal e-waste recycling

2.1. Impacts of informal e-waste recycling

Informal e-waste collection, recycling, legislation, and its health impacts on informal workers have become an increasingly popular topic in the last ten years. There are a plethora of literature on e-waste toxins and their environmental and health effects, especially on informal workers in developing countries, who are easily exposed to toxins in dismantling and resource recovery. The production of electronics and recycling of e-waste has enormous impacts on the environment and accounts for a large amount of the world's hazardous pollution from the moment of obtaining raw resources to recycling the EoL product. Modern electronic appliances have a complex mix of materials and can contain up to 60 different elements, some of which are reusable, some hazardous and some both (StEP2009:6). This complex mix is especially found within PCBs (Printed Circuit Boards), which are burned in the open air and mined for chips and precious metals. Informal workers do not utilize personal protective equipment due to either lack of education about the dangers of unsafe recycling practices or lack of access to equipment. Workers handle, disassemble, shred, burn, and smelter e-waste products to recover reusable materials within. The burning of e-waste is used to retrieve precious metals and raw material. Copper is stripped from wires in open-air acid baths, rotors are melted to extract aluminium and silver, and the majority of dismantling is done by hand (Yang et al., 2008). During dismantling, recyclers are exposed to dioxins, POPs (persistent organic pollutants), PAHs, PCBs, PHCs,[3] hexavalent chromium, brominated flame retardants (Poly brominated diphenyl ethers PBDEs) and heavy metals, which persist in the environment for long periods of time. Emissions are exacerbated by crude recycling methods, and the combined burning of certain materials as shown in Table 1 creates harmful by-products. Many studies show workers are exposed to many toxins at e-waste sites, such as through contaminated dust inhalation and dietary exposure; severe soil contamination is also a problem (Tang et al., 2010; Fu et al., 2008; Luo et al., 2011; Labunska et al., 2014; Perkins et al., 2014). Song and Li (2014) give a review of these body burdens from e-waste exposure and (Zheng et al., 2008) show high levels of heavy metals in children exposed, as they are more susceptible. Xu et al. (2012) found that at the e-waste recycling town Guiyu, prenatal exposure to e-waste recycling had four times higher risk of stillbirth and resulted in high concentrates of cadmium, nickel, and lead in new-borns.

Many challenges and possible solutions to informal e-waste recycling have been discussed in current literature. Liu et al. (2006) believe that legislation should ban informal recycling techniques and large-scale formal recycling plants should be built, combined with a strengthening of EPR policies in the private sector. Wilson et al. (2009) discuss building recycling rates through the informal sector, as the informal system effectively reduces formal recycling costs. They also argue that informal labourers be organised into cooperatives to strengthen their bargaining power with the government. Kumar and Li (2007) address social protection for urban informal workers, and the question remains if it is possible to protect informal workers from unsafe recycling practices without a large percentage of workers losing their livelihoods. Rouse (2006) sees informal jobs as enabling the poor to improve their livelihoods. It is vital that the informal sector be seen not just as an objective whole, but as individuals that act as crucial links in a complex network. Tong et al. (2014) recognize the fragmented informal network in China and point out the shortcomings of formalizing the e-waste recycling system, including certified plants' lack of materials, its employment of family workshops and "certified salvagers" who work in conjunction with informal collectors. Gutberlet (2012) argues for cooperatives of informal recyclers (using Brazil as a case study) to help poverty reduction and to consider their work as an important aspect of realising development goals and promoting sustainable communities. The International Labour Organization also recently proposed cooperative models (Brazil, India, Serbia) to strengthen informal workers' rights and leverage their labour power (ILO, 2014).

There is much discussion on take-back mechanisms for e-waste and the principle of Extended Producer Responsibility (EPR) (Yu et al., 2010a, b, 2008; Zhang, 2011). EPR is also a main facet to most global WEEE legislation in the EU, U.K., U.S., Canada, Australia, and Japan. Connected to take-back effectiveness are studies on consumer behaviour and use of household electronics and their and

[2] The term "dealers" is used to refer to people who buy and sell e-waste products and components. They also may or may not be collectors and many times they are also dismantle e-waste products.

[3] Polycyclic Aromatic Hydrocarbons, Polychlorinated biphenyls, Petroleum hydrocarbons.

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