Rohan Maharjan

Dr. Jana Giles

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Wasting Away: The Dangers of the E-waste Recycling System in China

There has been an increase in the purchase, use, and discard of electrical and electronic equipment across the world due to rapid population growth and technological advancement. This rapid consumption of digital equipment has caused many electronic devices to become trash or Waste Electrical and Electronic Equipment (WEEE) after a few short years of use. Globally, an estimated 41.8 million metric tons of WEEEs were generated in 2014 (Awasthi and Li 228). These e-wastes need to be disposed of and recycled safely to prevent any hazards to the environment or people’s health. However, a majority of these WEEEs are often shipped from developed nations to developing ones for recycling where the significant portion of the e-waste is processed by traditional or crude methods in the informal sectors (Awasthi and Li 228). One developing nation where the e-waste gets transported is China where the informal recycling system has drastically damaged its environmental components like air, water, and soil and has also caused severe illnesses like cell cancer and psychotic disorder to its people. To fix this problem, China must take measures to replace its informal recycling system with a more formal one which will improve its current recycling methods and reduce the adverse effects of those practices on the environment and the individual’s health. China can achieve this system by taking a hybrid approach—a combination of formal and informal methods—for recycling of e-waste, promoting foreign involvement, providing incentives to formal recycling sectors, and increasing consumer convenience for digital dumping on the formal industries to help solve the e-waste problems.

About 80% of the global e-waste is exported to Asia, and ninety percent of that is sent to China, making it the largest destination of e-waste from developed countries (Xu, et al. 220). The main reason for this is China’s inexpensive labor compared to other developed nations. For instance, the cost of glass-to-glass recycling of computer monitors in the US is ten times more than in China (“Where does e-waste end up?”). The real problem with China recycling most of the e-waste is that only 25% of the e-waste is recycled safely by formal sectors while the remaining 75% is recycled informally (Orlins and Guan 71). This informal recycling of e-wastes has resulted in many environmental problems such as high metal contamination in the air and soil, absorption and accumulation of pollutants in sediments, and heavy metal contamination in water (Song and Li 2588). This can give rise to many health problems in an individual like endocrine toxicity, respiratory system toxicity, reproduction toxicity, neurotoxicity and genetic toxicity (Xu, et al. 222). Such consequences of informal recycling have adverse effects on China.

These effects are of grave importance to the well-being of the Chinese population, and although several developed nations dispose of electronic waste in China, America is a significant constituent of the e-waste problem in China. It is estimated that each year approximately 1.5-3.3 million tons of e-waste are imported to China illegally and that 35% of it comes from the United States (Chi et al. 88). In his book *The U.S of Excess*, Paarlberg notes, “America became a clear consumption outlier among other rich countries during the first half of the twentieth century, when it alone escaped serious material damage from both the First and Second World Wars” (14). A binge of personal acquisition and consumption started in America during that time (15). As a result, consumption of electronic products became massive among American consumers. Paarlberg states that, “When consumption increases, pure waste increases as well” (4). The amount of e-waste America produces is much more than it can handle, so it exports a significant amount of that e-waste to the developing nations for recycling, a considerable amount of which end up in China. Additionally, over 2.3 million tons of e-waste is produced by China itself annually, and this is expected to increase significantly.

Currently, informal sectors recycle most of that e-waste in China. These sectors use environmentally unsafe methods such as unprotected manual disassembly, stripping in an acid bath, and open burning to separate reusable components and to recover metals (Chi, et al. 87). Copper is removed from wires in spacious acid baths, rotors are melted to extract aluminum and silver, and different acids like hydrochloric acid and nitric acid are used with mercury to obtain gold from printed circuit boards. Many times, the e-waste materials are burned to extract precious metals from them (Orlins and Guan 72). Such hazardous methods cause greenhouse gases to be produced in abundance and, in turn, pollute the atmosphere. Paarlberg states that, “In 2014, the Intergovernmental Panel on Climate Change (IPCC) warned that a continued increase in atmospheric concentrations of greenhouse gases such as CO2 would lead to ‘severe and widespread impacts on unique and threatened systems, substantial species extinction, [and] large risks to global and regional food security. . ..’ A tipping point might eventually be reached, resulting in ‘abrupt and irreversible change’ (IPCC 2014).” (4-5).

Although greenhouse gases may have negative impacts on China’s ecosystem, the nation is not interested in backing out from producing an excess in electronic products to reduce greenhouse gases from the atmosphere. According to Paarlberg, “Per capita GDP in China is still only one-quarter the OECD (Organization for economic co-operation and Development) average, so Beijing sees no justice in sacrificing its own growth prospects to help solve a problem originally created by North Americans and Europeans” (26). If no countries are willing to take responsibility for each other’s actions regarding waste disposal, then greenhouse gases will undoubtedly hurt China soon.

Besides greenhouse gases, different types of heavy metals and organic pollutants can also be detected at the scene of the e-waste dismantling site and its surrounding environmental media such as air, water, and soil of China. Regarding toxic metal contamination through the air, a survey conducted in Guiyu, one of the largest digital dumping sites in the world, revealed that the heavy metal, particularly lead and copper concentration in road dust from the e-waste site, was 155 times higher than non-e-waste sites located eight to thirty kilometers away. The high amount of toxic metals in dust will cause a severe health problem to local inhabitants, especially children, due to the unintentional or direct ingestion of harmful dust particles via the “hand to mouth” pathway (Xu, et al. 221). In fact, a study from China found that every ten µg/L increase of lead concentration in blood is connected to a decrease in 0.71 IQ points and high lead concentration in the body affects the intellectual, psychological, and behavioral health of children (Xu, et al. 225). In a neonatal behavioral neurological assessment (NBNA) study conducted in Guiyu, the behavior of three to seven-year-old children was studied, and the results indicated that Guiyu children showed higher activity levels, approach-withdrawal, and adaptability than those living in a clean and healthy area. It was also found that the blood lead levels of those children were much higher than that of the other children in the study (Xu, et al. 225). This effect of toxic metal contamination is extremely worrisome when considering how those health issues may affect the future generation of China.

The effects of toxic metal contamination in water are also alarming. Another study on the impact of e-waste recycling activities in the surface water and sediments of rivers and ponds found out that the heavy metal concentrations in surface water and sediment samples from the Lianjiang River decreased from Guiyu (upstream, recycling site) to Haimen Bay (downstream, non-recycling site). In the surface water of Guiyu, Cu concentrations were 2.4 to 131 times higher than that in surface water of Haimen Bay. And, in sediment samples of Guiyu, Cu concentrations were 3.2 to 429 times larger than those from the Haimen Bay (Xu, et al. 221). Polluted water and sediments can also have chromium which is a contaminant that people living around informal recycling sites may be susceptible to drink. A study reported that in the body of informal workers in Guiyu the DNA injury rate and a tail length of lymphocytes were higher than those in the body of people in a non-recycling site, and there was a direct relationship between blood chromium and DNA injury rate and a tail length of lymphocytes (Xu, et al. 225). This result suggests that exposure to chromium can lead to DNA and cell damage and even cause mutation and cancer to the cells.

Besides toxic metal contamination through air and water, the presence of heavy metals in soil has become an increasing issue in recent years. The soil in the e-waste dumpsites in Guiyu was found to be severely polluted. The levels of metals in the soil samples at the burnt plastic dumpsite and the printer roller dumpsite were much higher than those in the non-dumpsite. The most abundantly found metals in the soil samples were lead, cadmium, copper, and antimony and their concentrations were more than ten times the allowable amount according to the national environmental quality standard for soils (Song and Li 2590). Because of heavy metal contamination in soil, plants were also subject to the metal contamination. For instance, it was found that the amount of lead in polished rice reached 0.69 mg/kg which is 3.5 times higher than the maximum allowable concentration (0.20 mg/kg). Similarly, in almost 31% of the rice samples, cadmium contents exceeded the national maximum allowable concentration which is also 0.20 mg/kg. Eating contaminated rice or contaminated plants containing heavy metal can lead individuals to psychotic disorders and many debilitating diseases (Song and Li 2591). Psychotic disorders, if not addressed and treated correctly, can have serious repercussions in Chinese society.

Although there are various adverse effects of informal recycling to the environment and human body, it is still widely practiced in China. Within China, there are an estimated 3.3 – 5.6 million low-income waste collectors working in the industry and nearly 200,000 in Shanghai alone (Westlake). One of the reasons for this is that the informal collection and dismantling of e-waste provides many job opportunities for people from low-income and underprivileged societies. Around 700,000 people in China work in the e-waste recycling industry, and ninety-eight percent of those workers are employed by the informal sectors (Chi, et al. 87). Another reason for the dominance of informal recycling in China is the people’s unwillingness to return their e-waste to companies or licensed plants as the price they receive from formal or government facilities is significantly lower due to collection and treatment costs. For instance, a pilot project in Suzhou (formal collectors) only offered 50 Yuan for an old computer whereas the informal collectors offered 150-200 Yuan. Also, the consumers had the convenience of door-to-door collection (Orlins and Guan 75). This practice automatically encourages the customers to give their electronic waste products to the informal sectors for handling rather than the formal ones.

Fortunately, managing the problems of informal e-waste recycling is not impossible. A household’s disposal preference is primarily affected by economic benefit and convenience of recycling. A survey on consumer recycling habit found that appropriate collection price is a major determining factor for consumers in choosing collectors (Chi, et al. 92). So, providing certain incentives to e-waste recycling enterprises such as subsidies, low-cost loans, tax cuts, and credits can improve the flow of e-waste to the formal sectors. For instance, if formal recycling sectors do not need to pay tax for recycling or are provided subsidies and credits then they can allocate much more money for recycling than they would have if no incentives were provided to them. Having a significant amount of money for recycling will allow the formal sectors to offer higher prices to the consumers for their old electronic products than the informal sectors. The high cost will attract the consumers to give their electronic waste products to the formal sectors rather than the informal ones. As a result, the recycling process becomes safe and non-hazardous to the environment and people.

In addition to offering more money to the consumers for their e-wastes, efficient networks must be established in the formal sectors to facilitate take-back service. The survey which was mentioned in the above paragraph also found that the convenience of service has great importance to household’s recycling behavior. The ability of a sector to collect other municipal wastes and to provide free door-to-door collection was viewed crucial by many respondents (Chi, et al. 92). Therefore, if a formal sector can introduce a system in which it will go door-to-door and collect e-wastes along with household garbage, then the consumers are more likely to hand their electronic wastes to the formal sectors as they will have the luxury of getting rid of all kinds of wastes at the same time. In the areas where a door-to-door collection of e-waste is not possible, the formal sectors can increase the number of recycling centers so that the consumers can easily dispose their e-wastes to those recycling sites. These steps will improve the flow of electronic wastes in the formal sectors which will reduce the problems of informal e-waste recycling.

Only increasing the flow of e-waste in the formal sector is not enough to eliminate the problems caused by electronic waste products in China. It needs to have advanced recycling industry too to get rid of all those e-wastes safely. However, the e-waste recycling industry in China lags behind in technology. So, recycling in China will generate a considerable amount of pollution rather than reduce it (Veenstra, et al. 453). It will be tough for China to eradicate its e-waste problem alone, therefore, promoting foreign involvement in this matter can help solve its digital waste crisis. International e-waste companies that do not want to spend in the Chinese industry for free can franchise their technology and expertise to the Chinese market. For instance, in 2013, a franchising agreement was made between an e-waste company named ‘Inc.’ and Chinese enterprise for the US $0.8 million for the license of its recycling technology (Wrest 1). The franchised technology was used to process e-waste in the formal sectors of China. With the availability of advanced recycling technology, China could recycle a large number of e-wastes safely in a short amount of time. However, a single company could not make a significant impact on solving the e-waste problems in a country as big as China. Therefore, other such franchising agreements should be made between foreign companies and Chinese recycling sectors so that new and advanced technologies could be used to recycle the e-wastes that flow in the formal recycling areas safely.

In addition to benefiting from franchising foreign technologies in China, qualified foreign recycling companies can make a lot of profits from China’s vast amounts of e-waste. Companies can collect e-wastes and extract various precious metals such as platinum, gold, and selenium which they can later sell or use in their own manufacturing. An example of such company would be an e-waste recycling firm in India named Attero Recycling. By 2013, Attero was able to collect and process around 1000 metric tons of e-waste a month in India which increased its revenues to the US $15 million over two years (Wrest 1). The recycling process was beneficial to not only the company but also to the areas near the dumpsite from where the e-waste was collected. Attero was able to recycle a massive amount of e-waste from the dumpsite which freed the local areas from the e-waste problems. If similar recycling companies are allowed to safely extract precious metals from the China’s vast e-waste collection, then it will lower the number of electronic waste materials from that area and help the country get rid of its e-waste problems.

Over the last few decades, informal recycling of e-waste has become a significant threat to the individual health of people in China. It has also caused severe damage to the environment near the recycling sites which affects all living organisms living in that area. Furthermore, as Paarlberg noted, “Because of China’s size and heavy dependence on coal, it has already passed the United States as the biggest emitter of CO2 despite its low income, and by 2050 it may be emitting as much CO2 from fuel combustion as all of today’s OECD nations combined” (26). This situation can be worsened by informal recycling practice in China where the vast amount of plastic materials and other metals are burned on a large scale producing enormous amount of greenhouse gases in the atmosphere. If informal recycling methods are not fixed, they will create incredibly dangerous problems for China's future generations that may not be fixable. Although the situation seems dire, it is still possible for China to bounce back and get rid of all of its e-waste problems. It might take a considerable amount of time to do so, but it is not impossible. Providing certain incentives to recycling enterprises, increasing recycling convenience for the consumers, and seeking help from foreign companies are all solutions that can increase the flow of e-waste in the formal sectors and significantly reduce the effects of informal recycling in China.

Works Cited

Awasthi, Abhishek Kumar and Jinhui Li. "An Overview of the Potential of Eco-Friendly Hybrid Strategy for Metal Recycling from WEEE." *Resources, Conservation & Recycling*, vol. 126, Nov. 2017, pp. 228-239. EBSCOhost, doi: 10.1016/j.resconrec.2017.07.014.

Chi, Xinwen, et al. "E-Waste Collection Channels and Household Recycling Behaviors in Taizhou of China." *Journal of Cleaner Production*, vol. 80, Oct. 2014, pp. 87-95. EBSCOhost, doi: 10.1016/j.jclepro.2014.05.056.

Orlins, Sabrina and Dabo Guan. "China's Toxic Informal E-Waste Recycling: Local Approaches to a Global Environmental Problem." *Journal of Cleaner Production*, vol. 114, 15 Feb. 2016, pp. 71-80. EBSCOhost, doi: 10.1016/j.jclepro.2015.05.090.

Paarlberg, Rober L. *The United States of Excess: Gluttony and the Dark Side of American Exceptionalism*. Oxford University Press, 2015.

Song, Qingbin and Jinhui Li. "Environmental Effects of Heavy Metals Derived from the E-Waste Recycling Activities in China: A Systematic Review." *Waste Management*, vol. 34, no. 12, Dec. 2014, pp. 2587-2594. EBSCOhost, doi: 10.1016/j.wasman.2014.08.012.

Veenstra, Albert, et al. "An Analysis of E-Waste Flows in China." *International Journal of Advanced Manufacturing Technology*, vol. 47, no. 5-8, June 2010, pp. 449-459. EBSCOhost, doi:10.1007/s00170-009-2356-5.

Westlake, Hayes. “Off the Books: Informal Recycling in China.” *Collective Responsibility*, The Collective, 21 June 2016, www.coresponsibility.com/off-books-informal-recycling-china/.

“Where does e-waste end up?” *Greenpeace International*, Greenpeace, 24 Feb. 2009, www.greenpeace.org/international/en/campaigns/detox/electronics/the-e-waste-problem/where-does-e-waste-end-up/.

Wrest, Samuel. "Out of the Scrapyard: How Foreign Involvement Can Help Solve China's E-Waste Crisis." *China Business Review*, Sept. 2016, p. 1. EBSCOhost, ulm.idm.oclc.org/login?url=https://search-ebscohost-com.ulm.idm.oclc.org/login.aspx? direct=true&db=bth&AN=118506178&site=eds-live.

Xu, Xijin, et al. "E-Waste Environmental Contamination and Harm to Public Health in China." *Frontiers of Medicine*, vol. 9, no. 2, June 2015, pp. 220-228. EBSCOhost, doi:10.1007/s11684-015-0391-1.