The road to recovery

Electronic waste is a global problem that requires global action.

Between April and September of 2017, the environmental watchdog Basel Action Network (BAN) attached GPS trackers to various pieces of old electronic equipment and left them at recycling centres across Europe¹. Of the 314 discarded devices, which included liquid-crystal displays, cathode-ray tube monitors, desktop computers and printers, 19 were found to have been exported out of the country they had been left in. The exported items travelled a combined distance of 78,408 kilometres and 11 of them ended up in developing countries, including Nigeria, Ghana, Pakistan and Thailand — exports that are likely to have been illegal.

Under the Basel Convention — an international treaty that concerns the movement of hazardous waste between nations and aims to prevent the dumping of waste in developing countries — all of the tagged electronics would be classified as hazardous. The liquid-crystal displays, for example, contained mercury-bearing lamps and the circuit boards contained lead, tin and brominated flame retardants. The electronics used were also broken and economically unrepairable, and thus qualified as waste under European Union (EU) rules.

The sample size here is small. But in their report¹, which was published last month, BAN suggest that 352,474 tonnes of waste could be being exported to developing countries each year, if the numbers observed are extrapolated to all electronic waste produced by the 28 countries of the EU. And the picture looks even worse elsewhere. An earlier study by the watchdog², based on similar methods, found that in the US the export rate for electronic waste was 34%, compared with the 6% observed in the European study. This, BAN notes, is likely due to the fact that the US has not ratified the Basel Convention and has limited environmental laws on the trade of global waste.

As the work from BAN implies, electronic waste is a global problem — and it is one that is getting worse. In 2016, the world generated 44.7 million tonnes of electronic waste, and only 20% of this is documented as being collected and recycled properly³. On current trends, the generated waste could reach as much as 120 million tonnes a year by 2050⁴. These volumes — combined with illegal trade, and the unsafe recycling and resource recovery that occurs

Manual electronic waste dismantling at the Agbogbloshie market sector in Accra, Ghana. Credit: Oladele A. Ogunseitan

in rudimentary processing centres across the world and particularly in emerging market economy countries — creates significant risks to human health and the environment⁵. Blood samples of children living near an informal electronic waste processing site in Guiyu, China have, for example, been found to have concentrations of lead that exceed safe levels⁶. And brominated flame retardants have been detected in the eggs of peregrine falcons in California, USA⁶.

To address the problem, global solutions and international cooperation are required⁷. Engaging the private sector, including manufacturers and retailers, is also necessary. In a [Comment](#) in this issue of *Nature Electronics*, Oladele Ogunseitan and colleagues suggest specific ways in which rudimentary electronic waste recycling in developing countries could be transformed into a safe and profitable component of a global circular economy.

The researchers — who are based at Tsinghua University, the University of Sheffield and the University of California, Irvine — highlight the gap that exists between cutting-edge technologies (such as a robot from Apple called Daisy that can dismantle iPhones at a rate of up to 200 phones per hour) and the manual approaches typically employed in rudimentary waste centres. They argue that the best available technologies need be shared internationally and scaled for

implementation in local contexts. They also make recommendations for integrating technology and financial incentives in order to improve the management of electronic waste at global, regional and national scales.

A significant amount of raw material is currently being squandered due to limitations in the recycling of electronic devices. It has, for example, been estimated that the total value of the raw materials present in electronic waste in 2016 was approximately €55 billion³ — a fact that creates its own set of economic opportunities⁴. The scale of the problem also calls for renewed efforts to rethink the way we design, build and use devices, such that thoughts of their future dismantling and destruction are ingrained in their creation. □

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