# WWW: WHAT E-WASTES WORTH

**Research** · September 2019

DOI: 10.13140/RG.2.2.34113.30560



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*Academic Journal of Science,*
CD-ROM. ISSN: 2165-6282 :: 08(02):267–274 (2018)

# WWW: WHAT E-WASTES WORTH

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Strategies adopted by many world leaders to tackle economic problems have failed; most especially in developing nations. This is sequel to the fact that the supposed schemes are capital intensive. Attentions are rather given to conventional economic approach for solving problems rather than looking into newer methods trending in modern technology. One of such methods is sustainable e-waste (electronic waste) management system. As new e-products are purchased, obsolete products are stored or discarded at alarming rates. If at all, a negligible percentage of this material is recycled while the vast majority is disposed of in landfills. These products could, however, be recycled for returns that worth appreciable values by recovering components. The existing system for managing e-waste is generally not sustainable because mechanisms for collecting, sorting, reuse, refurbishing, repairing, and remanufacturing are not well developed and/or implemented. Problems associated with market issues, obsolescence issues, feedstock collection, feedstock management, and product-design need to be addressed. This paper research and report values recoverable over certain volumes and quantities of obsolete electronic products when recycled. Solutions to factors mitigating sustainable e-waste management are also discussed. Recommendations for the adoption of recycling as a scheme for economic revenues are equally made based on the outcome of the research report.

**Keywords:** e-Waste, Recycle, Electronics, Economics.

## Introduction

Currently, many nations of the world are going through a period of economic recession. With hundreds of thousands of workers having lost their jobs, tens of thousands of families having lost their homes, and the prospect of continued high rates of unemployment in many regions for years to come, policymakers will continue to face pressure to create jobs and improve the economy. The policies available to states are limited, both in their range and their potential to create large numbers of jobs.

However, options that can help create jobs and increase economic growth are poorly harnessed. The available evidence suggests that the most effective options for creating jobs, in the short- and long-term, are investing in infrastructure [1]. This includes creation e-waste management centers.

E-Waste, short for electronic waste is the term used to describe old, end-of-life or discarded appliances using electricity. It includes computers, consumer electronics, fridges, televisions, stereos, copiers, and fax machines etc. which have been disposed of by their original users.

The production of electrical and electronic devices is the fastest-growing sector of the manufacturing industry in industrialized countries. At the same time, technological innovation and intense marketing engender a rapid replacement process. Every year, 20 to 50 million tons of electrical and electronic equipment waste ("e-waste") are generated worldwide [2].

Americans currently own nearly 3 billion electronic products and as new products are purchased, obsolete products are stored or discarded at alarming rates. For instance, in 2005, the USEPA estimates that 26-37 million computers became obsolete. In addition to computers, large numbers of TVs, VCRs, cell phones, and monitors also became obsolete such that an estimated 304 million electronic devices weighing between 1.9 and 2.2 million tons were removed from U.S. households. According to Consumer Electronics Association estimates, about two-thirds of the electronic devices removed from service were still in working order. However, only about 15% of this material was recycled while the vast majority was disposed of in landfills [3].

Aside from the losses incurred from e-waste disposal in landfills, they also contain toxic substances such as lead, mercury, cadmium, and lithium. These toxic materials can be released upon disposal, posing a threat to human health and the environment if not disposed of carefully. A typical e-waste landfill is as shown in Figure 1.

**Figure 1.** A typical e-waste landfill. Source: (Green Concept to Green IT)

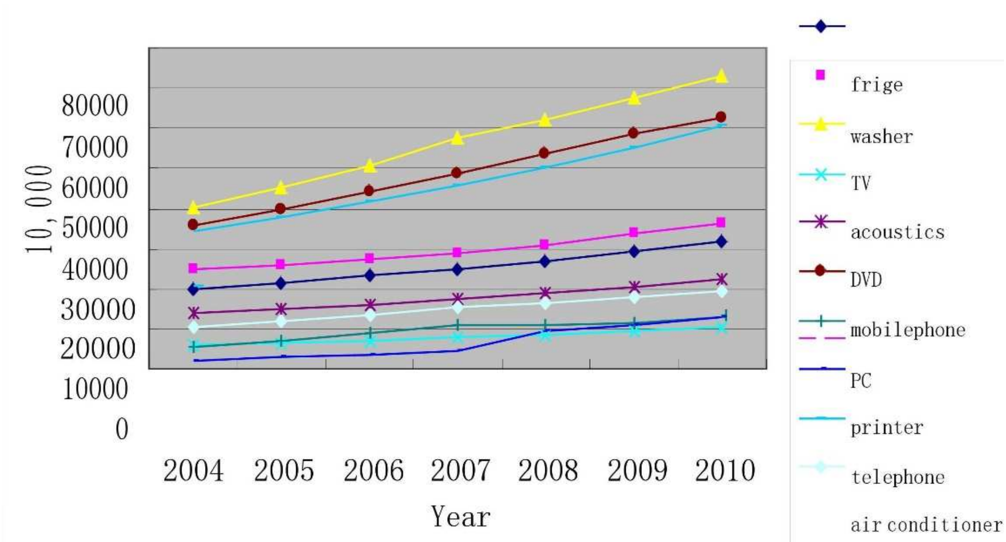


**Figure 2.** Amount of Electronic Products in Use in China.

Taking China as a case study, the life year for e-products is about 10 to 15 years in China. Research shows that in the year 2005; 2.1 billion sets of 10 major electronics products that include: fridge, washer, TV, acoustics, DVD, mobile phones, PC, printer, telephone, and air-conditioner were used. The quantity of e-waste generated was 79.23 million sets; an average of 2 million tons per year.

Figure 2 shows a graphical representation of e-products used in China from the year 2004 and 2010 while Figure 3 shows the quantity of e-waste within the same range [4]. An estimated value shows that about 4% of the total amount of e-products in circulation are being disposed of per annum. These electronic wastes contain precious metals such as gold, silver, which offer opportunities for economic extraction. For example, precious metals contribute well over 70% of all metals related value in cell phones, calculators, and printed circuit board scraps. [5].

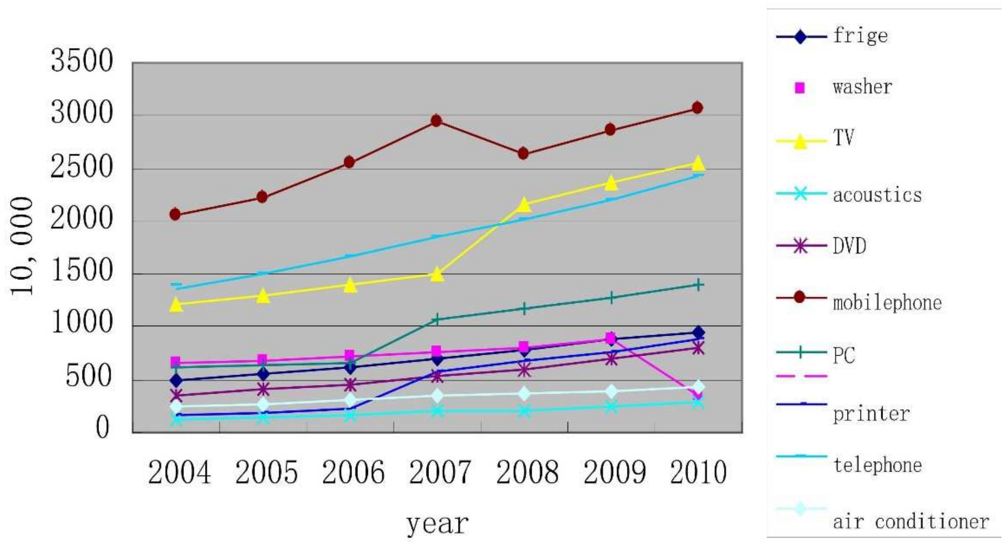


**Figure 3.** E-Wastes Generated in China
Source: State Environmental Protection Administration of China.

**Evaluation E-Waste Composition, Values and Worth**

Electrical and electronic equipment contain up to 60 different elements, many of which are valuable, such as precious and special metals. Precious metals have a high economic value, as demonstrated by the two most well- known precious metals; gold and silver. Special metals include nickel, nickel base alloys, cobalt base alloys, titanium, and titanium base alloys. Electronic equipment is a primary consumer of precious and special metals and therefore it is imperative that a circular flow is established in order to recover these metals and valuable elements. Investments are being made to treat e-scrap and reclaim the valuable metals, especially as raw materials become more scarce and expensive. One ton of scrap from discarded computers contains more gold than can be produced from 17 tons of gold ore [8]. Table 1 below displays the concentration of metals in common electronic products.

According to a report from Markets and markets [9], the global volume of e-waste generated is expected to reach 93.5 million tons in 2016 from 41.5 million tons in 2011 at a compound annual growth rate of 17.6 percent from 2011 to 2016 while the revenue generated from the Global e-waste management market is expected to grow from $9.15 billion in 2011 to $20.25 billion in 2016 at a rate of 17.22 percent within the same period.

**Table 1.** The concentration of Metals in Electronics (2007). Source: [6] [7]

| Electronic | Copper (% by weight) | Silver (ppm) | Gold (ppm) | Palladium (ppm) |
|---|---|---|---|---|
| Television (TV) Board | 10% | 280 | 20 | 10 |
| Personal Computer (PC) Board | 20% | 1000 | 250 | 110 |
| Mobile Phone | 13% | 3500 | 340 | 130 |
| Portable Audio Scrap | 21% | 150 | 10 | 4 |
| DVD Player Scrap | 5% | 115 | 15 | 4 |

Call2Recycle, North America's first and largest consumer battery stewardship organization, announced that its battery and cell phone recycling program has diverted 100 million pounds from landfills since 1994. The organization collects and recycles consumer batteries and cell phones at no cost throughout the US and Canada and ensures that these items are recycled to create new batteries and other products, keeping potentially hazardous materials from entering the waste stream. A report has it that in 20 years of the organization's establishment it has collected and recycled more than 2 million kilograms of batteries across Canada [9].

eRecyclingCorps (eRC), a company founded in 2009 and its joint ventures have surpassed 20 million devices collected since 2009, including 10 million devices in 2013 alone. The company says increasing operator and retailer involvement and updated projections are driving the market. In 2013 approximately one billion phones were retired. eRC estimates that those billion phones equate to more than $100 billion in untapped value potential of e-waste. Ninety-five percent of the 20 million phones eRC has collected to date have been returned to use as affordable restored devices [9].

**Table 2.** E-waste End-of-life Management in the U.S. (2010). Source: [10]

| Device | Total units ready for end-of-life management | Units Disposed | Percentage Disposed | Units Recycled | Percentage Recycled |
|---|---|---|---|---|---|
| Computers | 51.9 million | 31.3 million | 60% | 20.6 million | 40% |
| Computer displays | 35.8 million | 24.1 million | 67% | 11.7 million | 33% |
| Hard-copy devices | 33.6 million | 22.4 million | 67% | 11.2 million | 33% |
| Keyboards and mice | 82.2 million | 74.4 million | 91% | 7.83 million | 10% |
| Televisions | 28.5 million | 23.6 million | 83% | 4.94 million | 17% |
| Mobile Phones | 152.0 million | 135.0 million | 89% | 17.4 million | 11% |
| Total Units | 384 million | 310 million | -- | 73.7 million | -- |
| Total Short Tons | 2.44 million | 1.79 million | 73.4% | 649,000 | 27% |

### Trends and Challenges of e-Waste Management Systems

Due to lack of federal regulations mandating recycling, states have taken widely different approaches to recycling. It is now illegal for most American businesses to place electronics in the trash, and some states prohibit electronics from being disposed of in the municipal solid waste stream. As at the year 2010, there was no U.S. Federal mandate to recycle electronic waste; however, twenty-five states have enacted legislation requiring statewide e-waste recycling. Despite state-wide recycling efforts, it is estimated that 13.6% to 26.6% to e-waste is recycled in the U.S. According to the U.S. Environmental Protection Agency (EPA) Office of Resource Conservation and Recovery report "Electronics Waste Management in the United States through 2009," 2.44 million short tons were ready for end-of-life management in 2010 (Table 2). Based on this estimated generation and the aforementioned U.S. e-waste recycling rates, approximately 332,000 to 649,000 short tons of e-waste was recycled in the U.S. in 2010 [9][10].

In the U.S, as of the year 2015, where the collection of e-waste has become more convenient, recycling rates have improved. Recycling rates for laptops and flat-screen TVs have reached an estimated 84 percent and 78 percent, respectively (Figure 4).

Speedy improvement in e-Waste management system is peculiar to many developed nations of the world. Going by the report of OECD countries, Germany is taking the lead with 65 percent of all municipal waste recycled. The United States only accounted for 35 percent of all municipal waste recycled, Canada only managed to recycle 24 percent of its municipal waste in 2013 while Turkey could only manage a dismal 1 percent (Figure 5).

Certain factors are responsible for the shortfall in the widespread of recycling and reuse of e-products in many societies. Lack of recycling awareness and regulatory infrastructure has resulted in low recycling rate. E-waste represents less than 4 percent of the global landfill mass, it contains more than 75 percent of environmentally hazardous waste. A severe lack of "market intelligence" exists with respect to how the market values individual e-waste components. The materials are extremely complex and information regarding the availability and quality of recyclable materials is very limited.

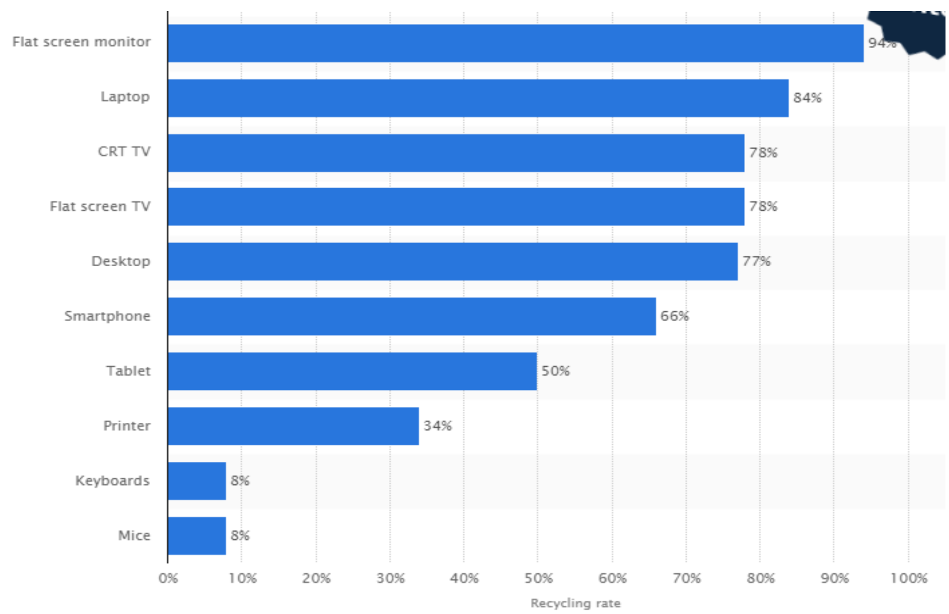


**Figure 4.** Rate of Electronic Waste Recycling in the U.S. in 2010. Source: [11]

Some electronic devices have relatively short lifespans with limited opportunities for maintenance and recycling. There is also no standardized methods that currently exist for executing successful e-waste collection events. Existing methods have resulted in events that are inconvenient for potential users. Additionally, procedures for preserving the quality of harvested components have been inadequate and the economics of holding collection events have not been strong. Labeling information on discarded electronics is limited, making it difficult to accurately identify parts. The available workforce tends to lack experience in part identification and training is not available regarding best practices. Many electronic devices are not designed for disassembly and maintenance. And more so, many items are not designed for remanufacturing. These and a lot more are the factors mitigating e-waste management system in the society. Measures for solving these challenges needs to be adopted for improved e-waste management system [12].

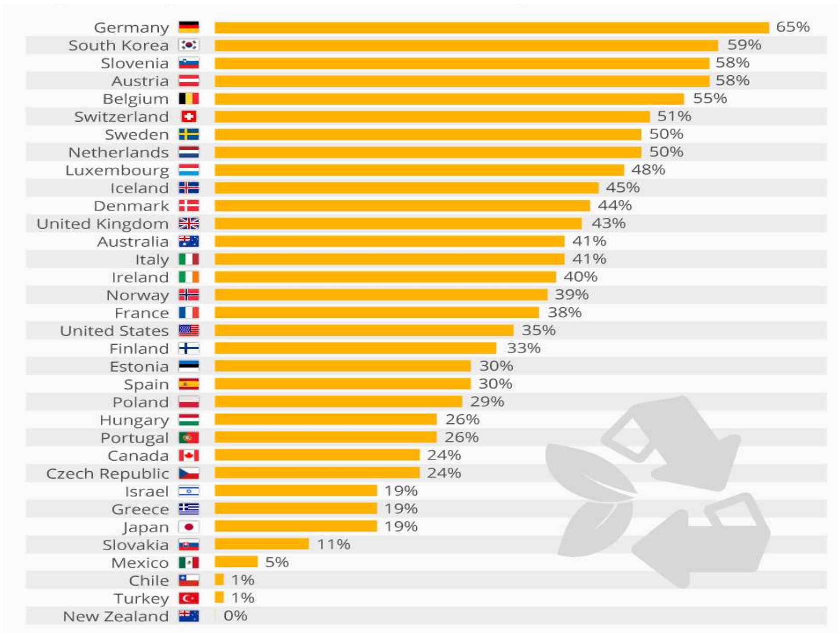


**Figure 5.** Recycled Waste as a Share of Total Municipal Waste in OECD Countries in 2013
Source [11]

**Recommendations for Improved E-Waste Management Systems**

Some potential solutions that could address the majority of e-waste management issues have been identified. Adequate data management facilities are necessary. Current methods for tracking the origin, use, and management of e-waste are extremely limited. Additionally, the information is woefully inadequate for making strategic decisions regarding feedstock, market and system management.

E-waste is well known for containing a wide range of materials that are hazardous to both the environment and the people who work with e-waste. Consequently, a need exists to develop products using "greener" raw materials and processes and to recover valuable materials from e-waste that can be used in other products. Development of methods for making products that are more easily disassembled, repaired, remanufactured and reused are essential to a more sustainable system. Methods for managing the complexity of recycled feedstock are extremely important. Techniques for collection, labeling, tracking, transportation, storage, data security, and assessing the quality of feedstocks are key components of an effective system.

Most users of electronics do not need to own them, they only need performance. Development of alternative mechanisms for delivering performance (e.g. leases, service contracts, etc.) could dramatically reduce waste. Specific design and engineering courses could be developed to advance the science of e-waste management. Some ideas for course topics include Life Cycle Assessment for Electronics Manufacture, Use, and Recycling, Environmentally Conscious Design of Electronics, Designing Electronics for Disassembly, Designing Electronics for Remanufacture, etc. Development and implementation of a consortium dedicated to designing, producing and handling of electronic devices are required for a more sustainable system.

## Conclusion

Without safe recycling facilities widely available, developing countries such as India, China, and countries in Africa are facing the heat of the e-waste being illegally dumped in these countries from the developed countries such as US and UK.

The global recycling market was valued at $9.84 billion in 2012. Implementation of strict recycling regulations, efforts to properly manage electronic waste and technological investments have contributed to the growth of this market [8]. Management of e-waste provides benefits such as job creation, improved technological knowledge, and environmental benefits. In developing countries, job creation also helps in the alleviation of poverty and improved health conditions.

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