Chapter 9

Urban Mining of E-waste

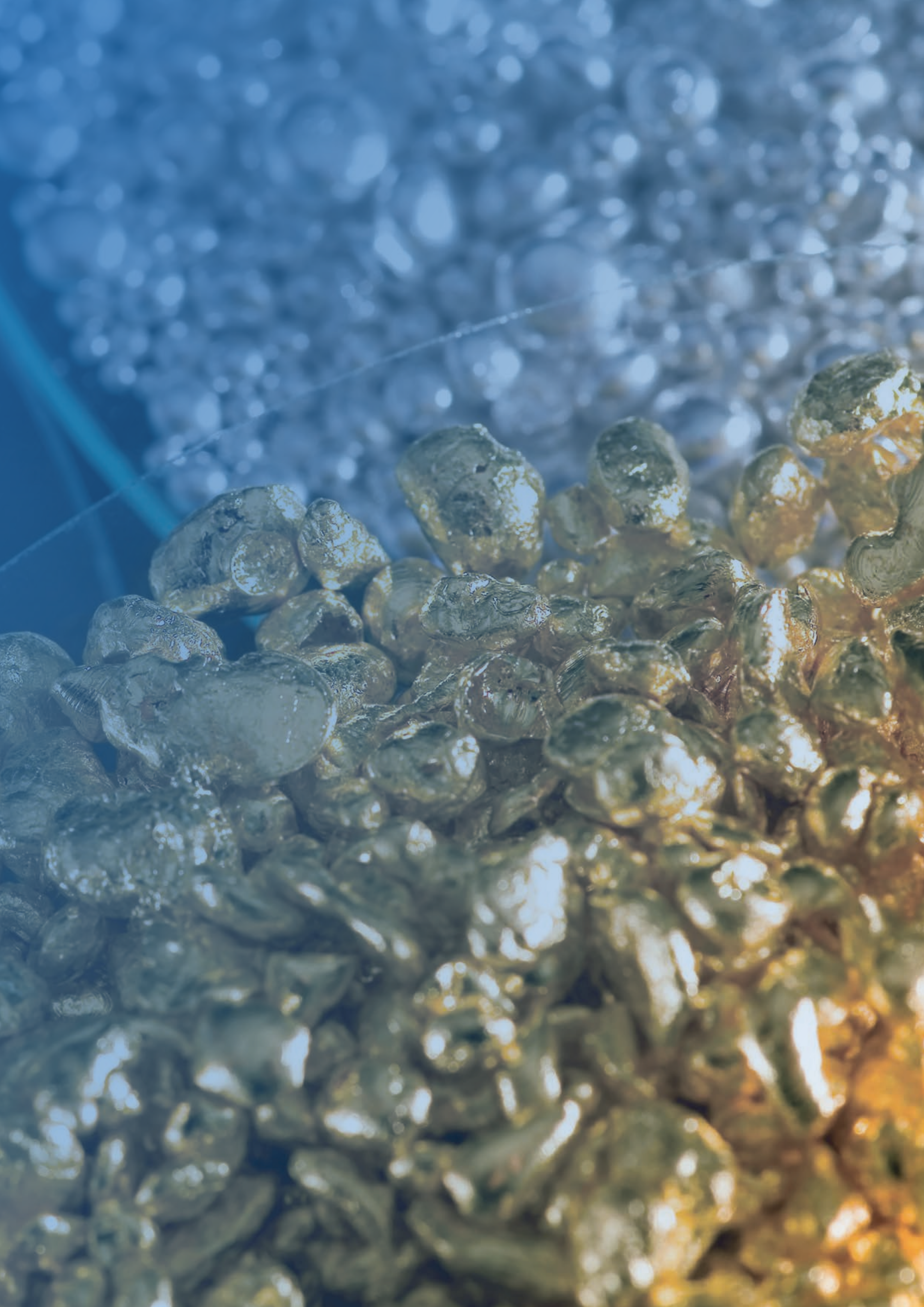
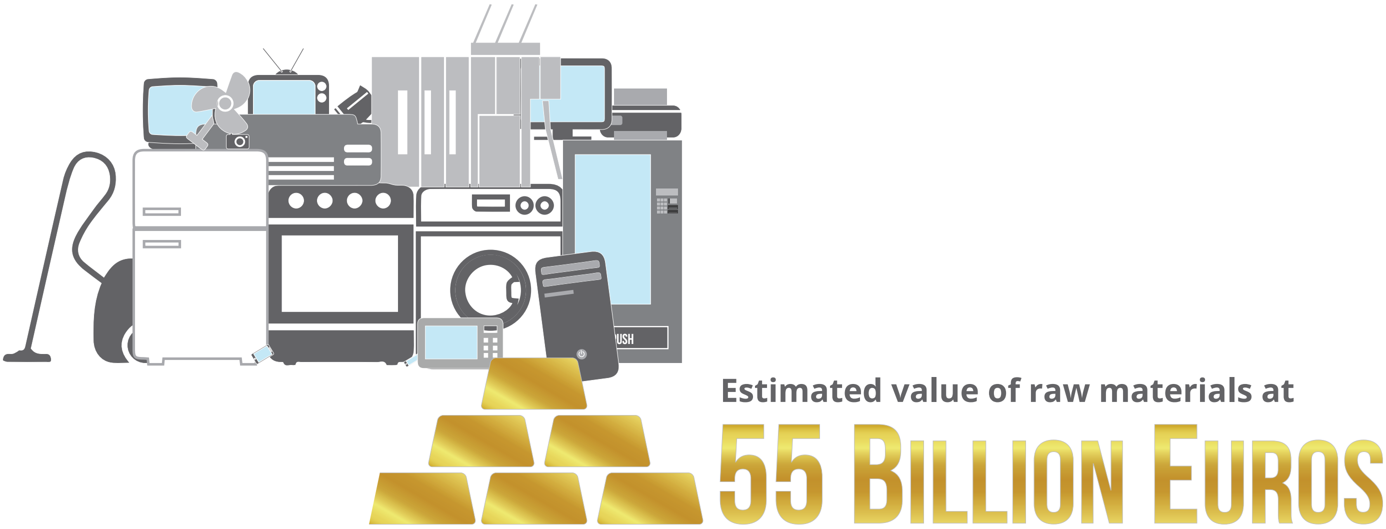


Illustration 9.1: Potential value of raw materials in e-waste in 2016



A large variety of valuable materials and plastics are contained in electric and electronic appliances. Up to 60 elements from the periodic table can be found in complex electronics, and many of them are technically recoverable, though there are economic limits set by the market. E-waste contains precious metals including gold, silver, copper, platinum, and palladium, but it also contains valuable bulky materials such as iron and aluminium, along with plastics that can be recycled. Overall, UNU estimates that the resource perspective for secondary raw materials of e-waste is worth 55 Billion € of raw materials.

EEE also contains rare earth, hazardous, and scarce metals. Common hazardous materials found in e-waste are: heavy metals (such as mercury, lead, cadmium etc.) and chemicals (such as CFCs/chlorofluorocarbon or various flame retardants).

Table 9.1: Potential value of raw materials in e-waste in 2016

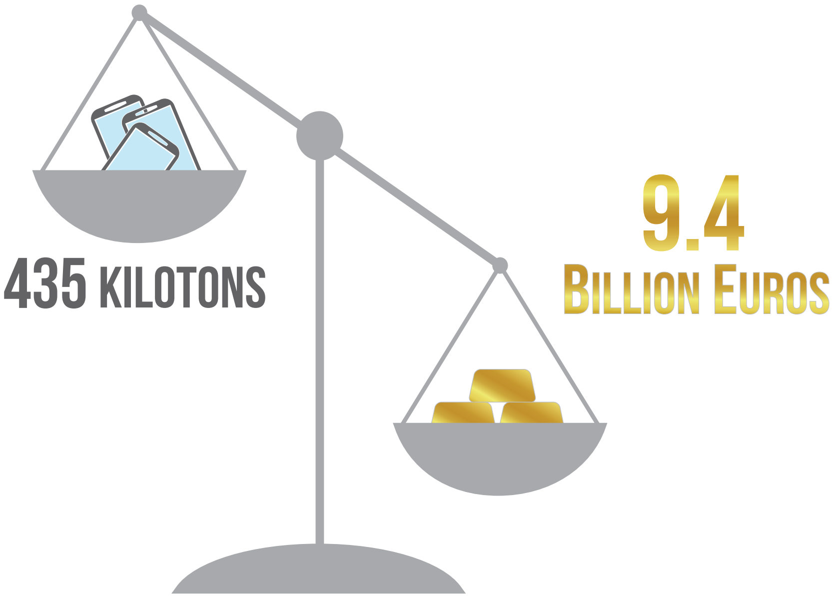
Material	kilotons (kt)	Million €
Fe	16,283	3,582
Cu	2,164	9,524
Al	2,472	3,585
Ag	1.6	884
Au	0.5	18,840
Pd	0.2	3,369
Plastics	12,230	15,043

It is extremely important to treat e-waste adequately in order to prevent the health and environmental risks that the hazardous substances contained in e-waste can pose. Proper management systems of e-waste also need to be established to allow for the recovery of the impressive value of precious and valuable materials contained in discarded equipment. In order to exploit this opportunity and simultaneously mitigate pollution, good policies are needed to facilitate the creation of an infrastructure and encourage the recovery of valuable materials.

One might think that the selling price of new EEE reflects the intrinsic value of the materials from which EEE are made. However, this is not fully true. For instance, the average selling price for a new smartphone worldwide in 2016 was around € 200 (ITU, 2016a). The average selling price for a used smartphone in the same year was € 118 (McCollum, 2017). However, based on UNU estimates, the intrinsic value of precious metals and plastics contained in a mobile phone of an average weight of 90 grams is € 2 per piece. Thus, the raw material value is a relatively small amount compared to the second-hand or new price. In 2016, around 435 kiloton (kt) of wasted mobile phones were generated across the globe. This means that the value of raw materials in wasted mobile phones was 9.4 Billion €. However, if all phones had a longer life span and could enter a second-hand market, the value could be even higher.

The current e-waste recycling indicators focus on percentages of recycled materials. However, in the previously illustrated result, a mass-based recycling indicator might show only a part of the resource efficiency story. In this regard, an indicator based on the monetary value of resources could be preferred over the indicators based on mass development that are used so far (Di Maio et

Illustration 9.2: Potential value of raw materials in mobile phone waste



al., 2017). If the recycling targets referred to the value of the materials, the whole recycling waste management cycle would be incentivised to recover valuable and precious materials incorporated in the discarded electric and electronic equipment. This would easily trigger a market mechanism that might facilitate improvements on the e-waste management worldwide.

In order to efficiently harvest resources through this "urban mine", it is necessary to overcome the inefficient "take-make-dispose" economic model and adopt the circular economy system which aims to keep the value in products for as long as possible and eliminate waste. In this regard, countries should come up with legislation to promote circular economy models in which the e-waste is treated as resource rather than waste. They should promote the reusing, repairing, redistributing, refurbishing, remanufacturing prior to recycling of materials. In addition, an efficient management system is required to divert the formal take-back system and avoid e-waste entering other channels, such dustbins or substandard recycling. Valuable materials are easily lost due to imperfect separation and treatment processes. These solutions should be coupled with an optimized design of the electric and electronic equipment to enable the disassembly and reuse of components, or the recovery of valuable and precious materials. Very often it is more expensive to repair an item (such as mobile phones or laptops) than to buy a new one. In addition, the material used and the design of EEE make recycling challenging, as they are designed using hazardous compounds such as mercury lamps in LCD screens, PVC, flame retardants, and other toxic additives in plastic components.

Circular economy models should allow the increase in value of EEE when wasted, while reducing the environmental pressures that are linked to resource extraction, emissions, and waste. Closing the loop of materials implies the reduction in the need for new raw materials, waste disposal, and energy, while creating economic growth, new "green" jobs, and business opportunities.

Illustration 9.3: A simplified model of the Circular Economy