

Popular Abstract

Circular economy is seen as an alternative concept that seeks to slow down the rate of resource consumption by circulating them in the society for longest time possible, and to eliminate waste by smarter product design and business models. The relevance of a circular model is greatly pronounced for the electrical and electronic products (e-products), the use of which has been growing rapidly in recent decades. Despite several well-intended initiatives, the management systems for the end-of-life (EoL) e-products (known as e-waste) has not been performing as planned, let alone being able to close the material loops. Stretching between these two burning topics of ‘e-waste management’ and ‘circular economy’, this thesis investigates the existing EoL system in order to explore the opportunities for implementing a circular model for e-products.

The study begins with seeking to understand the current e-waste management systems and the relevant organizational and legislative provisions. It then goes on to documenting product and material flows in the EoL material recovery chain using a handful of case studies. This understanding allows the identification of the hotspots for resource losses and their relation to product design. Further, in order to explore the potential of reuse, refurbishment, and recycling, the thesis empirically characterizes EoL products collected through the official system, which is supplemented by an economic assessment that compares the different EoL options. It also briefly investigates, based on an empirical field survey, the user perception of possible EoL scenarios for e-products with the goal of understanding the users’ role in the EoL management. Finally, in order to address the identified challenges, the thesis suggests solution frameworks and concepts that aim for an integrated product lifecycle management and improved resource efficiency.

The key contributions and insights offered by this PhD work include:

- a thorough diagnosis of existing EoL management systems and relevant legislative provisions,
- an updated understanding of product and material flows in e-waste management systems,
- identification of losses occurring in the resource recovery chain and the causes of these losses,
- an estimation of economic potential from reuse, repair and recycling of collected EoL products,
- an insight into users’ perception of product design, EoL, and the concept of circular economy,
- a framework for information exchange among the stakeholders in the e-industry in order to implement circular economy and a ‘design for EoL’ thinking, and finally
- a conceptual solution for better EoL resource recovery and design for EoL for e-products.

The findings of this PhD work are of significant implications for stakeholders in the different stages of e-products’ lifecycle – from design to EoL. The ideas proposed carry the potential for supporting the transition towards a circular economy for the e-industry and beyond.