

# Using a hierarchical optimisation model for WEEE recovery under independent producer responsibility: evidence from multiple functional copier recovery operation

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## Abstract

The extended producer responsibility (EPR) stipulates the electronic and electrical equipment producer either physically or financially to collect, recover, and dispose of waste of electronic and electrical equipment (WEEE). In an Individual Producer Responsibility (IPR) scheme where original equipment manufacturers (OEM) physically operate their circular plants to recover their own brand WEEE, it is always challenging because of the recovery complexity. The advantage is also obvious because OEM has full knowledge and expertise of the product (e.g., bill of material structure) and is in a position to extract higher value from the recovery which requires meticulous and intelligent recovery decisions. The study proposes a robust hierarchical optimization model for WEEE recovery decision-making at the product, sub-assembly, and component levels to retrieve maximum economic value. A Fujifilm multi-functional copier recovery decision case is introduced to validate the robust hierarchical optimization model. A total of nine scenarios under different combinations of the return quality grade and market demand uncertainties are analyzed. The robust efficient solution is identified by selecting the worst scenario of the profit projections. The results show that profit projection in hierarchical recovery mode significantly outperforms the traditional full disassembling recovery mode while the recovery percentage is slightly higher than it. Discussions on applying the robust hierarchical optimization model considering compliance constraints in China (no recovery target) and the EU (85% recovery target) are also conducted. The results show a higher standard of recovery target in the EU does erode the projected profit by 22.3% compared with China.