Addressing the Methodological Challenges Associated with E-waste Estimation

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Abstract

E-waste management is a growing concern for governments across the globe, majorly because of its composition. E-waste contains both hazardous as well as precious metals. The hazardous metals pose a serious threat to the environment and human health if not disposed of properly. Whereas precious metals such as gold, silver, platinum, and copper, could be recovered and reused, thus eliminating the need for virgin materials. Additionally, rapid urbanisation, increasing consumer demand, and shorter product lifespan have led to an increase in the consumption of electrical and electronic equipment, which would ultimately become e-waste (Duman et al. 2020). Given the importance of e-waste, the concept of reverse logistics (RL) has increasingly gained the attention of policy-makers, decision-makers, and academicians in recent years (Govindan et al. 2015). The RL aims to collect the End-of-life (EOL) products from the end-user to recover or extract the materials or components from EOL products which could re-enter the value chain. Recovery or extraction could include remanufacturing, reuse, and recycling. Moreover, unrecoverable and hazardous materials are disposed of or landfilled in an environmentally friendly manner (Dev et al. 2020).

Scholars highlight that setting-up of an efficient and effective recovery network in the context of WEEE requires an accurate estimate of the quantity of e-waste generated in the past, present, and future. For example, an accurate estimate could help in deciding the location of collection centers for WEEE collection, technology and capacity needs of the remanufacturing and recycling facilities could be decided, and the determination of location-capacity of the landfill sites. Thus, ensuring that hazardous materials do not directly or indirectly impact human health. Although lack of information arising due to error in estimation plays an inevitable part in RL network design decision-making, efforts are needed to develop methods for improving forecasting accuracy and reducing errors.

In this regard, the researchers have proposed various e-waste estimation methods ranging from simple material flow methods to non-parametric approaches to complex machine learning techniques. However, the choice of the WEEE estimation method, rather than being driven by the accuracy of the forecasting method, is more often driven by data availability. Hence in this study, we focus on reviewing various e-waste estimation methods proposed so far. The objective is to provide an in-depth understanding of the estimation methods, their pros which are majorly driven by the data availability, and the cons arising as a result of assumptions. Also, we shed some light on various sorts of data or proxies that could be used to make accurate WEEE predictions. Therefore, this article, by providing an in-depth understanding of the available e-waste estimation methods, could assist the reader in choosing the estimation method as per their needs and data availability. Moreover, it provides avenues for researchers who may want to delve deeper into the topic.

Keywords (12 font)
E-waste, estimation methods, sustainability, literature review.

Biography

Nitin Koshta is an Assistant Professor of Quantitative Methods and Operations Management at the Indian Institute of Management Amritsar. He earned PhD in Operations Management from the Indian Institute of Management Kashipur. His research broadly focuses on sustainable and socially responsible operations.