Chapter 3
Advancing E-Waste Management Through Circular Economy Principles:
A Pathway to Sustainable Innovation

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ABSTRACT

Our world has been seriously disturbed by the problem of electronic waste, or e-waste, due to the fast pace of our digital world. The inclination of consumers has increased due to faster and newer innovations, which have accelerated more quickly than expected. This has led to ever-decreasing product lifespans and higher electronic consumption. As a consequence, e-waste is among the wastes that is rapidly accumulating in the world. By 2019, the global generation of e-waste already exceeded 53.6 million metric tons, and by 2030, it is predicted to increase up to 74 Mt. Such an increase of e-waste raises critical environmental and health hazards as well as economic losses because when hazardous materials are not disposed of, resource content gets wasted. Therefore, there is a rapidly increasing desire to introduce the circular economy model to transform the design, production, use, and end-of-life processing of electronic products. The circular economy emphasizes product longevity, longer life cycles, and encourages the reuse and recycling of product materials.

1. INTRODUCTION

1.1 The Global Rise of E-Waste: Scope and Consequences

In recent decades, it has been demonstrated that advances in electronics have dramatically changed the face of industries, lifestyles, and economies around the world. No longer just simple mobile phones and laptops, these electronic devices in households and medical tools have mushroomed in numbers. Such reliance on electronic devices, however, comes with a stupendous cost-the rapidly piling up electronic waste. E-waste is defined as discarded electronic devices no longer usable, wanted, or functional. This category of waste ranges from smaller personal gadgets to large electrical appliances and industrial equipment.

In 2019, 53.6 million metric tons of e-waste were generated worldwide, which will increase by 30% within the next decade (Forti et al., 2020). The fast growth of e-waste is attributed to various factors, such as having short lifecycles of modern electronics, a boom in consumer demand for new technology, and the last but not least constant innovation cycle that encourages frequent upgrading. For example, the life cycle of smartphones is just about two or three years; therefore, people require new models to outperform the previous ones. The progression in technology requires millions of more aged gadgets and literally chucks them to the e-waste annually.

Exponential growth in e-waste has serious environmental and health implications. E-waste contributes to hazardous decays in landfills and incineration, releasing lead, mercury, cadmium, and brominated flame retardants into the ecosystems where it