Circular Economy Model for e-waste in South Africa

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Electrical and Electronic Equipment waste (WEEE), commonly known as e-waste, refers to end-of-life equipment discarded by its primary users. This waste stream often ends up in landfills, both formal and informal, or is exported from developed countries to third-world, developing countries where primitive and unsafe recycling methods can have a detrimental impact on the Environment. E-waste and the regulations surrounding its recycling and transportation are indeed a global dilemma. The lack of data on the amount of e-waste being generated, transported, and recycled between developed and developing countries poses serious challenges that need to be addressed. Proper management and regulation of e-waste are essential to safeguard the environment and human health. Collaboration among all nations is key to developing sustainable solutions for this escalating issue. Challenges include the reuse of limited raw materials, responsible transportation of hazardous e-waste, profitable management of e-waste recycling to attract entrepreneurs, and the enforcement of strict global legislation and monitoring. As the world enters the fourth industrial revolution with the rise of the Internet of Things (IoT), Machine-to-Machine communication (M2M), and Artificial Intelligence (AI), e-waste generation is expected to increase significantly, underscoring the urgent need for practical e-waste management solutions.

In 1976, a research study report presented to the European Commission in Brussels titled "The Potential for Substituting Manpower for Energy" by Stahel and Reday introduced a model of an economy based on loops known as the circular economy (Stahel, 2018). The report acknowledged the prospect of expanding the useful life of raw materials through recycling, economic profitability, and business drive, creation of jobs, and the prevention of waste generation. This study has aimed to develop a new practical, comprehensive, and dynamic circular economy model for e-waste whilst identifying the challenges for each fragment of the model. The model acknowledges the complete e-waste life-cycle from the design phase of a product to end-of-life where it is discarded, recycled, or transported to be discarded or recycled. Models that were studied and incorporated in this model included; the regenerative design model, cradle-to-cradle process, performance economy model, and an integrated closed-loop supply chain with reversed logistics. Figure 1 illustrates the different segments which are acknowledged in the model. The circular closed loop flow is essential as segment challenges and opportunities inform preceding segments in the circular flow chart.

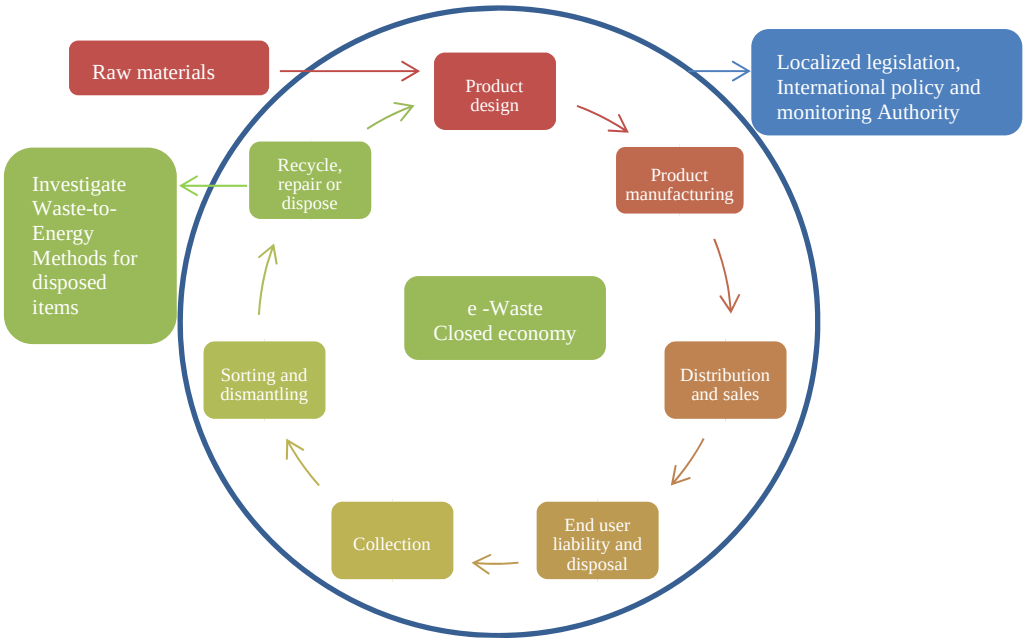

Figure 1: Generic Circular Economy Model for e-Waste

The methodology used in this study was fundamentally through a literature review of public and private entities studies, legislation, and reports concerning e-waste and hazardous waste management. The information assessed from the literature served as the baseline for conducting interviews with companies in South Africa involved in the collection, transport, handling, and disposal of e-waste. Sources of information included publications from the United Nations Environment Programmes, the Department of Environmental Affairs of the Republic of South Africa, journals, and case studies on e-waste in South Africa and globally. In 2017, the British Standards Institution (BSI) developed and published the first official circular economy guide; BS 8001:2017 which is a framework for implementing the principles of the circular economy in organizations. The study incorporates these principle guidelines for the e-waste sector. The connection between the circular economy standard BS 8001:2017 for waste-generating and handling organizations with well-defined accounting and assessment tools for material flows and their environmental as well as social impacts is needed (Pauliuk, 2018) and has been investigated for the e-waste sector.

This research has the potential to provide valuable insights for governments, environmental organizations, and private companies regarding the feasibility and benefits of adopting a circular economy model. It emphasizes the importance of finding a balance between corporate profits and environmental responsibility to sustainably manage finite resources. Through data collection and analysis of case studies, the study highlights the challenges associated with implementing an e-waste management system. It also recommends strict government policies on product design, production processes, manufacturer and owner responsibilities, e-waste exportation, and recycling practices. The study suggests that both local and global legislation should focus on establishing effective e-waste policies that benefit all countries, regardless of their level of development. By clearly defining stakeholders and holding them accountable for the entire life cycle of e-waste, the e-waste industry can be transformed to support the transition to a circular economy worldwide.

References:

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