Developing a circular economy model for e–waste in the global economy

J. Snyman[1], J. Snyman[2]

[1] Department of Civil Engineering, Faculty of Engineering and the Built Environment, Tshwane University of Technology, Pretoria, South Africa

[2] Directorate: Mechanical and Electrical Engineering, Department of Water and Sanitation, Pretoria, South Africa

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Presenting Author: J. Snyman (snymanj@tut.ac.za)

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WEEE (Waste Electrical and Electronic Equipment) referred to as e-waste is end-of-life equipment which is discarded by its primary users. This waste stream easily find their way into landfills (formal and informal) or are even exported from developed countries to third-world, developing countries which use primitive, unsafe recycling methods that have an impact on the environment. E-waste and the marginal regulations enforced on the recycling and transporting waste from developed to developing countries have become a global dilemma. With limited data available on the amount of e-waste generated, transported and recycled between developed and developing countries, there are serious challenges to address. The challenges include re-use of finite raw materials, transporting hazardous e-waste responsibly, effectively managing e-waste recycling in a profitable fashion to attract entrepreneurs and enforce strict legislation and monitoring on a global scale. The world is entering the fourth industrial revolution where the Internet of Things (IOT), Machine to Machine communication (M2M) and Artificial Intelligence (AI) will increase e-waste generation exponentially which drives the need for practical e-waste management solutions.

In 1976 a research study report to the European Commission in Brussels named “The Potential for Substituting Manpower for Energy” by Stahel and Reday identified a model of an economy in loops called the circular economy (Stahel, 2018). The report acknowledged prospect to expand useful life of raw materials through recycling, economic profitability and business drive, creation of jobs and the prevention of waste generation. The aim of this study has been 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 is acknowledged in the model. The circular, closed loop flow is essential as segment challenges and opportunities inform preceding segments in the circular flow chart.

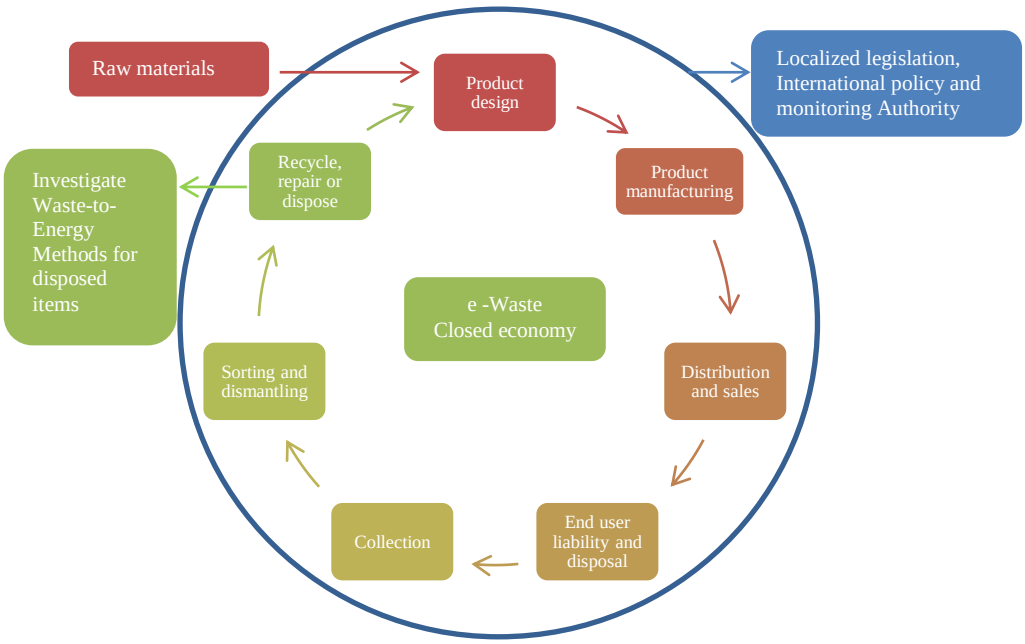

Figure 1: Generic Circular Economy Model for e-Waste

The methodology used in this study was fundamentally through literature review of public and private entities studies, legislation and reports with respect to 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 form the United Nations Environment Programmes, 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 study has the potential to inform governments, environmental originations and private companies on the potentials and practicality of a circular economy model. The balance between company profits and environmental responsibility to preserve finite resources extracted is addressed and incorporated to ensure a viable model is synthesised. The study identified challenges in the implementation of an e-waste management model through data collection and evaluation of related case studies. Furthermore, the study informed stringent governmental policy guidelines on product design, production processes, manufacturer and owner liability, exporting of e-waste and the recycling of end-of-life e-waste products. The findings of this study indicated that South African as well as global legislation should be addressing an e-waste policy and control that benefits both developed and developing countries in each segment of the closed loop model. The local and global e-waste industry should be transformed to a level where stakeholders are clearly defined and held accountable for the life cycle of e-waste to assist with the implementation of the circular economy in different regions of the world.

References:

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