

Remodeling of Domestic Recycling E-Waste Management

Abdullah C.W. Noorakma^{1,2,*}, A Hambali¹, Al Amin Mohamed Sultan¹

¹Fakulti Kejuruteraan Pembuatan, Universiti Teknikal Malaysia Melaka,
Hang Tuah Jaya, 76100 Durian Tunggal, Melaka, Malaysia

²Fakulti Reka Bentuk Inovatif dan Teknologi, Universiti Sultan Zainal Abidin,
21300 Kuala Nerus, Terengganu, Malaysia

*Corresponding e-mail: cwnoorakmaa@gmail.com

Keywords: E-waste; Collection System; Recycling

ABSTRACT – Fast technological growth has greatly accelerated the numbers of electrical and electronic waste (e-waste) in recent years. Due to its severe implication for human health and the environment, urged the researchers and government sector to conduct a well-organized e-waste management system. A review of present e-waste management by some researchers in Malaysia found some gaps in the success of the system. The awareness, mentality, and lack of knowledge of disposal method is the main factor that contributes to the failure of proper e-waste management among household consumer. In addition, proper household (domestic) e-waste management is in its early stage, with several projected regulations on household e-waste but it is yet incomplete. An appropriate e-waste collection facility is required to prevent and reduce the e-waste flow to the open dump or municipal solid waste facilities. Various optional collection systems also must be generated to encourage the consumer to dump the e-waste accordingly. Compared to the existing e-waste management model, the proposed model of the e-waste management framework has no option for the household user to dump the e-waste into the open dump or municipal solid waste facility. The take-back program with some incentives also is introduced to encourage the consumer to send their e-waste to scrap recyclers and collectors. The more various e-waste smart collector located nearby their neighborhoods may help the disposal process easily. Both scrap collector and recycler can redeem their incentive through the take-back program as encouragement for them.

1. INTRODUCTION

E-waste is electrical and electronic appliances created after the product nearing or reaching the end of its useful life. In Malaysia, electrical and electronic waste (e-waste) is categorized as scheduled waste under the code SW110 which contained hazardous substances and some valuable materials. Computers, television, mobile phone, and refrigerator are examples of everyday electronic products. Other electrical and electronic products range from home appliances, communications and information technology devices, medical equipment, home entertainment, and electronic utilities office. In these few years, more high technology products have been developed according to technological advancement and are evolving at a very fast pace. These high technologies and smart products

have shortened lifespans. Shortening product lifespans is a key factor in increasing e-waste [1]. Electrical and electronic waste (e-waste) generation become a global issue when it shows rapid-growing solid waste streams in the world [2]. High market demands for the production of electrical and electronic products and their reduced life cycle contribute to the high waste of e-waste. The issue of managing waste electrical and electronic equipment has become important in recent years due to the challenges to manage it. Effective waste management needs to be developed immediately. In Malaysia, industrial e-waste regulations are available but for household e-waste, the regulation is incomplete because of a lack of public awareness of the implication of e-waste to human health and the environment [3]. To the previous study by Haikal et. al [3], although the Department of Environmental (DOE) has published its proposal on an e-waste management system, however, the management system is not yet ready to be implemented. Consumer behaviors and knowledge of proper e-waste disposal systems are important for the success of an e-waste management system. In addition, the challenges in designing an effective e-waste management system depend on the effectiveness of the e-waste collection system [3]. Various e-waste collection system has been done by previous researchers for example Smart E-waste Collection Box to encourage household consumer to dump electronic waste in an easy way [4][5]. Therefore, in this paper, the e-waste system and management in Malaysia will be assessed and the recycling of e-waste will be remodeled based on the existing model.

2. METHODOLOGY

The review of literature review on the aspect of the e-waste recycling model was done and, in this study, a total of 20 papers published in the last five years were reviewed to assess the various e-waste management in several countries, and the recycling framework will be remodeled accordingly.

The current Malaysian household e-waste flow and e-waste management system is referred to according to Haikal et. al [3] as in Figure 1. Since household or domestic e-waste becomes the obstacle to the success of effective e-waste management, the framework model will be modified to suit the household consumer need so that less e-waste is sent to the open dump or municipal solid waste facility

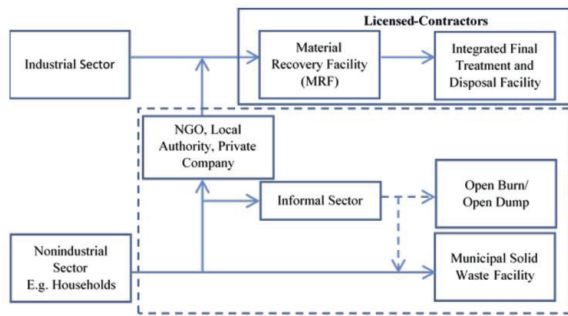


Figure 1 Current e-waste flow and e-waste management system in Malaysia [3]

3. RESULTS AND DISCUSSION

Figure 2 outlines the proposed framework for recycling domestic e-waste management. The overall framework is obtained from previous studies. The remodeling of the domestic e-waste recycling frames works been done based on the previous study.

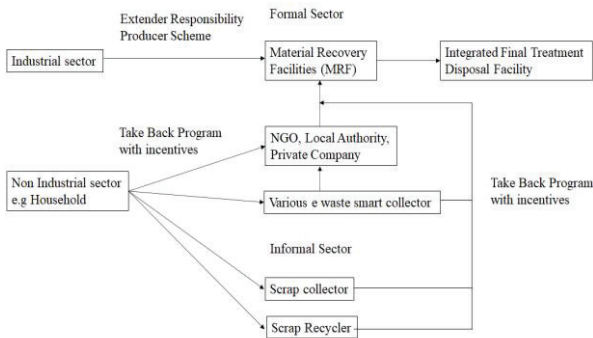


Figure 2 Proposed e-waste flow and e-waste management framework

An improvement has been done to the flow of the e-waste collection system for household (domestic) users. There is no option for household users to landfill the e-waste at the open dump or municipal solid waste facility. The waste can be sent directly to the scrap collector and recycler or private company and various smart collectors. The household user can earn some incentives from the take-back program. The incentives in terms of money or reward can be applied to encourage the household user to dispose of their electronic waste correctly. The examples of previous take-back programs that have been done by the private sector such as KITAREcycle by SWM Environment, and Trash to Cash by SWCorp must be carried out on a big scale. In addition, the various e-waste smart collector must be generated and located nearby their neighborhood such as shopping malls, institutions, or workplaces to help the household user dispose of their electronic waste easily. In the informal sector such as scrap collectors and scrap recycler, the take-back program with incentive also need to be implemented as an encouragement to them

4. CONCLUSION

The crucial factor to the success of e-waste management in Malaysia is the proper e-waste collection system. The various household recycling e-

waste management collection system may help the household consumer to deposit the electronic waste easily. The awareness and knowledge about the impact of e-waste on the environmental and human health of household users can be done by seeding some incentive whenever they dispose of their waste. The take-back program also can be an ideal solution for consumer awareness encouragement and motivation

REFERENCES

- [1] K. Jayaraman, S. Vejayon, S. Raman, and I. Mostafiz, "The proposed e-waste management model from the conviction of individual laptop disposal practices-An empirical study in Malaysia," *J. Clean. Prod.*, vol. 208, pp. 688–696, 2019, doi: 10.1016/j.jclepro.2018.10.125.
- [2] E. R. Rene, M. Sethurajan, and V. Kumar, "Electronic waste generation, recycling and resource recovery : Technological perspectives and trends," *J. Hazard. Mater.*, vol. 416, no. May 2020, p. 125664, 2021, doi: 10.1016/j.jhazmat.2021.125664.
- [3] H. Ismail and M. M. Hanafiah, "Discovering opportunities to meet the challenges of an effective waste electrical and electronic equipment recycling system in Malaysia," *J. Clean. Prod.*, vol. 238, 2019, doi: 10.1016/j.jclepro.2019.117927.
- [4] K. D. Kang, H. Kang, I. M. S. K. Ilankoon, and C. Y. Chong, "Electronic waste collection systems using Internet of Things (IoT): Household electronic waste management in Malaysia," *J. Clean. Prod.*, vol. 252, p. 119801, 2020, doi: 10.1016/j.jclepro.2019.119801.
- [5] Y. S. Yong, Y. A. Lim, and I. M. S. K. Ilankoon, "An analysis of electronic waste management strategies and recycling operations in Malaysia: Challenges and future prospects," *J. Clean. Prod.*, vol. 224, pp. 151–166, 2019, doi: 10.1016/j.jclepro.2019.03.205.