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Handling E-Waste in Malaysia: Management, Policies and Strategies

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Abstract

One of the concerns of life is the generation of waste. In today's modern life, the generation of the new type of waste is the waste of electrical and electronic equipment's or e-waste becoming a crucial problems to solve. E-waste containing both dangerous and valuable materials requiring a special treatment and recycling practices to avoid adverse environmental impacts and harmful impact on human health. Domestic e-waste generation in Malaysia has already climbed dramatically and forecasted to reach over a million tons in 2020. This increasing trend amount of e-waste is due to the high demand on the production of electric and electrical equipment from the Malaysia's consumers. Various steps been taken by government in order to tackle the ever growing threat of e-waste. This paper presents global and Malaysia e-waste scenario, initiatives and practices in handling an e-waste. Consequently, this paper suggest that e-waste policy development is crucial in Malaysia and requires more customized approach and a strategies environment assessment as part of national policy planning.

Keywords: E-waste management, policy and management, globalization, Malaysia

1. Introduction

E-waste is an important global environmental and health issue. The global quantity of e-waste generation in 2014 was around 41.8 million tons with only 6.5 million tons were collected by official take back system [1]. E-waste has become a serious environmental issue since the early 1990s due to two reasons which are its rapid growth in volume and its hazardous content [2]. As a new addition to the waste stream, the emergence and rapid increase of e-waste demands an inclusive management system. Source of e-waste come from a wide range of products, from industrial equipment to household appliances [3]. With rapid urbanization, technical innovation and economic development, e-waste becoming the fastest growth waste stream.

The definition of e-waste always been referred to the Directive 2012/19/EU which is said that electrical or electronic equipment which is waste including all components, sub-assemblies and consumables, which are part of the product at the time of discarding. Directive 75/442/EEC, Article 1(a) defines waste as any substance or object which the holder disposes of or is required to dispose of pursuant to the provisions of national law in force.

However, e-waste always been misconception that it only comprised of computer and information technology (IT) related components. It is universally understood that as electronic waste disposed by end user and includes a wide range of products. An e-waste been categorized into ten elements which are large household appliances, small household appliances, IT and telecommunications equipment (ICT), consumer equipment, lighting equipment, electrical and electronic tools, toys and sport equipment, medical devices, monitoring instrument and automatic dispenser [4].

The composition of e-waste contains more than 1000 different substances that fall under hazardous and non-hazardous category including ferrous and nonferrous metal, plastic, glass, wood and other items [5] which make the sampling process difficult [6]. Moreover, it is not only contain with bulk material but also hazardous and valuable substances. The normal composition found in e-waste are ferrous metal with 38%, non-ferrous metal 28%, plastic 19% and others including wood, rubber and ceramic with 11% [7].

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Studies by researchers stated that toxic metals that released from electronic waste will gives a negative impact to humans and the environment [8,9]. Tyagi & Chatterjee (2013) in their studies mention that about 50% - 80% of electronic waste generated around the world that end up in recycling sites and rise in domestic demand, has led to serious environmental and health challenges due to high toxicity and huge volume. According to the report by Basel Action Network, the import of hazardous electronic waste has caused a severe environmental pollution in certain countries due to inappropriate recycling methods [11]. The threat of e-waste toxicity to human health, both in terms of prolonged and acute conditions, has become a serious societal problem and as well demonstrated by case studies in China [12–14], India [7] and Ghana [15].

2. Malaysia Scenario and Management

Malaysia is a fast developing country with population of 29.9 million and it has been listed as 41 most populated country in the world with land size of 330,800 sq km [16]. Therefore by 2020, Malaysia were destined to be a major future of electrics and electronics producer and consumer that in future will lead to e-waste generation. Population in Malaysia were rising with average 0.4 million to 0.7 million per year [17]. According to International Labour Office Geneva (ILO), population leading to more demand in electrical and electronic equipment which leading to the generation of e-waste in the future [18].

Electronic waste management in Malaysia evolved since 2005 where it is under responsibilities of Department of Environment Malaysia (DOE). E-waste been defines as waste material from the electrical and electronic assemblies containing components such as accumulators, mercury-switches, glass from cathode ray tubes and other activated glass or polychlorinated biphenyl-capacitors or contaminated with cadmium, mercury, lead, nickel, chromium, copper, lithium, silver, manganese or polychlorinated biphenyl [19]. As per listed under Environmental Quality (Schedule Waste) Regulations 2005, e-waste been categorized to three different code which are SW 103 for batteries waste containing cadmium and nickel, SW 109 for waste containing mercury and it's compound and SW110 for other e-waste assemblies including printed circuit board, electronic components and wires [19].

Estimation of e-waste generation in Malaysia had been carried out in 2007 by Perunding Good Earth Sdn Bhd under the management of Department of Environment Malaysia (DOE). The inventory calculated and projected the future generation of e-waste in Malaysia. By year 2020, Malaysia were estimated to generate 1,119,155 metric tons of e-waste [20]. The StEP (Solving the E-waste Problem) organization had published a data from 184 countries on e-waste generation. The latest amount recorded for generation of e-waste in Malaysia for 2014 alone was 232,000 metric ton [21]. This amount showed an increment compared to year 2008 with only 12.065 metric tons [22]. Therefore, it is not possible to achieve the estimation of projected total with 690,827,529 metric ton of e-waste generation by year 2008-2020 [20].

This increasing trend amount of e-waste is due to the high demand on the production of electric and electrical equipment from the Malaysia's consumers. In addition, Malaysia is an attractive country for the illegal dumping of e-waste. This is due to the geographical position of Malaysia as it lies in the middle of international e-waste trade route [23]. The development of small-scale and informal recycling processes has also increased the potential of serious adverse impacts on the environment and public health [24].

2.1 Present e-waste management

A studied done by Norazli et al. (2015) predicted that the lifespan of electric and electronic appliances usage by Malaysian were around 0 to 15 years [25]. This prediction had been proved by previous study in 2013 which resulted that 73% of Malaysian will phased out their electric and electronic appliances within 10 years either it's broken, malfunction or demanding for newer technology [23].

E-waste in Malaysia normally coming from several sources namely industrial, household and business entities. Currently only e-waste generated from industries implemented a proper management of e-waste. Department of Environment Malaysia (DOE) recorded the generation of e-waste from the industrial sector between year 2009 and 2010 with amount 134,035.70 metric ton and 163,339.80 metric tons [26]. Figure 1 shows the general flow of Malaysia's e-waste from the sources to the disposal facility. All the recovery facilities in Malaysia were built and operated by private company which they need to register with DOE under the Environmental Quality (Prescribe Premises) (Treatment Disposal Facilities for Schedule Waste) Regulations 1989.

The process of collection, treatment, recycling and disposal of e-waste, Department of Environment Malaysia (DOE) had collaborate with National Solid Waste Management Department (NSWMD) in order to make sure the flow are clear especially when it's related with the household e-waste.

All the recovery facilities in Malaysia were built and operated by private company which they need to register with DOE under the Environmental Quality (Prescribe Premises) (Treatment Disposal Facilities for Schedule Waste) Regulations 1989. Currently there are 138 company who registered and operated the recovery facility either for partial or full recovery[27]. Other than collecting and transporting the e-waste, these recovery facilities also have a duties on dismantling, sorting, remarketing of reusable equipment and make sure a safe disposal of hazardous substances [28].

Currently there are 138 company who registered and operated the recovery facility either for partial or full recovery [29]. Other than collecting and transporting the e-waste, these recovery facilities also have a duties on dismantling, sorting, remarketing of reusable equipment and make sure a safe disposal of hazardous substances [30].

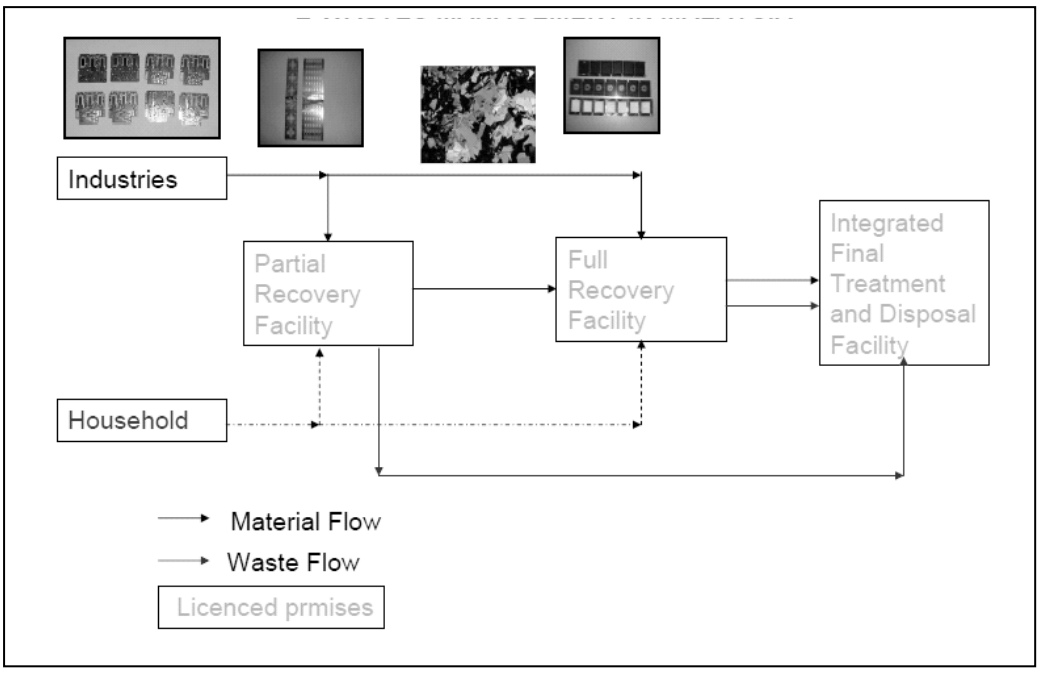

Fig. 1: General flow of e-waste in Malaysia

Unfortunately, the e-waste from household is still in uncertainty status because of various channels of disposing their e-waste before this e-waste can come to the recovery facilities compared to the industrial e-waste. Due to this complication or unorganized channels, most of household e-waste were less collected and sent to the recovery facilities [22]. Most of household told that they preferred disposing their e-waste either by selling to the second hand dealer or simply throw as a garbage [31]. This problem will lead to the informal recycling and ended to landfill without proper treatment.

2.2 Acts, Guidelines and Legislative

The sense of e-waste crisis problem come to raise when there always have anticipated growth from all over the countries. The containment of hazardous elements in every of e-waste clearly it cannot been disposed as in biological cycle neither to dumped to the landfill as it will harm the ground and soil [32]. Lot of initiatives had been taken in order to solve this issue when the European Union and Japan been the leaders in forming a legislation towards the e-waste problem.

The European Union had highlighted the policy toward e-waste through the WEEE Directive in 2002 that focusing into collection, recovery and recycling [4]. Together with Restrictive on Hazardous Substances (RoHS) Directive where it abandoned the movement of hazardous element as it makes as influencer into other countries to develop their e-waste management framework. Followed by that, in 2004 at the G8 Summit, Japan had voiced out on the seriousness of the e-waste problem and introduced of the 3Rs (Reduce, Reuse and Recycle) policy [33].

Basel Convention has been the most prominent initiative to reduce the movement of e-waste when it entered the force in 1992. Its' banning the hazardous material to been exported and put the Extended Producer Responsibility (EPR) as a core element in 2009. This convention has put a guide in e-waste movement that cross nations. As an example when the increasing numbers of e-waste in China and India were because they had become the illegal shipment of e-waste especially from develop country [34,35].

In Malaysia, all environmental issues are organized under the Department of Environment (DOE). Through the administration of the Environmental Quality Act 1974 (EQA 1974), the main responsibility of DOE are to avoid, control and abate pollution in Malaysia which is under the EQA 1974, the Environmental Quality (Scheduled Wastes) Regulation 1989 (EQSWR 1989) was structured [36]. These regulations were based on the life cycle concept where it is starting from production, packaging, usage and disposal are regulated. Later in 2005, the scheduled wastes are characterized based on the category of waste instead of the source of the waste. This Environmental Quality (Scheduled Wastes) Regulations 2005 (EQSWR 2005) are enforced to replace the EQSWR 1989 which puts the e-waste under SW110 in the First Schedule of EQSWR 2005 [26]. Not only that, Malaysia also created a special division for the hazardous e-waste and put an effort into managing this hazardous composition.

After 2005, Malaysia's Government started to realize the harmful of hazardous content in e-waste which will affect the environment [24]. Therefore, in 2008 a set of guidelines acknowledged as the Guidelines for the Classification of Used Electrical and Electronic Equipment, has been published by DOE which identified the characteristic and components of e-waste [19]. The extent of e-waste in these guidelines is to aid parties such as waste generators, waste importers or exporters and relevant authorities involved. At this moment, this guideline only differentiates between e-waste and non e-waste. Since Malaysia is one of the parties in Basel Convention, e-waste are not permitted to be import without a writing consent.

Currently, at this stage Malaysia were into developing the proper framework for managing the household e-waste. This initiative were develop with the cooperation of E-waste Alam Alliance Sdn Bhd and Japan International Agency (JICA). Through this initiative, the formal framework and management for the hazardous e-waste will be developed.

3. Best Available Practices

- The Extended Producer Responsibility (EPR) is a strategy to promote the integration of environmental cost in a way of extending the producer's responsibility to the post-consumer stage. It is involving the entire lifecycle especially for take back, recycle and final disposal. This initiative had been said as one of the best practice in e-waste management and should be include in the legislative framework [37]. Japan is an evidence where the implementation of EPR would give a positive impact towards managing the electronic waste[38].
- Switzerland has been a pioneer in the world to have establish their very own e-waste management system. They had been implemented the ARF approach in their e-waste management system. The effective collection of e-waste in Switzerland is primarily due to the efficient management of the e-waste formal producer responsibility such as SWICO and SENS. They still remain until now as voluntary membership organization with committees of producer representatives to take decision on important matters such as setting the Advance Recycling Fee (ARF) [39,40]. ARF is charged for all new appliances to covers the costs for collection, the transport and recycling [41]. The existing E-waste management system based on the ARF approach is given in Figure 2. The finance from ARF will goes from the consumers direct to retailer and manufacturer. This finance will then be divided to the collector, the carrier and the recycler [42].
- Adoption of Restriction of Hazardous Substances (RoHS) in order to tackle the issue on the increasing trend in the reduction in the use of hazardous substances such as lead, cadmium, mercury, polychlorinated biphenyls, and other toxic and hazardous substances for which safe substitutes have been found. Many countries have implemented the RoHS regulations in the manufacture of electrical and electronic equipment[43].

4. E-waste Management: Implications and Strategies

Although there have numerous legal framework and management been invented and adapted in Malaysia, there are still many obstacles to manage end-of-life of electrical and electronic waste especially the hazardous material. Lack of raw and base data for e-waste composition (glass, metals, plastic and others), lack of reliable data in detailing various e-waste fraction as well as lack of establish e-waste recycling infrastructure by means of individual e-waste fractions will impose a significant impact towards environment. Not only that, the main concern come when the Institute of the Advanced Study of Sustainability, United Nations (UNU-IAS) reported that Malaysia did not have national regulation on the e-waste been enforced [44]. Furthermore, the existing technologies currently been used in Malaysia are still conventional way recovery extraction especial for recovery of precious metal. Most of recovery facilities still limited to wet chemical processes, electrolysis processes, air separation and thermal [24,36]. Those all lacking components need a urgent strategy and vast implementation in order to tackle the e-waste issue.

Nowadays, Malaysia are heading towards into full implementation of Extended Producer Responsibility (EPR)[29]. This step been taken actively due to commitment of Malaysia's government to sustainable waste management that been expressed through Tenth Malaysia Plan [45]. At this moment, few multinational firms have volunteer to initiates the take back scheme such as Motorola Malaysia, Nokia Malaysia, Dell Malaysia, Apple Malaysia, HP Malaysia, Senheng Corporation and Toshiba Malaysia. These company focused mainly on the end of life (EoL) of IT and telecommunication appliances.

Malaysia have way more to come to have a sustainable e-waste management system. A lot of steps need to be taken and lot of problem need to be solve which relates from policy, technology and awareness. According to Fatihah et al. (2014), there were several issues been raised by the recovery facilities such as lacking of e-waste supply and e-waste processing technology. The issue of lacking e-waste supply maybe happen due to improper e-waste management that come from household or due to lower of awareness and readiness of the Malaysia citizens[46].

5. Conclusion

Electronic equipment and therefore e-waste are everywhere in our society. They are characterized by a complex chemical composition and difficulty in quantifying their flows at a local and international level. The pollution caused by their irregular management substantially degraded the environment mostly in poorer countries, receiving them for recycling and recovery of their valuable metals. As for the consequences on ecosystems, human health and environmental restoration of areas burdened by certain polluters generated by e-waste there are no sufficiently documented scientific studies. Without an effective safe e-waste infrastructure and complete data, the e-waste problem likely to continue without ending. Therefore, a needs of research in how the adopt the suitable effective ways in order to handle the e-waste without giving the negative impacts towards environment and human health.

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