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E-PROCEEDING OF

**1st INTERNATIONAL
E-CONFERENCE ON
GREEN & SAFE CITIES
2022**

“Sustaining the
Resilient, Beautiful and Safe Cities
for a Better Quality of Life”

20 & 21 SEPTEMBER 2022

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“ **Sustaining the Resilient, Beautiful and Safe
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HOUSEHOLD AWARENESS AND BEHAVIOUR TOWARDS E-WASTE MANAGEMENT SYSTEMS IN SHAH ALAM CITY

Nurul Ezaliya Husna Hussin^{1*}, Nor Eeda Haji Ali², Natasha Khalil³

***Corresponding Author**

Faculty of Architecture Planning and Surveying, University Teknologi MARA Perak Branch, Seri Iskandar Campus, 32610, Perak, Malaysia

*ezaliyahusna@gmail.com

noree038@uitm.edu.my

natas582@uitm.edu.my

Abstract

E-waste management has become a concern in today's technology-based era, where electronic equipment is on the rise, complicating the transition to sustainable management. As more electronic equipment is developed to fulfill people's demands worldwide, more resources are allocated to its development. From 1981 to 2020, the amount of E-waste generated in Malaysia increased considerably, and this trend is likely to continue in the coming years. Many governments have been forced to adopt and enforce environmentally sustainable management in order to decrease health and environmental hazards, as well as to maximize the reuse, recycling, and recovery of precious e-waste resources. However, there are challenges that make government strategies more difficult to implement, which are household awareness and behaviour. Therefore, this paper aim to determine household awareness and behaviour toward e-waste management systems in Shah Alam city. A total of ten participants were recruited for the survey in January 2022 as a result of a screening form issued to households based on the criteria set. The study's findings revealed that household awareness and behaviour are the key problems complicating e-waste management in Shah Alam city. This study emphasizes the importance of supporting environmentally friendly practices and education on e-waste management that meet the demands of households as a strategy for long-term sustainability.

Keywords: *Awareness, Behaviour, Challenges, Environmental, E-waste management.*

INTRODUCTION

Malaysia's economy is rapidly urbanizing, and the population is growing, with negative environmental consequences as waste generation increases (Ali et al., 2018; Samsudin & Don, 2013). Population growth in Malaysia has led to an increase in waste, which has become a critical problem (Izzati et al., 2020; Kalana, 2010; Yong et al., 2019). The population is projected to be 32.7 million in 2021 and 37.4 million in 2030 as urbanization continues (Ali et al., 2016; Bong et al., 2017). As mentioned above, population, economic and industrial growth in Malaysia is causing excess generation of municipal solid waste (MSW), which needs to be taken seriously in terms of management (Aja & Al-Kayiem, 2014; Ali & Ho, 2021). MSW is a term used to describe a wide range of solid wastes generated by cities and municipalities as a result of consumer activities, including electronic, biodegradable, and composite waste, as well as medical waste (Magutu & Onsongo, 2011; Noor et al., 2020). MSW is currently produced and processed at 25,000 metric tonnes per day in Malaysia, or 0.5–1.9 kg per capita per day. Nevertheless, a large part of the country's e-waste is generated as a result of population growth, rapid urbanization, and high demand for electronic devices and their eventual disposal

at the end of their useful life (EoL) (Almulhim, 2022; Attia et al., 2021; Miner et al., 2020).

In Malaysia, electronic waste, or e-waste, has been there since the 1940s when electrical devices were introduced (Alias, 2015). E-waste refers to any electronic product that is no longer working, has reached the end of its lifespan, or has been thrown away by its user (Ogbenna et al., 2018; Priya, 2018; Rani et al., 2021). All major electronic and electrical equipment, such as mobile phones, laptops, computers, televisions, and washing machines, are included in this category (Prueksasit et al., 2020). To an estimate, about 20 to 50 million tonnes of electronic material are dumped each year worldwide (Dato, 2014), and e-waste makes up 5% of municipal waste according to the United Nations. Human health and the environment are at risk if this e-waste is not properly disposed of (Priya, 2018; Senawi & Sheau-ting, 2020; Vildan, 2017). Although e-waste is detrimental to humans and the environment, e-waste is currently poorly managed due to the challenge of household awareness and behaviour (Almulhim, 2022; Attia et al., 2021; Kalana, 2014; Mahat et al., 2019; Tiep et al., 2015). Hence, this paper aims to determine household awareness and behaviour toward e-waste management systems in Shah Alam city.

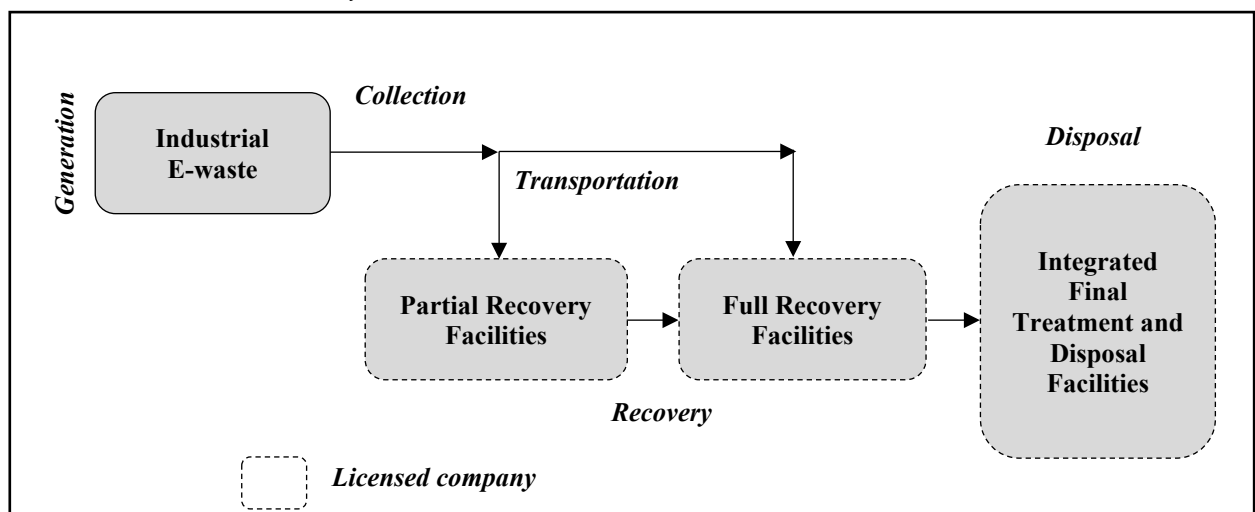
LITERATURE REVIEW

Electronic waste or e-waste can be defined as the users' discarded electrical and electronic equipment that has reached its end lifespan or is no longer wanted by the users (Mmereki et al., 2016). E-waste can be categorized into ten categories such as large household appliances (freezers, washers, microwaves, etc.), small household appliances (vacuum, toasters, grinder, etc.), IT and telecommunication equipment (mobile phones, computers, laptops, etc.), consumer equipment, lighting equipment, and others (Shad et al., 2021). E-waste typically contains hazardous substances that can contribute to environmental and health problems if not managed appropriately. Thus, the e-waste management systems (E-WMS) play a critical role in reducing the problem. E-WMS refers to managing the e-waste flows starting from e-waste generation, e-waste collection, e-waste transportation, e-waste recovery, and e-waste disposal that can contribute to environmental and health problems if not managed in appropriate ways (Mmereki et al., 2016). Appropriate E-WMS involving various stakeholders such as households, e-waste collectors, e-waste recovery facilities, and e-waste disposal. There are two significant sources of e-waste in Malaysia which are industrial and household e-waste (Yong et al., 2019). The electrical and electronic waste industry, commonly referred to as industrial e-waste, is regulated under the Environmental Quality (Scheduled Waste) Regulation 2005 (EQSWR 2005), as outlined in the Environmental Quality Act 1974, via the "e-SWIS" manifest system, while the Department of the Environment (DOE) is currently developing proper household e-waste generated by residential, complete with a legal framework (DOE, 2020). E-waste cannot be disposed of in landfills under the requirements of the EQSWR 2005 (EQA, 1974). Instead, e-waste must be recycled and recovered at prescribed or licensed facilities, and the disposal must only take place at allowed facilities and in an environmentally sound manner (Suja et al., 2014). Currently, only industrial e-waste is appropriately managed (Osman, 2016) (Figure 1). In contrast to industrial e-waste, the status of household E-waste is still undetermined because of the variety of e-waste disposal options accessible before the e-waste is recovered (Figure 2). The major challenge resulting from these issues was household awareness and behaviour based on previous studies (Kalana, 2010; Mahat et al., 2019; Mapa et al., 2018; Suja et al., 2014; Tiep et al., 2015).

According to Almulhim (2022), household awareness is one of the success factors in developing a long-term strategic E-WMS which is important in creating an economically and environmentally friendly management. Moreover, multiple studies have looked to improve household awareness and behaviour in dealing with e-waste (Chi et al., 2014; Islam & Huda,

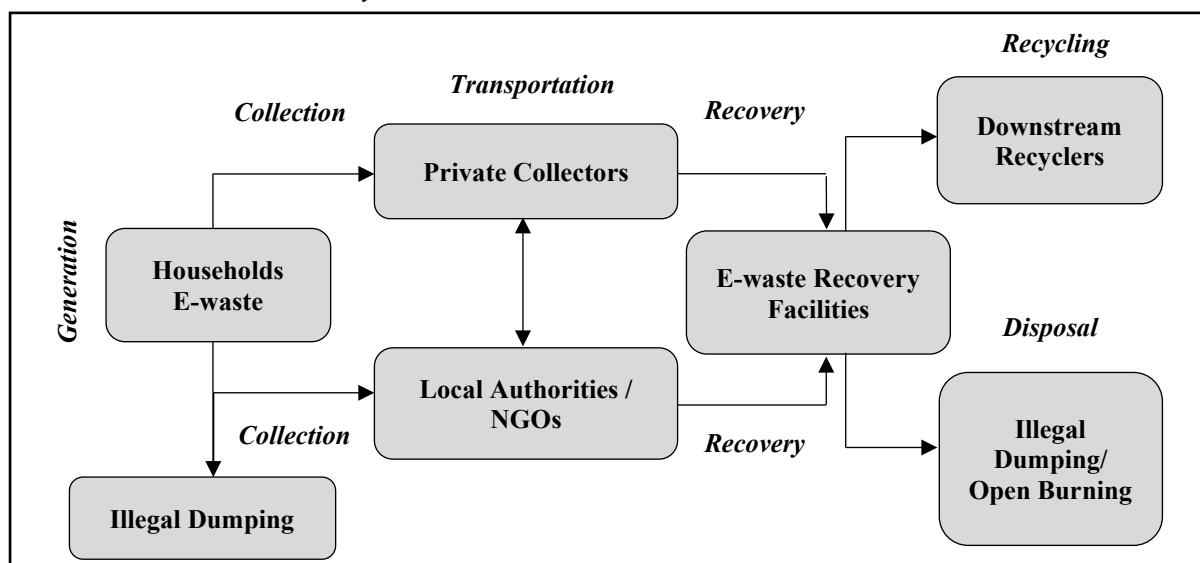
2020; Shad et al., 2021; Teck, 2013). The primary approach used in managing e-waste has been an attempt to change people’s behaviour and increase their awareness of the environmental problem e-waste presents. This information is being disseminated to households. Increased awareness and behaviours among consumers will play a significant role in reducing e-waste, helping manage e-waste dumping, and improving recycling strategies (Kalana, 2010; Mahat et al., 2019; Soo et al., 2013). However, there are still lacking measures that have been taken to ensure proper management of e-waste in Malaysia (Rautela et al., 2021), and the measure should be thorough in all aspects. Thus, the generation, separation, storage, recycling, collection, transportation, recovery, and disposal are crucial elements in E-WMS to see how good management and practices have been applied by the country not only in Malaysia but in all the countries around the world (Ismail & Hanafiah, 2019; Mmerekki et al., 2016).

Figure 1
Industrial E-WMS in Malaysia



Source: Osman (2016)

Figure 2
Household E-WMS in Malaysia

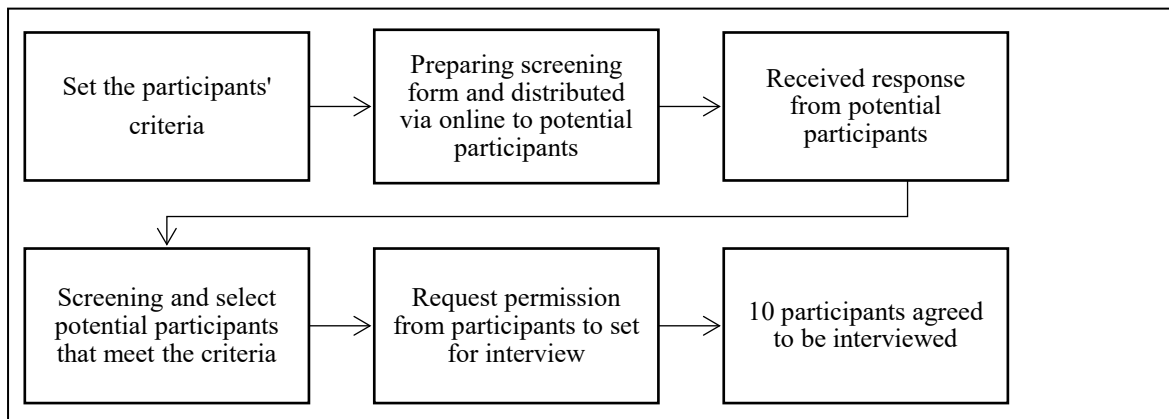


Source: Adapted from DOE (2020)

METHODOLOGY

The study of household E-WMS in Shah Alam city has used a qualitative approach to determine household awareness and behaviours toward household E-WMS. A semi-structured interview was conducted with ten (10) household representatives in Section U2 Shah Alam city in January 2022. Section U2 Shah Alam city was selected as the study area because of the facilities provided such as e-waste collection points, recycling centre, and e-waste program by its local authority which is more concentrated in this area. Ten participants involved are the result derived from a screening form conducted to select participants based on the criteria set. The criteria only include participants who lived more than five years in Shah Alam city (landed housing) and have experience in generating e-waste (IT and telecommunication). The participants were asked several questions about waste generation, separation, and recycling practices. The interview was recorded, transcribed, and analyzed using Atlas. ti software. Based on the data collection method, this paper presents household awareness and behaviours from the aspects of e-waste generation, separation, and recycling in Shah Alam city. Figure 1 below shows the process of selecting participants.

Figure 3
Process of Selecting Participants



Source: Authors (2022)

RESULTS

The developed and emerging countries face tremendous constraints and challenges in their household E-WMS (Islam & Huda, 2020). Therefore, by using semi-structured interviews face to face with households, several questions focusing on waste generation, separation, and recycling have been asked to determine their awareness and behaviour towards E-WMS in Shah Alam city. Their responses are depicted in Table 1, Table 2, and Table 3 below.

Table 1.
Participant’s Responses to Household’s Awareness and Behaviour (Waste Generation)

Question	Quotation References (Atlas.ti)	Answers
What types of e-waste were discarded, and how did you discard your e-waste?	1:1	<i>“I have to discard computers and laptops that have major broken.”</i>
	1:10	<i>“I discard it with other waste because I feel lazy to go to the recycling centre even though that place is not too far, but I just feel lazy. I don’t repair it because the repair price is high, so I discard it.”</i>
	1:18 (Participant 1,	<i>“As a normal local, if we just need to discard only one or two items</i>

Quotation 1, 10, 18)	<i>such as laptops, we just discard it in bins mixed with other waste.”</i>
2:1 (Participant 2, Quotation 1)	<i>“I have discarded mobile phones before this, discarded as usual in waste bins, put in plastic together with other solid waste, and the waste truck will collect every Monday or Wednesday.”</i>
3:6 (Participant 3, Quotation 6)	<i>“Before this, I discarded my phone that had major broken with other waste in the general waste bin.” “Usually, I keep at home for items that have minor broken before I send them to shop for repair or trade-in.”</i>
4:1 (Participant 4, Quotation 1)	<i>“I have all IT and telecommunication equipment. I have discarded one computer in the past two years. I send it to the recycling centre.”</i>
5:1	<i>“My monitor is sold to people who come to the house.” lack of understanding of the people.</i>
5:2 (Participant 5, Quotation 1, 2)	<i>“There is one I send to the disposal centre in a box, and some I just put in used storage.”</i>
6:1	<i>“For items such as CPUs, monitors, and keyboards, I try to sell them first at a shop that accepts ICT items that take a relatively reasonable price. The closest shop is in Cyberjaya. But sometimes, I give it away for free with the price offered. For example, my monitor can be RM 5 if it needs to be repaired. If the item is outdated, I’ll give it to them.”</i>
6:10	<i>“But I know we can send our e-waste to a neighbourhood recycling centre in U2. There is a collection run there. People that aware they will know, for people who aren't aware they don't know.”</i>
6:6 (Participant 6, Quotation 1, 10, 6)	<i>“It's just a matter of getting a little reward if we send it to the store. If we send it directly, we won't get anything. A reward is like one item can get RM 5 is quite okay.”</i>
7:2	<i>“I have discarded mobile phones. For a laptop, I have one that is broken, but I keep it in my house.”</i>
7:6	<i>“If broken, I try to repair first unless it cannot be fixed anymore or the cost for repair are too expensive and not worth it for repair, and then I’ll throw it away.”</i>
7:15 (Participant 7, Quotation 2, 6, 15)	<i>“Mobile phones that I discarded are mixed with other dry waste from my house such as old fabric, box, paper, etc.”</i>
8:1 (Participant 8, Quotation 1)	<i>“I have discarded mobile phones and laptops.” “If it’s a minor broken for handphone and laptops, I’ll send it to repair at shops. If major, I’ll throw it as it cannot be used anymore, and it’s no point to keep.”</i>
9:2 (Participant 9, Quotation 2)	<i>“Discard laptop in waste bins.”</i>
10:1	<i>“I have discarded my laptop and mobile phone because it has major broken. I put it in a garbage bag. It’s not worth money to repair because the repair price is high.”</i>
10:3 (Participant 10, Quotation 1, 3)	<i>“I decided to buy a new one than repair it because we don’t know if repair how long these items will work again.”</i>

Source: Authors (2022)

From the responses, most of the participants have generated mobile phones, as stated by P2 (2:1), P3 (3:6), P7 (7:2), P8 (8:1), and P10 (10:1). However, their way of discarding the items was not proper as most of them have discarded in waste bins together with other waste as done by P1 (1:10), P2 (2:11), P3 (3:6), P7 (7:15), P8 (8:2), and P10 (10:1). Therefore, their way of discarding the items showing their awareness and behaviour is weak in managing their waste.

Table 2*Participant's Responses to Household's Awareness and Behaviour (Waste Separation)*

Question	Quotation References (Atlas.ti)	Answers
Did you separate e-waste from other wastes before being collected or discarded?	1:5 (Participant 1, Quotation 5)	<i>"I don't waste separation as it has not been enforced yet. If no separation, you'll be charged for a compound."</i>
	2:5 (Participant 2, Quotation 5)	<i>"No. I discarded it as usual in waste bins with other solid waste."</i>
	3:3 (Participant 3, Quotation 3)	<i>"I'm not separating the E-waste; I usually mix all waste."</i>
	4:1 (Participant 4, Quotation 1)	<i>"Yes. Usually, I separated those items from other waste."</i>
	5:5 (Participant 5, Quotation 5)	<i>"I do separation for waste. I used to think that many did not cooperate because people didn't have time when they were on the ground. The management costing is relatively high."</i>
	6:8 (Participant 6, Quotation 8)	<i>"Usually, I separated kitchen appliances. But for, electronic items are rarely. Waste like bottles I put down beside the waste bins because it's heavy for the contractor to lift the bins if I put everything in the bins."</i>
	7:4 (Participant 7, Quotation 4)	<i>"No. I put it together in a garbage bag with other waste from my house, but not mixed with food waste, just dry waste. Then the contractor will come to pick up the waste as usual."</i>
	8:4 (Participant 8, Quotation 4)	<i>"No. I only do separation for bottles, plastic, and aluminium. Other waste I just mix."</i>
	9:6 (Participant 9, Quotation 6)	<i>"I'm not separating because I only have two trash cans in my house. So, I put everything in that."</i>
	10:5 (Participant 10, Quotation 5)	<i>"No. I discard those items in garbage bags mixed with other waste, but only dry waste like plastic, bottles, etc."</i>

Source: Authors (2022)

From the responses as shown in Table 2, P1 (1:5), P2 (2:5), P3 (3:3), P6 (6:8), P7 (7:4), P8 (8:4), and P9 (9:6) admit that they are not doing e-waste separation before discarding the items. These responses show that waste separation practices are lacking in the household. Even the local authority has already exposed to the residents about waste separation. The separation issue is also supported by previous studies, where during the collection, some of the residents are doing separation, and some are not (Mapa et al., 2019).

Table 3*Participant's Responses to Household's Awareness and Behaviour (Waste Recycling)*

Question	Quotation References (Atlas.ti)	Answers
Did you practice recycling the e-waste that you discarded?	1:9 (Participant 1, Quotation 9)	<i>"For e-waste, I don't practice recycling."</i>

2:5 (Participant 2, Quotation 5)	<i>"No, but I know the place for recycling, one at Section U2 (recycling collection point) and another at Section U13."</i>
3:5 (Participant 3, Quotation 5)	<i>"No, I don't practice recycling for E-waste."</i>
4:5 (Participant 4, Quotation 5)	<i>"Yes. Usually, we always repair those items once they break. If those items cannot be repaired, I send them to the recycling point Section U2."</i>
5:9 (Participant 5, Quotation 9)	<i>"I'm not sending E-waste to recycle centre."</i>
6:12 (Participant 6, Quotation 12)	<i>"No. Because I rarely discard e-waste and the quantity when I discard is not much only one or two items. Thus, I just discard it like other waste."</i>
7:12 (Participant 7, Quotation 12)	<i>"No, but I think the E-waste campaign has been provided."</i>
8:7 (Participant 8, Quotation 7)	<i>"No. Usually, I throw all waste together in the same garbage bag or the boxes I left in front of my house except for bottles, plastic, and aluminium. I separated them."</i>
9:8 (Participant 9, Quotation 8)	<i>"No, I never send E-waste to the recycling point. Because the quantity is very small, like one or two items, I just discarded them in the waste bin."</i>
10:8 (Participant 10, Quotation 8)	<i>"No. Because I rarely discard the e-waste and the quantity when I discard is not much, only one or two items."</i>

Source: Authors (2022)

From the participant's responses in Table 3, P1 (1:9), P2 (2:5), P3 (3:5), P5 (5:9), P6 (6:12), P7 (7:9), P8 (8:7), P9, (P9:8), and P10 (10:8) admit that they are not practice recycling for e-waste. Therefore, the recycling practice in Shah Alam city can be considered as still lacking, creating constraints and challenges for waste reduction. This issue is also supported by previous research, where indicates the major problem relating to e-waste in Malaysia is the poor attitude of Malaysians toward e-waste recycling (Kalana, 2010; Mahat et al., 2019; Tiep et al., 2015).

DISCUSSION

The awareness and behaviour of households are the major challenges for E-WMS. Without awareness and good behaviour by the households, waste management will be hard to achieve success. These challenges resulted from participants' responses on how they discarded the e-waste and their separation and recycling practices. In the city of Shah Alam, the amount of e-waste generated is increasing yearly. Households living in Sections U2 (landed urban neighbourhood) have generated e-waste from IT and telecommunication equipment. Their way of discarding the e-waste can be considered poor as some of them are still discarding the broken items in the waste bin together with other waste due to insufficient e-waste storage. At this moment, e-waste storage in Shah Alam city is provided in recovery facilities and a recycling collection point for temporary storage. The local authority does not provide E-waste storage in residential areas.

In addition, separation practice among households is still low as they love to mix waste together in general waste bins provided without separation. Although the recycling centre in Section U2 provides facilities for residents to discard e-waste, not all the residents are aware of the existence of these facilities provided for e-waste where resulting low recycling rate of e-

waste received. In order to tackle these challenges, environmentally friendly practices must be implemented at all levels to ensure that the risk of e-waste can be controlled to a minimum. Waste separation must be undertaken as a compulsory practice in the household to ease the waste collection process. Every household must separate their waste from home according to categories of waste to avoid mismanagement of waste. However, imposing a compound for those who do not practice separation is necessary to ensure they do not discard the items incorrectly. In the meantime, the local authority should reward the public that practices recycling because some people like doing something that can get the reward such as giving vouchers to them. Refer to Table 4 for a summary of the results.

Table 4
Summary of Results

Household's Awareness and Behaviour Challenge
<ul style="list-style-type: none"> Households still discard e-waste in regular waste bins, and some are stored at home. [P1 (1:10), P2 (2:11), P3 (3:6), P7 (7:15), P8 (8:2), P10 (10:1)]
<ul style="list-style-type: none"> During the collection, some of the residents are doing separation, and some are not. [P1 (1:5), P2 (2:5), P3 (3:3), P6 (6:8), P7 (7:4), P8 (8:4), P9 (9:6)]
<ul style="list-style-type: none"> Households lack recycling practice as they think the quantity of their items to be discarded is less, and they prefer throwing them in regular waste bins than going to a recycling centre to send one or two items. [P1 (1:9), P2 (2:5), P3 (3:5), P5 (5:9), P6 (6:12), P7 (7:9), P8 (8:7), P9, (9:8), P10 (10:8)]

Source: Authors (2022)

CONCLUSION

Preventing people from using electrical equipment is impossible because it is necessary for our daily lives. Still, it can be prevented by how the users discard those items after not using them. To tackle the household's awareness and behaviour in Shah Alam city on the E-WMS, environmentally friendly practices must be implemented at all levels to ensure that the risk of e-waste can be controlled to a minimum. Among the practices that can be done such as households can return any worn electronic items to the seller, replace old electronic items when buying new ones and send them to recycling centres. The use of computers, for example, needs to be serviced regularly to extend the life of electronic goods or buy old but still usable electronic items. Besides, the local authority must increase the number of e-waste recycling bins for mobile phones and increase the awareness programs among the community on the issue of e-waste dumping and its impact on the environment. Indeed, these strategies need to be implemented by the local authority with the cooperation of all stakeholders involved in E-WMS in order to achieve sustainable waste management and to prevent our country from continuing to dump e-waste that can affect the environment and human health. However, as good consumers, the changes should begin with us and adopt a sustainable and responsible lifestyle. The more concerned about the care of the environment, the more our lives will be secure and productive.

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Surat kami : 700-KPK (PRP.UP.1/20/1)

Tarikh : 20 Januari 2023

Prof. Madya Dr. Nur Hisham Ibrahim
Rektor
Universiti Teknologi MARA
Cawangan Perak



Tuan,

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Kelulusan daripada pihak tuan dalam perkara ini amat dihargai.

Sekian, terima kasih.

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Saya yang menjalankan amanah,

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PROF. MADYA DR. NUR HISHAM IBRAHIM
REKTOR
UNIVERSITI TEKNOLOGI MARA
CAWANGAN PERAK
KAMPUS SERI ISKANDAR