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E-Waste Recycling Behaviour with Reference to Consumers in Kuantan City

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Abstract

Managing e-waste among consumers poses significant challenges for the authorities, as proper e-waste management is more prevalent in industrial sectors than in households. Consumers are left to manage their household e-waste in a disorganised manner either by throwing it in the trash or dumping it illegally. This study seeks to fill this gap by identifying the factors that influence consumer e-waste recycling behaviour. A quantitative approach was adopted for this study and a survey data was collected from 200 households through systematic sampling method. The results for Pearson correlation coefficient showed that awareness (r = 0.553, *p* = .000), availability of facilities (r = 0.260, *p* = .000) and perceived behavioural control (r = 0.341, *p* = .000) were significantly and positively associated with consumer e-waste recycling behaviour. The results for multiple linear regression showed that adjusted R^2 is 0.336 which indicated that the determinants were able to predict 33.6% of the consumer e-waste recycling behaviour. Awareness and perceived behavioural control were significant determinants for consumer e-waste recycling behaviour among households while the most influential factor is awareness. The findings of this study would able to help the relevant authorities to increase the awareness of consumers to participate in e-waste recycling through campaigns and educational activities.

Keywords: E-Waste Recycling Behaviour, Consumers, Awareness, Availability of Facilities, Perceived Behaviour Control

Introduction

The final disposal of Waste Electrical and Electronic Equipment (WEEE) or e-waste has emerged as an issue of global concern (Andeobu et al., 2020a; Ismail and Hanafiah, 2020). E-waste is classified as hazardous waste as it contains elements that represent a threat to the environment and human health, such as heavy metals and brominated flame retardants, if inappropriate disposal methods are utilised during the disposal process (Tsai, 2020). Households, businesses, private organisations and the government agencies are the primary generators of e-waste (Wong et al., 2019). According to the Global e-Waste Monitor report (2020), an average amount of 53.6 million metric tonnes of global e-waste was generated in the year of 2019, an average of 7.3kg per capita and only 17.4% was officially documented as properly collected and recycled. It is also estimated that Malaysians generated 364 kilotons

of e-waste in 2019 or average 11.1 kg per capita, due to the large increase in the production of electrical and electronic equipment (Global e-Waste Monitor, 2020). These statistics show that e-waste is the fastest-growing domestic waste stream in the world, driven mostly by high rates of electric and electronic equipment consumption, short life cycles, and limited repair choices (United Nations Institute for Training and Research, 2020). Nonetheless, it is worrying that recycling initiatives are not keeping pace with the volume of e-waste generated each day (Sobri, 2021).

Sustainability is an essential criterion for all forms of development efforts, since it takes into account all perspectives that contribute to the well-being of life. E-waste that is not disposed of sustainably can pollute the soil, water and air (Andeobu et al., 2020a). A deeper knowledge and more information on e-waste will help to meet various goals of the 2030 Agenda for Sustainable Development such as Goal 3 (good health and well-being), Goal 6 (clean water and sanitation), Goal 11 (sustainable cities and communities), Goal 12 (responsible consumption and production), Goal 14 (life below water) and Goal 8 (decent work and economic growth) (Global e-Waste Monitor, 2017). Bhaskar and Kumar (2018) emphasised that by creating the necessary, needed, and required e-waste policies, implementing proper e-waste management strategies will help to achieve sustainable development goals and lessen the global climate crisis.

Malaysian e-waste management is still in its early stages, having only begun in 2005 (Ismail and Hanafiah, 2019). According to Shad et al (2020), only 25% of generated e-waste in Malaysia is recycled, with the remainder being disposed inappropriately. Furthermore, compared to the industrial sector, there is no legal framework mandating that consumers send electrical and electronic items to authorised e-waste recovery facilities (Netherlands Enterprise Agency, 2022; JICA, 2014). Licensed contractors prefer to collect e-waste from large corporations and industries, as it is not profitable to collect small quantities from consumers (Netherlands Enterprise Agency, 2022; Ho et. al., 2015). Since only industrial e-waste has a regulatory framework for its disposal system, consumers are left to manage household e-waste in a disorganised manner by throwing the e-waste in the garbage or disposing of it illegally (Ismail and Hanafiah, 2020; Yong et al., 2019). Because of this, there may be a gap between what consumers know about e-waste and how they dispose of it. There is also a gap between what consumers think they can do to recycle e-waste and what infrastructure is available.

In recent years, e-waste research has grown increasingly significant. E-waste management research has focused on a number of issues, including management systems and practices in developed and developing nations (Andeobu et al., 2020b; Schumacer and Agbemabiese, 2019; Ismail and Hanafiah, 2019; Masud et al., 2019; Bahers and Kim, 2018; Abarca-Guerrero et al., 2018; Salhofer et al., 2016; Lu et al., 2015). These studies provide viewpoints from different nations on management difficulties and management practices in order to offer improved solutions for various aspects of e-waste management (Ismail and Hanafiah, 2020). Another important research area is the policies and regulations governing e-waste management (Arya et al., 2020; Borthakur, 2020; Tsai, 2020; Zainu, 2020; Schumacer and Agbemabiese, 2019; Pathak and Srivastava, 2017). The legal framework of EPR in e-waste

management is one of the important subtopics under this research area (Tsai, 2020; Lodhia et al., 2017; Kojima et al., 2009).
The analysis of numerous consumer characteristics in relation to e-waste management is also an important research topic in e-waste management (Ismail and Hanafiah, 2020). This is due to the fact that consumers play a crucial role in the development of efficient collecting systems (Abdulhasan et al., 2019). Consequently, a number of research have been carried out to investigate various characteristics of consumers, such as awareness of e-waste treatment, preferences for e-waste collection, intention to participate in proper e-waste recycling, e-waste recycling behavior, and willingness to pay for the disposal of e-waste (Cao et al., 2016; Sidra et al., 2019; Afroz et al., 2020; Akhtar et al., 2014; Qu et al., 2019; Wang et al., 2016; Afroz et al., 2020; Wang et al., 2011; Afroz et al., 2013).

Research on consumer e-waste management behaviour is crucial for household to implement a proper handling and disposal method in order to reduce the volume of e-waste. Since no legal framework was provided in conducting e-waste recycling, households might not have clear idea on proper e-waste disposal. It is important for the final users to know the consequences and risks of improper handling of e-waste especially households who contribute a large proportion in using electrical and electronic equipment (Anusree and Balasubramanian, 2019). Effective and efficient effort should be required to induce households in conducting proper e-waste recycling behaviour in order to manage and control the tremendous increase of e-waste. Therefore, to determine consumer e-waste recycling behaviour, this study updated information on consumer awareness, perceived behaviour control and availability of e-waste facilities, which have been limited in previous research, especially in the context of Malaysian consumers. Thus, this study is conducted to identify the determinants for consumer e-waste recycling behaviour in Kuantan, Pahang. The following hypotheses were therefore proposed

H_1: There is a significant relationship between awareness, availability of facilities, perceived behavioural control and consumer e-waste recycling behaviour.
H_2: There is a significant influence of awareness, availability of facilities, and perceived behavioural control with consumer e-waste recycling behaviour.

Literature Review

According to Social Cognitive Theory (SCT) social behaviours and cognitive processes are formed as a result of people learning through imitation and observation (Bandura, 1986). Theoretically, human behaviour can be predicted and changed by using a framework for understanding human ideas, action, and behaviour (Magoro and Phahlane, 2019). In this theory, triadic reciprocal model was applied with three components that mutually influence each other. The three components include personal or cognitive factors (knowledge, expectations and self-efficacy), behavioural factors (skills, practice and effort) and environmental factors (social norms, access in community, influence on others) which can determine human learning and behaviour (Sawitri et al., 2015).

Previous studies have used Theory of Reasoned Action and Theory of Planned Behaviour to explain environmentally friendly behaviour (Afroz et al., 2020; Nguyen et al., 2018; Wang et

al., 2016). Although the use of SCT to explain pro-environmental behaviour is quite limited, several studies have demonstrated the theory's value in predicting pro-environmental behaviours (Sawitri et al., 2014; Lim et al., 2019; Tabernero et al., 2015). According to Tabernero et al (2015), the theory is able to predict sustainable behaviour such as recycling behaviour, green purchasing behaviour and sustainable consumption. SCT focuses on behavioural change where an individual is required to alter his or her own behaviour in order to address environmental problems (Lim et al., 2019). Therefore, this study uses awareness and perceived behavioural control as cognitive factors while availability of facilities as an environmental factor to explain the determinants for consumer e-waste recycling behaviour.

Consumer E-waste Recycling Behaviour

Recycling is an effective e-waste disposal method which can help to address environmental issue that caused by rapid e-waste generation (Wang et al., 2016; Echegaray and Hansstein; 2016). According to Balde et al (2017), consumers can recycle or return electrical or electronic devices to respective manufacturers or organizations for further recovery, treatment, or recycling, ensuring that e-waste is disposed properly. Recycling is considered as a better way and has emerged as a new trend in resolving e-waste products post-purchase issues, as consumer learn about waste problems and care about them (Akhtar et al., 2014). Hence, consumers should practise correct disposal behaviour so that they can recycle their e-waste in a proper manner and through the necessary channels, as improper disposal may endanger human and environment health (Andarani and Goto, 2014).

Although the Department of Environment has appointed licensed contractors and authorities that are responsible in collecting the e-waste from all sources, currently the contractors mainly obtained e-waste from industrial sites (Shumon et al., 2014). Since there is lack of legislative framework in managing household e-waste, it cause most of the unwanted household electrical and electronic appliances to end up sold to the scrap dealer (Rasnan et al., 2016). It was also found that household preferred to keep the e-waste and sell it to scrap dealers rather than paid for it to be collected and recycled (JICA, 2014). There is also lack of mechanism to track the e-waste that had been collected as informal collectors are not under the regulation of DOE which might lead to improper or illegal disposal such as landfilling or incineration (Shumon et al., 2014). Landfills and incineration can be said as a toxic time bomb that pose severe threat to both human, ecology and environment health. This situation has led to lack of e-waste supplies due to insufficient skills in e-waste management among households which consider as one of the issue in recycling e-waste (Pariatamby and Victor, 2013). Thus, it is necessary to create better approaches and systems in order to collect household e-waste effectively.

Awareness

Individual awareness is an important factor that determine one's understanding about e-waste disposal (Mahat et al., 2019). Lack of awareness is one of the issue that hinder the achievement of sustainability in waste management as the public has less concern on this problem (Tey et al., 2013). A large numbers of the households were unaware of the impacts of generated and improper management of e-wastes towards the environment, ecology as well as the health of current and future generations (Akhtar et al., 2014; Bhat and Patil, 2014).

On the other hand, Saphores et al (2012) had mentioned that awareness about hazardous waste is one of the factors that encourage household's willingness in conducting e-waste recycling.

Apart from the awareness of hazards of e-waste, awareness on the proper disposal method of e-waste is also crucial to ensure the consumers embrace the e-waste recycling behaviour. Several studies reveal that consumer awareness towards e-waste recycling is high but the awareness level on the correct way in managing e-waste is low (Mahat et al., 2019). Supian et al. (2015) found that consumers are unaware of the proper method to dispose e-waste although the government has mandated the segregation of solid waste. Borthakur and Govind (2017) highlighted that lack of awareness is a significant reason for negligent e-waste recycling behaviour. According to a survey, despite the government setting up recycle bins to collect mobile phones and their accessories in numerous locations, participation is still limited due to low awareness among residence (Chibunna et al., 2010). Hence, e-waste management is still a challenging issue as consumers have low awareness and insufficient knowledge or information in adopting the correct disposal behaviour (Wong et al., 2019; Bhat and Patil, 2014). Ismail and Hanafiah (2019) claimed that it is crucial to promote public awareness, which could enhance knowledge of the problems that improper e-waste management poses. Furthermore, since households are aware of the negative impacts of improper e-waste management, it could aid in increasing the rate of e-waste recycling.

Availability of Facilities

Wong et al (2019) revealed that having access to adequate disposal facilities is the most significant influence on conducting e-waste recycling. When consumers are faced with a shortage of facilities for recycling of waste, their level of recycling effort will diminish (Chen and Tung, 2010). Inadequate e-waste disposal facilities will have an impact on solid waste management since households may combine e-waste with general waste that uses different disposal methods (Mahat et.al., 2019; Elbeshbishy and Okoye, 2019). This is because majority of household e-waste has been disposed through different channels before being sent to the recovery facilities, as opposed to the industrial e-waste, which is collected by formal sectors (Osman et al., 2016). According to Kalana (2010), households tend to store or throw e-waste together with other general wastes due to lack of knowledge on the proper disposal of e-waste at the end of its lifespan.

The research conducted by Delcea et al (2020) in Romania suggested that the majority of respondents agree that any e-waste disposal program designed by relevant authorities or organisations will be an effective way for the e-waste recycling. Zhang et al (2015) claimed that e-waste recycling infrastructure or systems are one of the factors that will influence e-waste recycling behaviour. Moreover, Wong et al (2019) found that most of the respondents are willing to participate in e-waste recycling if the authority provides the necessary facilities. Furthermore, recycling and disposal facilities that are accessible within a reasonable distance will positively influence consumers' participation in recycling e-waste (Delcea et al., 2020; Senawi and Low, 2016; Sarath et al., 2015). Thus, easier access to recycling infrastructure will encourage consumers to recycle e-waste.

Perceived Behavioural Control

Several studies suggested that when predicting recycling behaviour, perceived behavioural control should account for elements that promote or impede the implementation of e-waste (Ofori and Mensah, 2022; Chen and Tung, 2010). According to Strydom (2018), perceived behavioural control has a stronger impact on consumer recycling behaviour when other factors are present. It has been shown that perceived behaviour control influences recycling behaviour more than recycling intention when consumers have access to resources and services (Strydom, 2018; Mahmud and Osman, 2010). In addition, another research in Vietnam uses inconvenience of recycling and cost of recycling as a factor in perceived behavioural control to measure household e-waste recycling (Nguyen et al., 2018). These findings suggest that if recycling facilities are available and convenient, they can promote consumer positive perception that they are able to conduct e-waste recycling.

Moreover, a study investigated the relationship between collection method, information, and self-efficacy with perceived behavioural control found that these three factors can influence consumer perceived behavioural in returning end-of-life electronic products (Kianpour et al, 2017). The result shows that the three factors positively influenced consumer involvement in returning unwanted electronic products to manufacturer or retailers. Therefore, with the availability of resources and opportunities, consumers will have confidence in their ability to recycle e-waste, which will improve their willingness to recycle e-waste.

Methodology

Population, Sample and Sampling Design

The total population in Kuantan was estimated to be 502,866. The targeted respondents will be focused on individuals within a household as a unit of analysis. The sample of this *exploratory study* consisted of 200 respondents who used electronic and electrical products living in the housing areas of Air Putih, Alor Akar, Beserah, Semambu and Indera Mahkota in Kuantan, Pahang. *Five residential areas, one from each of the five housing areas, were chosen at random*. These housing areas were randomly selected from the list of housing areas in Kuantan, as referred to by the Kuantan City Council. Kuantan was chosen as the study location after satellite readings conducted by the Malaysian Remote Sensing Agency revealed that among 11 districts in Pahang, Kuantan has the highest number of potential risk areas that could be contaminated with toxic waste, 69 out of total 225 areas (Hamzah, 2019).

Systematic sampling was utilised in this study. It is a probability sampling technique where respondents were selected from a target population using a random starting point and after a fixed interval (Mostafa and Ahmad, 2017). The selection of sample began with a random start and every 4^{th} element in succession from sampling frame will answer the questionnaire. This means that the sampling unit will be 4, 8, 12, 16 of the houses and so on until a total of 200 respondents were selected to answer the questionnaire. According to Hair et al (2010), the minimum sample size requirement is 200 while according to Guilford (1954), an absolute minimum of 200 samples are required for Pearson correlation analysis. Comrey and Lee (1992) provided a guidance for determining the adequacy of sample size, recommending 200 respondents as a fair number. Therefore, 200 respondents would be adequate for this exploratory study sample size.

Research Instrument

The questionnaire was organised into five categories based on literature. Section A inquired about the respondent's background, whereas Section B comprised of questions regarding consumer e-waste recycling behaviour and contained six items adapted from (Kochan et al., 2016). Next, section C consisted of six items of awareness of e-waste recycling as adapted from (Delcea et.al., 2020; Echegaray and Hansstein, 2016). Section D, on the other hand, included six items describing the availability of facilities as adopted from (Wong et al., 2019). Section E contained six items on perceived behavioural control taken from Echegaray and Hansstein (2016); Nguyen et al (2018), respectively. All items were measured on a scale ranging from 1 = "strongly disagree" to 5 = "strongly agree".

The full questionnaire was pre-tested among 20 randomly selected consumers, thereby resulting in a Cronbach's alpha value more than 0.700 and satisfied the recommended value by (Hair et al., 2007). The test's reliability was proved by the following values: consumer e-waste recycling behaviour (0.719), awareness of e-waste recycling (0.909), availability of facilities (0.889), and perceived behavioural control (0.818).

Data Analysis

The Statistical Package for Social Sciences (SPSS) version 22.0, was used to analyse the data, which included descriptive analyses, Pearson's correlation, and multiple linear regressions. A descriptive analysis was performed to summarise the respondent's background for easier understanding, whereas Pearson's correlation was utilised to determine the relationship between the independent variables and consumer e-waste recycling behaviour. Meanwhile, the most influential factor of consumer e-waste recycling behaviour was determined using multiple linear regression analysis.

Analysis of Findings and Discussion

Demographic Profile of Respondents

Table 1

Background of Respondents (n=200)

Variables	Frequency (n)	Percentage (%)
Gender		
Male	87	43.5
Female	113	56.5
Qualification		
Primary	6	3.0
Secondary	71	35.5
STPM/Diploma	64	32.0
Bachelor Degree	57	28.5
Master/PhD	2	1.0
Ethnicity		
Malay	83	41.5
Chinese	76	38.0

Indian		41	20.5
Other		0	0
Occupation			
Employee (public/private)		96	48.0
Self-employed	22		11.0
Retired	19		9.5
Others	63		31.5

Table 1 summarises the demographic data of all 200 respondents who participated in this study, There were 56.5% female respondents and the remaining 43.5% were male. In terms of education attainment, the majority of respondents (35.5%) have completed secondary education, followed by STPM/Diploma (32%), Bachelor Degree (28.5%), primary school level (3%) and Master/PhD (1%) accordingly. Meanwhile, 41.5% of the respondents are Malay, 38% are Chinese and 14% are Indian. When asked what they do for a living, nearly half of the respondents (48%) indicated that they work for either the public or private sector. The remaining 31.5% were either students, housewives, or fresh graduates seeking for work (31.5%). The rest of the respondents were either self-employed (11%), or retired (9.5%).

Descriptive Analysis of the Determinants of E-Waste Recycling Behaviour

The descriptive analysis results revealed that 77.5% of respondents have a high level of awareness about e-waste recycling, whereby 90% agree that it is wrong to dispose of electronic waste and regular waste together. Moreover, the highest percentage of 95% of respondents agree that e-waste contains potentially toxic substances. However only 66% of respondents were aware of the benefits of e-waste recycling. The results support the findings of Mahat et al (2019), who stated that awareness is the main factor influencing recycling behaviour. Furthermore, Borthakur and Govind (2017) asserted that lack of awareness is a significant factor in irresponsible e-waste recycling behaviour. In terms of availability of facilities, 75% of respondents believe that adequate facilities will enhance e-waste recycling behaviour. More than three-quarters of respondents agree they will drop-off e-waste if the government provides adequate infrastructure that are situated near to the community, with 78.5% are willing to sort the e-waste into separate containers. Previous research has shown that easily accessible and well-maintained recycle facilities condition will encourage more people to recycle (Chen and Tung, 2010). Wong et al (2019) highlighted that the convenience of e-waste recycling facilities will encourage more people to engage in recycling activities.

With regard to perceived behaviour control, more than half of respondents agree that e-waste recycling is their own responsibility, not someone's else. Nevertheless, 69.5% of respondents feel difficult to sort out e-waste, while 56% agree that they don't have time to send e-waste to the collection centre. In accordance with Nguyen et al (2018), perceived behavioural control has demonstrated that it significantly affects consumer e-waste recycling behaviour, as reported by (Strydom (2018) and Mahmud and Osman (2010). The results for consumer e-waste recycling behaviour showed that 70% of respondents have moderate level of e-waste recycling behaviour. More than half of respondents either agree or strongly agree that they will conduct e-waste recycling by donating (65%), reselling (69%), and drop-off e-waste at a nearby recycling station (71%). However, only 39.1% of respondents agree that

they will recycle e-waste regularly and only 38% agree to return e-waste to the retailer or manufacturer.

Pearson's Correlation Analysis

Table 2

Result of Correlation Analysis

Variable	Pearson Correlation (r-value)	Significance (p-value)
Awareness	.553**	.000
Availability of Facilities	.260**	.000
Perceived Behavioural Control	.341**	.000

Note: ** Correlation is significant at the 0.01 level (2-tailed)

Table 2 shows a significant correlation present between awareness and consumer e-waste recycling behaviour, as measured by the Pearson's correlation coefficient value (r = 0.553), indicating a strong and positive relationship. The result has indicated that a respondent's behaviour to recycle e-waste is positively correlated with the degree to which they are aware of the significance of recycling e-waste. The result was consistent with previous studies, including Safa'at et al (2019); Akhtar et al (2014); Roy (2016) who found that awareness is positively and significantly associated with consumer e-waste recycling behaviour. The findings strengthened the study of Echegaray and Hansstein (2016), who claimed that as consumer awareness of e-waste recycling increases, so will their participation rate in recycling. Thus, awareness is a significant predictor of e-waste behaviour.

However, a weak but positive relationship was perceived between availability of facilities and consumer e-waste recycling behaviour (r=0.260). The findings implies a minimal relationship between the variables. Hence, it is possible that the respondents give recycling facilities for e-waste a low priority. However, the results aligns with reports found in previous studies that availability of e-waste recycling services and facilities has a direct influence on consumer recycling behaviour (Wong et al., 2019). Nevertheless, past studies highlighted that lack of facilities as the main barriers of respondents' participation in e-waste recycling (Mahat et.al., 2019; Elbeshbishy and Okoye, 2019; Martin et al., 2006).

Meanwhile, perceived behaviour control was found to have a moderate and positive relationship with consumer e-waste recycling behaviour (r=0.341). The findings were in line with earlier studies by Mahmud and Osman (2010); Tam et al (2018); Strydom (2018); Afroz et al (2020) which found similar positive relationship between perceived control behaviour and recycling behaviour. It follows that a person with high perceived behavioural control will likely exhibit a positive e-waste recycling behaviour. In other words, when consumers have easy access to resources that facilitate e-waste recycling, they are more likely to recycle their e-waste. In conclusion, the findings revealed significant relationships between awareness, availability of facilities and perceived behaviour control with consumer e-waste recycling. Hence, hypothesis H_1 was accepted.

Multiple Linear Regression

Table 3

Result of Multiple Regression

Variable	Unstandardized Coefficients Beta (B)	Standardized Coefficients Beta (β)		Sig. (p value)
(Constant)	3.068		1.497	.136
Awareness	.502	.468	7.443**	.000
Availability of Facilities	.128	.110	1.830	.069
Perceived Behavioural Control	.176	.172	2.811**	.005

R^2 = 0.346, Adjusted R^2 = 0.336; F= 34.590, $^{**}p \leq 0.05$

Table 3 shows the results of regression analysis obtained in determining consumer e-waste recycling behaviour. The output indicated the regression model to be statistically significant due to the significance of F statistics generated (F=34.590; p≤ 0.05). Meanwhile, the adjusted R^2 would ascertain the percentage of variance explained by the independent variables that actually affected the dependent variable. Here, the adjusted R^2 value of 0.336 was obtained, thus indicating that all three independent variables explained 33.6 per cent of the variance when assessing the consumer e-waste recycling behaviour.

The standardised beta coefficient, in general, can compare the relative strength of the coefficients (Dhakal, 2019). Among the two predictors noted as statistically significant to consumer e-waste recycling behaviour, awareness was underlined as the most predictive factor (β = 0.468, *p* = .000) of consumer e-waste recycling behaviour. This was followed by perceived behaviour control (β = 0.172, *p* = .005). However, the availability of facilities (β = 0.110, *p* = .069) show non-significant as the p-value is above significance level of 0.05. The outcome could supported that the availability of facilities will have less of an impact on households' e-waste recycling behaviour. Since awareness and perceived behavioural control showed significant relationship while availability of facilities in not significant to consumer e-waste recycling behaviour, hence, H_2 was partially accepted.

The findings were consistent with those of Wong et al (2019); Shevchenko et al (2019); Roy (2016) who had previously noted that awareness is a significant predictor that directly influences e-waste recycling behaviour. Besides, a number of studies have shown that perceived behavioural control is a significant factor to determine e-waste recycling behaviour (Wang et al., 2016; Nguyen et al., 2018). One interesting discovery was made, which was that the availability of facilities is not a predictor of recycling behaviour. Additionally, the findings also contradict to those of earlier studies.

Conclusion and Recommendations

This study has examined three factors that influence consumer e-waste recycling behaviour. As an exploratory study and due to the constraints of the Covid-19 pandemic in conducting physical data collection, this study only involved a sample size of 200 respondents. The

findings consequently demonstrated the existence of correlations between awareness and perceived behaviour control with consumer e-waste recycling behaviour. In addition, the the analysis revealed that two predictors were statistically significant for consumer e-waste recycling behaviour, with consumer awareness being the most influential factor. Therefore, sharing these findings with the intended audience will guide them to engage e-waste recycling behaviour.

Accordingly, the implications provided by this study are critical in assisting the relevant government agencies, particularly the Department of Environment, in their efforts to raise consumer awareness. The Department of Environment, along with electronic appliances retailers and businesses, among others, can undertake public education and awareness campaigns to impart knowledge and information about proper e-waste disposal. Social media platforms are another way to spread information about e-waste as they can easily attract attentive and effective at reaching a large number of people. It will motivate more consumers to participate in e-waste recycling. Thus, it is critical to raise consumer awareness and understanding of e-waste recycling, as improper method of disposal will have harmful implications for both the environmental and humans. With the implementation of successful awareness raising campaigns, consumers are able to get a complete understanding of the issues surrounding the disposal of e-waste and can contribute to the promotion of the collection of household e-waste by retailers. This is because if the consumers are aware of the issue, they will be more concerned about their behaviour when recycling e-waste. Hence, For example, Taiwan Waste Management Act adopted the EPR to encourage e-waste recycling by providing subsidies and lower fee rates for environmentally friendly electrical and electronic equipment; this action significantly increased the e-waste recycling collection, with the collection rate reaching over 60% 2018 (Tsai, 2020).

Besides, the findings have practical implications for policymakers. E-waste is a critical issue for a the ecology, economy and health of a nation. With the findings of this study, policy makers can use it as a reference to evaluate the e-waste recycling behaviour of Malaysian consumers and enact applicable policies and rules to address the issue, particularly on the principle of extended producer responsibility (EPR) which is becoming increasingly urgent. The Twelfth Malaysia Plan (2021-2025) under the advancing sustainability theme has specifically proposed diverse policy measures including development of a new regulation in order to implement Extended Producer Responsibility (EPR) for e-waste. EPR is a policy approach where producers are held responsible for the treatment and disposal of post-consumer products. Several countries, such as Taiwan have implemented the EPR principles among consumers to promote e-waste recycling through the subsidisation and the reduced fee rates for the environmentally friendly electrical and electronic equipment (Tsai, 2020). Under the authority of the Taiwan Waste Management Act, the collection rate of e-waste for 2018 has significantly increased to over 60%, and the public has become more concerned about environmental pollution and human health implications as a result of e-waste recycling (Tsai, 2020). Hence, it is suggested that future research investigate on the perception and readiness of the consumers about the EPR rule for the households, especially on the take-back system by producers or brand owners as well as the adoption of the user-pay and polluter-pay principles.

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