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HOUSEHOLDS' INTENTION TO FORMALLY DISPOSE OF E-WASTE USING THE THEORY OF PLANNED BEHAVIOUR

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ABSTRACT

Electronic waste or e-waste is a global issue that continues to escalate. The e-waste contains hazardous materials, which could lead to health issues and pollution if improperly disposed. The most common e-waste sources are household appliances namely refrigerators, air conditioners, washing machines, radios, televisions, and telecommunications devices containing electric or electronic parts. Each e-waste item also encompasses valuable materials that will profit the business, which in turn can benefit the growth of the economy besides the preservation of resources. This study refers to the Theory of Planned Behaviour as a heuristic guideline to investigate the intention to formally dispose of e-waste among residents at Taman Bahau, Negeri Sembilan. As this study applied a quantitative approach, a questionnaire was utilized as the primary data collection tool, and three hundred seventy-five (375) respondents were selected using a convenience sampling technique to partake in the survey. The demographic characteristics and profiling of the respondents were analyzed using descriptive analysis. In contrast, regression analysis was employed to examine the contribution of variables towards the intention to dispose of e-waste formally. The finding shows the attitudes, subjective norms, and perceived behavioral controls constructed towards the intention to dispose of e-waste formally. The result also implies that perceived

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behavioural control explains the most variance in the respondents' intention to dispose of their e-waste items formally, compared to other variables. This research holds significance as it can enhance community awareness and encourage relevant stakeholders to find solutions to protect the environment from the detrimental consequences of improperly discarded electronic waste

1.0 INTRODUCTION

The electronics industry is one of the fastest growing as well as the largest manufacturing industry in the world today (Ikhlayel, 2018; Clarke et al., 2019), which leads to the generation of electric and electronics equipment waste (e-waste). E-waste is electronic and electrical equipment that is no longer in use or nearing its end of life (EOL) (Kumar et al., 2017). E-waste accumulates nearly three times faster than other waste (Cucchiella et al., 2015). Wang et al. (2018) mentioned that in China, between 20 and 50 million tonnes of e-waste are generated yearly. Moreover, nearly 70 percent of reported toxic and hazardous chemicals, including heavy metals such as lead, mercury, cadmium, and beryllium, as well as polluting PVC plastic, such as brominated flame retardants that can harm human health and the environment, come from e-waste (Islam et al., 2020). Department of Environment Malaysia (DOE) stated that there is a significant increase in e-waste in Malaysia, and it is forecasted to generate up to 24.5 million tonnes of e-waste in 2025. Nonetheless, many e-waste remains unrecorded (Andeobu et al., 2023). It has become a concern to the government and related NGOs to prepare for better e-waste management by involving all relevant stakeholders, such as recovery facilities, manufacturers, importers, retailers, collectors, and consumers of electric and electronic appliances to play their roles.

Moreover, human attitudes and behavior in society also lead to the depletion of natural resources (Oke & Kruijsen, 2016). In the context of e-waste, it is common knowledge that the way electric and electronic appliances and devices are produced, consumed, and disposed of has a major impact on the amount of waste generated in society (Vijayan et al., 2023). E-waste generators refer to all individuals or entities using household appliances and discarding unusable or broken electrical appliances into the system (DOE, 2023). These include a person, households, commercial, and institution. The generators must discard their household e-waste into the formal collection channels. However, the most common practices among households in disposing of e-waste were storing their e-waste at home for a long time, reselling it to unregistered e-waste collectors, and even discarding it with other solid wastes in a landfill. All of these unsound practices are categorized as informal ways of disposing of e-waste (Andeobu et al., 2023; Hoang et al., 2023).

The inappropriate handling of e-waste is unsafe for human health and the environment, as it discharges heavy metals and persistent organics (Cesaro et al., 2017; Zhang et al., 2022). Despite the negative effects of improper management of e-waste substances, e-waste can also provide important and high economic value from precious metals such as gold, platinum, silver, and others (Arain et al., 2022). Therefore, it is important to ensure that e-waste generators understand their role in managing e-waste correctly (Murthy & Ramakrishna, 2022). Also, this signifies the importance of the safe disposal of e-waste (Yong et al., 2019). Thi Thu Nguyen et al. (2018) found that most households in Vietnam city still need to know how to dispose of e-waste appropriately due to the lack of formal disposal facilities in the communities, especially in remote areas. Thus, it leads them to manage their e-waste informally. This study aims to investigate the contribution of each factor (attitude, subjective norms, and perceived behavioral control) in explaining the intention to formally dispose of e-waste by focusing on residents at Taman Bahau, Negeri Sembilan. The results are expected to be useful in raising societal awareness of the safe disposal of e-waste, and they should contribute to a growing body of research on formal and informal e-waste recycling practices in Malaysia.

2.0 LITERATURE REVIEW

This study applied the Theory of Planned Behavior (TPB), which was introduced by Ajzen (1991) as a conceptual extension of the Theory of Reasoned Action (TRA) through the incorporation of additional factors and is regarded as effective for predicting the behavior of individuals under specific conditions. In the theory of planned behavior (TPB), attitude towards behavior refers to the extent to which an individual has a favorable or unfavorable opinion or evaluation of performing the target behavior (Mohamad et al., 2022). Subjective norms are proposed as the second predictor of behavioral intention in the TPB model, defined by Ajzen (1991) as "the felt social pressure to do or not execute a behavior." The TPB expands by including perceived behavioral control (PBC), which reflects people's perceptions or "confidence in their ability to accomplish" specific activities, as well as indicators of "available resources and opportunities" (Strydom, 2018).

ATTITUDE

One of the key components in the design of an e-waste management system is the behavioral intention of residents to participate in e-waste disposal programs. It draws a realization that residents' participation is crucial to the success of a disposal program. Therefore, it is crucial to comprehend how the general public feels about disposing of e-waste in order to create effective regulations that may be used to address e-waste issues. The attitude construct is defined as how a person feels and thinks about something because it functions as a psychological emotion, whether positive or negative, toward an individual's practice (Jekria & Daud, 2016). According to Tukiman et al. (2021), individual attitude is important because it shows how they react to the knowledge they acquire and how they can implement it. Knowledge can influence a person's attitude, and a good level of knowledge will lead to a good attitude. Attitudes cannot be changed easily, but by increasing the level of knowledge, attitudes can eventually be changed (Desa et al., 2011). Residents with good information and knowledge of the facts tend to share information and encourage their families. According to Tukiman et al. (2021), many people have failed to change their awareness to commitment, while many people still have an unacceptable attitude towards the environment. Several studies have been undertaken to determine the elements influencing customers' attitudes and intentions towards e-waste disposal. Thi Thu Nguyen et al. (2018) and Gonul et al. (2016) believed that citizens' attitudes toward recycling and environmental awareness effectively increased their e-waste recycling behavioral intentions. Additionally, Sari et al. (2021) discovered that Indonesian individuals' recycling knowledge and attitudes had a demonstrably favorable influence on their recycling of batteries.

SUBJECTIVE NORMS

Generally, subjective norms (SN) is the perceived social pressure from other people or groups to engage in or refrain from certain conduct. This pressure may be exerted by family, classmates, neighbors, or anybody of personal significance (Fauk et al., 2022). In the context of environmental practices, people are more likely to care about their neighborhood's environment when they consider it to be of high quality, therefore establishing an atmosphere favorable to environmental conservation (Krettenauer & Lefebvre, 2021). Gao et al. (2015) discovered that social influence significantly impacted residents' intentions to utilize the proper online e-waste disposal service. According to the research, the higher the subjective standard, the greater the desire to dispose of e-waste properly. According to Nduneseokwu et al. (2017), the most important finding of their study was the positive influence of friends, family, and neighbors as social influences on the participants' involvement in disposal. It is further supported by Jusoh et al. (2018), who observed that social pressure was a motivating element for recycling, effectively ensuring the engagement of large populations in recycling. On the other hand, Yu et al. (2014) proved that the laws and regulations positively affected residents' willingness to recycle e-waste. Wang et al. (2016) revealed that enacting and disseminating rules and regulations raised environmental awareness among people, preparing them for disposing of e-waste.

PERCEIVED BEHAVIOURAL CONTROL

This study applied the definition of perceived behavior control (PBC) provided by Mohamad et al. (2022), which is the perception and comprehension of a person's capacity to accomplish an act based on prior experience and the obstacles that must be overcome. Noor et al. (2023) contended that one of the most important internal variables for determining people's propensity towards e-waste disposal was their recycling convenience and prior experience. Several studies reported that people's propensity to engage in recycling activities was negatively impacted by perceived inconvenience (Ari & Yilmaz, 2016; Xu et al., 2017). The higher the expense of e-waste recycling, the lower the possibility of residents' intention. Wang et al. (2016) found that residents' intentions to recycle e-waste declined as recycling costs rose. If they had to pay more, individuals would even choose not to participate in formal recycling programs. On the other hand, recycling facilities provide the perception of behavioral control that can encourage residents to dispose of e-waste in terms of disposal facilities, storage space, and ease of access to formal disposal sites that can ensure residents dispose of e-waste formally (Wang et al., 2019). Recycling services are crucial to persuading households to dispose of electronic trash. Residents' intentions to officially dispose of e-waste correlate with their perceived behavioral control.

CONCEPTUAL FRAMEWORK

The literature review section states that the TPB proposes three factors influencing behavioral intention: attitude towards behavior, subjective norms, and perceived behavioral control (Ajzen, 1991). Figure 1 shows the adaptation of the TPB as a basic guideline to illustrate the study framework, with specific antecedents of e-waste disposal behavioral intention. E-waste disposal behavioral intention is defined as residents' propensity and desire to dispose of e-waste in formal disposal sectors in the future.

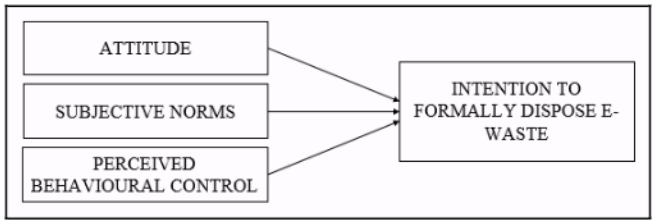

Figure 1: Conceptual Framework guided by TPB

Recycling as one of the formal disposal methods, relates to an individual's attitude towards the environment (Noor et al., 2023). Attitudes strongly influence behaviour, and it is vital to assess attitudes (Otto et al., 2019). On the other hand, subjective norms, represented by social pressure, laws, and regulations, serve as one of the factors in the framework. The importance of formal organisations in motivating people to participate in e-waste recycling programmes was also highlighted in previous research about e-waste management in Vietnam (Tran & Salhofer, 2016). In addition to laws and regulations, societal pressure that affects people's perception was regarded as a crucial element in studies on recycling behavioural intention (Mohamad et al., 2022). The third factor of the TPB, perceived behavioural control, pertains to the cost and inconvenience of disposal. Two aspects related to perceived behavioural control in this study are related to residents' opinions of whether they are given favourable conditions to participate in the e-waste disposal programme. Cost

of disposal and inconvenience have been cited as significant factors in disposal intention by Wang et al. (2016) and Nduneseokwu et al. (2017).

3.0 METHODOLOGY

This study uses a quantitative approach involving residents at Taman Bahau, Negeri Sembilan. As for the data collection procedure, the research instrument was self-administered questionnaire. This study has gone through a pilot study on 30 respondents before the actual survey, to test the reliability of instrument and examine the internal consistency of each construct (attitude, subjective norms, perceived behavior control, and intention to formally dispose of e-waste). This study employed a convenience sampling method and managed to reach 375 respondents. The analysis procedures involved descriptive analysis to describe the demographics and profiling of the respondents, while regression analysis was applied to accomplish the study's objective.

4.0 FINDINGS AND DISCUSSION

Statistical Package for the Social Sciences (SPSS) version 26.0 was used to analyses the demographic and profiling data of respondents. A pilot study was conducted on 30 respondents before the survey. The internal consistency of the of the instrument were done using Cronbach's Alpha analysis. Result shows that all variables posed good reliability based on established criteria by Saunders et al. (2022), that values of 0.7 or above indicate that the questions combined in a scale are measuring the same thing [attitude ($\alpha = 0.897$), subjective norms ($\alpha = 0.878$), perceived behavioral control ($\alpha = 0.732$) and intention to dispose of e-waste ($\alpha = 0.739$) formally]. Through the survey, majority of the respondents were Malay (64%), female (80%) and aged between 20 years old to 40 years old (52 %). Most were employed in the government sector (64%) and married (73%). It is also revealed that 85 percent of the respondents knew of e-waste. Even though most of them realized the impact on the environment if the e-waste was not properly managed (88%), only 45 percent of respondents declared that they had practiced formal e-waste disposal.

Table 1: Summary of Model's Goodness of Fit

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.694[a]	0.482	0.478	2.41663

a. Predictors: (Constant), PBC, ATTITUDE, SUBJECTIVE NORMS

Table 1 indicates the summary of model's goodness of fit. The coefficient of determination is the square of correlation coefficient (r^2) that measures the proportion of variation in dependent variable described by the independent variables. The coefficient of determination is expressed in percentage. As a result, r^2 value is 0.482 which indicates that 48.2 percent of the total variation in intention to formally dispose e-waste is explained by attitudes, subjective norms, and perceived behavioral control (PBC). A higher R-squared value suggests that the model has a better fit to the data in terms of explaining the observed variability.

A regression analysis was conducted and the result is shown in Table 2.

Table 2: Regression Results

Coefficients[a]						
		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	Constant	3.356	0.904		3.711	0.000
	ATTITUDE	0.327	0.043	0.327	7.620	0.000
	SUBJECTIVE NORMS	0.100	0.032	0.137	3.089	0.002
	PBC	0.377	0.047	0.386	8.088	0.000

a. Dependent variable: INTENTION

Thus, the regression equation can be written as follows;

$$\gamma = \alpha + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 \quad (1)$$

where;

γ = Intention to formally dispose e-waste,
x_1 = Attitude,
x_2 = Subjective norms,
x_3 = Perceived behavioural control.

Hence, the equation becomes;

$$\gamma = 3.356 + 0.327\, x_1 + 0.100 x_2 + 0.377 x_3. \quad (2)$$

Equation (2) interprets that for every 1 percent increase having a positive attitude towards managing their e-waste properly, it will develop the intention to formally dispose e-waste by 32.7 percent, ceteris paribus. As for subjective norms, if there is 1 percent influence from family members or peers or neighbours or environmental campaign towards formal e-waste disposal, the intention to dispose e-waste properly will increases by 10 percent, ceteris paribus. Next, as the easiness and convenient to dispose e-waste properly increases by 1 percent, the intention to formally dispose e-waste will also increases by 37.7 percent, ceteris paribus. To summarize, the regression result presented that perceived behavioural control explains the most variance in the intention to formally dispose e-waste among the residents at Taman Bahau. The predictor provides the highest β_3 value at 0.377. Moreover, based on Table 2, the finding shows that attitude, subjective norms and perceived behavioural control constructs significantly influence to the residents' intention to formally dispose e-waste. The statistical significance of the coefficients was examined by looking at the associated significant values (p-values). The p-values are below a predetermined significance level (e.g., $p < 0.05$), thus it suggests that there is relationship between the attitude, subjective norms and perceived behavioural control and the intention to formally dispose e-waste is statistically significant.

Furthermore, this present outcome in this study also in parallel with Thi Thu Nguyen et al. (2019) which demonstrated that the environmental awareness and attitude towards e-waste recycling were highly associated with e-waste recycling. According to Desa et al. (2011), the level of knowledge can affect the person's attitude. Babaei et al. (2015) mentioned that attitude is how a person feels and thinks about something and it can be either positive or negative ways on the practices of an individual (Jekria & Daud, 2016). Respondents feel satisfied if they properly disposing e-waste as they feel that by properly disposing e-waste is one of the ways to educate the community as it also can brings to a safe environment. In this study, respondents believed that the social concerns from family members, friends, neighbours, mass media as well as campaigns held by authorities provide a comprehensive view of explaining the intention to properly

dispose e-waste. The result aligned with Laeequddin et al. (2022), which found that subjective norms is positively associated with the intention to safely dispose of unused mobile phones. In addition, Sabbir et al. (2023) concluded that subjective norms is significantly and positively affect e-waste recycling. As reported by Wang et al. (2018), subjective norms were significantly affecting the intention to recycle e-waste. Perceived behavioural control is mainly measured by both the recycling experience and recycling convenience. This determinant is referred to people's perception of their ability to perform certain behaviour whether it would be easy or difficult to be done. The result was aligned with the study by Wang et al. (2018) reported a significant positive towards residents' behaviour intentions in regard to e-waste. In addition, perceived behavioural control influenced the customers' intention toward having a better e-waste management (Kianpour et al., 2017; Garg et al., 2023).

5.0 CONCLUSION

Theory of Planned Behaviour is a well-known theory that signifies elements that are likely encourage e-waste disposal behaviour. Through the regression analysis, it shows the attitudes, subjective norms, and perceived behavioural controls does have significant relationship in explaining the intention to dispose of e-waste formally among the residents in Taman Bahau, Negeri Sembilan. The result also implies that accessibility and convenient of the facilities to safely dispose e-waste affects respondents' intention to dispose of their e-waste items formally the most, compared to other variables. This research holds significance as it can enhance community awareness and encourage relevant stakeholders to find solutions to protect the environment from the detrimental consequences of improperly discarded electronic waste. However, in further studies, it is suggested to include other variables and expand the sample size and research area in order to optimize the prediction of intention to dispose of e-waste properly.

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