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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 (e-waste) is a global issue that continues to escalate. E-waste contains hazardous materials that could lead to health issues and pollution if improperly disposed. The most common e-waste sources are household appliances, such as refrigerators, air conditioners, washing machines, radios, televisions, and telecommunications devices containing electric or electronic parts. Each e-waste item also encompasses valuable materials that can profit the business, which in turn can benefit the growth of the economy, in addition to resource preservation. This study refers to the theory of planned behavior as a heuristic guideline to investigate the intention to formally dispose of e-waste among residents in 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 findings show that attitudes, subjective norms, and perceived behavioral controls were constructed towards the intention to dispose of e-waste formally. The results also imply that perceived behavioral control explains the most variance in respondents' intentions 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

Keywords: *electronic wastes, household intention, theory of planned behaviour*

1. INTRODUCTION

The electronics industry is one of the fastest-growing and largest manufacturing industries in the world (Ikhlayel, 2018; Clarke et al., 2019), resulting in the generation of electronic and electronics equipment waste (e-waste). E-waste refers to 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) reported that in China, between 20 and 50 million metric tons of e-waste are generated annually. Moreover, nearly 70% 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, can harm human health and the environment, and these originate from e-waste (Islam et al., 2020). The Department of Environment Malaysia (DOE) reported a significant increase in e-waste in Malaysia and forecasts that it will generate up to 24.5 million metric tons of e-waste in 2025. However, many e-waste items remain unrecorded (Andeobu et al., 2023). This is a concern for the government and related NGOs, who are preparing 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.

Moreover, human attitudes and behaviors in society lead to the depletion of natural resources (Oke & Kruijsen, 2016). In the context of e-waste, it is common knowledge that the way in which 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 that use household appliances and discard unusable or broken electrical appliances into the system (DOE, 2023). These include a person, households, commercial, and institution. Generators must discard their household e-waste through formal collection channels. However, the most common practice among households for disposing of e-waste is storing e-waste at home for a long time, reselling it to unregistered e-waste collectors, and discarding it with other solid waste 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).

Inappropriate handling of e-waste is unsafe for human health and the environment, as it results in the discharge of heavy metals and persistent organic compounds (Cesaro et al., 2017; Zhang et al., 2022). Despite the negative effects of improper e-waste management, e-waste can also provide important and high economic value, as it contains precious metals, such as gold, platinum, and silver (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). In addition, this highlights the importance of the safe disposal of e-waste (Yong et al., 2019). Nguyen et al. (2018) found that most households in Vietnam still need to know how to dispose of e-waste appropriately because of the lack of formal disposal facilities in the communities, especially in remote areas. This leads households 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 in Taman Bahau, Negeri Sembilan. The results are expected to raise societal awareness of the safe disposal of e-waste and contribute to the growing body of research on formal and informal e-waste recycling practices in Malaysia.

2. LITERATURE REVIEW

This study applied the theory of planned behavior (TPB; Ajzen, 1991), which is a conceptual extension of the theory of reasoned action (TRA) through the incorporation of additional factors, and regarded as effective for predicting the behavior of individuals under specific conditions. In the 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).

2.1 Attitude

One of the key components in the design of an e-waste management system is residents' behavioral intention 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 people 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; however, 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 conducted to determine the elements influencing customers' attitudes and intentions towards e-waste disposal. 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.

2.2 Subjective Norms

Subjective norms (SN) refer to 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 anyone 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 perceive it to be of high quality, thereby 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. This was further supported by Jusoh et al. (2018), who observed that social pressure was a motivating element for recycling, ensuring the engagement of large populations in recycling. In contrast, Yu et al. (2014) demonstrated that 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 to dispose of e-waste.

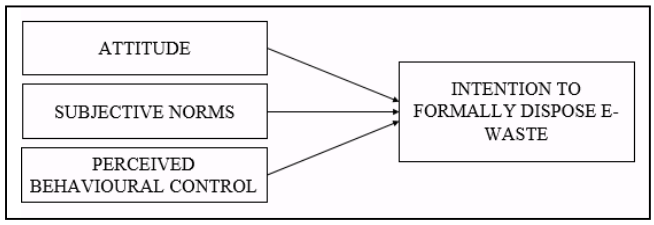
2.3 Perceived Behavioural Control

This study applied the definition of perceived behavioral 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 have reported that people's propensity to engage in recycling activities is negatively impacted by perceived inconvenience (Ari & Yilmaz, 2016; Xu et al., 2017). The higher the cost 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.

2.4 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, one of the formal disposal methods, is related to an individual's attitude towards the environment (Noor et al., 2023). Attitudes strongly influence behavior, and it is vital to assess attitudes (Otto et al., 2019). In contrast, subjective norms, represented by social pressure, laws, and regulations, serve as one of the factors in the framework. The importance of formal organizations in motivating people to participate in e-waste recycling programs was also highlighted in previous research on e-waste management in Vietnam (Tran & Salhofer, 2016). In addition to laws and regulations, societal pressure that affects people's perceptions was regarded as a crucial element in studies on recycling behavioral intention (Mohamad et al., 2022). The third factor of the TPB, perceived behavioral control, pertains to the cost and inconvenience of disposal. Two aspects related to perceived behavioral control in this study are residents' opinions of whether they are provided favorable conditions to participate in the e-waste disposal program. The 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. METHODOLOGY

This study used a quantitative approach involving residents in Taman Bahau, Negeri Sembilan. As for the data collection procedure, the research instrument was self-administered questionnaire. This study underwent a pilot study with 30 respondents before the actual survey to test the reliability of the instrument and examine the internal consistency of each construct (attitude, subjective norms, perceived behavioral control, and intention to formally dispose of e-waste). This study employed a convenience sampling method and reached 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. FINDINGS AND DISCUSSION

Statistical Package for the Social Sciences (SPSS) version 26.0 was used to analyze the demographic and profiling data of respondents. A pilot study was conducted with 30 respondents prior to the survey. The internal consistency of the instrument was evaluated using Cronbach's alpha analysis. The results showed that all variables posed good reliability based on the established criteria by Saunders et al. (2022); 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 was also revealed that 85% of the respondents were aware 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

4.1. 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 the correlation coefficient (r^2), which measures the proportion of the variation in the dependent variable described by the independent variables. The coefficient of determination is expressed as a percentage. Consequently, the r^2 value is 0.482, which indicates that 48.2% of the total variation in the 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 results are presented 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 expressed 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 behavioral 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% increase in having a positive attitude towards managing e-waste properly, it will develop the intention to formally dispose e-waste by 32.7%, ceteris paribus. Regarding subjective norms, if there is a 1% influence from family members, peers, neighbors, or environmental campaigns towards formal e-waste disposal, the intention to dispose e-waste properly will increase by 10%, ceteris paribus. In addition, as the easiness and convenience of disposing e-waste properly increase by 1%, the intention to formally dispose e-waste will also increase by 37.7%, ceteris paribus. To summarize, the regression result presented that perceived behavioral 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 findings show that attitude, subjective norms, and perceived behavioral control constructs significantly influence residents' intentions 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 a relationship between attitude, subjective norms, and perceived behavioral 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 a 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 regarding the practices of an individual (Jekria & Daud, 2016). Respondents felt satisfied if they disposed of e-waste properly, as they felt that proper disposal was one of the ways to educate the community and could also contribute 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. This finding aligns with Laeequddin et al. (2022), who found that subjective norms are positively associated with the intention to safely dispose of unused mobile phones. In addition, Sabbir et al. (2023) concluded that subjective norms significantly and positively affect e-waste recycling. As reported by Wang et al. (2018), subjective norms significantly affect the intention to recycle e-waste. Perceived behavioral control is mainly measured by both recycling experience and recycling convenience. This determinant refers to people's perception of their ability to perform certain behaviors, whether it would be easy or difficult. The results align with Wang et al. (2018), who reported significant positive towards residents' behavioral intentions and e-waste. In addition, perceived behavioral control influences customers' intentions toward having a better e-waste management (Kianpour et al., 2017; Garg et al., 2023).

5. 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 was shown that attitudes, subjective norms, and perceived behavioral controls have a significant relationship in explaining the intention to dispose of e-waste formally among the residents in Taman Bahau, Negeri Sembilan. The results also imply that accessibility and convenience of facilities to safely dispose e-waste affect respondents' intention to dispose of their e-waste items formally the most, compared to other variables. This research is significant because 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 to optimize the prediction of the intention to dispose of e-waste properly.

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