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To Recycle or Not to Recycle? Factors Affecting Malaysian Residents' Intention for Recycling E-Waste

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ABSTRACT

E-waste refers to all types of electrical and electronic equipment disposed of by the user. E-waste contains bromine, toxic gases, toxic metals, biologically active substances, acids, plastics, and plastic adhesives; where these substances are very toxic and dangerous to humans and the environment. In Malaysia, e-waste management is an immense problem in line with the increase in population, living standards, and industrial activity. Therefore, this study aims to determine the extent to which information, incentives, and attitude could influence e-waste recycling intention among the Malaysian public. This study used a quantitative method and random sampling and received 314 completed questionnaires, resulting in an 81.8% response rate. The results show a significant positive relationship between information, incentives, attitude, and e-waste recycling intention. Results also show that incentives are the most significant factor influencing the public's e-waste recycling intention. In conclusion, several suggestions have been put forward to help improve e-waste recycling practices among the Malaysian community.

Contribution/Originality: This study contributes to the existing literature on environmental prosocial behavior by extends the original TPB model to include the information and incentives as a vital approach of perceived behavioral control. This study also delivers new insights since this study has examined the model from the perspective of developing country, Malaysia which is scarcely examined by the previous empirical studies.

1. Introduction

Malaysia is one of the countries rapidly developing towards becoming a developed country, and the speed of this development process has caused the generation of solid waste or garbage (Chen et al., 2021; Dinggai, Mapa, & George, 2020). It is one of the main challenges faced by Malaysia in achieving the status of a developed country. Implementing sustainable waste management through continuous improvement in reducing the amount of solid waste sent to landfills is to support United Nations Sustainable Development Goals (SDGs) 11: Sustainable Cities and Communities (Devadoss et al., 2021). Countries such as Japan and Germany have devised several strategies to promote recycling. Japan enforces a fine of over 30,000 yen on those who throw away household items without recycling. The German government obliges businesses and industries to be discrete and recycle at least 80 percent of the goods they produce (Mintz et al., 2019). Electrical and electronic waste, or e-waste, refers to equipment no longer used by its original user (Islam et al., 2020). In Malaysia, e-waste is categorised as scheduled waste with code SW110 under the First Schedule, Environmental Quality Regulations (Scheduled Waste) 2005, Environmental Quality Act 1974 enforced by the Department of Environment (Ismail & Hanafiah, 2021). Code SW110 is interpreted as waste from electrical and electronic installations containing components such as accumulators, mercury switches, glass from cathode ray tubes and activated glass, or others (Department of Environment of Malaysia, 2022). E-waste is categorised as scheduled waste because it has ignitability, corrosiveness, reactivity, and toxicity (Devadoss et al., 2021). The generation of e-waste is divided into two sources, namely the industrial sector and produced from households (Ahmad et al., 2023; Masud et al., 2019). E-waste has become a problem worldwide. The more electrical and electronic goods are produced, the more e-waste needs to be disposed. Suppose e-waste is disposed of without using environmentally friendly methods such as throwing it into rivers, or landfills, burning it at will, or giving it to the wrong party. In that case, this e-waste is capable of endangering life, affecting our health, and causing the deterioration of nature (Sunder & Singh, 2021). The components in e-waste contain toxic and dangerous substances such as mercury, lead, cadmium, arsenic, bromine, beryllium, and others that will seep into the earth and subsequently water sources and threaten aquatic life and human (Ahmad et al., 2023; Beula & Sureshkumar, 2021).

The e-waste needs to be recycled to be reused to produce new electrical and electronic products. Components in e-waste also contain precious metals such as gold, silver, copper, platinum, and palladium, which have a high recycling value (Seif, Salem, & Allam, 2023). Recycling electronic waste is necessary to conserve energy, resources, and landfill space, create a job, reduce business costs, non-renewable support recycling, and minimise air pollution (Brindhadevi et al., 2023). Careful measures are taken to avoid hazardous exposure and leakage of materials such as heavy metals from waste pile ash and incinerators. The increasing trend of collecting electronic waste from households has become one of the main subjects globally, including in Malaysia (Ahmad et al., 2023; Mohamed & Rasnan, 2021). In Malaysia, people can personally send e-waste directly to e-waste collection centers registered with the Department of Environment (DOE) or a recovery facility licensed by the DOE. The public also can contact any collection center that offers e-waste collection services from home. Examples of e-waste collection centers are AEON Bandaraya Melaka, Grand Senheng Bangi, Grand Senheng Batu Pahat, and Lotus's Cheng (Department of Environment of Malaysia, 2022).

Based on existing legislation, only e-waste from industry needs to be managed by the party appointed by the DOE. There has yet to be specific legislation obliges households to dispose of the waste. Therefore, all types of e-waste should be managed systematically, not only e-waste from industry but also residential areas. Scheduled) 2005. As supported by the previous studies (Ismail & Hanafiah, 2021; Mahat et al., 2019; Mohamed & Rasnan, 2021), the researchers find that the awareness of e-waste recycling among Malaysian still needs to be higher. E-waste contains dangerous heavy metals such as lead, mercury, cadmium, and polybrominated diphenyl, which can destroy the environment (Sunder & Singh, 2021). Therefore, it is clear that the need to create sustainable e-waste management at the household level is essential. This study focuses on the Malaysian public intention to manage e-waste. The study results can provide information and help responsible bodies plan policies, regulations, or better legislation in the future (Jalloh, Dahalan, & Khalid, 2022).

E-waste produced from non-industrial sectors, especially houses such as televisions, air conditioners, washing machines, refrigerators, and others, yet regulated correctly in existing regulations, resulting in most e-waste being disposed of inappropriately (Beula & Sureshkumar, 2021). As a result, most electrical and electronic goods from residential areas end up on the site at garbage disposal. This situation creates a risk of pollution and health hazards (Devadoss et al., 2021). Although voluntary activities are carried out locally, there is no guideline or criteria for e-waste treatment. Past studies have found that gender, education, facilities, and environmental beliefs are the main factors that explain the population's willingness to send e-waste to recycling centers (Islam, Dias, & Huda, 2021; Otto et al., 2019). In addition, the willingness of households to recycle e-waste is also influenced by knowledge about the potential toxicity of e-waste and the e-waste recycling experience (Wang et al., 2021). Dias, Bernardes, and Huda (2022) concluded that there are significant differences in the behavior of e-waste disposal between developed and developing countries.

In this research, the theory of planned behavior (TPB) was used to see the relationship between attitudes, subjective norms, and perceived behavior control on the intention, affecting the existing habit of recycling e-waste. The research on community behavior towards e-waste recycling still needs to be improved, particularly in developing contexts such as Malaysia. Therefore, this study intends to explore critical elements of e-waste recycling intention among the Malaysian public. Based on previous empirical studies, three identified factors have been chosen: information, incentives, and attitude (Nanath & Kumar, 2021). Information is a mixture of understanding, experience, wisdom, and skill which can influence e-waste awareness. Community knowledge, understanding, and perception depend on the extent of information about the environment they get (Koshta, Patra, & Singh, 2022; Nanath & Kumar, 2021). Nowadays, there are many environmental information platforms, primarily through electronic and print media, but the message only reaches some of the community. Hence, the space of mainstream media needs to be expanded with a more exciting presentation adapted to every community group. Then, incentives can stimulate the public to take action to protect the environment while increasing their economic interests. For instance, Wang, Zhang, and Sun (2021) found that coupon incentives positively influenced recycling behavior and suggested integrating coupon promotional programs into the development of waste management policy. Finally, environmental attitude helps to create a positive attitude (Cai et al., 2020) and empirical studies believe that a feeling of love and affection for the environment needs to be inculcated through early education (Islam, Dias, & Huda, 2021; Otto et al., 2019). Parents at home should instill in their children noble values that can shape their

personalities and ultimately create individuals who are positive towards environmental changes and always strive to improve environmental quality.

The study offers several insights for e-waste recycling research. First, it contributes to e-waste recycling research by providing a theoretical framework that includes information and incentives in the theory of planned behavior, which account for the perceived behavioral control factors of e-waste recycling. Next, most studies on e-waste recycling have been conducted in specific developed countries (e.g., USA and Japan). Research in developing countries such as Southeast Asian countries is still scarce (Gollakota, Gautam, & Shu, 2020).

The rest of this paper is organised as follows: Section 2 explores the state of e-waste recycling in Malaysia. Section 3 reviews the relevant literature on the theory of planned behavior (TPB). Section 4 draws hypothesized relationships and constructs the research model, while section 5 presents the research methodology. Section 6 delineates data analysis and research findings. A discussion of research findings is outlined in Section 7. Finally, the research conclusions and future research suggestions are depicted.

2. Literature Review

2.1. E-Waste Management in Malaysia

E-waste is broken, non-functioning, or old electrical and electronic equipment such as washing machines, refrigerators, televisions, personal or desktop computers, air conditioners, and mobile phones (Department of Environment of Malaysia, 2022). A variety of e-waste can be divided into two categories. One category is relatively simple and less harmful to the environment, such as refrigerators, washing machines, air conditioners, and other equipment. Second is more complex materials such as computers, lead TV picture tubes, computer components, raw materials in mobile phones, arsenic, cadmium, lead, and others. E-waste contains dangerous substances such as lead, cadmium, mercury, arsenic, chromium, polychlorinated biphenyl, and others. If e-waste is disposed of at will, such as in landfills, rivers, or incineration, toxic chemicals will be released, affecting the environment (air, soil, water) and human health. For example, chromium compounds destroy the body's DNA, causing asthma and other diseases. E-waste also contains precious metals such as gold, copper, palladium, and silver, which have a high recycling value (Department of Environment of Malaysia, 2022).

The management of e-waste in Malaysia is regulated under the Environmental Quality (Scheduled Wastes) Regulations 2005 of the Department of Environment (DOE). E-waste is categorised as scheduled waste under code SW 110 (Ismail & Hanafiah, 2021). At present, Malaysia has yet to have specific regulations on e-waste. However, in 2010 the DOE issued the second revision of the "Guidelines for the Classification of Used Electrical and Electronic Equipment in Malaysia" to assist all parties involved in e-waste management in identifying and classifying the used EEE or components according to the regulatory codes (Department of Environment of Malaysia, 2022). The guidelines define used electrical and electronic equipment or components as e-waste if it has one or more criteria, such as a defect that materially affects its functionality, physical damage that impairs its functionality or safety, and others. Table 1 shows the electrical and electronic equipment considered e-waste in Malaysia.

Table 1: E-Waste Components in the Scope of the Malaysian Guidelines

No.	E-Waste Item
1	Used television
2	Used cathode ray tube
3	Used air-conditioner unit
4	Used electric cable
5	Used mobile phone
6	Used computer
7	Used motherboard
8	Used refrigerator
9	Used washing machine
10	Used video recorder
11	Used printed circuit board
12	Used lead frame
13	Used patterned wafer
14	Used telephone
15	Used photocopy machine
16	Use facsimile machine
17	Used ink cartridges
18	Used audio amplifier
19	Used hard disk drive
20	Used radio
21	Used printers
22	Used electrical and electronic equipment/products imported from other countries
23	Used microwave/oven
24	Used or rejected or waste of integrated circuit
25	Used waste metal contaminated with heavy metals such as cadmium, mercury, lead, nickel, chromium, copper, lithium, silver, or manganese.
26	Wastes or products processed out of the partial recovery facilities

Source: United Nations Institute for Training and Research, Sustainable Cycles (SCYCLE) Programme, 2022)

In Malaysia, the export and import of e-waste or used Electrical and Electronic Equipment (EEE) is not banned. However, it is restricted, and exporters or importers must obtain written approval from the Director General before shipment (Ismail & Hanafiah, 2021). However, specific difficulties present, such as adequate information, awareness of relevant entities and importers, and others. In Malaysia, several manufacturers and companies have taken the initiative to organise a Take-Back Program (TBP) to reduce the amount of used or discarded EEE disposed of in municipal landfills and increase community awareness on the issue of e-waste. There needs to be an incentive mechanism for e-waste management in Malaysia. Some manufacturers are conducting several recycling and reuse activities; however, the scope of the materials collected is limited. In 2023, a total of 116 collection centers, 92 collection points, and 55 recovery facilities were present in Malaysia, which can process the e-wastes to recover precious metals (Department of Environment of Malaysia, 2022).

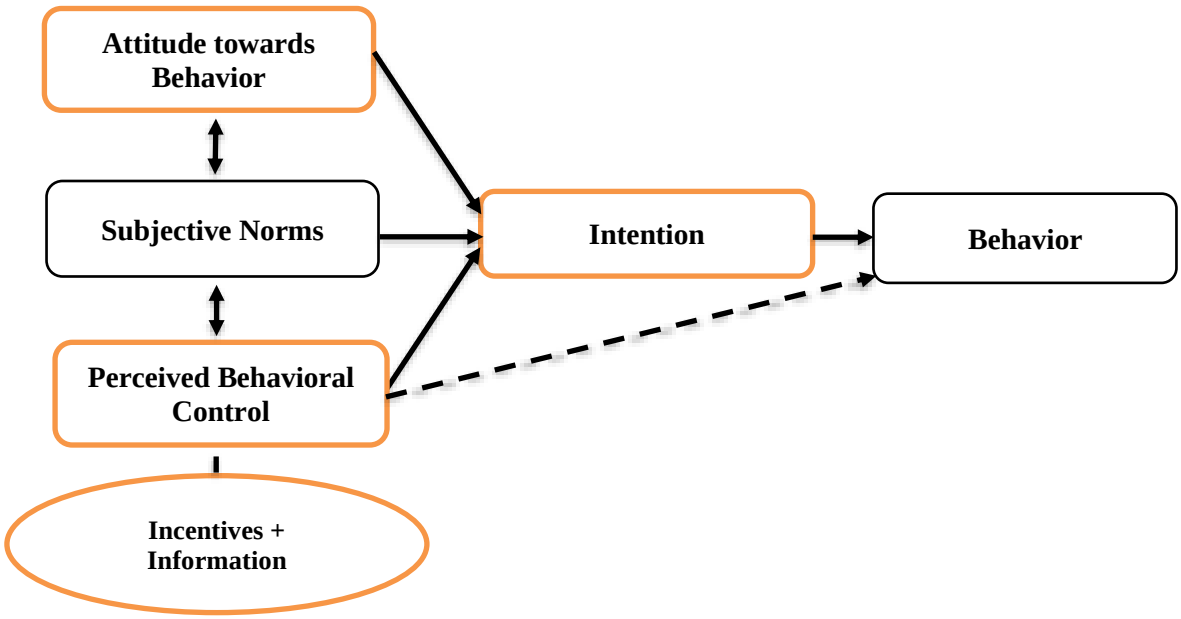
2.2. Theoretical Background: Theory of Planned Behavior (TPB)

In order to see the people's acceptance of e-waste recycling, the theory of planned behavior (TPB) by Ajzen (1991) was used and modified to suit the landscape of this study. This theory assumes that individuals are aware of their actions' implications before deciding to engage or not engage in an action. Every individual action has a reason, is planned, and is in a conscious state. The main goal of this theory is to predict

and understand individual behavior. Since individual behavior is under the control of the will, the intention is seen as the main factor determining the implementation of a behavior. The intention is determined by three main factors: attitude, social influence, and behavioral constraints (Kumar, 2019). Attitude is the positive or negative evaluation of individuals in acting. This factor is called attitude toward behavior. It is a person's assessment of whether acting is good or bad (Cai et al., 2020; Foon et al., 2020). Social influence or subjective norm is the perception of a person's social pressure, whether to do or not do an action. Social pressure can come either interpersonally, from parents, teachers, and friends, or externally such as from mass media, NGOs, and government agencies. Finally, the behavioral constraints factor becomes a constraint to individual actions, and among the factors are time, finances, abilities, and cooperation of others. When the individual evaluates something positively, and the essential people around think that he/she needs to act, and he/she has the opportunity and resources (external capabilities) and abilities (internal capabilities), it could help to influence intention and affect individual action (Foon et al., 2020).

Based on TPB, this study has divided the aspect into more specific factors. The information and incentives factors help to validate the perceived behavioral control components (Shevchenko, Laitala, & Danko, 2019; Wang et al., 2021). This study also proposes attitude since the positive feeling of an individual to do an action could influence the Malaysian public to recycle e-waste. In general, environmentally friendly actions lead to positive normative beliefs. In other words, sustainable behavior is widely promoted as a positive behavior. However, even when there is a behavioral intention to practice the behavior, perceived behavioral control can be hindered by constraints such as the belief that one's behavior will have no effect. For example, suppose a person intends to behave environmentally responsibly but lacks accessible recycling infrastructure. In that case, perceived behavioral control is low, and constraints are high, such behavior may not occur. Further research has concluded that attitudes, perceived behavioral control, and subjective norms are associated with adopting pro-environmental behavior (Koshta, Patra, & Singh, 2022; Nanath & Kumar, 2021). Based on Figure 1, this study believes promoting e-waste recycling behavior needs to be started with individual intention.

Figure 1: Adapted Model of the TPB



Measuring intention can help the government and responsible bodies evaluate Malaysian readiness for e-waste management and implementation. Several determinants, such as attitude, incentives, and information, can influence this intention. The researchers assume that these variables are essential and affect social norms. For instance, monetary incentives can help to promote community groups that actively collect e-waste, and information supply can be used as a driver or catalyst for promoting a positive attitude towards e-waste recycling.

2.3. The Influence of Information on the Intention for E-Waste Recycling

Mass media is the essential tool or instrument used to convey information, build perceptions and impressions, and shape community attitudes about e-waste (Nanath & Kumar, 2021). The media has proven to be the essential tool or intermediary in conveying certain information and messages (Koshta, Patra, & Singh, 2022). In the era of globalisation, the Internet has given the community a new dimension to increase environmental awareness. Various campaigns on social media such as Facebook, Instagram, and Twitter successfully opened the community's eyes to environmental issues (Vishwakarma et al., 2022). There are many studies conducted on community awareness about the environment and found that level of awareness and knowledge of the environment among Malaysian is good, but the behavior in caring for the environment is still low (Andeobu, Wibowo, & Grandhi, 2021; Ismail & Hanafiah, 2021; Mahat et al., 2019).

Information is related to knowledge creation. Knowledge is the capacity to acquire, retain, and use information. Information is a mixture of understanding, experience, wisdom, and skill. Awareness can be measured through indicators of the level of knowledge and practice done by individuals. Knowledge about e-waste can help the individual adapt to the environmental need (Jayaraman et al., 2019). Empirical studies have found that many youths are unaware of the e-waste phenomenon and its effects (Wang et al., 2021). Awareness of the effects of e-waste should be a main priority, and national leaders must shape and apply pure and moral values to the young generation (Jalloh, Dahalan, & Khalid, 2022). To improve e-waste awareness, educators and practitioners need to provide information on e-waste, which needs to be done as early as preschool age. This is supported by Islam, Dias, and Huda (2021), who stated that this age is the best phase in developing children's personalities, including involvement, awareness, and applying values pure about e-waste recycling practices. Informal education and learning can also be applied as early as at the home level (Otto et al., 2019). Empirical studies have found that if the level of knowledge of green practices is high, therefore, the level of green practices, namely, electricity-saving practices, water-saving practices, environmental care practices, and 3R practices, is also at the higher level (Ardoin, Bowers, & Gaillard, 2020; Jayaraman et al., 2019; Swanson & Ferrari, 2022). Therefore, supplying information using education is the primary key to increasing knowledge, involvement, and awareness of environmental issues, including recycling practices.

2.4. The Influence of Incentives on the Intention for E-Waste Recycling

Incentive policies could encourage e-waste recycling, and economic incentives can stimulate private sectors and individuals to take actions that serve their economic interests while promoting the development of environmental goals (Shevchenko, Laitala, & Danko, 2019; Zhong et al., 2022). Some examples of solid waste incentives are

recycling scrap tires, a deposit/refund system for lead-acid batteries, and a deposit/refund system for used oil. In Brazil, there is a reward scheme that endows credits on the electricity bill to the residents for recycling. Surabaya, Indonesia, the public can pay their public transportation fee with bottles (Oh & Hettiarachchi, 2020). There is Recycling Reverse Vending Machine (RRVM) in Kuala Lumpur, Malaysia. It is an automatic machine for recycled goods, and every recycled item put into RRVM will earn a reward of RM0.05 (National Security Council of Malaysia, 2022). Residents around the public housing in Kuala Lumpur can also enjoy necessities rewards by sending recycled goods to the *1Komuniti 1Kitar Semula* kiosk. The recyclable items that can be brought to the kiosk are aluminum cans, paper, plastic, and used cooking oil (National Security Council of Malaysia, 2020).

The program's goals are to encourage recycling practices among local communities, cultivate the spirit of local community cooperation in maintaining the cleanliness and cheerfulness of the environment and create a conducive residential environment. This initiative also could help improve the economy of the target group, B40, in turmoil due to the covid-19. B40 is an abbreviation for the word Bottom 40%. B40 groups are those households with monthly incomes less than RM2,500 to RM4,850. Besides local government roles in encouraging public recycling, many private organisations also start to pursue several initiatives to promote recycling. For example, through the M.A.C recycling program, customers can bring six M.A.C packaging containers, and in return, they will receive a free M.A.C Lipstick.

Similarly, in the H&M recycling program, customers can bring in a bag of old clothes, and in return, they get a 15% discount voucher for the next purchase. Nevertheless, Malaysia's number of e-waste incentives and e-waste recycling facilities still needs to be increased (Yong, Lim, & Ilankoon, 2019). Most recycling facilities are located in urban areas and metropolitan cities. In the Klang Valley, the local government and private provide many recycling centers such as UrbanR Recycle+, SOLS Tech, and Senheng E-Waste Recycling Program. Therefore, integrated e-waste management and the system must be implemented.

2.5. The Influence of Attitude on the Intention for E-Waste Recycling

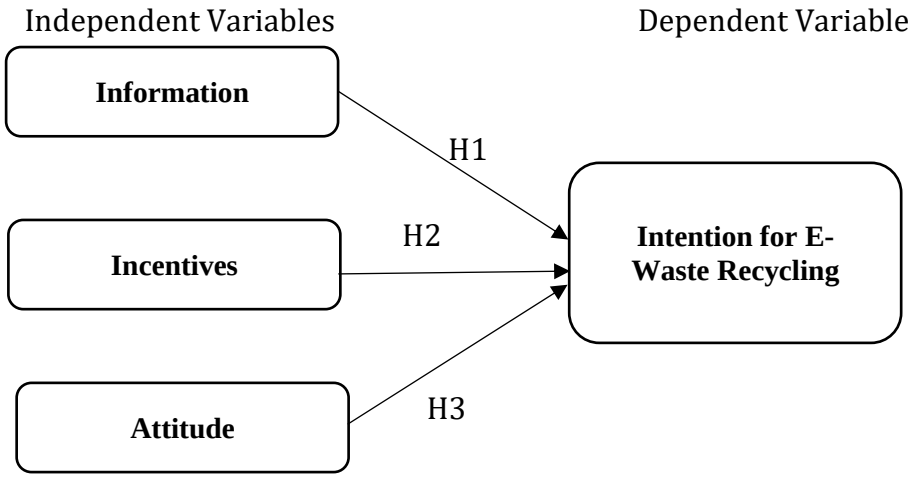
The practice of recycling is closely related to a person's attitude toward the environment. Attitudes strongly influence behavior, and it is vital to assess attitudes (Otto et al., 2019). Environmental attitude plays a vital role in influencing and motivating human behavior towards the environment (Ajzen, 1991; Otto et al., 2019). Individuals with a positive attitude toward the environment will apply that attitude daily (Ajzen, 1991; Izhar et al., 2022). Liu, Teng, and Han (2020) define environmental attitude as the value of individual judgment to environmental protection. Cai et al. (2020) define environmental attitude as a tendency to learn and respond consistently in or not in favor of the environment. Psychological factors such as personal values, close friends, family, and social groups influence individual attitudes (Rosa & Collado, 2019). For example, when individuals feel worried about environmental issues due to pollution that will affect their family, health, and quality of life, they will feel anxious and insecure. Some studies found a positive relationship between attitude and environmental behavior (Liu, Teng, & Han, 2020), while others infer a moderate or weak relationship (Izhar et al., 2022). Jayaraman et al. (2019) stated that the degree of consistency between individual environmental attitudes and behaviors is influenced by knowledge and awareness, commitment, and a sense of responsibility.

In comparison, a study by Janmaimool and Khajohnmanee (2019) and Izhar et al. (2022) found that environmental education programs can increase awareness and knowledge of environmental sustainability. Efforts to increase community awareness are a possible way to overcome environmental problems. Efforts towards building a sustainable society must be fostered so that the Malaysian public, especially the younger generation, are highly committed to environmental activities. Therefore, these explanations lead to the following hypotheses:

H1: Information positively influences the intention for e-waste recycling
H2: Incentives positively influence the intention for e-waste recycling
H3: Attitude positively influences the intention for e-waste recycling

This study aims to see the relationship between the factors that give rise to the intention to e-waste recycle and subsequently influence e-waste recycling habits among the community. In this study, the TPB is used, which three elements are stated to contribute to the intention and subsequently influence a person's behavior. The three elements are attitudes, subjective norms, and perceived behavior control. Information, incentive, and attitude will be used as independent variables based on these three elements. At the same time, the intention for e-waste recycling is identified as the dependent variable (see Figure 2).

Figure 2: Conceptual Model



3. Methodology

The study population involves the Malaysian public living in Peninsular Malaysia. The researchers used a quantitative research design with a survey method. The questionnaire was constructed and adapted from previous research (Akhtar, Masud, & Afroz, 2014; Thi Thu Nguyen et al., 2018) to obtain data about the relationships between independent variables and intention for e-waste recycling. The constructed questionnaire has three parts, namely, Part A: respondent profile (5 items), Part B: information, incentives, and attitude (16 items), and Part C: intention for e-waste recycling (4 items). Table 2 summarise the instrument items. A pilot study was conducted to obtain the reliability of the instrument. The Cronbach Alpha value obtained for all four variables in the study instrument is above 0.60. Three hundred eighty-four respondents were randomly selected based on the table sample size (Krecjie & Morgan, 1970). According to Comrey and Lee (1992), the appropriateness sample size between 30 and 500 is adequate. Three hundred fourteen completed questionnaires resulted in

an 81.8% response rate were received. This study uses the Statistical Package for Social Science (SPSS) version 25 software to conduct descriptive, correlational, and multiple regression tests.

Table 2: Variable Items

Variable	Item
Intention for E-Waste Recycling	1. I will contact formal e-waste recycling organizations to deal with e-waste in the future. 2. I intend to drop off my e-waste if formal collection systems are available. 3. I am willing to participate in environmental programs held by the government. 4. I am willing to tell my relatives about the e-waste recycling experiences.
Information	1. I learn about e-waste management through formal education at school/university. 2. I know about e-waste management through social media, advertisements, and pamphlets. 3. I know where to recycle the e-waste in my living area. 4. I know the benefits we can gain from proper e-waste management. 5. I love to listen to environmental issues sharing. 6. I love to search for environmental information online to enhance my understanding of e-waste.
Incentives	1. Awarding shopping vouchers would stimulate the behavior of e-waste management. 2. Encouragement on e-waste management among the public can be done if the government allocates a budget to build the centers in housing areas. 3. Payment out of the spoilt electronic products submission could interest the individuals to participate in e-waste management. 4. Government incentives such as tax holidays would attract many corporates to engage with e-waste management initiatives. 5. Non-financial incentives such as giving appreciation letters for e-waste management will help foster e-waste management behavior among the community.
Attitude	1. I am practicing proper e-waste management to help protect the environment. 2. I will share my awareness of e-waste management with my close acquaintances. 3. Proper e-waste management would contribute to a healthy and safe environment. 4. I am responsible for managing the e-waste that I have adequately produced. 5. The e-waste management should be done collectively to see the impact.

4. Result

Table 3 shows the background information of the respondents. Based on Table 3, the majority of respondents are female, with 226 respondents (72%), followed by males, with 88 respondents (28%). Next, regarding age, most respondents are between 18-28 years old, with 223 respondents (74.2%). As for the highest academic qualification, most respondents are Bachelor's Degree holders, with 194 (61.8%) participating in this study. The majority of respondents are from an urban area, with 141 respondents (44.9%), followed by semi-urban with 125 respondents (39.8%), and rural area with 48 respondents (15.3%). Regarding the household income segment, the majority of respondents are from the B40 group, with 165 respondents (52.5%). This is followed by the M40 group (n=110, 35.0%) and the T20 group (n=39, 12.4%).

Table 3: Demographic Profile

No	Profile	Frequency (n)	Percentage (%)
1	**Gender**		
	Male	88	28.0
	Female	226	72.0
2	**Age**		
	18-28 years old	233	74.2
	29-39 years old	32	10.2
	40-50 years old	28	8.9
	51-61 years old	21	6.7
3	**Highest Academic Qualification**		
	Sijil Pelajaran Malaysia (SPM)	28	8.9
	Sijil Tinggi Pelajaran Malaysia (STPM)	8	2.5
	Certificate/Foundation	6	1.9
	Diploma	72	22.9
	Bachelor Degree	194	61.8
	Master Degree	4	1.3
	Doctor of Philosophy (Ph.D.)	2	0.6
4	**Living Area**		
	Urban	141	44.9
	Semi-urban	125	39.8
	Rural	48	15.3
5	**Monthly Household Income**		
	B40 (RM4,851 and below)	165	52.5
	M40 (RM4,852 to RM10,970)	110	35.0
	T20 (RM10,971 and above)	39	12.4

Based on the results in Table 4, the reliability values for information are 0.759, followed by incentives (0.857), attitude (0.860), and intention for e-waste recycling (0.895). All variables have Cronbach's alpha coefficient values of more than 0.6. Therefore, this study fulfilled the assumptions of reliability.

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Table 4: Reliability Results

Variable	Cronbach's Alpha	No. of Items
Independent Variable		
Information	0.759	6
Incentives	0.857	5
Attitude	0.860	5
Dependent Variable		
Intention for E-Waste Recycling	0.895	4

The measurement of the mean score level is based on three levels, namely: 1) 1.00-2.39 (Low), 2) 2.40-3.79 (Medium), and 3) 3.80-5.00 (High) (Wiersme, 1995). Based on Table 5, the mean value for information (3.501) shows a moderate level of information received by the participant on e-waste. On the other hand, the mean value for incentives (4.061), attitude (4.056), and intention for e-waste recycling (4.200) are at a high level. This study data has a normal distribution because the skewness and kurtosis values are in the estimated range (see Table 5). According to Chua (2008), data is normal if the skewness and kurtosis values are in the ±2.0 range for social sciences.

Table 5: Normality Results

Variable	Mean	SD	Skewness	Kurtosis
Independent Variable				
Information	3.501	0.782	-0.548	0.916
Incentives	4.061	0.729	-1.632	4.934
Attitude	4.056	0.684	-1.615	5.402
Dependent Variable				
Intention for E-Waste Recycling	4.200	0.764	-1.666	4.204

The Pearson correlation coefficient, also known as the Pearson R test statistic, measures the strength between different variables and their relationship. The Pearson correlation coefficient returns a value between -1 and 1. The interpretation of the correlation coefficient is as below:

1. If the correlation coefficient is -1, this indicates a strong negative relationship. This implies a perfect negative relationship between the variables.
2. If the correlation coefficient is 0, this indicates no relationship.
3. If the correlation coefficient is 1, this indicates a strong positive relationship. This indicates a perfect positive relationship between the variables.

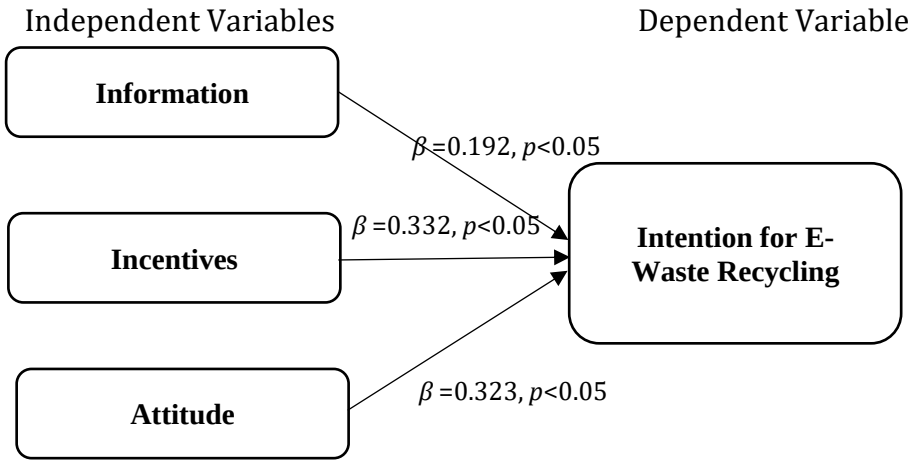
Table 6 shows a strong and positive association between information (r = 0.538, p < 0.05), incentives (r = 0.634, p < 0.05), and attitude (r = 0.644, p < 0.05) on the intention for e-waste recycling (Cohen, Manion, & Marrison, 2007). Based on the results of correlation analyses, all hypotheses were accepted.

Table 6: Correlation Results

		Intention for E-Waste Recycling
Information	Pearson Correlation	0.538**
	Sig. (1-tailed)	0.000
	N	314
Incentives	Pearson Correlation	0.634**
	Sig. (1-tailed)	0.000
	N	314
Attitude	Pearson Correlation	0.644**
	Sig. (1-tailed)	0.000
	N	314

Based on Table 7, regression results showed that all three factors were identified as predictors of intention for e-waste recycling with an adjusted R^2 = 51.7%. The ANOVA generated in this test also shows a significant probability value (p=0.000) and signifies that information, incentives, and attitude significantly affect intention for e-waste recycling. A high beta value for incentives indicates that incentive explains a high degree of intention for recycling e-waste (β=0.332, p<0.05). This shows that if the respondent's opinion on incentives experiences an increase of one unit, it will increase the intention for e-waste recycling by 0.332 units. The final model of this study is shown in Figure 3.

Figure 3: Final Hypothesised Model



The multicollinearity test is to ensure there is no intercorrelation between independent variables. Two results can be obtained from the Variance Inflation Factor and Tolerance value. There is no multicollinearity problem when the VIF value is smaller than 10.00. On the other hand, if the Tolerance value is more than 0.10, then the data does not have multicollinearity. Based on Table 7, the result of tolerance and VIF values also concluded that there is no symptom of multicollinearity between independent variables in the regression model.

Table 7: Regression Result

Variable	β	p	Tolerance	VIF
Information	0.192	0.000	0.651	1.535
Incentives	0.332	0.000	0.562	1.778
Attitude	0.323	0.000	0.507	1.971
R^2	0.521			
Adjusted R^2	0.517			
Sig.	0.000			

5. Discussion

Electronic waste or e-waste is the fastest growing waste because humans in the millennium are too dependent on electronic equipment. The demand for electronic equipment has increased, and electronics manufacturing has become the fastest-growing industry (Sunder & Singh, 2021). In the Malaysian context, waste production has also increased with time. Developments in the electronics industry caused electronic equipment release and increasingly flooded the market with excessive electronic equipment. Improper disposal of electrical goods will cause negative implications for the environment and humans (Ahmad et al., 2023; Beula & Sureshkumar, 2021). For example, mobile phones thrown into the trash that ends up in a landfill will release Polynuclear Aromatic Hydrocarbons (PAHs), a type of chemicals produced when exposed to hot temperatures and materials those chemicals will cause air pollution. This study aims to determine the extent to which information, incentives, and attitude could influence e-waste recycling intention among the Malaysian public. The results show a significant positive relationship between information, incentives, attitude, and e-waste recycling intention. This finding is supported by previous studies such as Nanath and Kumar (2021), Shevchenko, Laitala, and Danko (2019), and Cai et al. (2020). Results also show that incentives are the most influencing factor influencing the public's e-waste recycling intention. Consistent with other studies (Shevchenko, Laitala, & Danko, 2019; Zhong et al., 2022; Yong, Lim, & Ilankoon, 2019).

This study proposed solutions for improving and developing e-waste management based on the findings. One of the efforts to manage electronic waste is to adopt recycling practices in daily life. The government should enforce laws related to the disposal of electronic waste. Malaysia still has weak laws regarding the disposal of electronic waste (Andeobu, Wibowo, & Grandhi, 2021; Ismail & Hanafiah, 2021; Mahat et al., 2019). In this regard, relevant departments such as the Department of Environment should enforce the law by mandating that people divide daily waste with electronic waste to facilitate waste collectors to take electronic waste items to a particular disposal center for electronic waste. Anyone who does not do so will be punished and fined. With that, people will feel fear and will manage electronic waste (Patil & Ramakrishna, 2020). In short, enforced laws can encourage citizens to manage electronic waste. In addition, the preparation of bins for e-waste materials in every house will increase the collection of recycled materials. An effective promotional strategy by garbage collection companies with residents is one of the keys to increasing the rate of e-waste materials that can be recycled (Sthiannopkao & Wong, 2013). Singapore introduced its first nationwide electrical and electronic waste (e-waste) management system in 2021. E-waste is one of the priority waste streams identified under Singapore's Zero Waste Masterplan. The e-waste management system ensures that e-waste is appropriately treated to protect the

environment and public health while valuable resources are recovered (Kerdlap, Low, & Ramakrishna, 2019).

In addition, the authorities need more monitoring and initiatives to curb the e-waste disposal problem from continuing to destroy the environment (Patil & Ramakrishna, 2020). Concerning that, all parties, including the private sector and nongovernmental organisational (NGOs), need to mobilise their energy and efforts in dealing with this crisis—for example, DRB-Hicom Environmental Services Sdn. Bhd. has collaborated with Alam Flora by holding the 3R on Wheels program. Under this program, consumers can enjoy cash incentives and Petronas Mesra reward points by selling e-waste and other recyclable items such as old newspapers, magazines, and cans. In addition, several Buy Back Centers have been established in Putrajaya, Cyberjaya, and Kuala Lumpur to make it easier for the community to do recycling activities. However, some still are less concerned about the environment by throwing e-waste behind their houses, rivers, and others.

In conclusion, awareness of recycling e-waste needs to be emphasised and applied in the community. Hence, education and awareness in e-waste management and disposal are more critical. Accordingly, environmental education aims to form a society that is more sensitive and concerned about environmental issues and acquire knowledge, skills, values, and commitment toward solving environmental issues (Ardoin, Bowers, & Gaillard, 2020). The educational institutions also should add the knowledge of repairing electronic goods or e-waste recycling approach in the syllabus of subjects. With this, students can repair electronic items that have been damaged by themselves if they are equipped with the knowledge. This can help manage e-waste because electronic devices can continue to be used.

6. Conclusion

In this era of globalisation, the use of electrical and electronic devices such as smartphones, computers, and home appliances is increasing in line with technological advancement. This phenomenon causes an increase in electronic waste or e-waste production. E-waste will release heavy metals into soil and water when not disposed of or recycled correctly. Furthermore, e-waste poses not only a threat to the environment but also a threat to human health and safety. In Malaysia, e-waste management has been introduced since 2005 under the jurisdiction of the Department of Environment. Malaysian community should practice a more sustainable way of life and be responsible for using equipment and electronics because change starts from the individual itself. The paper concludes that sustainable solutions to e-waste require support from the government, private sector, NGO, and community to work together to overcome the complications of e-waste.

There are limitations of this study that should be taken into account in evaluating the results of the study. The first limitation of this study is that the findings only focus on the responses from the respondents in Peninsular Malaysia. The effect and ability to give a better picture of the sample are limited. Therefore, the results of this study cannot be generalised. Future researchers should generalise the sample area so that the information can be seen from various state clusters and areas. Second, this study only looks at information, incentives, and attitudes' influence on e-waste recycling intention. Therefore, the results of this study are only limited to these factors. It is hoped that future researchers will highlight other influencing factors such as social norms, rules and

regulations, personality traits, gender differences, environmental values, and others. Finally, future researchers should conduct research by combining quantitative and qualitative methods. Quantitative research methods can provide enough information to generate research hypotheses. However, their emotions, bias, or the people around them, may be influenced by the answers given. Therefore, the qualitative method can validate the quantitative findings.

Ethics Approval and Consent to Participate

The researchers used the research ethics provided by the Research Ethics Committee of Universiti Teknologi MARA (UiTM). All procedures performed in this study involving human participants were conducted in accordance with the ethical standards of the institutional research committee. Informed consent was obtained from all participants according to the Declaration of Helsinki.

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Conflict of Interest

The authors declare no conflict of Interest.

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