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Analyzing the intention of the households to drop off mobile phones to the collection boxes: empirical study in Malaysia

Rafia Afroz
Department of Economics, Kulliyyah of Economics, International Islamic University Malaysia, Kuala Lumpur, Malaysia, and
Mohammad Muhibbullah, Puteri Farhana and Mohammad Niaz Morshed
Department of Economics, Kuliyyah of Economics and Management Sciences, International Islamic University Malaysia, Kuala Lumpur, Malaysia

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Abstract

Purpose – To achieve proper waste management, the disposal of electronic waste (e-waste) is one suitable method. Most developing countries, including Malaysia, are facing lack of e-waste recycling facilities and low household participation. Using a survey method using a questionnaire, this study aims to examine the intention of Malaysian households to drop-off their mobile phones to the nearest collection boxes (n = 600).

Design/methodology/approach – This study expanded the theory of planned behavior by adding environmental awareness and knowledge. In addition, the cost of disposal and the convenience of the available disposal infrastructure were measured as two parts of the perceived behavioral control.

Findings – The results of this study show that environmental knowledge and awareness have a significant impact on attitudes toward recycling intention of the households. In addition, it was also found that the attitude and cost of disposal infrastructure is positively related to household intention.

Originality/value – These results show that if e-waste collection boxes are provided to the nearest community and e-waste management information is distributed, this will increase household participation in e-waste management.

Keywords Theory of planned behavior (TPB), Structural equation modeling (SEM), Mobile phone, E-waste recycling

Paper type Research paper

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1. Introduction

All countries together produced 6.1 kg per capita (kg/inch) of electronic waste (e-waste) per year in 2016, compared with 5.8 kg/inch created in 2014. It is predicted that the amount of e-waste will increase to 6.8 kg/inch by 2021. In 2016, Asia generated the largest volume of e-waste (18.2 million tons), followed by Europe (12.3 million tons), America (11.3 million tons), Africa (2.2 million tons) and Oceania (0.7 million tons). E-waste has become significant waste in Malaysia since 2012. In 2014, e-waste accounted for 4.5% of the total waste generation schedule (Jamin and Mahmood, 2015). The total amount of e-waste generated was about 77 kilotons in 2017 (Baldé *et al.*, 2017) and 7.6 kg per person in 2016 (StEP (Solving the e-waste problem), 2018). Between 2015 and 2017, an increase (60.3%) in e-waste was observed in the industrial sector (DOE, 2015a, 2015b, 2015c, 2017). According to forecasts, in 2020, the volume of e-waste will be 10 million tons, and annual progress will be 14%, and this is believed to be because of televisions and mobile phones (Shumon *et al.*, 2014).

The initial stage of e-waste processing causes significant damage to the health of garbage collectors, workers without personal protective equipment and the environment. In Malaysia, the Department of the Environment (DOE) has provided rules and regulations for the disposal of e-waste. A recycling policy is very important because of scare resources and proper waste management system (Oguchi *et al.*, 2013). It is also inevitable that recycling can reduce greenhouse gas emissions, save energy and materials, reduce human health impacts and increase job creation (Hotta *et al.*, 2014). Consequently, these rules do not provide any data on the current nature of technological waste, practice and economic conditions, although the effective management of e-waste has a very significant impact on the ability to dispose of e-waste (Zeng *et al.*, 2017). Thus, progress in e-waste management in Malaysia has not become attractive since 2010 (Kalana, 2010). Malaysia expects to become a technologically advanced country by 2020, and an effective e-waste management system is an important policy to achieve the 2020 goal, but it is still in its preliminary stages (Shumon *et al.*, 2014). Malaysia does not have a systematic management of hazardous wastes for the transport and disposal of wastes, as well as law enforcement agencies (Nnorom and Osibanjo, 2008). Consequently, it is becoming increasingly necessary for governments to adopt specific legislation on e-waste and to develop integrated e-waste management systems to minimize these consequences of the improper disposal of such waste (Pariatamby and Victor, 2013).

Consequently, adequate knowledge is needed about consumer behavior regarding e-waste and about factors that will increase consumer intentions to participate in environmental behavior. Previous studies have shown that awareness of recycling, norms, availability of infrastructures and disposal services, housing conditions and economic benefits, information about the potential toxicity of e-waste and previous experience in recycling e-waste also influence the decision of the consumer whether they are going to recycle. In addition, some studies have found that gender and marital status are also a significant predictor of disposal behavior (Saphores *et al.*, 2012; Wang *et al.*, 2016; Wang *et al.*, 2011a, 2011b).

The theory of planned behavior (TPB) model can be used to identify factors that influence households' decision on e-waste disposal because it is a very systematic, theoretically sound, successful and proven approach. Therefore, because of these advantages, many previous studies have recognized that TPB is very useful for identifying environmental factors (Yazdanpanah, 2016).

In addition, TPB is familiar because it has general applicability in explaining behavior on various topics, culture and society (Klöckner, 2015). For example, TPB has been used to explain pro-ecological behavior in various areas, such as tourism sustainability (Han *et al.*, 2010), use of public transport (Heath and Gifford, 2002), energy use (Abrahamse and Steg, 2009) and water conservation (Lam, 2006). Moreover, in some cases, TPB has surpassed other decision models associated with this study. For example, Kaiser *et al.* (2005) and Aguilar-Luzón *et al.* (2012) showed that TPB surpasses the theory of norms of belief in value, which was first introduced by Stern *et al.* (1999) in predicting pro-ecological behavior. However, many studies analyze the determinants of processing behavior using the expanded TPB model, adding various constructs such as moral standards, convenience, infrastructure and a sense of duty (Wang *et al.*, 2011a, 2011b; Nigbur *et al.*, 2010; Ramayah *et al.*, 2012; Yin *et al.*, 2014; Kumar, 2017).

However, there is insufficient research in the scientific literature on household intentions to process and their participation in e-waste management in emerging markets. It is also noted that there are very few studies that examine the behavior of e-waste disposal among households in Malaysia using the extended TPB model. Thus, this study offers an understanding of the key determinants that influence households' intentions to abandon their mobile phones at a mobile phone collection center using an extended TPB model. The rest of this article is structured as follows: a discussion of e-waste management in Malaysia is provided in Section 2. A theoretical research model, hypothesis based on previous studies, data sources and research methods are presented in Section 3. The results of the study are discussed in Section 4. Finally, Section 5 summarizes the conclusions of this document and offers relevant policy recommendations.

2. Electronic waste management in Malaysia

2.1 Electronic waste generation in Malaysia

In Malaysia, the DOE describes e-waste as "wastes from the electrical and electronic assemblies containing components such as accumulators, mercury-switches, glass from cathode-ray tubes and other activated glass or polychlorinated biphenyl-capacitors, or contaminated with cadmium, mercury, lead, nickel, chromium, copper, lithium, silver, manganese or polychlorinated biphenyl's" (DOE, 2010). Mobile phones and mobile phone rechargeable batteries have been increasing at an alarming rate since 2008/2009.

2.2 Collection of electronic waste initiatives in Malaysia

To develop a more established household e-waste collection system, the Malaysian Ministry of Energy has worked with the Japan International Cooperation Agency to implement a household e-waste collection policy. In connection with this policy, they carried out various pilot projects in different places in Malaysia to collect very small amounts of e-waste from households, and most of the e-waste collected was washing machines (JICA, 2014; Shumon *et al.*, 2014; Yong *et al.*, 2019). In addition, the Department of Energy has established several collection points for household e-waste. The Alam Alliance e-waste recycling program (e.g. Senheng Electric) managed most collection points (DOE, 2015a, 2015b, 2015c; DOE, 2018a, 2018b, 2018c).

The Malaysian Communications and Multimedia Commission (MCMC) is an organization managed by the Ministry of Communications and Multimedia of Malaysia. The MCMC has installed its e-waste collection boxes at the nearest locations for its program participants. They are also trying to disseminate information about the devastating consequences of waste of electrical and electronic equipment improper disposal to encourage households to abandon their old mobile phones (MCMC, 2018a, 2018b; Otto *et al.*, 2018). Telecommunications companies (e.g. Telco), schools/universities, retailers and corporate organizations are also involved in this program.

In addition to MCMC, two well-known mobile phone manufacturers, Nokia and Motorola, also distribute a limited amount of recycling facilities to users of their products. Nokia launched a waste management program called Nokia Kiosks in 2001. Under this program, they established collection points in only three cities of the country (Kuala Lumpur, Petaling Jaya and Puchong) (www.nokia.com.my/nokiakiosk). Another company, Motorola, provides seven collection points for users of its products to recycle their mobile phones as part of the ECOMOTO return program (www.motorola.com). It is reported on their website that information about these collection points is reported on their website.

In Malaysia, despite the growing trend of e-waste generation, households are not required to dispose of their e-waste in a recycling center (Yong *et al.*, 2019). Although the MCMC and DOE are trying to implement various e-waste recycling programs, they are criticized that their programs are mainly focused on cities and urban areas. As a result, the impact of their initiatives is so small compared to the growing trend toward the production of mobile e-waste.

Malaysia lacks information on e-waste disposal. Kalana (2010) stated that 43% of household members in Shah Alam, Selangor, Malaysia, were unaware of e-waste, and most participants were not concerned about the correct ways to dispose of their household e-waste. Many households sincerely do not want to discard their e-waste, as they believe that garbage is still priceless (Wang *et al.*, 2011a, 2011b; Shumon *et al.*, 2014). Contrary to their results, Afroz *et al.* (2013) found that most Malaysian households (59 %) from their Kuala Lumpur poll know the effects of e-waste on the environment and human health.

Some studies have shown that in some countries, such as Bangladesh and India, households do not want to dispose of their e-waste because they do not benefit if they recycle, and instead they have to pay e-waste recycling fees that can reduce their consumption revenue (Islam *et al.*, 2016; Song *et al.*, 2012), and in China, thanks to the availability of alternative models, consumers receive payment for the processing of e-waste (i.e. reverse logistics systems with automatic vending machines (Tong *et al.*, 2018).

In addition, Babayemi *et al.* (2017) stated that only a few of the selected respondents in their study tend to store their old and used mobile phones in their homes, and later they simply dispose of them along with their ordinary household waste; while few of them bring their old phones to Dropbox, distributed by laptop makers such as Dell. In addition, informal e-waste collectors are desirable for households that use an official e-waste collection system. Thus, Malaysian regulators planned to provide incentive schemes to the general public when they return their electrical and electronic equipment (JICA, 2014), but these schemes have not yet been effectively implemented across the country.

3. Literature review

Correct knowledge of household behavior and the factors that influence recycling behavior can help create more efficient and faster recycling programs in society to increase household participation in recycling programs. Therefore, it is important to investigate and conduct empirical studies to identify the tools responsible for handling behavior (Pakpour *et al.*, 2014; Kofoworola, 2007; Rahardyan *et al.*, 2004; Wilkinson *et al.*, 2007).

Although numerous studies related to behavioral inequality have been conducted to elucidate the factors that motivated behavior (Bakshan *et al.*, 2017), the relationship between people's intentions and behavior is poorly defined in the literature. There are also some studies that explain indicators of how people try, what level of effort they plan and what problems directly affect their behavior (Ajzen, 1991). Consequently, an analytical method of decision-making from a microstructural point of view is desirable, which includes the

Schwartz norm activation model (Van Liere and Dunlap, 1978), the theory of reasoned action (TRA) (Fishbein and Ajzen, 1980) and the TPB (Ajzen (1991).

3.1 Theory of planned behavior

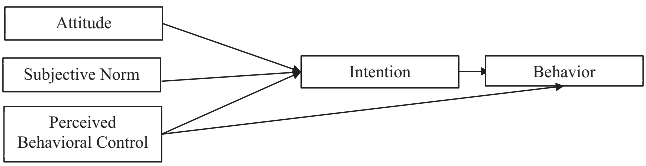
Against this background, a clearly defined TPB is an extension of TRA, offers a theoretical basis for recognizing behavioral factors during processing (Oztekin *et al.*, 2017) and is recognized as one of the most effective socio-psychological models that clarify behavior. TPB confirms that a person's intention is determined by three principles, including attitude, subjective norms and perceived behavioral control (Ajzen, 1993). "Attitude" means the degree to which a person evaluates behavior as satisfactory or unsatisfactory (Ajzen, 1991). "Subjective norms" are the result of the influence of external social characteristics on human behavior (Ajzen, 1991). "Perceived behavioral control" means for people an awareness of the ease of executing behavior (Ajzen, 1993) (Figure 1). In studying recycling intent, the importance of the TPB model is highly appreciated when comparing strong positive associations between the three above-mentioned constructs and recycling behavior using path analysis (Chan and Bishop, 2013; Mak *et al.*, 2019). The TPB model is shown in Figure 1.

In this study, the cost of recycling and the convenience of the available recycling infrastructure were measured as two parts of the proposed behavioral control variables, which were subsequently analyzed for household intentions to recycling. In addition to these variables, environmental knowledge and awareness are also taken into account, which are expected to stimulate the relationships.

3.2 Previous studies on recycling behavior

As studies of waste management behaviors are well thought out, it has been proven that TPB is a capable structure for identifying factors that influence people's behavior in recycling. For example, Kumar (2019) reported that respondent attitudes greatly inspire respondents to recycle their e-waste. Nixon and Saphores (2007) found that respondents' attitudes toward the environment greatly affected their willingness to pay advanced process fees for electronics.

Wang *et al.* (2016) reported that environmental awareness, attitudes toward recycling, the perception of informal recycling, revenues and recycling costs indirectly influenced the Chinese resident's intent on recycling e-waste. In another study also conducted in China, along with living conditions and economic benefits, the recycling habit and convenience of processing facilities and services were also two key additional precursors to the desire and behavior of Beijing residents to process e-waste (Wang *et al.*, 2011a, 2011b). Echegaray and Hansstein (2017) also found that the majority of women, middle-aged and low-income people surveyed in Beijing are positive about e-waste processing. Nguyen *et al.* (2018) argued that inconvenience to recycling negatively impacted behavioral intentions of residents on recycling, and some studies have shown that inconvenience to recycling did not



Source: Ajzen (1991)

Figure 1. Theory of planned behavior

significantly affect behavioral intentions. A more recent study by Gonul Kochan *et al.* (2016) concluded that people are aware of the consequences of processing, the more they are involved in processing activities and the more they feel the convenience of recycling, the more they participate in processing. More recently, Han *et al.* (2010) conducted a study on plastics processing in Pakistan. The results of their research show that subjective norms, awareness of the consequences and convenience are the main predictors of the intention to return/process. In the same year, Wang *et al.* (2019) conducted an online study on the behavior of Chinese people for waste management. The results of their study show that perceived behavioral control, subjective norms, attitudes and economic motivation were positively and significantly related to online readiness. The conceptual basis of this study is shown in Figure 1.

Many studies acknowledged the empirical and theoretical relation ration between environmental knowledge and intention of the households to do recycling (Wang *et al.*, 2016; Ramayah *et al.*, 2012). Many researchers establish that accurate knowledge on disposal has very dominant effect on the recycling behavior of the households (Kelly *et al.*, 2006). Moreover, several researchers also found that the households will participate more in recycling activities if they can receive more adequate knowledge about the importance of disposal, and how and where to dispose of it (Ramayah *et al.*, 2012). Therefore, the following hypothesis was proposed:

H1. Environmental knowledge and awareness are positively associated with attitude.

Chan (1998) reported that respondent attitudes determine their behavior. If a person is positive, he will be engaged in recycling, because he believes that if he disposes of e-waste, this will reduce environmental damage, increase the proper use of landfills and preserve the ecological environment. A study of the behavior of processors in Malaysia (Ramayah *et al.*, 2016) found that attitudes are an important predictor of the behavior of processors. Many studies have reported a positive and significant effect of attitudes on human behavior (Masud *et al.*, 2015; Afroz *et al.*, 2013). In contrast, some studies also report that attitudes do not significantly affect intention (Dixit and Badgaiyan, 2016; Lizin *et al.*, 2017; Wan *et al.*, 2014). Based on the literature sought in this study, the following hypothesis was put forward:

H2. The attitude is positively related to disposal behavior.

Existing research on behavior related to processing emphasizes that social norm is a critical factor. Singh *et al.* (2018) denote a subjective norm as a mixture of prohibitive and descriptive norms that follow the perception of satisfactory/unsatisfactory behavior by interactive relationships and neighboring societies. Many researchers report that household subjective norms and intentions were significantly and positively related (Echegaray and Hansstein, 2017; Lizin *et al.*, 2017). Based on these views, the following was suggested:

H3. Subjective norms are positively associated with processing behavior.

Many literary sources have found that the inconvenience and cost of disposal separately affects household behavior during disposal. For this reason, it is proposed to classify these two elements as two parts of perceived behavior control (Wang *et al.* (2016); Ramayah *et al.*, 2012). Convenience is an essential component of stimulating behavior during processing (Gonul Kochan *et al.*, 2016). In previous studies, it was found that people most often go to landfills when they make recycling available (Sidique *et al.*, 2010). If there are difficulties in storing waste and creating more places for collecting items to be recycled (Gonul Kochan *et al.*, 2016), households will be more motivated to participate in recycling activities.

Therefore, many studies show that convenience is associated with the intention of recycling (Wang *et al.*, 2015; Chen and Tung, 2010; Bezzina and Dimech, 2011). Thus, the evidence presented created the following hypothesis:

H4. Convenience of available recycling infrastructure is positively related to recycling behavior.

Diekmann and Preisendörfer (2003) put forward two hypotheses about the cost of disposal: low cost of disposal and high cost of disposal. They explained that psychological factors have different effects on behavior that is relatively less costly (low cost) compared to behavior that is more expensive (expensive). In fact, the cost of disposal depends on how people perceive the situation. Proposed to include the available time, distance, space and ease of processing operations for items of processing costs. Therefore, based on the literature, we propose:

H5. Cost of recycling is positively related to recycling behavior.

Figure 2 shows the extended TPB model that has been used in this study to test the hypotheses.

3.3 Methodology

The survey was conducted from January to April 2018. All respondents were owners of mobile phones and laptops. The issue of adequacy of sample size remains the main problem in the application of structural equation modeling (SEM). To obtain sample size, this study uses the most widely used formula presented by Yamana (1967), which is given below:

$$n = \frac{N}{1 + N(e)^2}$$

where:

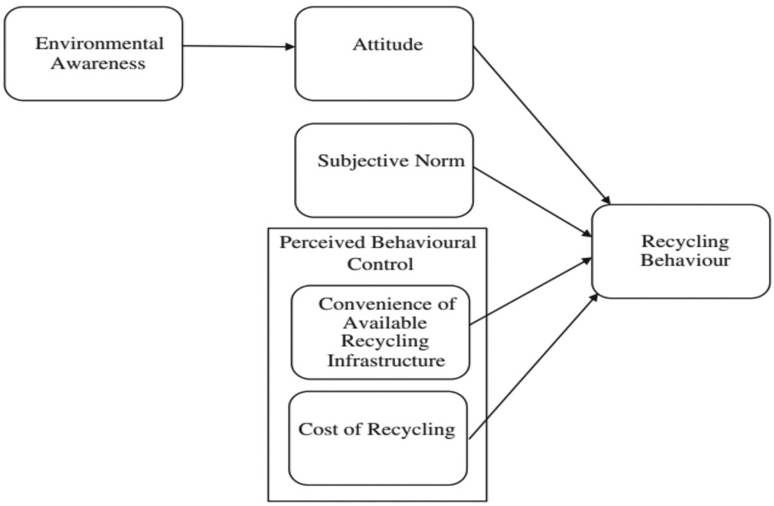


Figure 2. Extended theory of planned behavior

n = desired sample size;
N = the population size (7.2 million); and
e = level of precision or sampling error (sampling error in this study is 5%).

Based on the above formula, the required sample size required in this study is 399.77. Thus, it is considered equal to 400. It is calculated with a 95% confidence level and a 5% error rate. Data for this study were obtained from five different locations in the Klang Valley, including Shah Alam, Pekeling, Cheras, Gombak and Bandar-Tasik-Selatan. A total of 600 samples were randomly selected, and household heads were interviewed face-to-face. Of the 600 distributed questionnaires, 525 questionnaires were used to analyze the study. The questionnaire used in the survey of this study was compiled in two languages (English and Malay). The questionnaire consists of two sections. The first section includes issues related to the socio-economic conditions of households. The second section contains questions that were used to evaluate several elements of all the different TPB constructs (Table 1). The dependent variable was the intention of households to recycle. All responses were rated on a five-point Likert scale with 1 = strongly disagree and 5 = strongly agree.

3.4 Statistical analysis techniques

SEM (AMOS version 16) is used to establish the model. The maximum likelihood estimation was used in this study (Jöreskog and Sörbom, 1996). The SEM was analyzed using two-step procedures (Byrne, 2013; Anderson and Gerbing, 1988). First, we completed the confirmatory factor analysis (CFA) to confirm the reliability, convergent and divergent validity. Second, we completed the hypothesis testing to investigate the causal relationships between the latent variables. The method of maximum likelihood estimation was performed on each stage as suggested by Byrne (2001).

4. Analysis and results

4.1 Convergent validity

The CFA results presented in Table 4 shows that all the latent constructs have the composite reliability values of at least 0.70 and average variance error (AVE) of at least 0.50, it can be decided that the measurement model has an adequate convergent validity level (Table 2).

4.2 Discriminant validity

The results, as reported in Table 3, showed that the values in the rows and column of the table are smaller than the square root of AVE in the diagonal which confirms the discriminant validity of the model. So, it can be concluded that the model has adequate reliability, convergent validity and discriminant validity.

4.3 Structural model results

The hypothesis of the study was examined by conducting the structural model when the validity and reliability of the model is confirmed. Figure 3 shows the causative associations and fit indicators for the structural model. Figure 3 demonstrates that the value of λ^2/df for measurement model is 2.845. The value of adjusted good of fit indicator is 0.860. The values of normed fit index or Tucker Lewis index and comparative fit index are 0.920 and 0.930, correspondingly. Moreover, value of root mean square error approximation is 0.069. The outcomes of the model confirm that it can efficiently reproduce the covariance matrix.

Attitude	E-waste recycling is enjoyable (Att1) E-waste recycling is decent (Att2) E-waste recycling is accountable (Att3) E-waste recycling is helpful (Att4) E-waste recycling is relaxed (Att5)	Kumar (2019), Oskamp *et al.* (1991), Cheung *et al.* (1999), Tonglet *et al.* (2004)
Subjective norm	I think that most of the people who are significant to me should participate in the recycling of e-waste (SN1) My friends/peers anticipate me to recycle (SN2) Most people who matter to me would support my recycling of e-waste (SN3) Specialists expect me to recycle (SN4)	Ajzen (2002), Tonglet *et al.* (2004), Kumar (2019)
Environmental-related knowledge and awareness	Recycling is a main method to decrease pollution (EW1) Recycling is a main method to decrease extravagant usage of dumping site (EW2) Recycling is a main method to preserve natural environment (EW3)	Ramayah *et al.* (2016), Kelly *et al.* (2006), Wang *et al.* (2016)
Convenience of available recycling infrastructure	I am used to drop off my mobile phone into the collection boxes in my area (CRI1) There are enough collection boxes of mobile phones in my area (CRI2) I trust that there are enough websites in Malaysia that will support to decrease the pollution to the environment (CRI3)	Ramayah *et al.* (2016), Wang *et al.* (2012), Chen and Tung (2010), Bezzina and Dimech (2011)
Cost of recycling	E-waste recycling is an relaxed task for me (CR1) There are sufficient place in my house to stock the e-waste (CR2) I have sufficient time to sort the e-waste and other waste for purpose of recycling (CR3)	Ramayah *et al.* (2016), Wang *et al.* (2012), Chen and Tung (2010), Bezzina and Dimech (2011), Sidique *et al.* (2010)
Intention to recycle	My intention is to make strategies to recycle e-waste frequently (IN1) My intention is to recycle e-waste (IN2) My intention is to put additional determination into recycling e-waste (IN3)	Holland *et al.* (2006), Kumar (2019)

Table 1. Measurements of constructs

Table 4 shows the summary of the measurement model. The value of R^2 is 0.79, which describes that the independent variables explained 79% of the discrepancy in intention of the households. The results of hypothesis testing demonstrate that the coefficient of environment awareness is 0.30 and it affects attitude positively and significantly at 1% level of significance. This result is consistent with other studies who also prove that knowledge of the individuals about the recycling scheme is a significant and positive determinants of the attitude of the individuals (Kelly *et al.*, 2006; Ramayah *et al.*, 2012). But this was not proved true in a recent study conducted by Noordin and Sulaiman, (2010) on environmental awareness among secondary students in Malaysia. They found that although the students are aware of environment, they find it hard to make their own environment better.

In this study, the coefficients of attitude and convenience of available recycling infrastructure are 0.08 and 0.56, respectively. Both of the variables positively and significantly affect intention of the households to drop off their mobile phones at 1% level of significance. Furthermore, subjective norm (β = 0.09, $p > 0.05$) and cost of recycling (β =

Variable	Item	Corrected item-to-total correlation	Cronbach's α	Factor loading λ	AVE	Composite reliability
Attitude	Att1	0.929	0.938	0.815	0.739	0.825
	Att2	0.923		0.856		
	Att3	0.915		0.908		
	Att4	0.919		0.876		
	Att5	0.921		0.871		
Subjective norm	SN1	0.708	0.766	0.746	0.540	0.939
	SN2	0.711		0.753		
	SN3	0.711		0.712		
	SN4	0.789				
Environmental-related knowledge and awareness	EW1	0.858	0.891	0.892	0.716	0.882
	EW2	0.848		0.904		
	EW3	0.861		0.731		
Convenience of available recycling infrastructure	CRI1	0.780	0.834	0.832	0.607	0.822
	CRI2	0.785		0.753		
	CRI3	0.781		0.780		
Cost of recycling	CR1	0.938	0.944	0.740	0.611	0.825
	CR2	0.927		0.741		
	CR3	0.926		0.813		
Intention to recycle	IN1	0.935	0.939	0.784	0.755	0.939
	IN2	0.920		0.877		
	IN3	0.919		0.917		

Table 2.
The results of CFA

0.09, $p > 0.05$) are not important factors of recycling intention. The previous studies also show that subjective norm does not have significant impact on recycling intention (Dixit and Badgaiyan, 2016; Lizin *et al.*, 2017; Wan *et al.*, 2014; Ghani *et al.*, 2013). Thus, the results of the hypotheses testing follow *H1*, *H2* and *H4* and they do not follow *H3* and *H5*. Convenience of recycling infrastructure has the largest coefficient followed by attitude of the individual.

Surprisingly, the results also revealed that coefficient of the costs of recycling is positive but it is not significant. It is in discrepancy with the results from some of the previous studies. For example, Ramayah *et al.* (2012) found that although cost of recycling is not a significant predictor of recycling behavior but it has negative association with the intention of recycling. However, Nguyen *et al.* (2018) reported that in the case of Vietnam, people are more concern about their health than their expenditure they have to spend on recycling

	CR	ATT	SN	EW	CRI	INT	Minimum	Maximum	Mean	SD
CR	0.782						1	5	3.45	0.932
ATT	0.203	0.866					1	5	2.41	0.954
SN	0.226	0.455	0.735				1	5	2.66	0.981
EW	0.169	0.249	0.205	0.846			1	5	3.89	0.727
CRI	0.233	0.241	0.322	0.663	0.779		1	5	4.00	0.645
INT	0.233	0.235	0.292	0.528	0.575	0.869	1	5	4.03	0.710

Notes: CR = cost of recycling; ATT = attitude; SN = subjective norm; EW = environmental knowledge; CRI = convenience of recycling infrastructure; INT = intention to recycle

Table 3.
Discriminant validity and descriptive analysis

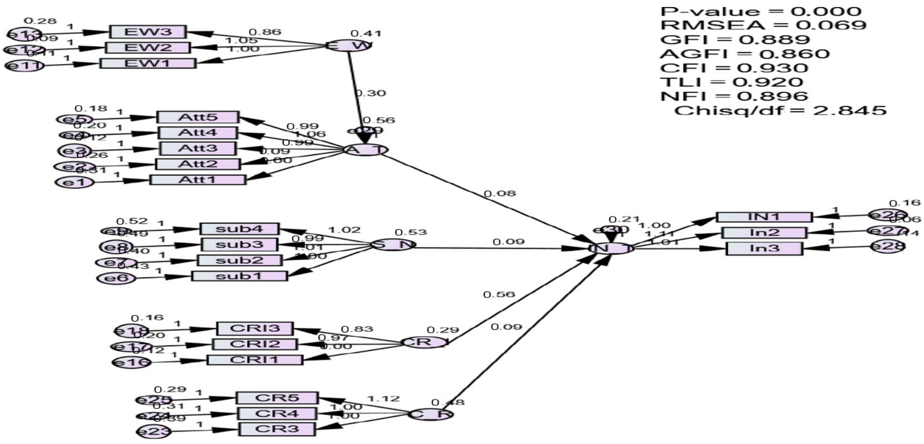


Figure 3.
The structural model

e-waste. This idea is also supported by the strong relationship between the awareness and recycling intention as analyzed above. When citizens are well aware of the risks associated with toxins in e-waste, they tend to pay more attention to protecting their health and are willing to participate in the recycling of e-waste, despite the costs they have to pay. This suggests that cost is not a big problem for residents when they agree to join in recycling activities.

5. Discussion, conclusion and recommendations

This study used an extended TPB to provide a better understanding of how attitudes, subjective norms and perceived behavioral control influence households in the Klang Valley to drop-off their mobile phones to the nearest collection points. Obviously, examining the behavioral intentions for e-waste disposal is extremely important, which is considered an important milestone and provides a solid foundation for the success of e-waste management in a developing country like Malaysia. Especially, in the context of the rapidly growing amount of e-waste, while current e-waste legislation is not very effective.

The results of this study show that environmental knowledge and awareness have a significant impact on attitudes toward recycling intention of the households. In addition, it was also found that the attitude and cost of disposal infrastructure is positively related to household intention. To raise household awareness, adequate information must be provided on the advantage of recycling e-waste and the location, method and incentive for e-waste

Path	Hypothesis	Path coefficient	*t*-value	Results
EA → ATT	*H1*	0.30	4.562**	Supported
ATT → INT	*H2*	0.08	3.269**	Supported
SN → INT	*H3*	0.09	1.345	Not Supported
CRI → INT	*H4*	0.56	9.205**	Supported
CR → INT	*H5*	0.08	1.456	Not supported
R^2 = 0.79				

Notes: CR = cost of recycling; ATT = attitude; SN = subjective norm; EW = environmental, knowledge; CRI = convenience of recycling infrastructure; INT = intention to recycle. $**p < 0.01$ and $*p < 0.05$

Table 4.
Summary of the structural model

disposal (Tanskanen, 2013). Chibunna *et al.* (2012) postulated that awareness of e-waste management at National University Malaysia is still seriously lacking. Consequently, their study showed that to raise awareness, the government should deliver additional facts on e-waste management in formal and informal classes and seminars. In addition, it can be suggested that the manufacturer of mobile phones must deliver info on how to dispose of it and its significances, if not disposed of properly. For example, Nokia and Motorola could notify, disseminate and introduce recycling to the local population through better-understood advertising, promotions and channel more resources to recycling activities like those practiced in Taiwan (Chen and Tung, 2010).

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Corresponding author
Rafia Afroz can be contacted at: rafia@iium.edu.my