Extend Theory of Planned Behavior for Recycling in Electronic Waste

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Abstract

Electronic waste (e-waste) is generated at a rapid pace when there are millions of electronic appliances including mobile phones, televisions, computers, laptops, and tablets have very short time lifespans. In addition, e-waste is classified as any types of electric and electronic merchandises that have no value to consumers. Even though e-waste is known as trash, but it can be used as a secondary resource to decrease the number of hazardous contents that may harm the environment. Despite being thrown away, e-waste can be reused, resold, recovered, remanufactured, and recycled. Theory of Planned Behavior (TPB) is used as an underpinning theory to examine the factors that influence consumer's behaviour towards e-waste recycling in Malaysia. TPB is a classical theory to predict one's beliefs and behaviour. The theory shows that attitude, subjective norms, and perceived behavioural control could explain an individual's behavioural intentions and behaviours. However, TPB is insufficient to explain pro-environmental actions such as returning e-waste. Recycling behaviour involves external resources and expertise. Thus, this study extended the theory by incorporating other factors such as awareness of the environment consequences, perceived convenience, and moral obligation. This study will use an online survey. Data will be selected and collected from respondents in Malaysia who age above 18 years old and use electronic products via purposive sampling method. Structural equation modelling (SEM) approach will be employed for data analysis and hypotheses testing. The findings of this review are significant to the government, organizations, electronic consumers and researchers that e-waste recycling can be enhanced using extended TPB.

Keywords: Electronic waste (e-waste), Electronic Appliances, Recycling, Theory of Planned Behavior (TPB)

Introduction

Electronic waste (e-waste) is one of the world's fastest emerging waste categories, with the highest growth rate, which is about 3 percent to 5 percent per year (Isernia et al., 2019). Leblanc (2020) indicated that global e-waste generation is expected to reach 50 million tons by 2020, with an annual increase of between 4 percent and 5 percent. While by 2021, it is estimated that the annual total of e-waste will reach 57 million tons (Larmer, 2018). Unfortunately, only 20 percent of this tremendous amount of electronic waste was recycled into some useful sense. The remaining 80 percent were usually will be disposed at the landfill, which will cause harm to the environment (Vaute, 2018). Apart from that, based on the current United Nations' report, the United States generates around 6.3 million tons of the world's e-waste, which is approximately 14 percent. The recycling rate in the United States is close to 25 percent (Vaute, 2018). Also, for Asian country like Japan has generated 2,139 kilo tonnes of e-waste, and only 26 percent were formally collected (Leblanc, 2020). While Malaysia has generated 8.8kg of e-waste per person in 2016, which totalling 280 kilo tonnes (Department of Environment, 2019). According to the Malaysian government statistics, about 25 percent of the e-waste in this country is recycled, the remaining of e-waste which is not properly recycled, is worth about RM3 billion (The Straits Times, 2019). Recently, e-waste is becoming the world's current problems in waste

generation (Laha, 2015). This is because Leoi (2019) claimed that e-waste includes chemical substances such as chlorofluorocarbon and flame retardants and dangerous metals like mercury, lead, and cadmium. Yong et al. (2019) also agreed that e-waste contains cytotoxic metals and chemical substances that may cause negative surroundings and health impacts. Thus, e-waste will release greenhouse gasses and ozone-depleting substances. For instance, the refrigerator and air-conditioner contain chlorofluorocarbons (CFCs) (Freon) gases which have a high potential for global warming and contribute significantly to ozone depletion. Degradation of ozone could lead to an increase in ultraviolet (UV) radiation to the surface of the earth and skin cancers (Department of Environment, 2019).

On the other hand, E&E waste are also highly valued as secondary raw materials such as gold and cooper. Leoi (2019) also added that most e-waste contains precious metals (such as gold, silver, platinum and palladium), iron, copper, aluminium and plastics that can be extracted and sold. Widmer et al. (2005) indicated that the recovery of these materials from e-waste is now becoming a profitable venture. Since a large number of precious metals are in e-waste, the recovery of e-waste will signify an appropriate economic advantage because it will help to save spending on limited and costly resources needed for the production of new electronic goods (Isernia et al., 2019).

Lau and Wang (2019) claimed that dumping the e-waste in landfills is not a practical solution. This is because some of these discarded electronic products do contain value-added substances after implementing the appropriate recovery or remanufacturing process. Hence, e-waste leads to a profitable business in developed countries. Despite being thrown away, it is supposed for reuse, resale, recovery, remanufacture, recycling, or disposal. Hence, previous researchers have indicated that there are three ways to dispose e-waste such as burning, recycling, and landfilling. However, from these three methods, recycling is the most suitable way to successfully reducing the e-waste efficiently (Sharif and Keat, 2017).

Indeed, recycling is famous as cost-effective for job prosperity and act as pollution reductions, which simultaneously offers both employment creation and economic development opportunities (Whitmarsh, 2009). Moreover, Malaysia also has the viewpoint that recycling is a method or solution to overcome the environmental, social and economic issues (Omrani et al., 2009).

Therefore, the purpose of this paper is to propose a new framework by extending the theory planned of behavior (TPB) to investigate the factors of intentions and behavior towards e-waste recycling among consumers in Malaysia. This study will use an online survey. Data will be selected and collected from respondents in Malaysia who age above 18 years old and use electronic products via purposive sampling method. Structural equation modelling (SEM) approach will be employed for data analysis and hypotheses testing.

Literature Review

It is very crucial to recognize the determining factors of consumers' intention to return the e-waste to the manufacturers or local authorities rather than keep it at home so that the manufacturers can implement reverse logistics on the e-waste products (Dixit and Badgaiyan, 2016). For this study, Theory of Planned Behavior (TPB) is used to examine the factors that influence consumer's behaviour towards logistics e-waste recycling in Malaysia. Returned behavior is subject to a large number of non-psychological limitations such as access to appropriate networks is not under people's controls (Heath and Gifford, 2002). Thus, TBP is an appropriate tool for predicting pro-environmental actions such as returning e-waste (Dixit and Badgaiyan, 2016; Echegaray and Hansstein, 2017).

However, the TPB model in recycling has limitations because it is complicated for the model to predict or determine behavior that is not from the personal desire and decision. Recycling behaviour involves external resources and expertise (Strydom, 2018). For instance, one of the key factors for the unwillingness to recycle e-waste in developing countries is because of the shortage of recycling facilities (Sidique et al., 2010). Apart from that, Dixit and Badgaiyan (2016) claimed that consumers might not be interested in recycling their e-waste if there are no incentives provided when they are returning the e-waste. Also, when the location to dispose of their e-waste is not strategic and far from their residential. Hence, this return behavior is derived from moral obligation. In addition, Akhtar et al. (2014) found that vast numbers of consumers do not know that e-waste would cause environmental and human health problems. Thus, the percentage to recycle and return the e-waste is still low among consumers.

Therefore, in order to overcome the limitations of TPB model in e-waste recycling studies, many researchers have extended the TPB model by adding other factors to influence the consumer's behavior such as moral norms, sense of duty, convenience and infrastructure to explore the return or recycling behaviors of consumers (Kumar, 2019). Ling et al. (2018) also indicated that some researchers had extended the TPB model to provide new variables since this can enhance the model's overall percentage of variation in recycling behavior. For example, Dixit and Badgaiyan (2016) developed an extended TPB model by adding other variables such as moral norms, willingness to sacrifice, and anticipate positive emotions to investigate e-waste return intention and behavior. While some of previous researchers (Tonglet et al., 2004; Wan et al., 2012; Akhtar et al., 2014; Saphores et al., 2012; Echegaray and Hansstein, 2017) extended the TPB model by adding awareness towards the environmental consequences to examine the determinants of consumer intentions and behavior towards e-waste recycling. On the other hand, some studies believed that by making recycling more convenience will improve

the recycling intentions of consumers and enhance recycling behavior (Saphores et al., 2006; Sidique et al., 2010; Sharif and Keat, 2017; Haron et al., 2018; Zhang et al., 2019). Therefore, to addresses the limitations, this study develops an extended TPB model to investigate consumer recycling intention and behavior in Malaysia by adding other variables such as awareness of environmental consequences, perceived convenience, and moral obligation.

Attitude

Attitude refers to the level in which an individual has a positive or negative evaluation or assessment of the behavior concerned (Ajzen, 1991; Tonglet et al., 2004; Kumar, 2019; Kochan et al., 2016). However, Kaiser et al. (1999) claimed that attitude involves not only assessing a particular result, but also calculating the probability of the outcome and providing great facts as experiential knowledge is a fundamental requirement for every kind of attitude.

According to Greaves et al. (2013), recycling attitudes can be formed by having a favourable assessment towards the recycling, for instance, a person should assume that waste disposal is responsible, conscientious, and convenience to be performed. Apart from that, Wang et al. (2018) claimed that recycling attitude can be increased by raising awareness of environmental protection among residents and constantly guiding the residents with recycling attitudes. While Echegaray and Hansstein (2017) stated that attitude recycling is motivated by the belief that recycling is beneficial for both the environment and human health. However, Tonglet et al. (2004) indicated that recycling attitudes are shaped by getting adequate incentives, easy access to disposal centers, having a good knowledge towards recycling and not dissuading issues or challenges of physical recycling. On the contrary, Wan et al. (2012) believed that recycling attitude could be accomplished via educational and promotional programs. For example, by emphasizing the powerful and influential needs to recycle and show the people how recycling behaviour can change the beliefs and principles of an individual towards a safer environment. In this study, a recycling attitude can be described as the degree to which participants measure their recycling behavior such as e-waste recycling is consumer's responsibilities, e-waste recycling is such a good and pleasant to conduct and e-waste is sensible to conduct (Kumar, 2019).

Subjective Norms

Subjective norm means beliefs perceptions, pressures, and factors that can be either positive or negative from one's social group (Ajzen, 1991; Kumar, 2019). Singh et al. (2018) defined social pressure as a mixture of injunction and descriptive norms that reflect social networks and immediate surrounding societies' beliefs of certain behaviour.

According to Kochan et al. (2016), since recycling behavior is more likely to include elements of moral and social responsibility, perceived norms can be considered as a significant predictor of recycling behavior. Wang et al. (2018) stated that subjective norms in the recycling could be formed by implementing suitable rules and regulations on e-waste recycling as well as the behaviour and the mentality of surrounding people will influence the eagerness of the residents to engage in a recycling process. Moreover, Dixit and Badgaiyan (2016) claimed that a person will not engage in behaviour like recycling if pro-environmental activities such as recycling in society are not publicly adopted even though if that person has strong personal values about environmental issues. In this study, recycling behavior stresses that social or peer pressure is a significant influencer of e-waste recycling intention (Kumar, 2019).

Perceived Behavioral Control

Perceived behavioral control (PBC) is the perception and understanding of the capability of a person based on his or her previous experience and perceived challenges or difficulties to perform certain behavior (Wang et al., 2019). While Dixit and Badgaiyan (2016) indicated that PBC is described as the degree of control that a person perceives in the action that he or she is going to perform.

According to Echegaray and Hansstein (2017), the existence of nearby disposal facilities could influence PBC in recycling so that the consumers believes they can save their time to conduct e-waste recycling activities. On the contrary, Wang et al. (2018) indicated that PBC is primarily evaluated by the experience of recycling. Hence, a person with experience in recycling is more interested in taking part in further recycling compared to a person who does not has experience

in recycling activity. Similarly, Tonglet et al. (2004) claimed that PBC in the recycling could be measured when individual beliefs of possible effortlessness or complexities involved in performing certain behaviors such as recycling. For example, a person who is confident in recycling such as knows how, where and when to recycle is more likely to express and conduct recycling behavior compared to someone who feels they have less control over existing or potential constraints to perform that behavior. In this study, PBC in recycling could be measured when individual beliefs of potential convenience or complexities associated with conducting certain behaviors such as recycling (Tonglet et al., 2004). While Dixit and Badgaiyan (2016) indicated that PBC is described as the degree of control that a person perceives in the action that he or she is going to perform.

Awareness of Environmental Consequences

Awareness of consequences is known as a person's knowledge and understanding of environmental effects when a person acts in a certain behaviour (Kochan et al., 2016). Generally, individuals also tend to choose to survive with little or no pollution, which is in a safe and healthy environment. As such, individuals who are willing to change, more compassion and empathy for others and seem connected to nature are more probably to be environmentally friendly or engage themselves in recycling (Haron et al., 2018).

Saphores et al. (2012) indicated that a key element of e-waste recyclers is awareness of the environmental consequences of e-waste. Generally, individuals also tend to choose to survive with little or no pollution, which is in a safe and healthy environment. As such, individuals who are willing to change, more compassion and empathy for others and seem connected to nature are more probably to be environmentally friendly or engage themselves in recycling (Haron et al., 2018). In this study, awareness of environmental consequences can be described as individuals believe that recycling the e-waste can conserve and preserve energy and natural resources, reduce pollution, and protect human health (Ho et al., 2013).

Perceived Convenience

Wan et al. (2012) claimed that perceived convenience is the concept of which a person feels that the availability of time to remove, sort and store e-waste will impact his or her e-waste recycling behavior. Sidique et al. (2010) and Valle et al. (2005) indicated that one of the main factors of unwillingness to reuse e-waste in developing markets is because of the shortage of recycling facilities in which it contributes to inconvenience for the consumers to recycle the e-waste.

Apart from that, Tonglet et al. (2004) and Sidique et al. (2010) claimed that by making recycling more convenience will improve the recycling intentions of consumers and enhance recycling behaviour. Therefore, the condition of the logistic waste collection structure is very important, including providing adequate physical proximity of recycling bins and curbside collection in order to achieve more consumer participation in recycling. In this study, the perceived convenience towards recycling can be explained when there is an appropriate logistic waste collection structure for the consumers, including the physical closeness of recycling bins or the provision of container collection for the consumers (Ho et al., 2013).

Moral Obligation

Botetzagiasa et al. (2015) highlighted that the presence of a personal moral obligation in the TPB model is based on the belief that conducting certain behaviors would not only rely on the rational, price-benefit calculations inherent in TPB but also about unselfish, compassionate or pro-social motives. While Godin et al. (2005) have proposed that TPB should consider the importance of internalized norms such as moral norms in establishing intrinsic motivations for the adoption of a particular behavior.

According to Thøgersen (2009), returning e-waste might be pricey because customers may be needed to go to the disposal center to deposit their e-waste, as well as the motivation to perform recycling behavior could be intrinsic when there are no incentives. Therefore, this kind of behavior can be defined as moral rather than rational in which it derives from moral norms (Dixit and Badgaiyan, 2016). In this study, moral obligation towards recycling can be perceived as an intrinsic motivation for the adoption of a particular behavior, which can lead to the creation of the intention to recycle (Tonglet et al., 2004).

E-waste Recycling Intention

Intentions can be defined as a good predictor of behaviour, and it can produce the strongest reliable predictor of behavior if a suitable

measure of intention can be achieved (Fishbein et al., 1980; Mahmud and Osman, 2010). Moreover, intentions represent certainty about the potential expected outcome in a given situation and also represent the degree of readiness and level of effort to achieve a desired result (Ajzen, 1991; Dixit and Badgaiyan, 2016).

Kochan et al. (2016) defined recycling behavioural intention as the extent in which a person assumes that his / her intention to recycle e-waste, such as drop the e-waste at a pickup point or return e-waste to collectors or producers. This intention would have an impact on recycling behavior. Similarly, Nguyen et al. (2018) identified that recycling behavioral intention as the probability and tendency of consumers to recycle e-waste in the future to the formal waste management sectors. Philippsen (2015) described recycling behavioral intention as the effort intended by individuals to transform waste into valuable material. In this study, the behavioural intention of consumers to participate in e-waste recycling activities means that consumers tend to engage with authorized e-waste recycling agencies to handle the e-waste, take part in government green campaigns and inform relatives about the advantages of e-waste recycling as well as has the intention to drop the e-waste if there are authorized collection structures accessible (Nguyen et al., 2018).

E-waste Recycling Behavior

Bamberg and Moser (2007) have defined recycling behaviour as a combination of self-interest, such as adopting a plan that significantly reduces one's own health risk and concerns for other people or natural ecosystems, including the prevention of air pollution and emissions which could pose dangers to the people's health and/or the global climate. Similarly, Kollmuss and Agyeman (2002) defined recycling behavior as behavior that aims to reduce the bad effect of individual's behavior on the environmental and develop new sustainable community such as reducing the usage of resources and energy, use more of non-toxic materials, and reducing the generation of waste. In this study, e-waste recycling behaviour as the degree to which a person decides to donate or intends to resell and store the e-waste (Kochan et al., 2016).

A representation of the extended version of the TPB is depicted in Figure 1. In this framework, besides the key components of the TPB (attitudes, social norms and perceived behavioural control), other variables such as awareness of the environment consequences, perceived convenience, and moral obligation factors are added as predictors of e-waste recycling intention and behaviour for the study.

Figure 1. Proposed research framework

Methodology

This study aims to investigate the factors of intentions and behaviour towards e-waste recycling among consumers in Malaysia by using an extended TPB model. As the study uses the extended TPB model and develops hypotheses to examine the determinants that can influence recycling intention and behaviour, thus a descriptive study is the most suitable research design to be used in this study as well as quantitative approach for data collection and analysis of the study by testing the hypotheses that have been developed by using the extended TPB. The sampling size technique used in this study is G*Power analysis. After calculating by software G*Power, the total minimum sample size is 138. Non-probability sampling technique is chosen using purposive sampling method. This is because the targeted respondents for this study are Malaysians who aged 18 to 69 years old which have purchasing power of electrical and electronic products and have

intention to recycle the electrical and electronic products. For data analysis, Smart Partial Least Squares (PLS) 3.2.9 will be used to test model validity, reliability and hypotheses.

Conclusion

In conclusion, this study focuses on investigating the impact of attitudes, subjective norms, perceived behaviour control (PBC), awareness of the environmental consequences, perceived convenience, moral obligation and e-waste recycling intention as well as e-waste recycling intention and e-waste recycling behaviour in Malaysia by using an extended TPB framework. Thus, from the academic perspective that conducting similar studies could be used this paper as a resource for their studies, especially in investigating the intention and behaviour of consumers towards e-waste recycling by incorporating a new approach by using an extended TPB framework. In addition, the findings and results of this study might theoretically be beneficial to the government in an attempt to encourage environmental, social, and economic sustainability. For example, the government may encourage consumers to return such unwanted electrical and electronic goods to licensed recovery facilities and implement more e-waste recycling programmes or initiatives, especially to consumers or community. So that consumers will realize that e-waste should be recycled to reduce contamination of the environment and human health. This study also can help to enhance awareness for the government to introduce new legislations or structures to handle and cope with the ever-increasing e-waste in which have been generated by consumers in an effective method. This is because the unlicensed recovery facilities handle most of these e-wastes. From the industry context, especially in the electronics industry, they will be more conscious that e-waste can obtain environmentally friendly treatment through an appropriate management strategy as well as implementing systematic reverse logistics techniques. Therefore, through the process of remanufacturing, reconditioning and recycling the e-waste, the industry can recapture valuable components from e-waste and produce more eco-friendly goods.

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