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EXAMINING THE HOUSEHOLDS E - WASTE RECYCLING INTENTION: APPLICATION OF THEORY OF PLANNED BEHAVIOR

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Abstract

The purpose of this study is to analyze the factors that influence people's recycling intention to recycle e-waste. Research on the factors that encourage household interactions in sorting waste or recycling waste is a priority due to low participation in the e-waste recycling process. This study aims to build a model and examine the relationship between variables. It is based on the Theory of Planned Behavior (TPB). We studied mobile phone and laptop users who had changed their phones. A total of 324 respondents were selected by the purposive sampling method. Multiple regression was used to analyze the data. The results show that Theory of Planned Behavior and additional variables (environment awareness & knowledge, convenience and recycling costs) are also positively related to household recycling intention. Using the results, policy implications and research limitations were discussed.

Keywords: Theory of Planned Behavior,Environmental Awareness and Knowledge, cost of recycling, convenience.

1. Introduction

The combined production of electronic waste (e-waste) in 2016 was 6.1 kg per capita (kg/inch), up from 5.8 kg/inch in 2014. The amount of e-waste is predicted to increase to 6.8 kg/inch by 2021. As of 2016, Asia generated the largest amount of electronic 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). According to Baldé et al. (Solving the e-waste problem), there were 77 kilotons of e-waste generated in 2017 and 7.6 kg per person in 2016. Approximately 10 million tons of e-waste are expected in 2020, and a 14% annual increase is expected due to televisions and mobile phones (Shumon et al., 2014).

During the initial stages of e-waste processing, garbage collectors, workers without personal protective equipment, and the environment suffer significant health consequences. Due to the scarcity of resources and the need for proper waste management, a recycling policy is very important (Oguchi et al., 2013). Recycling also reduces greenhouse gas emissions, saves energy and materials, improves human health, and creates jobs (Hotta et al., 2014). Therefore, these rules do not provide any data on technological waste, practices, and economic conditions, even though effective management of e-waste greatly impacts e-waste disposal (Zeng et al., 2017). Thus, these rules provide no data on current technological waste, practices, or economic conditions, although effective management has an important impact on how e-waste can be disposed of (Zeng et al., 2017).

In order to increase consumer intentions to participate in environmental behavior, adequate knowledge about consumer behavior regarding e-waste is necessary. In previous studies, it has been shown that awareness of recycling norms, infrastructure and disposal services availability, housing conditions, economic benefits, information about e-waste's potential toxicity, and previous experience recycling e-waste also affect a consumer's decision to recycle. Furthermore, some studies have found that gender and marital status are also significant predictors of disposal behavior (Saphores et al., 2012; Wang et al., 2016; Wang et al., 2011a, 2011b).

As technology and the economy have advanced rapidly in the last few decades, electronic products have become more affordable, increasing their consumption (Andarani, P Goto N 2014). As people consume more electronic products, e-waste also increases. In developing countries, e-waste management has become one of the most challenging problems (Arya, S, Kumar 2020). According to

Illankoon et al (2018), it is one of the fastest-growing waste categories in the world, with a growth rate of 3–5% per year. It is difficult for developing countries, such as India, to handle large volumes of e-waste. According to the Global E-waste Monitor 2017-Quantities, Flows, and Resources-the Indonesian population produced 1.274 million tons of e-waste in 2016, which is an average of 4.9 kg per capita. According to these data, Indonesia is the 9th largest producer of e-waste in the world.

Smartphones account for the largest proportion of e-waste. Smartphone usage increased worldwide due to the Coronavirus pandemic. As a result of this pandemic, many people worked online and studied online, resulting in the use of electronic communication devices, especially smartphones. For smartphones, laptops, and personal computers, the proportions are 70%, 40%, and 32%, respectively. https://www.statista.com/statistics/1106607/device usage due to Corona virus - world - wide - by - country

Pollution can be caused by improper waste handling. A large amount of e-waste contributes to ozone depletion, causing high environmental impacts (UNEP 1987). In order to minimize the impact on the environment and increase the economic value of waste, an e-waste management system must be designed. The value of e-waste can be recovered even though it is classified as hazardous waste Illankoon et al (2018)). In order to prevent negative impacts on humans and the environment caused by mishandling e-waste, proper e-waste management procedures, including reverse logistics (RL) management networks, should be in place.. By collecting and managing waste, a sustainable supply chain can be created.

In order for waste management networks to succeed, consumers must play a crucial role. Consumers' willingness to participate as waste suppliers determines whether the network will operate.Because the theory of planned behavior (TPB) is a very systematic, theoretically sound, successful and proven approach, it can be used to identify factors that influence households' e-waste disposal decisions. Because of these advantages, TPB has been proven useful in identifying environmental factors in numerous previous studies (Yazdanpanah, 2016).

Additionally, TPB is familiar because it is applicable to a variety of topics, cultures, and societies (Klöckner, 2015). The TPB can be used for explaining pro-ecological behavior in a number of areas, such as tourism sustainability (Han et al., 2010), transport use (Heath and Gifford, 2002), energy use (Abrahamse and Steg, 2009) and water conservation (Lam, 2006). TPB has also outperformed other decision models associated with this study in some cases. Kaiser et al. (2005) and Aguilar-Luzon et al. (2012) found that TPB predicts pro-ecological behavior better than the theory of norms of belief in value introduced by Stern et al. (1999). Nevertheless, many studies analyze the determinants of processing behavior using the expanded TPB model, including moral standards, convenience, infrastructure, and a sense of duty (Kumar, 2019).

In emerging markets, however, there is insufficient research on household intentions to process and their participation in e-waste management. Using the extended TPB model, very few studies have examined the behavior of household e-waste disposal in Malaysia. Using an extended TPB model, this study examines the key determinants that influence households' intentions to abandon their electronic waste at a collection center. The remainder of the article is organized as follows: Section 2 discusses e-waste management in Malaysia. Section 3 presents a theoretical research model, hypotheses based on previous studies, data sources, and research methods. Section 4 discusses the study's results. Section 5 summarizes the conclusions of this document and makes relevant policy recommendations.

2. Theory of Planned Behavior

In order to increase household participation in recycling programs, it is crucial to have a correct understanding of household behavior as well as the factors that influence recycling behavior. Consequently, empirical studies must be conducted in order to identify the tools responsible for dealing with behavior (Pakpour et al., 2014; Kofoworola, 2007; Rahardyan et al., 2004; Wilkinson et al., 2007).

TPB is a clear extension of TRA, provides 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 for clarifying behavior. Three principles determine a person's intention, including attitude, subjective norms, and perceived behavioral control (Ajzen, 1993). "Attitude" refers to the degree to which a person evaluates a behavior as satisfactory or unsatisfactory (Ajzen, 1991). In other words, "subjective norms" result from the influence of external social characteristics on human behavior (Ajzen, 1991). The concept of “perceived behavioral control” refers to the ease of executing a behavior for an individual (Ajzen, 1993) (Figure 1). It has been recognized that the TPB model is highly valuable when comparing the strong positive associations between the three above mentioned constructs and recycling behavior using path analysis (Chan and Bishop, 2013; Mak et al., 2019). Figure 1 shows the TPB model. 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. These variables were subsequently analyzed for household intentions to recycle. In addition to these variables, environmental knowledge and awareness are also taken into account, which are expected to stimulate the relationships.

2.1 Previous studies on recycling behavior

TPB has proved to be a useful structure for identifying factors that influence people's recycling behavior, as studies of waste management behaviors are well thought out. The attitudes of respondents, for example, greatly influence their desire to recycle e-waste, according to Kumar (2019). According to Nixon and Saphores (2007), respondents' attitudes toward the environment influence their willingness to pay advanced processing fees for electronics. As reported by Wang et al. (2016), environmental awareness, attitudes toward recycling, informal recycling perception, revenues, and recycling costs indirectly affect Chinese residents'ecycle e-waste.

A number of studies have demonstrated a correlation between environmental knowledge and the intention of households to recycle (Wang et al., 2016; Ramayah et al., 2012). Research has shown that accurate knowledge of disposal has a very dominant effect on households' recycling behavior (Kelly et al., 2006). Moreover, several researchers also found that households will participate more in recycling activities if they are given a better understanding of 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.

When someone evaluates a certain behavior favorably or unfavorably, they have an attitude towards it [68]. A given object interacts with a summarization of its evaluation in memory [62]. An attitude is a psychological emotion, which is directed through consumer evaluation.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 recycling behavior

Researchers have found that social norms play an important role in behavior related to processing. Singh et al. (2018) define a subjective norm as a mixture of prohibitive and descriptive norms that follow the perception of satisfactory/unsatisfactory behavior in interactive relationships and neighboring societies. There is a significant and positive correlation between household subjective norms and intentions (Echegaray and Hansstein, 2017; Lizin et al., 2017). The following recommendations were made based on these views:

H3. Subjective norms are positively associated with processing behavior.

There is evidence from many literary sources that household behavior during disposal is affected by the inconvenience and cost of disposal separately. These two elements are therefore classified as two parts of perceived behavior control (Wang et al. (2016); Ramayah et al., 2012). During processing, convenience is an essential component of stimulating behavior (Gonul Kochan et al., 2016). According to previous studies (Sidique et al., 2010), people go to landfills most often when recycling is available. The more difficult it is to store waste and create more places to collect recyclable materials, the more likely households are to recycle (Gonul Kochan et al., 2016). As a result, many studies have shown that convenience is associated with the intention to recycle (Wang et al., 2015; Chen and Tung, 2010; Bezzina and Dimech, 2011). As a result, the evidence presented led to the following hypothesis:

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

According to Diekmann and Preisendörfer (2003), there are two hypotheses about disposal costs: low disposal costs and high disposal costs. They explained that psychological factors influence behavior differently based on whether it is relatively less expensive (low cost) or more expensive (expensive). A person's perception of the situation determines the cost of disposal. It is proposed to include the available time, distance, space, and ease of processing operations for items related to processing costs. As a result, we propose the following based on the literature:

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

Figure 1 shows the extended TPB model that has been used in this study to test the hypotheses.

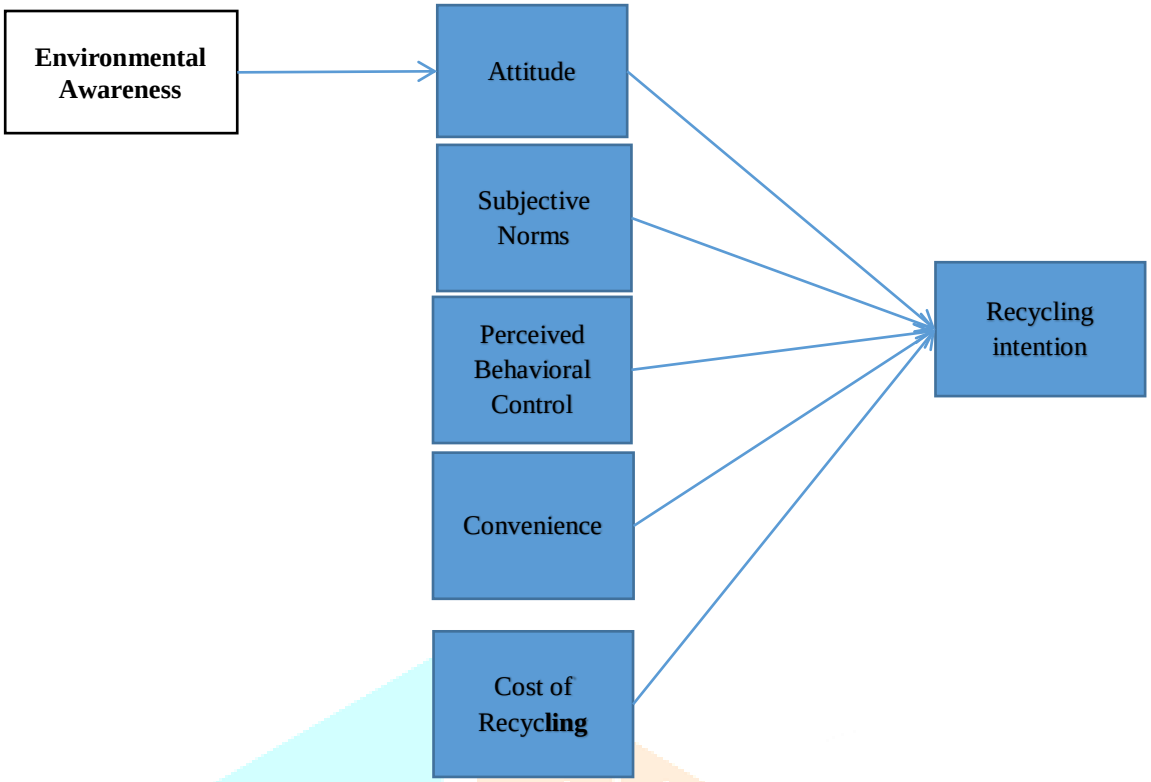

Figure. 1 Extended theory of planned behavior.

3. Research Methodology

In September and November 2022, a purposive sampling technique was used to conduct the survey. A purposeful sampling technique is one that involves determining the sample based on criteria that relate to the research objectives, such that it is expected to be able to solve the research problems (Mishra S.B.; Alok, S 2011). For this study, the criteria are men and women 18 years and older who use smartphones and laptops.This minimum age was adopted because consumers in this range can decide to participate in e-waste collection programs by bringing their used smartphones to collection centers. The data collection method used by the researchers was a questionnaire.A total of 400 samples were randomly selected, and household heads were interviewed face-to-face. 324 questionnaires were used to analyze the study. There are two sections to the questionnaire. Household socioeconomic conditions are addressed in the first section. In the second section, questions were used to assess several elements of all the different TPB constructs (Table 1). Households' intention to recycle was the dependent variable. We rated all responses on a five-point Likert scale, with 1 = strongly disagree and 5 = strongly agree.

Table 1 shows the sample distributions

Variable	Category	Frequency	Percentage
Gender	Male	139	42.90
	Female	186	57.10
Age	18 - 25 years	67	20.37
	26 - 35 years	121	37.35
	36 - 45 years	99	30.86
	46 - 55 years	32	9.88
	56- 65 years	3	0.93
	Above 66 years	2	0.62
Marital Status	Single	210	64.81
	Married	114	35.18
Monthly Income	Below Rs.10,000	33	10.19
	Rs.10,001 - 20,000	40	12.35
	Rs.20,001 - 30,000	104	32.10
	Rs.30,001 - 40,000	103	31.79
	Above Rs.40,000	44	13.58
Education Qualification	School level	3	0.93
	Higher Secondary Level	35	10.80
	Bachelor's Degree	194	59.88
	Master's Degree	62	19.14
	Doctoral Degree	12	3.70
	Diploma	16	4.94

From the descriptive table shown in Table 1, the majority of respondents were female (57.10%),aged 26 - 35 years (37.35%), single (64.81%), and had a monthly income ranging from Rs.20,001 - 30,000 (32.10%),and majorly had a bachelor's degree (59.88%).

3.1 Measurement

The measurement variables shown in Table 2 were considered for each variable used in this study and were either selected or modified from previous studies.A total of eleven variables were used , including attitude (5 indicators), subjective norms (4 indicators), perceived behavioral control (3 indicators), convenience (4 indicators), cost of recycling (3 indicators), and recycling intention (3 indicators).The likert scale was used to measure the research variables.The questionnaire used a five point likert scale ranging from 1 strongly disagree to 5 Strongly agree.

Table 2: Reliability Measures

Variables	Indicators	Cronbach's alpha	Source
Attitude	A1	0.838	Kumar (2019, Oskamp et al (1991), Cheung et al (1999)
	A2		
	A3		
	A4		
	A5		
Subjective Norms	SN1	0.768	Ajzen (2002), Tonglet et al (2004), Kumar (2019)
	SN2		
	SN3		
	SN4		
Perceived Behavioral Control	PBC1	0.803	Echegaray (2016)
	PBC2		
	PBC3		
Environmental knowledge and awareness	EW1	0.890	Ramayah et al (2016), Kelly et al (2006)
	EW2		
	EW3		
Convenience	CN1	0.832	Ramayah et al (2016), Chen and Tung (2010)
	CN2		
	CN3		
Cost of Recycling	CR1	0.844	Ramayah et al (2016),Wang et al (2012),Sidique et al (2010)
	CR2		
	CR3		
Recycling Intention	INT1	0.937	Holland et al (2016), Kumar (2019)
	INT2		
	INT3		

3.2 Hypothesis Testing

To determine whether the differences between attitudes, subjective norms, perceived behavioral control,convenience, cost of recycling environmental awareness and recycling intentions to gender and age groups , t - test and one way ANOVA were conducted.

Table 3. Results of t-Test

Variables	Gender	N	Mean	Standard Deviation	t	Significance 2 tailed
Recycling Intention	Male	139	4.04	1.632	-1.311	0.191
	Female	186	4.33	1.769	-1.354	0.177
Attitude	Male	139	2.93	1.672	0.391	0.696
	Female	186	2.85	1.800	0.402	0.688
Subjective norms	Male	139	3.66	1.967	-1.542	0.124
	Female	186	3.61	1.596	2.631	0.166
Perceived Behavioral Control	Male	139	2.33	1.783	-1.542	0.608
	Female	186	3.53	1.776	-1.393	0.618
Environmental Awareness	Male	139	4.37	1.697	-0.116	0.476
	Female	186	3.65	1.765	0.500	0.489
Convenience	Male	139	2.99	1.757	1.823	0.083
	Female	186	2.33	1.680	2.064	0.040
Cost of Recycling	Male	139	3.44	1.846	1.752	0.081
	Female	186	2.86	1.723	1.728	0.088

The caring nature of women and society-oriented socializing patterns could be expected to be distinguishing factors for environmental behavior. In any of the variables measured, there are no differences in attitudes between genders.

Both men and women rate their current recycling level below average, but they intend to recycle much more.The respondents were divided into six age groups: 18-25 years old, 26-35 years old, 36-45 years old, 46-55 years old, 56-65 years old, and above 66 years old. As shown in Table 4, all variables under investigation are significantly different depending on the age group.

Table 4. Results of Oneway ANOVA

Variables	Age group	Sum of Squares	Df	Mean Square	F	Sig
Attitude	Between Groups	45.227	2	.665	2.907	.000
	Within Groups	43.476	322	.229		
Subjective Norms	Between Groups	23.591	2	.347	1.667	.004
	Within Groups	39.536	322	.208		
Perceived Behavioral Control	Between Groups	106.47	2	.948	1.692	.003
	Within Groups	170.96	322	.560		
Environmental awareness and knowledge	Between Groups	134.55	2	1.976	1.513	.015
	Within Groups	248.52	322	1.308		
Cost of Recycling	Between Groups	44.138	2	1.103	1.897	.002
	Within Groups	126.827	322	.582		
Convenience	Between Groups	24.525	2	.613	2.083	.000
	Within Groups	64.177	322	.294		

* significant at 5 percent level

From the above table it is found that ,there is significant difference between extended theory of planned behavior factors and recycling intention and age of the respondents as the significant value is less than the p values (0.05). Therefore, the null hypothesis is rejected .

Relationship between attitudes, subjective norms, perceived behavioral control, environmental awareness, convenience, cost of recycling and intentions to recycle.

To reveal what domains would setve as predictors of future intentions to recycle multiple regression was used with elements of theory of planned behavior as independent variables and intention to recycle as dependent variable. It showed that attitudes towards behavior and assessment of recent recycling level very well explain intentions to recycle (R^2 = 0.583). The suggested relationship in the model were as demonstrated in Table 5.

Table 5. Attitudes, subjective norms, perceived behavioral control, environmental awareness , cost of recycling , convenience of recycling as predictors of intentions to recycle: summary of multiple regression model coefficients.

Dependent variable and Model coefficients	Predictors identified by regression	Unstandard co efficient B	beta	t	sig	Accepted / Rejected
Intention to recycle N= 324 R^2 = 0.583, F=104.927 p= 0.000	Attitude	0.034	0.195	4.641	0.000	Accepted
	Subjective norms	1.575	0.188	2.447	0.015	Accepted
	Perceived Behavioral control	0.801	0.124	2.105	0.036	Accepted
	Environmental awareness and knowledge	1.666	0.204	2.580	0.010	Accepted
	Cost of Recycling	0.648	0.657	15.100	0.000	Accepted
	Convenience	.787	.467	7.457	0.000	Accepted

a. Dependent variable : Recycilng Intention

The R^2 value (0.583) reveals that the independent varibles (extended theory of planned behavior) accounts for 58.3 % of the variance of dependent variable (recycling intention). All the variables level is the major predictor of future recycling intention.All the hypothesis are confirmed.

4. Discussion and Policy Implication

This study is based on the theory of planned behavior (TPB). 58.3% of the variance in recycling intention can be explained by Model1. A theory of planned behavior component accounts for 39 % of the variance in intentions, according to Armitage and Conner (2001). As a result, we conclude that our mode yields satisfactory results. Although all three TPB constructs (ATT, SN, PBC) significantly predict household recycling intention, attitude is the most important predictor. Thus, households' intentions to recycle are primarily

driven by their attitude toward recycling, as well as the pressures and expectations of others, as well as their sense of control over the process. Ramayah et al., (2012) have shown that knowledge of recycling schemes is a significant and positive determinant of individuals' attitudes toward recycling schemes. 0.648 and 0.787, respectively, were the coefficients of convenience and cost of recycling in this study. E waste recycling intentions are positively and significantly affected by both variables at the 5% level of significance. It is in discrepancy with the results from previous studies , Ramayah et al., (2012) found that although recycling cost is not a significant predictor of recycling intention, it has a negative association with recycling intention. The strong association between awareness and recycling intention also supports this idea. When the 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.

A fundamental milestone in e- waste management in a developing country like India is examining the behavioral intentions associated with e- waste disposal. This provides a solid foundation for its success. It is especially important in light of the rapidly increasing amount of e- waste, while the existing legislation on e- waste is ineffective.

The results of this study indicate that households' recycling intentions are significantly influenced by environmental knowledge and awareness. In order to raise household awareness, adequate information has to be provided on the benefits of recycling e- waste, and where, how, and why e- waste should be disposed of (Tanskanen , 2013). According to their study, the government needs to provide additional facts on e- waste management in formal and informal classes and seminars in order to raise awareness. Furthermore, the manufacturer of the electronic products must provide information on how to dispose of them and their significance if not disposed of properly. Nokia and Motorola, for instance, could use better understood advertising, promotions and channel more resources to recycling activities like those practiced in Taiwan (Chen and Tung, 2010) to inform, disseminate, and introduce recycling to the local population.

5. Conclusion

This paper contributes to the understanding of what factors influence recycling in both a theoretical and practical sense. From a theoretical perspective, it tests the applicability of TPB on recycling intentions. In contrast to previous studies that used TPB elements as recycling predictors, this study adds convenience, environmental awareness and knowledge, and recycling cost as variables that are significant predictors of recycling. According to the findings of this study, the theory of planned behavior predicts household recycling intentions. In contrast, the extended PTB model provides a better explanation of household recycling intentions. The recycling facilities, recycling collection centers are also paramount to the success of recycling programs in the study area (Stovea and Alrikson 2017). In cities with problems managing waste, this approach would be particularly beneficial.

Future research should address several limitations of this study. For example, it only focused on smart phones, so future research should extend the findings to other products with a larger volume, such as refrigerators, washing machines, televisions. Other variables such as past experiences, inconvenience, openness to change, responsibility and social and moral norms. These factors can be considered variables that may be added to the TPB in order to analyze intention relating to the e - waste recycling more comprehensively.

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