The Driving Factors of Behavior Management of E-Waste Using an Approach to the Theory of Planned Behavior

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Abstract

An understanding of the factors driving behavior management of e-waste is very important to understand. The purpose of this research is to test an attribute theory planned behavior in the context of concern on e-waste. The respondents in this study are 200 respondents from Central Java Indonesia. The analysis used is the structural equation modeling-Partial Least Square (SEM-PLS). To process data is by using WarpPls software version 6. The results of this research show that the attitudes, behavior and perceived knowledge is very influential on improving a person's interest in managing e-Waste. Other results make it clear that a person who has an interest to manage e-waste then it will affect directly on the behavior. Managerial implications in this research were the establishment of community e-waste Manager. The goal is to accelerate society's behavior in managing e-waste.

Keywords: *e-waste; management; SEM-PLS; behavior; community.*

1. Introduction

E-waste is one of the research topics that are important to researched. Electronics waste or e-waste is often said is that electrical and electronic equipment is disposed of as waste without intent for reuse (Step, 2014). Some of the literature makes it clear that many countries are starting to care for and manage e-waste, among others China, India (Awasthi & Li, 2017), Australia (Golev et al., 2016), India (Saoji, 2012), Europe Union (Awasthi et al., 2018). E-waste has become a worldwide attention (Awasthi & Li, 2017) because it has become a threat and challenge to the sustainability of the Earth. The main problems related to electronic waste management is an improper disposal, causing significant environmental impact (Herat & Agamuthu, 2012).

The growth of e-waste is the negative impact of the development of industrial technology, information, and communications (Saoji, 2012). Electronic goods are developed, applied, sold and used at a very high level all around the world (Imran et al., 2017). E-waste is the waste electrical and electronic equipment is a whole that cannot be processed. The waste residue could either be in the form of tools, equipment, or parts of the already broken and unused again. Some examples of electronic waste are such as computers, LCD, cell phone, refrigerator, television and others. This shit is dangerous because it contains toxic materials that are able to harm human health. E-waste also contains a number of toxic substances that can't be ignored (e.g., cadmium and lead) and thus considered harmful if administered improperly (Bakhiyi et al., 2018).

This research uses the Theory of Planned Behavior (TPB) as a basis. Some research related to e-waste and recycling using basic TPB (Philippsen, 2015). The purpose of this research was to test an attribute theory planned behavior in the context of concern on e-waste. In the current study developed some research questions, namely:

Q1: Does knowledge effect on interest in managing e-waste?

Q2: What is the attitude of the effect on interest in managing e-waste?

Q3: Does the subjective norm effect on interest in managing e-waste?

Q4: What does the perceived behavior control will be effect on interest in managing e-waste?

Q5: Does the interest effect on behavior of managing e-waste?

2. Theoretical Frameworks and Hypotheses

2.1. Behavioral and Socio-cultural aspects in E-waste management

In our globalized economy, increasing volumes of used electronics are shipped across national borders. While global and regional regulations prioritize electronics reuse as a prudent approach for conserving resources and reducing environmental toxicity, their effect on cross-border shipping activities of the reuse industry is not well-known. Due to rapid economic growth, faster upgrade of electrical and electronic equipment causes the ever-increasing quantity of waste electrical and electronic products (WEEE). E-waste is one of the fastest growing waste streams in the world in terms of volume and its environmental impact on the planet. The existence of precious metals in the e-waste stream provides a major economic benefit for recycling industries but due to the presence of hazardous chemicals, a proper recycling technique is required prior to the disposal of the e-waste. Through reviewing the present status of e-waste industry and the legal system in China, Wei and Liu's (2012) article analyzing several problems and barriers in China's e-waste recycling industry: (a) illegal e-waste import from developed countries; (b) the booming development of China's informal recycling sectors; (c) informal disposal leading to serious environmental problems and human health impacts; (d) formal companies facing with the problems of severe lack of e-waste; (e) the morbidity of China's regulatory and legal system.

This is based on the fact that at present, China is not only a large consumption nation of electrical products, but also a largest importer of e-waste. What's more, compared with several developed countries in e-waste management, Wei and Liu (2012) recommend that (a) building up the regulatory system of e-waste management in both central and local government; (b) encouraging the development of formal disposal of WEEE; (c) forcing enterprises to focus on Extended Producer Responsibility (EPR). Moreover, e-wastes in China are growing dramatically. Since 2009, the Chinese government has continuously issued a series of laws and regulations and established a preliminary e-waste management system based on extended producer responsibility (EPR) principles, so as to protect the environment and improve resource utilization. In a similar sense, Cao et al. (2016) conducted analysis to examine the effectiveness of current e-waste management in China in detail from the government policy, enterprise and public awareness perspective. Government regulations and amendments of relevant policies, which are consistent with the status to promote the emergence and development of formal e-waste recycling enterprise, are introduced and examined. Chinese current e-waste recycling technology, capacity and equipment are discussed as well as the construction and operation of several leading enterprises and a national industrial park. Chinese people's awareness of e-waste hazards, disposal habits and participation in environmental initiatives are also surveyed to guide the future measures. Promoted by the efforts of the government, enterprises and citizens, Chinese e-waste management has been improving for the past six years and it continues to develop. Finally, potential remaining problems of e-waste management are examined and their possible solutions are proposed.

Favot and Grassetti (2017) examine the performance of household electrical and electronic waste (WEEE) collection in 20 Italian regions from 2008 to 2015. The impact of several explicative variables on the results of e-waste collection is evaluated. The independent variables are socio-economic and demographic ones (age, gender, household size, education level, migration and income) along with technical-organizational variables (population density, presence of metropoles, macro regions, characteristics of the territory, percentage of household waste collected separately and number of e-waste collection points). The results show that the presence of collection points, the percentage of household waste collected separately and the percentage of females are positively correlated with the kg collected per inhabitant per year. For example, a variation of 1% of input (presence of collection points) corresponds to a 0.25% variation in the output (collection results) while 1% difference in the percentage of females in the population corresponds to a 7.549% difference in the collection rate. Population density, instead, is negatively correlated. It is interesting to note that there is a discrepancy between the Southern regions and the Centre regions (the former has an outcome 0.66 times lower than the latter) while the Northern regions perform similarly to the Centre ones., the first year (2008) had a very low performance compared to the following years when the scheme constantly improved, mainly due to the additional collection points available. The Stochastic Frontier Model allows for the identification of the optimal production function among the 20 Italian regions. The best performing region is Tuscany (in the centre), followed by Sardinia and Sicily (in the South). In addition, Kumar et al. (2017) present an overview of the statistics on global e-waste generation and the sales of new electrical equipment and electronics in general. The total amount of e-waste produced has reached approximately 41 million tons in 2014 and increasing at a rate of 3–5% every year. A correlation between e-waste generated, gross domestic product and population of the country has also been explored that suggested that the GDP of any country has a direct correlation with the amount of e-waste produced by that country. The population of the country does not have a significant impact. The paper also describes the importance and benefits of recycling are emphasized while presenting the techniques currently used by the recycling facilities.

Milovantseva and Fitzpatrick (2015) analyze data from nine cases collected in 2012–13 via interviews and a survey of reuse organizations to identify the effects of these regulations on transboundary reuse activities, which respondents perceive as barriers to electronics reuse. Overall, three broad areas were identified in which regulations may directly influence the reuse organizations that participated in this study: (i) definitions, classification, operating procedures, and enforcement; (ii) evaluation of shipments; and (iii) requirement for functionality testing. These findings suggest that, contrary to the goal of encouraging reuse of discarded electrical and electronic equipment, in some cases regulations may be contributing to raising barriers for reuse organizations' business. To help eliminate these barriers, policy recommendations proposed in this paper include: appropriate legislative amendments; inclusion of issues related to reuse in the development of relevant national policies; establishment of a comprehensive international legislative database; creation of refurbishment operations close to the install base and integration of informal recyclers in the reuse sector; and an introduction of a regulated green e-waste transboundary channel.

2.2. Knowledge and Intention of managing E-waste

The concept of "knowledge" is a category locks where an understanding of the complex process that is capable of changing society (Karpov, 2017). Knowledge will change the way in which the standpoint of education would involve a priority person's socio-cognitive growth (Karpov, 2015). Knowledge is seen as one of the sustainable competitive advantage that should be owned by the company (Von Krogh et al., 2001). In the context of business, knowledge is able to create a new business process in order to create a superior performance (Wu et al., 2014).

Some research explained that the knowledge was able to increase interest in something (Arcury, 1990; Levine & Strube, 2012). Knowledge about harmful chemicals associated with the recycling of electronic waste treatment options and End-of-Life (EoL) for developing countries and developed countries (Tsydenova & Bengtsson, 2011). The true knowledge of electronic waste will be greatly impacted the interest of someone to behave. Hornik et al. (1995) explained that knowledge of the technical aspects of recycling can increase the motivation of individuals to recycle. Several studies come to the conclusion that "knowledge" about recycling, i.e. a separate sewage and trash is placed, is an important factor to explain the behavior of recycling (De Young, 1989; Schultz et al., 1995; Susilo, 2018).

H1: knowledge has a positive and significant effect on attitudes on E-Waste

2.3. Theory of Planned Behavior

Theory of Planned Behavior (TPB) is one of the theories that attempted to predict the behavior of someone in doing something. TPB is an extension of the Theory of Reasoned Action (TRA). In the TRA that the intention of a person is against behavior formed by two main factors, namely attitude toward the behavior and subjective norms (Fisbein & Azjen, 1975). Both of good attitudes and subjective norms, should be able to predict someone's interest and its impact on the performance of the behavior (Azjen, 1991; Head & Noar, 2013; Nugroho, et al., 2017). In TPB, in addition to attitudes and subjective norms, the driving factor of interest and behavior coupled with perceived control behavior (Azjen, 1991, 2005). As stated by Ajzen (1991) that TPB is suitable to describe any behavior that requires planning, such as entrepreneurship). Perceived behavioral control is the perception of the individual to control his powers with regard to certain behavior (Ajzen, 2005). These factors

according to individual perception refer to Ajzen about easy or hard it is degrading behavior. Attitude is a positive or negative evaluation of the individual to a particular behavior. Whereas subjective norm is the perception of a person against the social pressure to do or not do a certain behavior (Fishbein & Ajzen 1975).

This theory can be used to predict a person's behavior and interest in doing recycling. Basically, the attitude of somebody to love the environment will greatly impact on the interest in performing the behavior of green (Farida & Ardyan, 2015). Subjective norm is related to how well the others thought such behavior and whether their opinion (friend or family) affect the individual to behave in certain ways (Azjen, 1991). Subjective norm also greatly affects a person's interest in behaving (Azjen, 1991). People will be more likely to engage in a certain behavior, such as recycling, if their contact people believe it is the right thing to do (Philippsen, 2015). The perception of someone about whether doing something easy would greatly impact on behavior (Azjen, 1991). A person who perceives that do recycle it easy then it would have an impact on their behavior or interest in doing recycling.

H2: Attitude has a positive and significant effect on interest in managing e-waste

H3: Subjective norm has a positive and significant effect on interest in managing e-waste

H4: Perceived behavioral control has a positive and significant effect on interest in managing e-waste

H5: Interest someone positive influential and significant at the behavior of managing e-waste

3. Research Method

3.1. Sample and Respondents

Dissemination of the questionnaire was used to obtain the data. A questionnaire distributed to 200 respondents. From 200 respondents who is using e-waste there are 120 people or amounted to 80% of respondents-sex male and 80 people or amounted to 40% of the female sex. Most of respondents found on the requirement of 25 – 35 years old that is as much as 134 people with percentage of 67% of the respondents age categories, 36 – 46 years as many as 35 people or amounted to 17.5% and respondents aged 47 years as much as > 31 person or of 15.5%. Table 1 can be known that as much as 99 people or amounted to 49.5% attended to Senior High School, respondent as much as 87 people or 43.5% of educated scholars, the respondent as much as 21 people or 10.5% attended a diploma, respondents as many as 10 people or as big as 4.5% attended Junior High School, as many as 10 people or by 5% of respondents attended a postgraduate education. Moreover, as many as 81 people or amounted to 40.5% of respondents have monthly spending of IDR 2,000,000-3,000,000 (equal to 142-213 USD), as much as 79 people or amounted to 39.5% have monthly spending IDR 3,000,000- 5,000,000 (213-355 USD), as many as 28 people respondents or 14% have spending per month amounted to > IDR 5,000,000 (>355 USD) and r as many as 12 people or 6% respondents monthly have spending of IDR 1,000,000- 2,000,000 (71-142 USD). The explanation can be summarized in the table 1.

No	Characteristics	Frequency	Percentages
1	**Gender:**		
	Male	120	60%
	Female	80	40%
2	**Age:**		
	25 – 35 years old	134	67%
	36 - 46 years old	35	17.5%
	> 47 years old	31	15.5%
3	**Education Level:**		
	Elementary School	-	-
	Junior High School	9	4.5%
	Senior High School	99	49.5%
	Diploma	21	10.5%
	Bachelor Degree	87	43.5%
	Postgraduate	10	5%
4	**Monthly spending:**		
	<IDR 1,000,000 (71 USD)	-	-
	IDR 1,000,000 – 2,000,000 (71-142 USD)	12	6%
	IDR 2,000,000 - 3,000,000 (142-213 USD)	81	40.5%
	IDR 3,000,000 – 5,000,000 (213-355 USD)	79	39.5%
	>IDR 5,000,000 (>355 USD)	28	14%

Table 1. Characteristics of Respondents

3.2. Variable Measurement

Each item in this question in the study measured with a scale of 7, where 1 explains answers disagree while 7 explains the answers strongly agree. Table 2 shows the indicators developed in this research.

3.3. Analysis

In this study is using structural equation modeling analysis of PLS (SEM-PLS). To process data use WarpPls version 6. There are some things that are tested, among other things: (1) examine

No	Variable	Indicators
1.	Knowledge	a. Knowing the knowledge regarding the reduction of household equipment products related to electronic garbage b. Knowing the knowledge of usage back to the household equipment products related to electronic waste c. Knowing knowledge about recyclers back for the products household appliances related to electronic waste d. Knowing knowledge about waste of energy for household equipment products related to electronic waste
2.	Attitudes	a. Saving the household appliances which are already damaged, although it is not used again b. Using of electronic household appliances, while other equipment still stored warehouse c. Classifying good for household electronic waste that is recycled d. Giving satisfy for electronic household appliances damaged processed again by the company
3.	Subjective norms	a. Intended use electronic equipment waste returns households are still worth sharing b. Intend to do waste recycling electronics to household appliances. c. Intend to do the processing to turn garbage into energy household appliance
4.	Perceived Behavior Control	a. Thinking tools and materials that there is inadequate for processing electronic bins for household appliances b. Thinking there is no special place to process electronic waste for household appliances c. Thinking no special learning related with garbage processing electronics to household appliances d. Thinking there is no institution to accommodate junk electronics to household appliances e. Haven't feeling to the other party to accept the electronic garbage for household appliances
5.	Interest in Managing E-Waste	a. Intending to do waste recycling electronics to household appliances b. Intending to do the processing to turn garbage into energy household appliances
6.	Behavior Management of E-Waste	a. Choosing the household appliances that use the most energy-efficient b. Using household appliances with the lowest energy resources c. Using electronic household appliances with efficient power d. Always taking care of household electronic equipment in accordance with instructions from the company

Table 2. Measurement

the validity and reliability of instruments; (2) examine for goodness of fit; (3) examine the hypothesis that was built in this research.

4. Results

4.1. Validity and Reliability

Validity is to measure the precision and accuracy of a construct in performing the functions of its measures (Azwar, 1986). In this study, to test the validity of using the factor loading and the extrated the Average variance. The instrument is said to be valid if the value of the factor loading and AVE above 0.50 (Hair et al., 2010). Table 3 explains that the whole instrument is already said to be invalid because the value is already above 0.50.

Reliability which means the extent to which the results of a measurement has benefiting, rely on, stability, consistency, can be trusted (Azwar, 1986). In this study, measurement reliability using compositing reliability and cronbach alpha. It can be said as instruments have a high reliability if the value is above 0.60 (Hair et al., 2010). Table 3 explains that the whole instruments are reliable because the value is above 0.60.

Variable & Indicators	Factor Loading	AVE	Composite Reliability	Cronbach Alpha
Knowledges		0.612	0.862	0.786
P1	0.822			
P2	0.825			
P3	0.800			
P4	0.673			
Attitudes		0.529	0.816	0.698
S4	0.760			
S5	0.840			
S6	0.665			
S7	0.625			
Subjective Norms		0.584	0.799	0.618
NS2	0.500			
NS3	0.881			
NS4	0.865			
PBC		0.523	0.812	0.691
PBC1	0.577			
PBC2	0.714			
PBC3	0.785			
PBC4	0.797			
Intention		0.731	0.845	0.632
I3	0.855			
I4	0.855			
Behavior		0.596	0.854	0.769
PG2	0.745			
PG3	0.870			
PG4	0.798			
PG5	0.658			

Table 3. Factor Loading, AVE, Composite Reliability and Cronbach Alpha

Before examining the hypothesis, the alignment of the data with a model that is built must be fit. Goodness of fit in the PLS use some measurement indicators. The value of the average path's (APC) is of 0.279 with P < 0.001, the average R-squared (ARS) is of 0.203 with P < 0.001, and Average adjusted R-squared (AARS) is 0.193 with P < 0.001. Moreover, the value of average block VIF (AVIF) is 1.127, and this is acceptable if <= 5 with ideal value of <=3.3. The value of average full collinearity VIF (AFVIF) is 1.197, and this is acceptable if <= 5 with ideal value of < = 3.3. The value of Tenenhaus GoF (GoF) is 0.348 >= 0.1 with small, medium, large value of >= 0.25>= 0.36. Moreover, the value of Sympson's paradox ratio (SPR) is 0.800, and this is acceptable if > = 0.7 with the ideal value of = 1. The value of R-squared contribution ratio (RSCR) is 0.898, and this is acceptable if > = 0.9 with the ideal value of = 1. In addition, the statistical suppression ratio (SSR) has the value of 1,000, making this acceptable if > = 0.7. The value of nonlinear bivariate causality ratio (NLBCDR) is 1,000, making this acceptable if > = 0.7. It can be concluded that the entire measurement goodness of fit is already good, so the data is already fit with the model created.

In this study, there are proposed 5 hypotheses. From the five hypotheses there is only one hypothesis were rejected namely H3 (β = -0.118; p = 0.045), whereas H1 (β = 0.201; p = 0.001), H2 (β = 0.291; p < 0.001), H4 (β = 0.462; p < 0.001), and H5 (β = 0.322; p < 0.001) accepted. The results of measurements of the hypothesis can be seen in table 4.

Hypothesis	β	ρ	Verification
H1: Knowledge → Intention	0.201	p=0.002	Accepted
H2: Attitude → Intention	0.291	p<0.001	Accepted
H3: Subjective Norms → Intention	-0.118	p=0.045	Rejected
H4: Perceived Behavior Control → Intention	0.462	p<0.001	Accepted
H5: Intention → Behavior	0.322	p<0.001	Accepted

Table 4. Hypotheses Examination

In this research, knowledge has a positive and significant effect on the interest of someone to care about the e-waste. This research shows that the attitude was able to increase the interest of someone to manage e-waste. In the study, subjective norm is not able to increase the interest of someone to manage e-waste. The influence of subjective intention on norms is negative. It is possible because it is those who provide recommendations are not the right person in the context of the e-waste management. Moreover, this study also found that perceived behavioral control would be able to improve a person's interest in managing e-waste.

5. Discussion

Electronic waste or waste is one of the growing problems in the world (Saoji, 2012). E-waste is composed of various components, some of which contain toxic substances that can have an adverse impact on human health and the environment if not handled correctly. E-waste contains more than 1000 substances, which includes various materials such as metal, plastic and glass (Vadoudi et al., 2015). This danger arises because the process of recycling and disposal are not good in managed (Pinto, 2008). Recycling is the process by which the material that has been used previously collected, processed, rebuilt and reused (Rudnik, 2007).

The knowledge that e-waste was able to make of diseases greatly affect one's attitude on e-waste (Sivasthanu, 2016). Hornik et al. (1995) explained that knowledge is the most effective Predictor to affect his desire do recycling. People must have awareness or knowledge related to e-waste. E-waste is a product that is very dangerous. Even the base material is primarily material that is able to cause various types of the deadly disease to humans. Therefore, the correct knowledge is about e-waste badly more interesting for someone to manage e-waste.

The attitude is positive and negative assessment of someone about something (Azjen, 1991), in this case assess e-waste. The higher a person's stance on e-waste, then the higher is also of interest to interest someone to manage e-waste. The results of this research are the same as the research done by Philippsen (2015), where a person who has a positive attitude to want to recycle used items will have an impact on their interest in conducting employee Administration of e-waste.

This finding about the positive influence of perceived behavioral control on the interest in managing e-waste is in line with the theory of TPB (Azjen, 1991), where a person who has the optimism granular management of e-waste, it will have an impact on interest to manage e-waste. Research conducted by Philippsen (2015) had different results where the perceived behavior control is not able to increase interest in doing recycling. The respondents in the study are students where students are

not a people who delight in doing recycling. Research shows that if someone found it easy to do the management of e-waste then it will bring up the person's interest to do the management of e-waste.

The theory of planned behavior to explain that someone who is interested in doing something then it will have an impact on the person's behavior (Azjen, 1991). The results of this study make it clear that a person who is interested to manage e-waste properly then it will have an impact on their behavior. Bring up someone's interest is an important part of enabling the person performing a particular behavior. Interest in managing e-waste means a person has a strong desire to perform all activities related to the management of e-waste. A strong desire is what will impact the real behavior of the person in managing e-waste. People tend to be doing activities such as do not dump e-waste in vain, trying to do a variety of ways in order to recycle e-waste, and a variety of other behaviors.

Based on the findings, this study suggests for forming community who has the desire to manage e-waste. Community that built that made the people in it will give a variety of input is more positive impact on the other members. Within the community there is an activity based on knowledge-sharing. Within the community there is motivation. The attitude of the people in the community must be positive. This will speed up a member to perform various behaviors in the management of e-waste, such as jointly collect e-waste, mutual reminding each other, build networks more broadly, and work together with an industry that has a concern in the management of e-waste. The community should also cooperate with the Government, and other communities and industries to create larger recycling movement again.

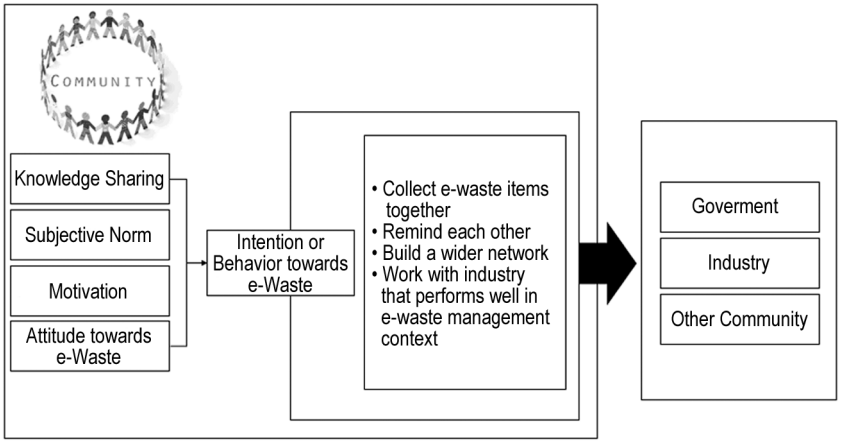

Figure 1. E-Waste Management through Community Involvement

6. Conclusion

This research highlights some important considerations regarding the effects of behavioral aspects on the intention of managing e-waste. First, the results of this research show that the subjective norm has the negative effect on a person's interest in managing e-waste. Second, increase knowledge of someone in e-waste management should increase the promotion of e-waste management should be more extensible. A growing number of communities have an awareness of the importance of managing e-waste, the more the society moved in the management of e-waste.

The limitations in this research are the research sample which is still within the scope of Central Java. For upcoming research suggested observing the areas of research, namely Indonesia. The other weakness is not focusing on the characteristics of certain respondents. For upcoming research expected to classify respondents based on certain things, such as level of education. After being grouped with the same model then compared between groups, its results are same or there is a difference.

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