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Consumer Behavior and Awareness Analysis of Electronic Waste in Indonesia: A Case Study in Java Island

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Abstract. Technology is a new standard that becomes a basic human need in today's era. Advances in technology, especially in electronic products, that make many electronics industry to join the competition to create products that consumers need. This competition makes the number of electronic products circulating in the community and the life of products that become increasingly, especially in developing countries such as Indonesia. This research aims to understand the variables that influence the consumer disposal behavior on electronic waste (e-waste) using data from the residents of Java Island as the most populous island in Indonesia. This study focused on the specific patterns of electronic consumer behavior which is divided into six major groups: Socio-Demographic, Socio-Psychological, Technical Organization, Study Specific Variables, Intention, and Disposal Behavior. Analysis of this behavior is done using the Structural Equation Model which combines two separate statistical method that is factor analysis with statistical modeling. By using the development of Basic Behavior Theory with some modified form of group behavior.

1. Introduction

Nowadays, the diversity of electronic products around the world has evolved massively, directly proportional to the number of new technologies associated with electronic products that continue to grow over time. It certainly has a positive impact as well as a negative impact from another perspective. A positive thing is the growing knowledge of technology that can push the progress of human civilization. The negative thing is that electronic waste not used by consumers, in general, is not handled correctly. Starting from the wrong storage, the unnecessary disposal process, until the wrong way of dismantling. That can have an impact on the environment and health if not getting the right attention and handling. However, the continuous renewal of sophisticated techniques and management strategies that target consumer behavior and habits are needed as a means of reducing environmental damage and as a form of environmental conservation of natural resources against materials from electronic products that have the potential to damage the environment. [1].

Consumer knowledge of how to deal with electronics products that they have can be studied more by researcher because no research discusses the pattern of electronic waste collection behavior among households explicitly. This is undoubtedly important, especially in areas of high population and urban populations where the number of electronic products in circulation. Also, factors such as the level of urbanization, the rapid development of electric industry and the exploitation of metal materials composing part of the excessive electronic product is not following the principles in maintaining the environment are: Reducing, reusing, and recycling. [2].



Developed countries, in general, have applied the principle of how to prevent bad behavior of consumer and practice on the handling of electronic waste. One way of these principles is by setting strict rules on the disposal e-waste [3]. Currently, many studies focus on e-waste management system that directly impacts on the consumers like technological, economic and e-waste sides, while research on indirect influences such as consumer behavior and awareness have less attention [1]. Whereas if viewed as a whole, the awareness factor and the active participation of consumers in their electronic products influence the success of the idea of electronic waste management. Disposal behavior and consumer awareness are the main factors affecting the economic development of e-waste collection that applies to household electronic waste. [4].

Four strongest predictors obtained from previous studies are gratify, normal morale, information and environmental awareness that directly affect the intentions and behavior of consumers that form the consumer habits. Other variables that complement the influence of the four most influential factors are the personal effort to collect, the social norms prevailing in the consumer's neighborhood, the number of opinions consumers receive and the information needed in an electronic waste collection [5].

2. Literature Riview and Conceptual Model

2.1 Theory of Planned Behavior (TPB)

Theory of Planned Behavior (TPB) is a theory developed further from the Theory of Reasoned Action (TRA) theory. The purpose of making TPB is as a conceptual framework of thinking about the determinants of specific behaviors. The central factor of individual behavior is that behavior is reinforced by the intention of an individual (behavior intention) to the behavior such as subjective, subjective attitude and perception of behavioral control [6].

Attitude is an essential antecedent or as a predictor of intent for physical activity and behavior. Consumer attitudes are the most critical factors that will affect consumer decisions. The concept of attitude is closely related to the idea of belief and behavior [7]. The subjective norm is a person's or an individual's beliefs about expectations of those around him who are influential, whether individual or group to do or not to perform a particular behavior. [8]. Perceptive control perceptions illustrate the feelings of one's ability to perform a behavior. The perceived Behavioral Control leads to the understanding of ease or difficulty in carrying out the behavior and a certain amount of control of a person over the attainment of the aims of a behavior [9].

2.2 Conceptual Model for The Study

Conceptual Model made from the results of previous studies on different variables that influence and determine the behavior of electronic waste recycling at the household level. The variables that influence consumer behavior in collecting electronic waste are divided into four main variable groups, namely: Sosio Demographic, Socio-Psychological, Technical Organization and Study Specific [5].

Based on that idea, Figure 1 is further development in the next phase where concentration is centered on ways to increase long-term commitment to collect electronic waste based on the concept of social and psychological motivation in determining behavior.

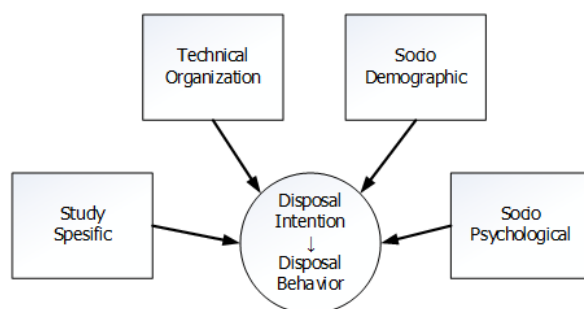


Figure 1. Conceptual Model from Conceptual for The Study.

Socio-Demographic relates to a group of variables with empirical studies in which they are the basis of one's information. This group of variables is often named as socio economic because it is most often a standard prediction in some publications on recycling concepts after socio-psychological. But only a few consider the dependence or correlation between recycling behavior and socio-demographic factors. The most frequently discussed variables in socio-demographic are age, sex, income, education level, residence status and residence location [10]. Socio- Psychological indicates that it belongs to the leading variable group in research relating to one's behavior. The most common variables include Personal Efforts, Legal Norms, Social Norms, Personal Information, Past Habits, Normal Morals, and Environmental Awareness [10].

Study Spesific Variables discusses a relatively diverse group of variables, some of the variables categorized into this study were conducted with consideration of quantitative analysis. Some of the variables that go into study specific variable studies such as Ethnic Influence, Data Security, community issues and the amount of electronic waste contained in the environment. [11]. Intention can be interpreted as a behavioral disposition that has the right opportunity to be realized in the form of action, or other words intention is an indication of the extent of effort to someone who issued to implement a behavior [6]. Disposal Behavior description of the habit of collecting and sorting electronic waste has found that the intention has a firm basis in the final step to collect (disposal) and sort out electronic waste.

3. Hypotheses and Data Collection

Describes division of the hypothesis used is the statement that became the basis of research conducted. Subsequent discussion on the way in which the data collection, identities of respondents, sampling areas up to the method to test the reliability of the questionnaire and the data obtained.

3.1 Hypotheses

Initial hypotheses is a temporary answer to the problem that is still no yet know. The preparation of the hypothesis was developing 8 hypotheses that became the basis and purpose of doing the following research is a hypothesis in the following:

3.1.1 Socio-Demographic variables has a significant influence on intention. Socio-Demographic variables on intention shows that the main points of a person's profile can provide an overview of intent in dealing with electronic waste such as age, gender, salary, education, geographical location and general knowledge of managing electronic waste.

3.1.2 Socio-Psychological Variables has a significant influence on intention. Socio-Psychological Variables on intention shows that the main points of a person's psychological influence affect the intention of disputes or recycling of electronic waste such as environmental concerns, moral norms, legal norms and social norms. Then the other three factors are summarized as information and knowledge, past behavior, and personal effort.

3.1.3 Study-Specific Variables has a significant influence on intention. Study-Specific Variables on intention shows that the main things of various factors in a person. It can have an impact on intent on handling electronic waste such as `as a community in behavior, consumer behavior and variables such as shopping behavior, data on a secure factor in electronic devices (in smartphones or memory devices in electronic waste).

3.1.4 Social-Demographic variables has a significant influence on Disposal behaviour. Social-Demographic variables on intention shows that the main points of a person's profile can provide an overview of disposal behavior in handling electronic waste such as age, gender, salary, education, geographical location and general knowledge of managing and sorting electronic waste.

3.1.5 Socio-Psychological Variables has a significant influence on Disposal Behavior. Socio-

Psychological Variables on Disposal Behavior shows that the main points of a person's psychological influences affect recycling behavior. In disputes or recycling electronic waste such as environmental concerns, moral norms, legal norms and social norms. Then the other three factors are summarized as information and knowledge, past behavior, and personal effort on the Dispose behavior.

3.1.6 Study-Specific Variables has a significant influence on Disposal Behavior. Study-Specific Variables on Disposal Behavior shows that the main points of various factors in a person can have an impact on recycling behavior in handling and disaggregating behavior on electronic waste such as communities in action, consumer behavior and variables such as shopping behavior, data on secure factors in electronics. Device (on smartphone or memory device in electronic waste).

3.1.7 Technical-Organizational variables has a significant influence on Disposal Behavior. Technical-Organizational variables on Disposal Behavior shows that the significant points of the System in the Technical Organization can affect the Variables Habit of Sorting including collection vehicles, distance to the end of the collection, economic incentives, infrastructure and environmental knowledge about management or electronic waste collection facilities.

3.1.8 Intention has a significant influence on Disposal Behavior. Intention variables on Disposal Behavior shows that matters such as the influence of intentions influence some habits in sorting e-waste between such behaviors as in storing habits, reselling habits, habits in donating, recycling habits and disposing habits.

3.2 Questionnaire and Data Collection

Identification of SEM model is done first by knowing the amount of data needed in doing further research that is by using the formula $(n \times (n + 1)) / 2 = (25 \times (25 + 1)) / 2 = 325$. Some observed variables contained in the model there are 41 observed variables so that it can get the value of the degree of freedom of $325 - 59 = 266$ which is positive. This indicates that the number of variant data points and the observed variables covariance is greater than the number of parameters that must be estimated, so-called the over-identified model.

The survey was conducted using an online questionnaire distributed to respondents spread across six provinces in Java Island: D.K.I Jakarta, Banten, West Java, Central Java, East Java and D.I Yogyakarta. The survey was conducted using the Likert scale with the value of 1 (strongly disagree) to 5 (strongly agree) and with the condition that the respondent is more than 15 years old [12]. Any respondent who answers from all five behaviors is the same to maintain consistency of the answers [4]. Before performing a measurement using an online questionnaire, the reliability (reliability testing) of a survey must be tested using Cronbach's Alpha on each latent variable. The amount of Cronbach's Alpha minimum value set is above 0.6.

Table 1. Questionnaire Reability Testing

Variabel	Activities	Cronbach Alpha	Variable	KMO Values	.sig
Socio Demographic		0,690	Socio Demographic	0,641	0
Socio Psychological		0,702	Socio Psychological	0,664	0
Study-Specific Variables		0,608	Study-Specific Variables	0,666	0
Technical-Organizational		0,729	Technical-Organizational	0,517	0
Intention	Store	0,849	Intention	0,553	0
	Resale	0,870	Disposal Behavior	0,589	0
	Donate	0,816			
	Recycle	0,886			
	Discard	0,950			
Disposal Behavior	Store	0,696			
	Resale	0,736			
	Donate	0,668			
	Recycle	0,757			
	Discard	0,802			

If done with reliability test then tested the validity by looking at the value of Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) and Barlett is higher than 0.5 according in Table 1. Against all latent variables used and results obtained. The following is the result of KMO testing of all latent variables used in the conceptual model [12].

4. Data Analysis

Results obtained on the reliability test and the KMO test show that the questionnaires that are built already have good results and are not biased. This becomes important because in this study the effects of data processing are very dependent on the data obtained because it is susceptible. If the data collected right, then it will affect the results of data processing done. Data is used on five different practice in disposal behavior. These behaviors include Storage, resale, donate, recycle, and discard. so the results obtained represent each of the existing behaviors.

Table 2. Goodness Of Fit from Respecification Model

GOLF MEASURES	STORAGE	RESALE	DONATE	RECYCLE	DISCARD
ABSOLUTE MEASURES TESTING					
Relative Chi-Square	2.59	3.085	2.604	2.83	3.285
NCP	M:1667.496	M:490.089	M: 373.787	M: 463.091	M: 541.642
	L: 1531.827	L:412.770	L: 304.742	L: 386.996	L: 460.883
	H: 1810.593	H:575.022	H: 450.500	H: 546.825	H: 630.000
GFI	0.927	0.889	0.817	0.804	0.876
RMR	0.048	0.035	0.103	0.016	0.003
RMSEA	0.038	0.002	0.07	0.004	0.0044
ECVI	M: 3.402	M: 4.297	M: 3.723	M: 4.322	M: 4.546
	S: 2.774	S: 3.015	S: 3.015	S: 3.266	S: 3.015
	I: 9.882	I: 11.097	I: 11.155	I: 12.727	I: 11.788
INCREMENTAL FIT MEASURES					
NNFI/TLI	0.859	0.995	0.866	0.848	0.888
NFI	0.814	0.864	0.821	0.912	0.861
AGFI	0.875	0.973	0.865	0.848	0.916
RFI	0.859	0.906	0.869	0.858	0.905
IFI	0.903	0.845	0.907	0.992	0.937
CFI	0.998	0.941	0.903	0.988	0.932
PARSIMONIOUS FIT MEASURES					
AIC	M: 677.083	M: 855.089	M: 740.787	M: 860.091	M: 904.642
	S: 552.000	S: 600.000	S: 600.000	S: 650.000	S: 600.000
	I: 1966.496	I: 2208.363	I: 2219.767	I: 2532.676	I: 2345.896

Testing the measurement model on the model that has been built is done by using AMOS 21 software that is by using Confirmatory Factors Analysis (CFA) method. The function of the CFA is to confirm or test the model, i.e., the measurement model whose formulation comes from the theory. Precisely to verify whether the observed variable represents every latent variable contained in Table 2 then the purpose of the CFA method is to find the value of Standard Loading Factors (SLF), the benefits of the Goodness of Fit are: absolute match test, incremental matching test, and parsimony

match test. Chi-Square results are very influential on the amount of data where the more significant the data the resulting chi-square numbers will be higher. The value of Chi-Square is considered good if it is smaller than 5. Results obtained in the initial data if not able to meet the requirements of the goodness of fit that has been set on each parameter used then done respecification model. This step is a step in identifying the problem of research, so a robust theory must support the relationship between hypothesized variables. Specification of the model based on previous theory or study or can also use the path diagram. following is the result obtained from the respecification model obtained earlier.

These results suggest that the most influential behavioral model is storage. This matter is shown with data that is on an endogenous variable that is intention have Socio demographic value is 0.46, Study specific variables 0.09 and socio Psychological 0.67 beside that at the variable of Disposal Behavior is Socio-Demographic equal to 0.68, Study Specific Variable 0.2, Socio-Psychological 0.62, Technical Organization 0.21, and Intention 0.87.

5. Conclusion

Conclusion shows that the best value of chi square is on the storage behavior of 2.59 then the next best value in sequential that is donate of 2.6, Recycle of 2.83, resale of 3.08, and then Discard of 3.2. Storing behavior indicates that factors such as intentions most influence the behavior of respondents this is evidenced by the amount of value obtained. Also, factors such as past habits conducted by respondents such as previous saving than other factors such as moral values and less awareness to make respondents prefer to save. Intent has a positively significant influence on storing behavior

Other results show that storing is still the choice of an electronic consumer in Indonesia to their electronic waste. The most influencing factors on the overwriting behavior if sorted from the largest to the smallest are the intentions, then the factors in the latent group Socio demographic variables such as age, gender, salary, education, residence, and residence status. Other socio-Psycological factors such as moral norms, information, social norms, past habits, environmental awareness, religion, legal norms. Besides the fourth most influential factor is the technical organization that is the factor of infrastructure, economic incentives and Information Management of electronic waste.

Main conclusions obtained are some hypotheses that can be accepted by the model of Socio-Psychological have a significantly positive influence on the intention. Socio-Psychological, Study Specific Variables, Technical Organization, and Intention have a significant positive influence on disposal behavior.

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