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Factors Influencing Household Behavior in Storing WEEE: A Case Study from Java

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ABSTRACT

The escalating pace of technological progress is leading to a rise in the consumption of electronic devices. Unfortunately, the excessive use of these devices results in the trash that comes from obsolete technology. Consumers frequently store electronic devices that are no longer in use at home. The practice of storing waste electrical and electronic equipment (WEEE) at home, like a systemic problem by consumers, needs to eventually be abolished right away due to the harm it poses. Developing an effective WEEE management system requires first analyzing customer behavior with regard to electronic storage that is no longer in use. This study delves into the analysis of how consumers store and dispose of WEEE, outlining the factors influencing these behaviors. The research conducted was based on the Theory of Planned Behavior (TPB), and data processing was carried out by statistical analysis and the Partial Least Square (PLS) method. The research employs statistical analysis and the Partial Least Square (PLS) approach for data processing, grounded in the Theory of Planned Behavior (TPB). The study, conducted through both manual and online surveys, enlisted 403 respondents from six provinces of Java. The conclusions incorporate numerous statistical findings and a model illustrating the predictor components that shape storage and disposal behavior. The findings reveal significant predictors, such as attitudes towards recycling, perceived behavioral control, and subjective norms, which shape the decision to store or dispose of WEEE. These results contribute to the existing literature by providing a deeper understanding of the psychological and contextual factors influencing WEEE storage. The study's novelty lies in its focus on a developing country context, offering insights that can inform the design of more effective WEEE management systems.

1. INTRODUCTION

The rapid advancement of technology has made electronic devices essential to human existence. Electronic devices are used in almost every aspect of modern life; cell phones, laptops, televisions, DVD players, washing machines, refrigerators, microwave ovens, and more are heavily relied upon by households in an effort to improve comfort and streamline daily activities [1-3]. When it comes to communication, some people feel more at ease using computers with internet connections to send and receive information and share knowledge globally, while others prefer to use phones and cell phones. The public eagerly devours the electronic equipment produced as a result of manufacturing enterprises increasing their output in response to a significant market demand for new electronics. One of the largest and fastest-growing industrial sectors in the world is electronics [4]. Unfortunately, extensive consumption of these electronic products leaves the consequences behind of waste from electronics that are no longer used [2, 5]. Electronic devices that are no longer in use and have found their way into the waste stream are known as WEEE [6]. Additionally, classified as WEEE are used electronics that are recycled, resold, reused, or disposed [5-7]. Because it is the type of waste that is expanding the quickest in the world right now, discarded electrical equipment, or WEEE, has become a worldwide problem that threatens human life [7, 8]. Regional estimates of garbage recycling rates differ. Based on the available statistics, it is approximated that the production of 25% of WEEE occurs within the European Union [9] and 40% in the United States [10] are annually recycled, while the rest become untraceable. Globally, there were approximately 44.7 million tons of WEEE in 2016, 47 million tons were predicted to be produced in 2017, and 52.2 million tons were predicted in 2021, growing at a rate of 3 to 5 percent annually [11-13] however WEEE technology management, particularly in newly industrialized nations, is still insufficient quality.

Electronic items that are not in use are frequently stored at home by consumers [14]. This WEEE is not immediately disposed of, is not repaired if there is damage, or is not immediately sold back to the second-hand market. Despite the fact that there are numerous risks associated with storing this WEEE due to the number of hazardous substances [11, 15] included in it, particularly if the storage method is not proper

[5, 16]. WEEE stored in this house makes the flow of the WEEE management system not work properly. Stored at home by consumers, WEEE is like a ticking Time bomb that needs to be released right away due to safety concerns [15, 17]. This behavior of storing becomes a real obstacle to the implementation of a good WEEE management system [18]. In order to create an effective WEEE management system, it is crucial to examine customer behavior with regard to obsolete electronic storage [14].

The Theory of Planned Behavior is a conceptual framework that explains human behavior (TPB) [19]. According to this theory [19], intentions to carry out specific behaviors are formed for a variety of reasons or form factors, such as perceptions about behavioral control, attitudes, and subjective standards. The relationship model between preset behavioral factors is described by the SEM (Structural Equation Modeling) method using the TPB framework [20]. SEM is a second-generation multivariate analytic method that gives researchers a thorough understanding of the overall model by examining both recursive and nonrecursive relationships between complex variables [21]. SEM is a multivariate research technique frequently applied in various academic disciplines, including social sciences, psychology, management, economics, sociology, political science, marketing science, and education [22, 23]. The reasons underlying the use of SEM in these studies are that SEM can clarify how many study variables relate to one another [22, 23].

In the scope of waste sorting, many studies have been carried out using the TPB framework to see the factors that influence consumer behavior in conducting waste sorting. In fact, there are already those who combine it with the SEM (Structural Equation Modeling) method to see the value of the relationship of the related factors in TPB. In the scope of waste disposal, which also includes the behavior of recycling waste and reselling it to the secondhand market, there have also been many studies that discuss this behavior using the TPB framework combined with the SEM method to see factors that influence consumer behavior in conducting waste disposal electronically. For the scope of waste storage, no one has discussed consumer behavior in storing this WEEE, what WEEE is stored by consumers, how long it has been stored, the factors that have the most influence, and the relationship between the factors.

The problems of household consumer behaviors in storing used/damaged WEEE occur almost all over the world [18]. It must be resolved because it involves the smooth running of the process within the WEEE management system [11, 24]. Considering the quantity of WEEE stored by consumers in their households, it will make material inputs to the waste processing industry become unstable and have a long-term effect on the health sector. Based on the description of the TPB framework and SEM above in conducting behavioral analysis, the merger of both is appropriate for analyzing the behavior of household consumers in storing WEEE. In addition, statistical collection and processing of data on storing behaviors will also be very helpful in providing an overview of consumer behavior and can be used as a basis for determining what steps to take in the future regarding these issues.

Based on the background information and previous literature analysis, it is well known that consumers have a tendency to store electronic equipment in their homes, whether it is broken, no longer in use, or still functional. Undoubtedly, this conduct poses a significant risk and hinders the development of an effective WEEE management system. Therefore, more research is required to fully understand how household consumers store used or damaged electronic equipment. This research should focus on the types of damaged or overused electronics that are stored, how long they have been kept in storage, why customers choose to store damaged or used electronics at home, and how these factors relate to one another in terms of influencing consumer behavior.

The specific research questions this study seeks to answer are: (1) What types of electronic equipment do consumers most commonly store? (2) How long do they typically store these items? (3) What are the key factors that influence their decision to store rather than dispose of this equipment? (4) How do these factors interact to shape consumer behavior? By investigating these questions, the study will not only fill a critical knowledge gap but also provide actionable insights for improving WEEE management practices and policies.

2. THEORETICAL REVIEW

2.1 WEEE

Electrical and electronic equipment, based on EU Directive 2002/96/EC, that has expired and been disposed of in the discharge stream is known as WEEE [12]. It includes all of its parts, subassemblies, and materials [2, 12, 15, 25]. Electronic products that have reached the waste stream due to their discontinuation of use are referred to as WEEE, or e-waste [6, 26]. Used electronics that are reused, resale, recycled, or disposed of are also regarded as waste or WEEE [6, 26].

The reason why an electronic product is not used anymore can vary, such as it is broken or has out-of-date technology and design. Therefore, it is no longer functional [27]. According to the study [28] in actuality, electronic goods are typically no longer in use even though they are still functional and can be replaced with new ones because users desire new features, the old ones are insufficient for the operator's newest services, or they are simply outdated. As a result, electronic items that are already unused eventually end up as waste, also known as WEEE. WEEE has different characteristics from other wastes. This is because the definition of WEEE is very dependent on the perspective of each person.

WEEE is one of the wastes with the fastest growth of around 8% per year [29]. The amount of WEEE produced worldwide in 2016 was 44.7 million metric tons (Mt), equivalent to 6.1 kilograms per population (kg/inh), compared with 5.8 kg/inh produced in 2014. The amount of WEEE is expected to grow to 52.2 million metric tons, or 6.8 kg/year, in 2021. From 44.7 Mt, only 8.9 Mt or 20% of WEEE is processed properly, and the rest is unknown where to go [13, 30].

Throughout the previous ten years, there has been a notable growth in the amount of WEEE produced in emerging nations, the United States, and the European Union. According to the study [29], WEEE production per person in developing nations like China and India is still only about 1 kg annually, but this amount can rise quickly. Due to their vast populations, these two countries will soon create more WEEE overall than Western nations. In addition, the amount of WEEE in new and The number of developing industrial countries is rising as well due to the import of WEEE from developed countries.

According to certain research, between 50 and 80 percent of the WEEE produced in affluent nations is exported to underdeveloped nations for recycling or reuse [29]. In several

European and American countries, the disposal of WEEE is by sending waste to several developing countries in Asia and Africa, such as China, Indonesia, Vietnam and others. About 80% of the total WEEE produced is disposed of or sent to countries in Asia and Africa [31]. With a high rate of EEE penetration, Australia stands as the most extensive and advanced country in the region. In 2014, EEE sales were 35 kilograms per capita [32].

There are six categories of WEEE [2, 13, 24, 30]:

1. Products like refrigerators, freezers, air conditioning units, and heating devices exemplify temperature exchange apparatus.
2. Display screens and monitors, including products like televisions, monitors, laptops, notebooks, and tablets.
3. Lamps, with examples of products such as bulb lights and LED lights.
4. Large equipment, with examples of products such as washing machines, dishwashers, electric stoves, and photocopiers.
5. Small equipment, with examples of products such as calculators, digital scales, microwaves, bakeries, and cameras.
6. Small IT and telecommunication equipment, with examples of products such as cellphones, home phones, GPS (Global Positioning System), printers, and routers.

2.2 Theory of Planned Behavior (TPB)

The Theory of Planned Behavior (TPB) was a hypothesis formulated by Ajzen [19], which is a refinement of the theory of reason action (TRA) proposed by Fishbein and Ajzen [33]. The main focus of this Theory of Planned Behavior is similar to the theory of rationale for action, specifically, people's intent to engage in particular actions. It is believed that intention may be the driving force behind actions. Intention serves as an indication of the level of effort an individual is willing to exert and how determined they are to perform a particular behavior.

TPB (Figure 1), developed by Ajzen from TRA, was developed to overcome measurement weaknesses that caused a weak relationship between attitude and behavior, the conduct articulated by Seymour Epstein in his two articles that drew the interest of psychologists in 1979 and 1980 [34, 35]. Fishbein and Ajzen [33] argued that the low correlation between attitude and behavior is caused by different measurement levels. Attitudes are measured at a very general level, while behavior is measured at a specific level.

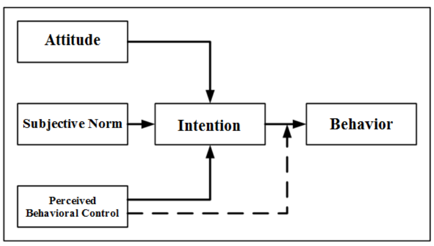

Figure 1. Model of theory planned behavior [19]

In improving the predictive power of attitudes toward behavior, it is necessary to measure attitudes and measure behavior at the same level. Attitudes towards the use of contraceptives (specific) and the use of contraceptives (specific). Reviewing the idea or its forming aspects in TPB was the first step in understanding more about behavioral control, subjective standards, and attitude assessment.

2.3 Partial Least Square (PLS)

Due to its lack of reliance on numerous assumptions, PLS (Partial Least Square) is an extremely effective analytical technique [22, 23]. PLS can be used to explain whether there is a relationship between latent variables or not, as well as to support the theory [36]. The fundamental difference of PLS, which is a variant-based SEM using covariant-based LISREL or AMOS software, is the purpose of its use, whether testing theory or developing theory for prediction purposes. In contrast to covariance-based Structural Equation Modeling (as seen in AMOS, LISREL, and EQS software), the variant-based Partial Least Squares (PLS) method successfully circumvented two significant issues encountered by covariance-based SEM, specifically the challenges of inadmissible solutions and indeterminacy factors [22, 37].

PLS has used several reasons study [21, 22, 38]:

1. PLS is an approach for data analysis that operates under the assumption that the sample size does not need to be substantial;
2. PLS is applicable for examining theories considered to be relatively weak, as it is effective in making predictions;
3. PLS enables algorithms to utilize a series of ordinary least squares (OLS) analyses, enhancing the efficiency of algorithmic calculations;
4. In the PLS method, there is an assumption that all measures of variance can be employed to elucidate each variable;
5. PLS also does not pay attention to data distribution (normal or abnormal).

Use SmartPLS software to analyze data and use structural equation modeling with the following steps [23, 38]:

1. A Structural Model Design (Inner Model).
2. A Measurement Model Designing (Outer Model).
3. Constructing the Path Diagram.
4. Path Chart to Equation System Conversion.
5. Estimation: Path coefficient, Loading, and Weight assessments.
6. Determine the Fit's Quality.
7. Testing of Hypotheses (Resampling Bootstrapping).

3. RESEARCH METHOD

Following the identification of the research topic and the completion of a literature review, data processing and collection will be done. The author's methodical approach to data collecting and processing is depicted in Figure 2 below.

To conduct the research, both manual and electronic surveys were filled out. The surveys included 403 participants from 6 Java provinces, with the province of West Java having the highest number of responders. In this work, two different approaches to data analysis were employed: descriptive analysis and PLS-based inferential statistical analysis. Descriptive analysis is the term used to describe empirical analysis that is used to summarize data obtained to provide a summary or explain an event collected for the study. The information is gathered from participants' answers to the survey questions. In addition, the data will be tabulated, grouped, and explained after processing [39].

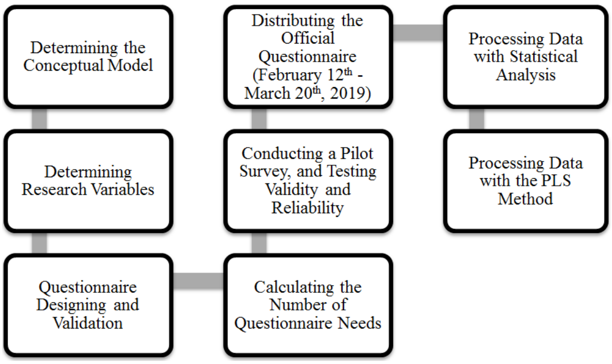

Figure 2. Research methodology

Data are analyzed using a statistical method known as inferential statistical analysis, which is often referred to as inductive statistics or probability statistics. The results are then applied to the population. If a clear and random sample of the population was collected, then this statistic is appropriate [39]. This study measured inferential statistical data analysis using the SmartPLS software version 3.0, starting with the measurement model (Outer Model), model structure (Inner Model), and hypothesis testing.

Carrying out literature reviews is the process of developing a model. Attitude, Subjective Norm, Perceived Behavior Control, Demographics, Past Behavior, Situational Factors, Consequences/Outcomes of Behavior, Intention, and Behavior are the nine latent variables that the model built was based on. The reason for this is that several recent studies, particularly in the field of behavioral analysis, have added additional predictors to strengthen predictions of an individual's intention to engage in specific behaviors. As a result, the authors also use predictor factors other than those found in the TPB basic framework by modifying models that are already used in the context of waste recycling, such as Past Behavior, Situational Factor, and Consequences/Outcomes of Behavior, in addition to Demographic factors (age, sex, education, etc.) [40].

The survey was designed for respondents over the age of 26 and domiciled in Java. Questions were created to explore the behavior of e-waste storage, consisting of 3 sessions, demographics, Household Consumer Behavior to Store Used/Damaged Electronics and Household Consumer Behavior to Dispose of Stored Used/Damaged Electronics using closed-ended questions with each question having a different scale or scales used, this conceptual model is based Brando et al. [41] (Figure 3).

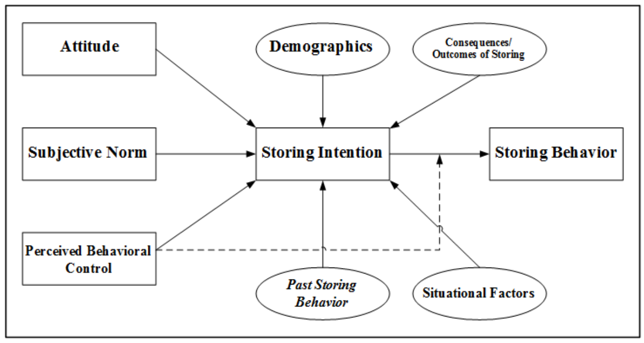

Figure 3. Conceptual research model for storing behavior

4. RESEARCH RESULT

Based on the survey results, the questionnaire was completed by 403 respondents. The demographic information of the respondents is presented in Table 1.

Table 1. Respondents' demographic data

Characteristic	Respondents	Characteristics	Respondents
Gender		**Occupation**	
Male	48.1%	Civil Servants	41.2%
Female	51.9%	Private Employees	25.1%
Age (years old)		Entrepreneur	9.2%
18 - 25	9.43%	Teacher	2.0%
26 - 36	53.35%	Student	7.4%
> 36	37.22%	Housewife	8.4%
Education		Others	6.7%
High School	15.9%	**Location**	
Diploma	10.4%	DKI Jakarta	22.6%
Bachelor	61.0%	West Java	39.5%
Master	12.2%	Central Java	15.6%
Doctor	0.5%	East Java	9.9%
Marital Status		DI Yogyakarta	2.7%
Single	20.8%	Banten	9.7%
Married	76.2%	**Residence Type**	
Widow	3.0%	Landed house	96.03%
Role within the Home		Apartment	1.24%
Head of the family	39.0%	Dormitory	2.73%
Wife	40.4%	**Residence Ownership**	
Children	18.1%	Own by self	40.20%
Other Members	2.5%	Own by parent/family	47.64%
Family Size		Rent/lease	11.91%
1 Person	2.23%	Own by company	0.25%
2 Persons	7.69%	**Residence Size**	
3 Persons	28.29%	< 50 m^2	14.9%
4 Persons	35.73%	50 - 100 m^2	50.4%
5 Persons	17.62%	> 100 m^2	34.7%
> 5 Persons	8.44%		

There are 17 different types of electronic equipment on the list that were employed for the research, and most of them are found in homes. The information gathered regarding each respondent's ownership of electronic devices at home is displayed in Table 2.

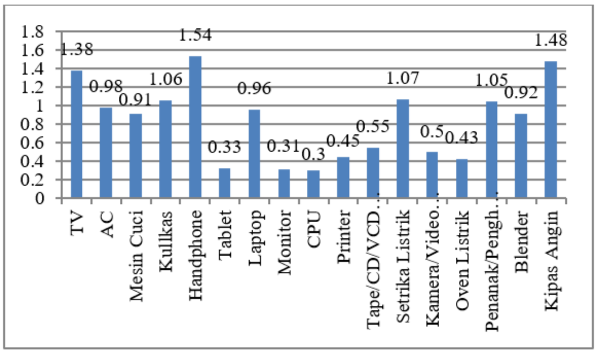

Figure 4. Average electronic respondents' ownership

As can be seen from Figure 4 above, the average electronic equipment that respondents most frequently own includes TVs, refrigerators, cell phones, electric irons, rice warmers, cookware, and fans. Not all respondents have access to the remaining electronic devices, which include air conditioners, washing machines, tablets, laptops, monitors, CPUs, printers, tape/CD/VCD/DVD players, cameras/video recorders, electric ovens, and blenders.

Following each respondent's electronic data collection at home, the authors also gathered information on the reasons behind consumer equipment replacements for both personal and household devices. The respondents' justifications for changing their household's electronic equipment are listed in Tables 3 and 4 below.

It is known from Tables 3 and 4 that damage is the most common cause given by respondents for replacing household and personal electronic equipment at home. When it comes to updating electronic equipment in the home, there is less diversity than when it comes to personal electronics, as no respondent indicates being bored or lost. Due to its compact size and ease of portability, personal electronic equipment can be lost. Furthermore, respondents have more motivation to update their personal electronic equipment due to the advancement of such complex technologies.

Table 2. Recapitulation of respondent electronic equipment ownership data

Electronic Equipment	**Number of Ownership (pcs)**							**Average (pcs)**
	0	**1**	**2**	**3**	**4**	**5**	**>5**	
TV	11	261	98	31	2	0	0	1.38
AC	130	179	74	13	7	0	0	0.98
Washing Machine	46	349	8	0	0	0	0	0.91
Refrigerator	14	356	27	6	0	0	0	1.06
Handphone	0	215	159	29	0	0	0	1.54
Tablet	278	117	8	0	0	0	0	0.33
Laptop	93	234	76	0	0	0	0	0.96
Monitor	292	100	10	1	0	0	0	0.31
CPU	294	100	7	2	0	0	0	0.30
Printer	232	161	10	0	0	0	0	0.45
Tape/CD/VCD/DVD Player	192	203	7	1	0	0	0	0.55
Electric Iron	7	361	33	2	0	0	0	1.07
Camera/Video Recorder	219	171	10	3	0	0	0	0.50
Electric Oven	241	150	12	0	0	0	0	0.43
Cooker / Rice Warmer	28	325	50	0	0	0	0	1.05
Blender	62	314	25	2	0	0	0	0.92
Electric Fan	17	225	120	33	8	0	0	1.48

Table 3. Reasons for replacing household electronic equipment

Reasons for Replacing Household Electronics Equipment (such as TVs, Washing Machine, Air Conditioning, Refrigerator, etc.)	**Amounts**	**Percentages (%)**
The electronic equipment condition is not good	33	8.19%
Follow the Trend	1	0.25%
Broken	363	90.07%
Outdated Technology	6	1.49%
Grand Total	**403**	**100**
Reasons to replace personal/personal electronic equipment (such as handphones, laptops, tablets, etc.)	**Amounts**	**Percentages (%)**
Lost	6	1.49%
The electronic equipment condition is not good	56	13.90%
Follow the Trend	9	2.23%
Broken	224	55.58%
Bored	9	2.23%
Outdated Technology	96	23.82%
Others	3	0.75%
Grand Total	**403**	**100**

Table 4. Stored data on used / damaged electronic equipment stored

Electronic Equipment	Number of Ownership (pcs) 0	1	2	3	4	5	>5	Average (pcs)	Total Stored
TV	320	76	7	0	0	0	0	0.22	90
AC	388	15	0	0	0	0	0	0.04	15
Washing Machine	380	20	3	0	0	0	0	0.06	26
Refrigerator	383	16	4	0	0	0	0	0.06	24
Handphone	170	180	40	8	3	2	0	0.76	306
Tablet	369	31	3	0	0	0	0	0.09	37
Laptop	335	57	10	1	0	0	0	0.20	80
Monitor	358	42	3	0	0	0	0	0.12	48
CPU	355	45	2	1	0	0	0	0.13	52
Printer	361	40	2	0	0	0	0	0.11	44
Tape/CD/ VCD/DVD Player	340	57	4	1	1	0	0	0.18	74
Electric Iron	327	70	5	1	0	0	0	0.21	83
Camera/ Video Recorder	377	22	4	0	0	0	0	0.07	30
Electric Oven	385	17	1	0	0	0	0	0.05	19
Cooker / Rice Warmer	349	43	11	0	0	0	0	0.16	65
Blender	375	21	7	0	0	0	0	0.09	35
Electric Fan	313	78	12	0	0	0	0	0.25	102

Table 5. Duration of storage for used/damaged electronic equipment

Electronic Equipment	Duration of Stored (years) 0 - 1	1 - 2	2 - 3	3 - 4	4 - 5	5 - 6	Average (years)
TV	21	27	28	5	3	2	1.895
AC	9	3	0	0	1	2	1.633
Washing Machine	10	7	1	0	1	1	1.400
Refrigerator	8	5	2	1	2	2	2.000
Handphone	36	88	64	11	7	12	2.046
Tablet	11	7	5	1	2	0	1.577
Laptop	14	21	6	5	6	5	2.202
Monitor	9	7	13	7	3	7	2.696
CPU	8	6	14	8	3	7	2.783
Printer	10	8	8	5	3	5	2.449
Tape/CD/VCD/DVD Player	9	9	21	9	3	7	2.655
Electric Iron	41	18	9	1	1	1	1.176
Camera/Video Recorder	9	3	4	3	0	3	2.091
Electric Oven	10	4	2	1	0	0	1.147
Cooker / Rice Warmer	22	16	4	3	3	0	1.438
Blender	16	7	3	0	2	1	1.397
Electric Fan	34	32	13	2	3	3	1.546

Next, by asking respondents if they had any electronic equipment stored at home, the author started gathering information about their practices regarding the storage of broken or used electronics. In the event that you have, please list the kind of electronic products you have saved, their quantity, duration of storage, and your motivations. 305 out of the 403 respondents that filled out the survey, or nearly 76% of the total, stated that they have used or broken electronic devices. We collected information from each respondent regarding who owned broken or reconditioned electronics at home, which is indicated in Table 5.

According to Figure 5, respondents store mobile devices more often than any other type of electronic equipment. This indicates that mobile devices are used or damaged. It makes perfect sense given that, according to Figure 5, respondents own the greatest number of electronic devices, with cellphones being the most common. Electronic equipment needs to be stored at home because the more persons who possess it, the more likely it is to get destroyed or become obsolete.

Determined the kinds and numbers of damaged or old electrical equipment. The second question concerns how long electronic equipment that has been used or damaged is kept in storage at home. The data regarding the duration of time respondents maintained the broken or used electronic equipment at home is summarized in Table 5.

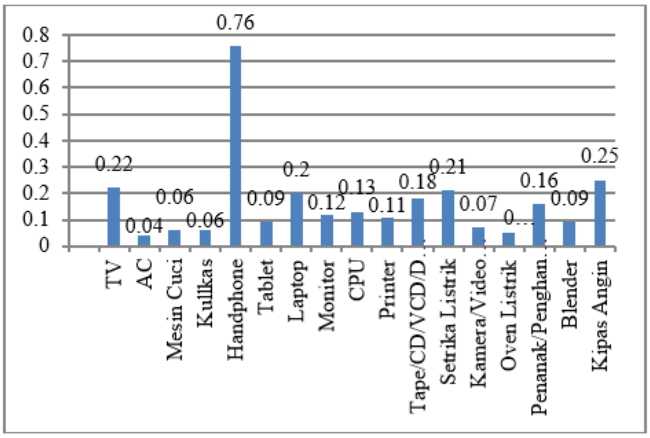

Figure 5. Average ownership of used / damaged respondents

According to Figure 6, a monitor, a tape/CD/VCD/DVD player, and a CPU are the electrical devices that have been used or damaged and have been kept at home the longest. The author then asks why electronic equipment that has been broken or used is kept at home. Respondents gave reasons for keeping used/broken household electronic equipment, as shown in Table 6. There is a distinction made here between personal/personal and domestic electronic devices. The data are summarized in Tables 7 and 8 below.

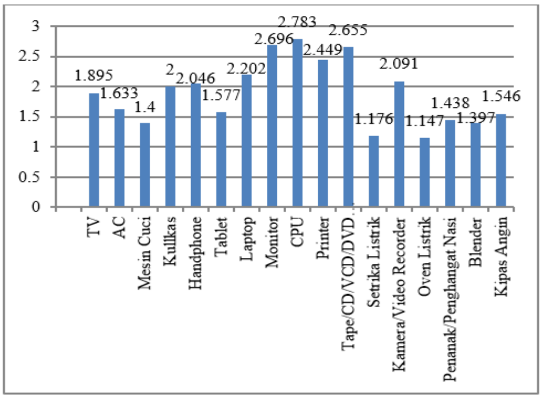

Figure 6. Average time to store used / damaged electronic equipment

Table 6. Reasons for used / damaged household electronic equipment stored

Reason	Amount	Percentage (%)
It will be used later as a backup/replacement	37	12.1
Want to give to others later	32	10.5
Want to sell again later	15	4.9
Do not know where to dispose	75	24.6
There is still historical value	21	6.9
Just keep it	14	4.6
Want to be repaired later	99	32.5
Others	12	3.9
Total	**305**	**100**

Table 7. Reasons for used / damaged personal / stored electronic equipment stored

Reason	Amount	Percentage (%)
It will be used later as a backup/replacement	118	38.69
Want to give to others later	31	10.16
Want to sell again later	13	4.26
Do not know where to dispose	18	5.90
There is still historical value	39	12.79
Just keep it	14	4.59
Want to be repaired later	42	13.77
Maintain data security	19	6.23
Others	11	3.61
Total	**305**	**100**

Tables 6 and 7 show that, when it comes to home electronics, the majority of respondents (32.5%) prefer to fix it later, with the second most common reason being that they are unsure of where to dispose of it (24.6%). With regard to personal electronic equipment, the majority of respondents (38.7%) indicated that they would use it as a backup or replacement down the road, while 13.77% said they wanted it repaired later.

With an average of 0.76 units saved per respondent and 58 percent of respondents owning them at home, the study's findings show that mobile phones are the most often kept electronic equipment in terms of quantity. Subsequently, regarding the duration of Time saved, based on 17 electronic devices under investigation, it was discovered that the CPU emerged as the most commonly used and damaged device at home, with an average save time of 2,783 years. Additionally, as much as 32.5% of the respondents kept it for electronic distribution within their homes because they hoped to enhance later, and as much as 24.6% said they were unsure of where to go. Up to 38.7% of people who save their personal electronic equipment do so with the intention of using it as a backup or replacement in the future, and 13.77% do so in order to make improvements.

The PLS approach was used in the data analysis that followed. Version 3.0 of the SmartPLS program was used to evaluate the structural models in PLS. Partial Least Square (PLS) involves the following steps:

4.1 Designing a structural model

Models are built using predefined variables and indicators in conjunction with conceptual models. A structural model and measurement that are derived from the formulation of behavior storage concerns are shown in Figure 7.

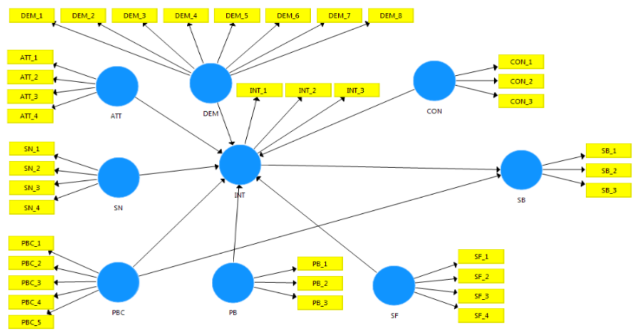

Figure 7. Structural models of the behavior of storing WEEE

Description:
DEM: Demographics
ATT: Attitude
SN: Subjective Norm
PBC: Perceived Behavioral Control
PB: Past Behavior
SF: Situational Factors
CON: Consequences/Outcomes of Storing
INT: Storing Intention
SB: Storing Behavior

4.2 Perform an outer model test

Analysis of the outer model was designed to make sure the measurements were practical (valid and reliable). The examination of the outer model is evident from several indicators:

1) Convergent validity is represented by the loading factors on latent variables along with their indicators, with an anticipated value exceeding 0.5.
2) Discriminant validity is assessed through cross-loading values, serving as a valuable factor to establish whether a construct has sufficient discriminant validity. This involves comparing loading values with the intended construct, ensuring they exceed the loading value associated with another construct.
3) Composite reliability refers to data with a composite

reliability exceeding 0.7, indicating a high level of reliability.

4) For Average Variance Extracted (AVE), the anticipated AVE value should be greater than 0.5.

5) Cronbach's Alpha reliability testing was strengthened by Cronbach's.

Based on these preliminary results, a Convergent Validity and Discriminant Validity test will be conducted. This test is done by evaluating the AVE and cross-loading values obtained from the initial data processing. The results of the Convergent Validity and Discriminant Validity tests for the storage behavior of WEEE are displayed in Table 8 below.

Table 8. Test results of convergent validity and early discriminant validity behaviors of storing WEEE

Measurement Model	Output		Critical Value	Model Evaluation
	Outer Model			
	Variable	**AVE**		
Convergent Validity	ATT	0.547	> 0.5	Valid
	CON	0.629		Valid
	DEM	0.495		Not Valid
	PB	0.839		Valid
	PBC	0.555		Valid
	SF	0.525		Valid
	SN	0.735		Valid
	INT	0.878		Valid
	SB	0.884		Valid
	Indicator	**Cross Loading**		
Discriminant Validity	ATT_1	0.807	> 0.5	Valid
	ATT_2	0.773		Valid
	ATT_3	0.774		Valid
	ATT_4	0.583		Valid
	CON_1	0.899		Valid
	CON_2	0.841		Valid
	CON_3	0.612		Valid
	DEM_1	0.771		Valid
	DEM_2	0.75		Valid
	DEM_3	0.8		Valid
	DEM_4	0.726		Valid
	DEM_5	0.616		Valid
	DEM_6	0.654		Valid
	DEM_7	0.643		Valid
	DEM_8	0.644		Valid
	PB_1	0.911		Valid
	PB_2	0.924		Valid
	PB_3	0.911		Valid
	PBC_1	0.819		Valid
	PBC_2	0.888		Valid
	PBC_3	0.835		Valid
	PBC_4	0.464		Not Valid
	PBC_5	0.633		Valid
	SF_1	0.495		Not Valid
	SF_2	0.722		Valid
	SF_3	0.848		Valid
	SF_4	0.785		Valid
	SN_1	0.773		Valid
	SN_2	0.892		Valid
	SN_3	0.885		Valid
	SN_4	0.875		Valid
	INT_1	0.903		Valid
	INT_2	0.959		Valid
	INT_3	0.948		Valid
	SB_1	0.924		Valid
	SB_2	0.952		Valid
	SB_3	0.945		Valid

For storing behavior, because several variables or indicators are not valid, then the indicator must be deleted, namely PBC_4 and SF_1, except for the DEM variable (one indicator chosen has the smallest Cross Loading value, DEM_5).

Figure 8 below is a model obtained for the behavior of storing WEEE after the Outer Model test.

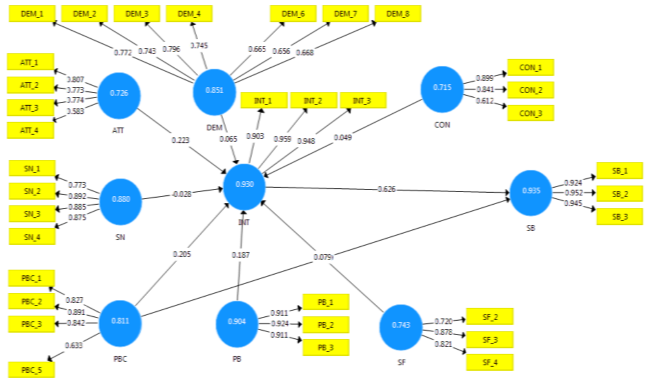

Figure 8. Evaluation results of the storing behavior model

4.3 Perform an inner model test

In guaranteeing the accuracy and robustness of structural models, inner model testing was conducted. Various indicators indicate the Inner Model Test, such as:

- The determination coefficient (R^2) for endogenous variables
- Predictive Relevance (Q^2)
- Goodness of Fit Index (GoF)

Table 9 below is the R^2 value of the measurement model for storing WEEE.

Table 9. R^2 values of the measurement model for the behavior of storing WEEE

Construct	R^2 Value
INT	0.382
SB	0.584

From the results of data processing, it is known that for the measurement model of the behavior of storing WEEE, the value of R^2 from the intention construct variable (INT) with the path scheme is 0.382. it means that the variation of intentions that can be explained by the construct variables DEM, ATT, CON, PBC, PB, SN, and SF is 38.2%, while other variables outside the model explain the other 61.8%. Likewise, for the construct behavior (SB) construct variable, the variation of storing behavior that can be explained by the construct and INT construct variables is 58.4%. According to Ghozali [37], the value of R^2 is 0.67 (strong), 0.33 (moderate) and 0.19 (weak). After that, Inner Model testing can be done by looking at the Q^2 value (predictive relevance).

$$Q^2 = 1 - (1 - R_1^2)(1 - R_2^2) \ldots .(1 - R_p^2) \quad (1)$$

$$Q^2 = 1 - (1 - 0.382)(1 - 0.584) \quad (2)$$

$$Q^2 = 0.743 \quad (3)$$

From the results of data processing, the Q^2 value for the behavior of storing WEEE is 0.743. The last is by looking for the value of Goodness of Fit (GoF).

$$GoF = \sqrt{\overline{AVE} \times \overline{R^2}} \quad (4)$$

$$\text{GoF}= \sqrt{\frac{(0.547+0.629+0.522+0.839+0.647+0.654+0.735+0.878+0.884)}{9} \times \frac{(0.382+0.584)}{2}} \quad (5)$$

$$GoF = \sqrt{0.704 \times 0.483} \quad (6)$$

$$GoF = 0.583 \quad (7)$$

The GoF value for the behavior of storing WEEE is 0.583. GoF values are said to be small if = 0.1, moderate if = 0.25, and large ≥ 0.38 [37]. From testing R^2, Q^2, and GoF, it can be seen that the model form for the behavior of storing WEEE is robust. So that hypothesis testing can be done.

4.4 Testing the hypothesis

Hypothesis testing can be seen from the value of t-statistics and probability. The significance of the Outer Model parameter can be evaluated through the bootstrapping procedure. In PLS analysis with the path scheme, the number of replications used is 500 resamplings, and the output results, such as Table 10, obtained for the behavior of storing WEEE:

Table 10. Results of the WEEE storing model bootstrapping procedure

Relationship	Original Sample	Sample Mean	Std. Error	*t* Statistics	*p* Values
ATT -> INT	0.223	0.230	0.069	3.227	0.001
CON -> INT	0.049	0.051	0.066	0.740	0.460
DEM -> INT	0.065	0.066	0.052	1.263	0.207
INT -> SB	0.626	0.622	0.044	14.378	0.000
PB -> INT	0.187	0.174	0.066	2.849	0.005
PBC -> INT	0.205	0.211	0.079	2.610	0.009
PBC -> SB	0.347	0.347	0.063	5.500	0.000
SF -> INT	0.079	0.079	0.054	1.470	0.142
SN -> INT	-0.028	-0.028	0.058	0.489	0.625

Furthermore, the probability value obtained is compared with the critical value to reject/accept the hypothesis. To reject/accept the hypothesis using probability, H1 is accepted if the value of $p < 0.05$. The following Table 11 shows the results of evaluating probability values for the behavior model of storing WEEE.

Table 11. Evaluation of the probability value of the WEEE storing behavior model

Relationship	*p* Values	Critical Value	Evaluation
ATT -> INT	0.001		Significant
CON -> INT	0.460		Not Significant
DEM -> INT	0.207		Not Significant
INT -> SB	0.000		Significant
PB -> INT	0.005	< 0.05	Significant
PBC -> INT	0.009		Significant
PBC -> SB	0.000		Significant
SF -> INT	0.142		Not Significant
SN -> INT	0.625		Not Significant

The results of this study support the Theory of Planned Behavior (TPB) by showing that consumers' decision to keep used or damaged electronic equipment (WEEE) is driven by a belief in its potential future value, such as repair or use as a backup. This attitude is reflected in 32.5% of respondents keeping household appliances for later repair and 38.7% keeping personal appliances as a backup. In addition, uncertainty regarding the appropriate disposal site (24.6% of respondents) suggests that subjective norms and perceived constraints also play an important role. These findings underscore the need for education and adequate disposal facilities to reduce the tendency of WEEE storage.

By integrating these elements, existing literature, thoroughly discuss the implications of our results, we aim to provide a comprehensive understanding of the study's significance and its potential impact on the broader discourse in WEEE management to know how behaviour from user.

5. CONCLUSION

The purpose of this study is to identify the factors that are the reasons why consumers choose to store electronic equipment that is already unused at home and describe the correlation among the elements that influence these consumers' behavior.

From the results of the study, it was found that in terms of quantity, Mobile was used/damaged electronic equipment that most respondents kept at home. Then, for a long time store, it was found that the CPU became used/damaged electronic equipment that had been stored for the longest. Furthermore, the reason why respondents save it for household electronic equipment is to repair it later. In comparison, the reason for storing personal/personal electronic equipment is to use it later as a backup/replacement.

Furthermore, for the purpose of defining the connection between the elements that influence the way that consumers behave, store and dispose of used/damaged electronic equipment. The results in the saved model show that the variables that most influence the behavior of storing in order from the most influential ones are Intention (INT), Perceived Behavior Control (PBC), Altitude (ATT), Past Behavior (PB), Demographics (DEM), Situational Factors (SF), Consequences/Outcomes of Storing (CON), and Social Norms (SN).

The following recommendations can be made for upcoming studies or in the future:

1. Research can be done using other latent variables that have a strong influence on behavior.
2. Respondent data can be carried out on a wider scale in Indonesia to get more diverse results.
3. The scope of electronic equipment that is used as the object of research can be expanded or narrowed to be more specific.
4. Determining the acceptable incentives sought by household consumers for the disposal of their owned Waste Electrical and Electronic Equipment (WEEE).
5. Find out the most effective and efficient WEEE collection program.

However, it should be noted that the results of this study are still limited to respondents in the Java area. Therefore, future research can be expanded to include respondents from other regions in Indonesia to obtain more diverse and representative results. In addition, further research can explore other latent variables that have a strong influence on behavior, as well as expand or narrow the types of electronic equipment used as the object of research for a more specific focus. Additional recommendations include researching incentives that household consumers can receive for their WEEE disposal, as well as finding the most effective and efficient WEEE collection program.

REFERENCES

[1] (EU), E.P. (2003). Copenhagen: European Environment Agency. https://www.eea.europa.eu/publications/corporate_document_2004_2/at_download/file.

[2] Babu, B.R., Parande, A.K., Basha, C.A. (2007). Electrical and electronic waste: A global environmental problem. Waste Management & Research, 25(4): 307-318. https://doi.org/10.1177/0734242X07076941

[3] Pandebesie, E.S., Indrihastuti, I., Wilujeng, S.A., Warmadewanthi, I.D.A.A. (2019). Factors influencing community participation in the management of household electronic waste in West Surabaya, Indonesia. Environmental Science and Pollution Research, 26: 27930-27939. https://doi.org/10.1007/s11356-019-05812-9

[4] Schwarzer, S., De Bono, A., Giuliani, G., Kluser, S., Peduzzi, P. (2005). E-waste, the hidden side of IT equipment's manufacturing and use. Environment Alert Bulletin, 5: 1-4. https://access.archive-ouverte.unige.ch/access/metadata/c0eacbb0-ece8-43eb-8d88-ea542e79582c/download.

[5] Cui, J., Forssberg, E. (2003). Mechanical recycling of waste electric and electronic equipment: A review. Journal of Hazardous Materials, 99(3): 243-263. https://doi.org/10.1016/S0304-3894(03)00061-X

[6] Organization for Economic Co-operation and Development (OECD). (2001). The Extendend Producer Responsibility for Governments. https://doi.org/10.1787/9789264189867-en

[7] Sepúlveda, A., Schluep, M., Renaud, F.G., Streicher, M., Kuehr, R., Hagelüken, C., Gerecke, A.C. (2010). A review of the environmental fate and effects of hazardous substances released from electrical and electronic equipments during recycling: Examples from China and India. Environmental Impact Assessment Review, 30(1): 28-41. https://doi.org/10.1016/j.eiar.2009.04.001

[8] Ogunseitan, O.A.A. (2009). The electronics revolution: From e-wonderland to e-wasteland. Policy Forum, 326: 670-671. https://bdt.semi.ac.cn/download/0.3616983415056253.pdf.

[9] Perkins, D.N., Drisse, M.N.B., Nxele, T., Sly, P.D. (2014). E-waste: A global hazard. Annals of Global Health, 80(4): 286-295. https://doi.org/10.1016/j.aogh.2014.10.001

[10] (US-EPA), U.S. (2015). Advancing sustainable materials management: 2015 Fact sheet. https://www.epa.gov/sites/default/files/2018-07/documents/2015_smm_msw_factsheet_07242018_fnl_508_002.pdf.

[11] Menikpura, S.N., Santo, A., Hotta, Y. (2014). Assessing the climate co-benefits from waste electrical and electronic equipment (WEEE) recycling in Japan. Journal of Cleaner Production, 74: 183-190. https://doi.org/10.1016/j.jclepro.2014.03.040

[12] Bressanelli, G., Saccani, N., Pigosso, D.C., Perona, M. (2020). Circular economy in the WEEE industry: A systematic literature review and a research agenda. Sustainable Production and Consumption, 23: 174-188. https://doi.org/10.1016/j.spc.2020.05.007

[13] Baldé, C.F. (2017). The global e-waste monitor. United Nations University (UNU), International Telecommunication Union (ITU) & International Solid Waste Association (ISWA). https://collections.unu.edu/eserv/UNU:6341/Global-E-waste_Monitor_2017__electronic_single_pages_.pdf.

[14] Sabbaghi, M., Esmaeilian, B., Mashhadi, A.R., Behdad, S., Cade, W. (2015). An investigation of used electronics return flows: A data-driven approach to capture and predict consumers storage and utilization behavior. Waste Management, 36: 305-315. https://doi.org/10.1016/j.wasman.2014.11.024

[15] Shittu, O.S., Williams, I.D., Shaw, P.J. (2021). Global E-waste management: Can WEEE make a difference? A review of e-waste trends, legislation, contemporary issues and future challenges. Waste Management, 120: 549-563. https://doi.org/10.1016/j.wasman.2020.10.016

[16] Saphores, J.D.M., Nixon, H., Ogunseitan, O.A., Shapiro, A.A. (2009). How much e-waste is there in US basements and attics? Results from a national survey. Journal of Environmental Management, 90(11): 3322-3331. https://doi.org/10.1016/j.jenvman.2009.05.008

[17] Milovantseva, N., Saphores, J.D. (2013). Time bomb or hidden treasure? Characteristics of junk TVs and of the US households who store them. Waste Management, 33(3): 519-529. https://doi.org/10.1016/j.wasman.2012.07.020

[18] Wilson, G.T., Smalley, G., Suckling, J.R., Lilley, D., Lee, J., Mawle, R. (2017). The hibernating mobile phone: Dead storage as a barrier to efficient electronic waste recovery. Waste Management, 60: 521-533. https://doi.org/10.1016/j.wasman.2016.12.023

[19] Ajzen, I. (1991). The Theory of planned behavior. Organizational Behavior and Human Decision Processes, 50: 179-211. https://publons.com/publon/10.1002/hbe2.195.

[20] Huang, C.L., Kung, F.H. (2011). Environmental consciousness and intellectual capital management: Evidence from Taiwan's manufacturing industry. Management Decision, 49(9): 1405-1425. https://doi.org/10.1108/00251741111173916

[21] Ghozali, I. (2008). Structural equation modeling: Metode alternatif dengan Partial Least Square (PLS). Badan Penerbit Universitas Diponegoro.

[22] Hair, J., Alamer, A. (2022). Partial Least squares structural equation modeling (PLS-SEM) in second language and education research: Guidelines using an applied example. Research Methods in Applied Linguistics, 1(3): 100027. https://doi.org/10.1016/j.rmal.2022.100027

[23] Purwanto, A. (2021). Partial least squares structural squation modeling (PLS-SEM) analysis for social and management research: A literature review. Journal of Industrial Engineering & Management Research. https://ssrn.com/abstract=3982764.

[24] D'Adamo, I., Rosa, P., Terzi, S. (2016). Challenges in waste electrical and electronic equipment management:

A profitability assessment in three European countries. Sustainability, 8(7): 633. https://doi.org/10.3390/su8070633

[25] Schafer, T., van Looy, E., Weingart, A., Pretz, T. (2003). Automatic separation devices in mechanical recycling processes. In Proceedings of the International Electronics Recycling Congress, pp. 13-15.

[26] Coughlan, D., Fitzpatrick, C. (2020). Trialling the preparation for reuse of consumer ICT WEEE in Ireland. Journal of Cleaner Production, 256: 120512. https://doi.org/10.1016/j.jclepro.2020.120512

[27] Pongracz, E. (2006). Industrial ecology and waste management: From theories to applications. Progress in Industrial Ecology, An International Journal, 3(1-2): 59-74. https://doi.org/10.1504/PIE.2006.010041

[28] Osibanjo, O., Nnorom, I.C. (2007). The challenge of electronic waste (e-waste) management in developing countries. Waste Management & Research, 25(6): 489-501. https://doi.org/10.1177/0734242X0708202

[29] Widmer, R., Oswald-Krapf, H., Sinha-Khetriwal, D., Schnellmann, M., Böni, H. (2005). Global perspectives on e-waste. Environmental Impact Assessment Review, 25(5): 436-458. https://doi.org/10.1016/j.eiar.2005.04.001

[30] Islam, M.T., Huda, N. (2020). Reshaping WEEE management in Australia: An investigation on the untapped WEEE products. Journal of Cleaner Production, 250: 119496. https://doi.org/10.1016/j.jclepro.2019.119496

[31] Zoeteman, B.C., Krikke, H.R., Venselaar, J. (2010). Handling WEEE waste flows: On the effectiveness of producer responsibility in a globalizing world. The International Journal of Advanced Manufacturing Technology, 47: 415-436. https://doi.org/10.1007/s00170-009-2358-3

[32] Golev, A., Schmeda-Lopez, D.R., Smart, S.K., Corder, G.D., McFarland, E.W. (2016). Where next on e-waste in Australia? Waste Management, 58: 348-358. https://doi.org/10.1016/j.wasman.2016.09.025

[33] Fishbein, M., Ajzen, I. (1977). Belief, attitude, intention, and behavior: An introduction to theory and research. Reading. MA: Addison-Wesley, 10(2): 130-132. https://doi.org/10.2307/2065853

[34] Epstein, S. (1979). The stability of behavior: I. On predicting most of the people much of the time. Journal of Personality and Social Psychology, 37(7): 1097-1126. https://doi.org/10.1037/0022-3514.37.7.1097

[35] Epstein, S. (1980). The stability of behavior: II. Implications for psychological research. American Psychologist, 35(9): 790-806. https://doi.org/10.1037/0003-066X.35.9.790

[36] Latan, H., Noonan, R. (2017). Partial least squares path modeling. In Basic Concepts, Methodological Issues and Applications. Springer. https://doi.org/10.1007/978-3-319-64069-3

[37] Ghozali, I. (2014). SEM metode alternatif dengan menggunakan Partial Least Squares (PLS). Semarang: Badan Penerbit Universitas Diponegoro.

[38] Munerah, S., Koay, K.Y., Thambiah, S. (2021). Factors influencing non-green consumers' purchase intention: A partial least squares structural equation modelling (PLS-SEM) approach. Journal of Cleaner Production, 280: 124192. https://doi.org/10.1016/j.jclepro.2020.124192

[39] Sugiyanto. (2009). Model-Model Pembelajaran Inovatif. Surakarta: Panitia Sertifikasi Guru Rayon 13 FKIP UNS.

[40] Ioannou, T., Zampetakis, L.A., Lasaridi, K. (2013). Psychological determinants of household recycling intention in the context of the theory of planned behaviour. Fresenius Environmental Bulletin, 22(7): 2035-2041.

[41] Brando, R.M., Ardi, R., Mayasari, R. (2020). Conceptual model of household consumer behavior in storing WEEE (waste electrical and electronic equipment). In Asia Pacific Conference on Research in Industrial and Systems Engineering, APCORISE 2020 - Proceedings, pp. 219-224. https://doi.org/10.1145/3400934.3400975