

Analysis The Effect of Green Computing on Green Satisfaction, Green Perceived Quality, and Green Trust on The Apple Consumer using SEM-PLS in Surabaya

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Abstract—The use of electronic devices such as smartphones has become a part of daily activities, it also led to the growing number of smartphones users as well as brands emerged. Smartphones can help humans, but it also can endanger the environment and living things, because electronic waste contains hazardous materials that can harm the environment. The implementation of green computing in IT companies can be one of the solutions for facing the electronic waste that keeps growing and one of the IT companies that already implemented it was Apple. By using Structural Equation Modeling – Partial Least Square (SEM-PLS) method, this study aims to examine whether there is a positive influence of environmental friendliness created in the implementation of green computing to green satisfaction, green perceived quality, and green trust. The results showed that there is an influence given by the friendliness of the environment from the implementation of green computing on green satisfaction, green perceived quality and green trust with the highest correlation value, environmental friendliness towards green trust with a value of 0.644 which can be a consideration for IT companies.

Keywords—Environmental Friendliness, Green Computing, Green Perceived Quality, Green Satisfaction, Green Trust

I. INTRODUCTION

Every year the technology develops and advances towards a more modern direction, one of the technologies that are often found in smartphones. Human daily activities are actively influenced by the use of smartphones [1]. Indonesia's population in 2019 reaches more than 269 million [2], where the number

of smartphone users in Indonesia in 2019 is predicted to increase and will reach 140.4 million users [3], the data shows that more than 52% Indonesian residents are smartphone users. The increasing number of uses of electronic devices also the more electronic waste produced [4]. Electronic waste contains several materials that are harmful to the environment, some of which are: Nonylphenol, Antimony, Cadmium, Lead, Mercury, Polybrominated Diphenyl Ether, Polychlorinated Biphenyls, Polychlorinated Naphthalene, and Triphenyl Phosphate. Some negative impacts on the environment and health of living things around, namely: causing damage to the kidneys, bone structure, central nervous system, reproductive system, skin and intersex in fish [5].

Besides, electronic waste can also cause air pollution which is certainly dangerous to human health. Some electronic waste cannot be recycled, so it must be burned or buried, only 15-20% that can be recycled. Electronic waste can be reduced by implementing Green Computing because some of its goals are to recycle, make maximum use of the product's energy efficiency and reduce the use of hazardous materials [6]. Green Computing is an effective and efficient activity for the electronic or electrical devices, the activity includes green design, green manufacture, green use and green disposal [15]. Green Computing focuses on reducing the carbon footprint and saving energy use [7], besides, the implementation aims to create an environmentally friendly Information and Communication Technologies [16]. Green Computing originated from the Energy Star program in 1992 which is a label for computer products that can provide maximum

efficiency results by utilizing minimum energy [7]. Energy Star is a program launched by EPA and a symbol of energy efficiency [8].

One well-known IT company that implements green computing is Apple, every product produced by Apple not only complies with and meets Energy Star's strict guidelines but also has gone far in terms of energy efficiency. The Electronic Product Environmental Assessment Tool (EPEAT) also assigns gold rankings to Apple products. Products made by Apple are environmentally friendly products, this is proven by Apple eliminating harmful substances for the environment. Not only that, Apple also think about how to using paper more efficiently in product packaging, where more than two-thirds of it comes from recycled materials. Apple is responsible for the hazardous waste they produce even in small amounts by ensuring the treatment given is suitable for any material that can harm the environment [9]. Daisy is a robot developed by Apple that aims to recycle iPhone components [10].

Thus, the researcher is interested in conducting a research to examine whether there is a positive effect of Green Computing that has been implemented by Apple company to create products that are Environmental Friendliness of Green Satisfaction, Green Perceived Quality and Green Trust on consumers of Apple products in Surabaya.

Environmental Friendliness is also referred to as Green Buying Behavior, which is a consumer behavior that supports the environment by taking actions that are considered appropriate [17]. If the level of environmental friendliness in a brand, product or service felt by consumers can be following their expectations, then consumers will feel satisfied [18]. **H1:** The level of Environmental Friendliness of the product positively influences Green Satisfaction on consumers [19]. Environmental friendliness means a product, service that has a minimal negative impact on the environment. The level of environmental friendliness on a product, brand, or service has a positive influence on increasing consumer trust [20]. **H2:** The level of Environmental Friendliness of the product

positively influences Green Trust on consumers [18]. The existence of consumer concern for the environment so that actions that are considered appropriate by consumers are to buy environmentally friendly products. This encourages companies to further improve the quality of their products in terms of environmental friendliness. **H3:** The level of Environmental Friendliness of the product positively influences Green Perceived Quality on consumers [19].

Green Satisfaction is a satisfaction perceived by consumers of a product, service or brand that is in line with their expectations [21]. Consumer satisfaction can build and enhance the trust of the consumer in a product, service or brand [19].

H4: Green Satisfaction has a positive and significant impact on Green Trust [22]. Green Perceived Quality means consumers assess the quality of a product, service or brand in terms of environmental friendliness, the consumer assessment is to find out the difference between these products and similar products in terms of strengths and weaknesses, it will not be done in a short period [23]. Consumers can feel the quality of the product through their experience in buying previous products, if consumers feel the quality of the product is following their wants, needs and expectations, it can have a positive impact on trust (Green Trust) [18].

H5: Green Perceived Quality has a positive and significant impact on Green Trust [22]. Green Trust means consumers voluntarily want to rely on a brand, product or service [23]. Consumers assess whether the promises made by the company in terms of environmental friendliness have been fulfilled or not [24].

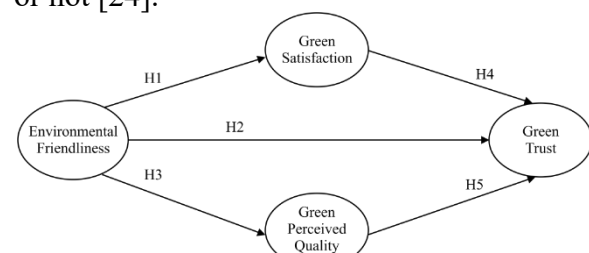


Figure 1
Theoretical Model

Does the level of Environmental Friendliness have a positive and significant impact on Green Satisfaction, Green Perceived Quality and Green Trust? does Green Satisfaction have a positive and significant impact on Green Trust? does Green Perceived Quality have a positive and significant impact on Green Trust? Those questions will be answered from this research.

II. METHOD

This study uses SEM-PLS as a data test method. The minimum number of samples for SEM-PLS is 10 samples multiplied by each pathway [11], this study has five lines so the minimum sample of this study is 50. The sampling technique used is non-probability sampling and accidental sampling. Non-Probability Sampling means the method of taking samples without randomization and Accidental Sampling is a way of determining samples where anyone who has characteristics that are following those determined by researchers, can be respondents [12]. The sample of this study is a small group of the population of consumers of Apple products in Surabaya, the number of samples of this study is 65 samples.

Structural Equation Modeling (SEM) analysis technique is used to analyze the design of relationships between variables, that are variables with indicators and the variables themselves with other variables [13].

Partial Least Square (PLS) is a variance or component-based SEM analysis model. The PLS method does not require data to be normally distributed, PLS can confirm a theory, explain the relationship between latent variables about whether or not there is a good relationship can directly conduct construct analysis formed with reflective and formative indicators [14].

III. RESULTS AND DISCUSSION

Population Characteristics Test

Tests carried out on 65 respondents collected data, the results of the population characteristics test showed 2 respondents data

that had to be issued and 63 respondents data that could go to the next test.

Convergent Validity Test

Validity Test is a test for questions to be distributed, whether the question is valid or not [25]. Convergent Validity Test explains the extent to which correlations or positive relationships occur between indicators on one latent variable. If the value of Outer Loadings value > 0.7 [26] or AVE (Average Variance Extracted) > 0.5 then the indicator is considered valid [27].

Table 1

Convergent Validity Test: Outer Loadings				
Indicator	EF	GPQ	GS	GT
EF1	0.832			
EF2	0.934			
EF3	0.726			
GPQ3		0.759		
GPQ4		0.875		
GPQ5		0.850		
GS1			0.928	
GS2			0.924	
GT1				0.840
GT2				0.879
GT3				0.737
GT4				0.759

Table 2

Convergent Validity Test: AVE	
Variable	AVE
EF	0.697
GPQ	0.688
GS	0.857
GT	0.649

Table 1 and Table 2 state that the test results passed the convergent validity test.

Discriminant Validity Test

There are two tests on the discriminant validity test, the first is the indicator level and the second is the variable level. In the discriminant validity test, the indicator level that needs to be considered is the value of outer loadings which can be seen in the cross-loading menu, where the value of the outer loadings of an indicator to its latent variable $>$ the value of the outer $>$ loadings of an indicator to its latent variable. Testing the discriminant validity at the level of latent variables seen from the Fornell-larcker criterion menu and paying attention to the

value of the root of AVE between the latent variable itself > the root value of AVE between the latent variable with other latent variables [26] & [27].

Table 3
Discriminant Validity Test: Indicator Level

Indicator	EF	GPQ	GS	GT
EF1	0.832	0.524	0.358	0.574
EF2	0.934	0.499	0.436	0.554
EF3	0.726	0.433	0.546	0.478
GPQ3	0.468	0.759	0.378	0.491
GPQ4	0.533	0.875	0.474	0.528
GPQ5	0.456	0.850	0.459	0.659
GS1	0.496	0.484	0.928	0.554
GS2	0.496	0.495	0.924	0.533
GT1	0.448	0.652	0.486	0.840
GT2	0.547	0.590	0.512	0.879
GT3	0.532	0.419	0.385	0.737
GT4	0.557	0.506	0.498	0.759

Table 4
Discriminant Validity Test: Variable Level

Indicator	EF	GPQ	GS	GT
EF	0.835			
GS	0.584	0.829		
GPQ	0.536	0.529	0.926	
GT	0.644	0.679	0.587	0.806

Table 3 and Table 4 state that the test results passed the discriminant validity test.

Reliability Test

The Reliability Test shows a consistent measure and stability of the respondents in answering questions on the questionnaire [28]. If the value of Cronbach's Alpha value > 0.7 and Composite Reliability > 0.7, the latent variable can be said to be reliable [27].

Table 5
Reliability Test

Variable	Cronbach's Alpha	Composite Reliability
EF	0.775	0.872
GPQ	0.771	0.868
GS	0.834	0.923
GT	0.818	0.880

Table 5 state that the test result passed the reliability test.

Path Coefficient Test

Explain the relationship or relations between latent variables following the research

hypothesis. The relation described here is a positive or negative relationship [27].

Table 6
Path Coefficient Test

Variable	EF	GPQ	GS	GT
EF		0.584	0.536	0.229
GPQ				0.386
GS				0.223
GT				

Table 6 state that the relations between latent variables are all positive.

R-Square Test

Explain the value of the variance of endogenous latent variables caused by all exogenous latent variables connected with it. The value of R-Square ranges from 0 - 1, if the value of R-Square approaches 1, explaining the greater accuracy of prediction [26].

Table 7
R-Square Test

Variable	R-Square
GPQ	0.341
GS	0.287
GT	0.585

Table 7 explains that:

1. GPQ latent variables are influenced by EF latent variables by 34% while the remaining 66% are influenced by latent variables outside this research model.
2. The GS latent variable is influenced by the EF latent variable by 28% while the remaining 72% is influenced by the latent variable outside this research model.
3. The latent variable GT is influenced by the latent variables GPQ, GS, and GT by 58% while the remaining 42% is influenced by latent variables outside this research model.

Hypothesis Test

Explain the significance of the hypothesis, seen from the comparison of the T-Statistic value with the T-Table, if T-statistic > T-Table then the hypothesis is accepted [11]. The test conducted in this study is one-tailed

because this study has a directed hypothesis such as the "Positive" direction [26]. T-Table value is obtained from $df = 62$, confidence level = 95% and one-tailed calculation, then the value of T-Table is 1.997 so the T-Statistics value > 1.997 .

Table 8
Hypothesis Test

Hypothesis	Path	T-Statistics
H1	EF → GS	6.999
H2	EF → GT	2.134
H3	EF → GPQ	6.899
H4	GS → GT	2.213
H5	GPQ → GT	3.087

Table 8 state that all the hypothesis are significant.

From the results of the respondents' test data, it was stated that H1, H2, H3, H4 and H5 were accepted

IV. CONCLUSION

From all the tests that have been done state that:

1. Environmental Friendliness has a positive and significant influence on Green Satisfaction and Green Perceived Quality, and Green Trust.
2. Green Satisfaction has a positive and significant impact on the Green Trust.
3. Green Perceived Quality has a positive and significant impact on Green Trust.

The highest value of the relationship is the relationship of environmental friendliness to green trust with a value of 0.644, from this value, companies can pay more attention and improve the environmental friendliness side which is also referred to as green buying behaviour to increase consumer trust. The way to further enhance the environmental friendliness side is to increase environmental awareness [29].

While the lowest value of the relationship is the relationship of green satisfaction to green trust with a value of 0.233, which means that the effect given by customer satisfaction on consumer trust is not high, it is better to not spend too much on the green satisfaction side.

Then for the consumer, consideration is needed in choosing electronic device products to be purchased and used in terms of their performance towards environmental friendliness. Consumers are expected to have a concern for the environment and living things around. The matter of choosing environmentally friendly electronic devices is one of the actions that can support the safety of the environment and living things.

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