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Hey Google: Does Environmental Beliefs and Perceived Privacy Risk Influence Potential User's Intention to Use a Smart Home System in Indonesia?

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HEY GOOGLE: DOES ENVIRONMENTAL BELIEFS AND PERCEIVED PRIVACY RISK INFLUENCE POTENTIAL USERS' INTENTION TO USE A SMART HOME SYSTEM IN INDONESIA?

ABSTRACT

Automation technology has grown at a rapid pace recently. One technology growing rapidly right now is the Internet of Things or IoT. IoT consists of many devices, and one of the IoT devices that are popular right now is called the smart home device. This smart home device can be used to make the user's house smart. It can be used to save energy for efficiency for the user's daily life, such as electricity and water that can negatively impact the environment if used extensively. This smart home device can help to make the energy expense much more efficient. Therefore, this study aims to see and examine the relation between pro-environmental behavior (environmental beliefs and concern), the moderating variable of materialism, perceived privacy risk, and trust that can influence the intention to use smart home devices. This study is an empirical study with a quantitative research method. The respondents in this study live in Jabodetabek, are older than 18 years old, are tech-savvy, and know the concept of smart home technology but do not have the smart home device. The sample used in this study is 294 samples. The data collected was tested using and analyzed using SEM with LISREL 8.5. The research results show that environmental concern, perceived usefulness, and trust positively and significantly affect the intention to use smart home devices. The relationship between environmental beliefs and concerns has a positive and significant effect. The result also shows that perceived privacy risk significantly negatively affects trust in smart home devices. The results of this research are important for developing the smart home market in Indonesia.

***Keywords**: Intention to use; Internet of things; perceived privacy risk; pro-environmental behavior; Smart home devices.*

INTRODUCTION

A smart home device is a device that can be integrated and connected with a similar device using sensors and internet connectivity to help the user to control their home devices automatically or remotely using their smartphones (Rosslin & Tai-hoon, 2010). This technology can also be designed and programmed according to what the user wants and needs, such as controlling the color and turning on/off the lamp automatically, notifying the user when the room temperature is too hot or too cold and controlling it automatically, and notify elderly to take their medicine (Marikyan et al., 2019). There are many kinds of smart home devices, including but not limited to smart lighting, smart locks, smart speakers, smart thermostats, smart water controllers, and motion detection sensors (Shuhaiber & Mashal, 2019). These devices are controlled by an app on the user's smartphone and can also be controlled by voice (Schomakers et al., 2021). These devices can

manage and optimize house energy consumption and enhance home security (Ford et al., 2017; Peetoom et al., 2015). Those are examples of smart home devices.

In Indonesia, the usage of smart home devices is increasing because of the broadened internet penetration from year to year (Arradian, 2021). Arradian (2021) also stated that some users use the device to help them do their house chores faster and more easily because of the work-from-home situation they face because of the COVID-19 pandemic. From the data released by Datareportal (2021), in 2020, 1.29 million houses in Indonesia have already used smart home devices. Statista (2021) stated that most use smart home devices for security and comfort. In 2021, the number rose to 6.35 million houses that use smart home devices.

Aside from doing house chores, smart home devices can also be used to manage and monitor energy usage, such as electricity, water, and gas, and can indirectly help to maintain the energy and sustain the environment by keeping the energy consumption rate to more efficient (Schill et al., 2019). Based on the Katadata (2021) survey conducted to 3,631 respondents in 2021, as many as 47.8 percent of respondents bought an environmentally friendly domestic appliance, and 19.2 percent of respondents bought an environmentally friendly electronic device. This percentage was because they are aware of the importance of a sustainable environment and want to help preserve the environment by buying products that are considered eco-friendly.

Nevertheless, smart home devices also have some disadvantages. The disadvantages are the concern for privacy and trust (Vimalkumar et al., 2021). Because these devices are always connected to the internet and the user's smartphone, they can obtain the user's privacy data and listen to their conversation (Yus & Pappachan, 2022). This ability can lead to a risk of the user privacy data being spread across the internet, or the provider of the smart home devices can acquire it without permission. This risk can be a barrier to people continuing or starting to adopt and use smart home devices because there is a fear of data misuse among the users (Hong et al., 2020; Schomakers et al., 2021).

Most previous studies have only examined the intention to use smart home devices based on utilitarian motivation both outside and inside Indonesia (Baudier et al., 2020; Gultom & Asvial, 2020; Hubert et al., 2019; Nikou, 2019; Salimon et al., 2018; Yasirandi et al., 2020). These studies examine whether the usefulness and convenience can lead to the intention to use the smart home device. There are still very few studies that look at the intention to use smart home devices in terms

of the environment (Schill et al., 2019), so it is necessary to conduct research from the environmental point of view of the device.

This study aims to understand the consumers' intention to use smart home devices better. Particularly to see if and to what degree the environmental factors (Environmental Beliefs and Concerns) and Perceived Privacy Risk and Trust can influence the Intention to Use smart home devices. For that reason, there are several research questions that this research wanted to solve: Can Environmental Beliefs and Concerns influence the Intention to Use smart home devices? Does the Perceived Usefulness influence the Intention to Use smart home devices? Can Perceived Privacy Risk and Trust influence the intention to use smart home devices? Based on those research questions, this research studies the effects of Environmental Beliefs and Concerns, Perceived Usefulness, Perceived Privacy Risk, and Trust towards the Intention to Use smart home devices in Indonesia. Below is the development of the hypotheses used in this study.

Environmental Beliefs and Environmental Concerns towards Intention to Use

Environmental Beliefs can be defined as a belief that someone has about environmental issues, such as climate change and global warming (Huang, 2016). Stern (2000), in his article, stated that Environmental Beliefs could predict pro-environmental behavior. Pro-environmental behavior is the behavior of an individual or society that has the intention to act towards saving the environment (Steg & Vlek, 2009). Stern (2000) also stated that this pro-environmental behavior also could be defined in terms of its impact and purpose. If defined by its impact, this behavior is a behavior that can change the availability of energy or materials from the environment positively. If defined by its purpose, this behavior has the purpose of changing the environment for the better. In this case, using an energy management smart home device to preserve the environment could be considered a pro-environmental behavior.

These beliefs can influence Environmental Concerns and positively affect them (Kashi, 2020). Environmental Concern is a sense of responsibility that arises from concern towards the environment and how far people can act towards reducing the negative impact on the environment (Howe et al., 2015; Qiao & Dowell, 2022; Schill et al., 2019). Schill et al. (2019) found that Environmental Beliefs can create a tendency toward the environment, such as Environmental Concern, because the value that someone has can become a guide for them to act toward certain actions. Usually, people with high Environmental Beliefs tend to act more Environmentally

Friendly and are more concerned about environmental issues, so it can make Environmental Concerns appear (Kilbourne & Pickett, 2008; Schill et al., 2019).

Environmental Concern in marketing has been studied since the 1970s to see the characteristics of consumers concerned for the environment (Kilbourne & Pickett, 2008). Environmental Concern is also based on the belief that environmental health is declining, making the responsibility to protect the environment appear. It can predict the environmentally friendly intention (Mukherjee & Chandra, 2021). Because Environmental Concern can predict how far people will act to help reduce the negative impact on the environment, according to Maichum et al. (2016), people that care for the environment tends to use or buy environmentally friendly product, and this proves that Environmental Concern has an important role in the consumer decision making. From his research, Lee et al. (2014) also concluded that when consumers have a high Environmental Concern, they will do something that positively impacts the environment. Similarly, Schill et al. (2019) also stated that Environmental Concern significantly affects the intention to use smart home products.

Perceived Usefulness

Perceived Usefulness is one of the two factors in the Technology Acceptance Model. It can be described as the user perception that uses a new technology depending on whether it can help them do something easier or better (Davis, 1989; Schill et al., 2019). Consumers with Environmental Concerns often perceive that adopting new technology can help reduce the negative impacts on the environment produced by the old technology (Schill et al., 2019). This Environmental Concern can significantly affect Perceived Usefulness. According to Wu et al. (2019), it happens because when someone is so concerned about the health and the quality of the environment, the thought of the usefulness of the environmentally friendly product will increase. Based on the theory above, these are the hypothesis.

H1: Environmental Beliefs and Concerns positively affect Perceived Usefulness and Intention to Use.

Perceived Usefulness and Intention to Use

Perceived Usefulness can be a significant factor in Intention to Use because the user can evaluate whether the technology they are using truly helps them in their daily life and, at the same

time, can help them to reduce the negative effect on the environment (Schill et al., 2019). Hsieh & Lee (2021) also stated the same thing because Perceived Usefulness is one of the key factors influencing the Intention to Use some technology. Kowalczuk (2018) found that the other factor in the TAM model, perceived ease of use, did not significantly affect the Intention to Use. Therefore this study only uses the Perceived Usefulness factor. Furthermore, Perceived Usefulness is important for predicting the intention to use a newly introduced technology (Koo et al., 2015; Schill et al., 2019).

H2: Perceived usefulness has a positive effect on the Intention to Use.

Perceived Privacy Risk and Trust

Perceived Risk is a user's concern about how far the user can trust the technology they are using from a risk perspective, such as the potential of a privacy or data breach (Shuhaiber & Mashal, 2019). Perceived Privacy Risk is one factor influencing the refusal to use the smart home device because the user is afraid that their privacy and data can be stolen and spread widely on the internet (Hong et al., 2020). This risk can also harm trust. It can be a barrier to Trust in the smart home usage intention because of the data security (Shuhaiber & Mashal, 2019; Vimalkumar et al., 2021). Klobas et al. (2019), in their research on smart home devices, concluded that Perceived Risk also negatively influences the attitude to use smart home devices.

Furthermore, Trust can also influence the Intention to Use smart home devices because Trust has a significant positive effect on intention (Shuhaiber & Mashal, 2019; Vimalkumar et al., 2021). Yang et al. (2017) stated that Trust has a significant influence because the user relies not only on the technology's features but also on the Trust side to build the behavioral intention toward that technology. When the user has a positive behavior toward a certain technology, the intention to use it will appear (Shuhaiber & Mashal, 2019). Trust is one of the important factors for consumers to decide if they want to use the smart home device because trust will indicate if the device is secure or not (Vimalkumar et al., 2021). Based on the above, the hypothesis is:

H3: Perceived Privacy Risk has a negative effect on trust, while trust positively affects the intention to use.

METHODS

This study uses a quantitative descriptive method based on an empirical study done in the Greater Jakarta area. This descriptive method describes a phenomenon or a characteristic associated with the subject population and the relationship between the variables (Cooper & Schindler, 2014). In this study, purposive sampling will be used. Purposive sampling is a part of nonprobability sampling that fills the criteria that the researcher wanted (Cooper & Schindler, 2014). Before the questionnaire was spread across social media, validity and reliability test for the variable used in the study were done so that the questionnaire would affect the variables. Validity tests are used to measure a set of items and see whether they can truly represent what is being studied using Cronbach's alpha.

In contrast, reliability tests are done to see how far the variable or group of variables is consistent with what is being studied by seeing the Kaiser-Meyer-Olkin (KMO) and Bartlett's Test of Sphericity (*sig*) and component matrix (Hair et al., 2014). The steps to test the questionnaire are translating the questionnaire, then pre-testing the questionnaire to only 32 respondents (the validity and reliability test are conducted in this step), and lastly, distributing the main questionnaire. After the main questionnaire was distributed and the data was gathered, Structural Equation Modelling (SEM) was used to test the hypotheses.

The sample criteria used in this study are based on the demographics of smart home device users from Statista (2021), but with minor modifications to suit the research. The sample criteria are participants older than 18 years old, who live in Greater Jakarta, who use the internet more than three hours a day, and who do not have smart home devices related to energy-saving but know about the device. In the questionnaire, there are two attention check that says “if you read this question, please pick option number 2” and “if you read this question, please pick option number 6”. These attention check questions are placed in the opening of the questionnaire and near the end to see if the respondents answer the questions. The final questionnaire gathered a total sample of 294 respondents data. Before the data is processed, the screening process excludes the respondents who did not meet the sample criteria and those who did not pass the attention check questions. Of 294 total respondents, 60 did not get through the screening and attention check question, so only 234 were used. The following are the profile of the respondents that fill the questionnaire. The majority of the gender who filled out the questionnaire was female, with a percentage of 73.1%. Of the respondents' age, the majority were between 23 to 28 years old, with a percentage of 40.6%.

Most of them live in Jakarta, with a percentage of 40.6%. 34.2% of the respondents mostly work in the private sector. 55.1% of them already have their own house. With a percentage of 88.5%, the majority of the respondent always access the internet for more than three hours a day.

The main data used in this study are mainly primary data. Primary data is collected directly by the researcher for their research (Saunders et al., 2016). The primary data was gathered using a Google Form questionnaire and spread across multiple social media. The ordinal scale was used to measure the demography of the respondents, a nominal scale was used to see the gender of the respondents, and the Likert scale was used to measure the variable in the research model. The complete measurements are shown in Table 1, and the research model for this study can be seen in Figure 2.

Table 1. Measurement Item and Operationalization Variable

Variable	Definition	Measurement Item	Source
Environmental beliefs	The belief that the probability of environmental problems or the beliefs of climate change or global warming is significant (Schill et al., 2019).	Many types of pollution are rising to dangerous levels	Kilbourne & Pickett (2008)
		Some species are being threatened with extinction.	
		Shortages of some important resources will occur soon.	
		Global warming is becoming a problem.	
		Ozone depletion is an environmental problem.	
		The availability of clean water will become a problem in the future.	
Environmental concern	The responsibility that emerges from the concern towards the environment and the actions that may worsen the surrounding environment (Schill et al., 2019)	I am concerned about the environment.	Hamzah & Tanwir (2021)
		The condition of the environment affects the quality of my health.	
		I am willing to make sacrifices to protect the environment.	
		I think individuals have a responsibility to protect the environment.	
Perceived usefulness	The extent of consumers who believes that the technology can or may contribute to helping them solve their	Smart homes are useful for me to control home expenses and bills	Shuhaiber & Mashal (2019)
		Using smart homes would enhance the quality of my life.	
		I feel that the smart home would enable me to accomplish tasks more quickly.	Nikou (2019)

	problems (Davis, 1989)	I would find smart homes useful for doing various tasks at home.	
		I feel that using smart homes would increase my productivity at home.	
Perceived privacy risk	The perception of privacy risk from the technology they are using (Shuhaiber & Mashal, 2019)	I am concerned that a smart home may be storing my personal information.	Mamonov & Benbunan-Fich (2021)
		I am concerned that a smart home would know too much about our comings and goings.	
		I am concerned that a smart home would collect data about my habits.	
		I am concerned that data collected by the smart home may be sold.	
		I am concerned that a smart home may make it possible to predict the hours when people are home or not.	
		I am concerned that a smart home can lead to information being stolen.	
		I am concerned that a smart home may lead to the sale of information about my location.	
Trust	The expected trust that some have towards the smart home device (Shuhaiber & Mashal, 2019)	I feel smart homes are trustworthy.	Shuhaiber & Mashal (2019)
		I trust the smart home.	Hsieh & Lee (2021)
		I believe that my smart home company is honest	Barack et al. (2021)
		Smart home applications behave in an opaque manner	Schomakers et al. (2021)
		I distrust the decisions of smart home applications.	
		Smart home applications provide security.	
Intention to use	To which extent some will have the intention to use a product or service, in which this case is technology (Nikou, 2019)	I intend to use smart home technology in the future	Nikou (2019)
		Given that more and more smart home products and services are on the market, I predict that I would intend to use them.	
		I plan to install smart home technology in my house soon.	
		I will frequently use smart home devices.	(Gao & Bai, 2014)
		I will recommend smart home devices to others.	

RESULTS

Reliability test and validity test result

The reliability test and the validity test were conducted using SPSS 25. The reliability test was done to see how far the study's variables are consistent with what this study wants to measure using Cronbach's alpha (Hair et al., 2014). The reliability test result indicates that all the variables are consistent and can represent the factors used in this study. This outcome was indicated by Cronbach's alpha score above 0.60 or 0.70 (Hair et al., 2014). The model's highest variable with Cronbach's alpha value was Intention to Use, which scored 0.961. At the same time, the lowest was Environmental Concern, with a score of 0.613. The variables with high scores imply that the variable truly is reliable, and the variables with the lowest score might be less reliable than the higher ones. Table 2 summarises the reliability and validity test, and appendix A is the formula of Cronbach's alpha.

Next, a validity test was done on the data. The validity test was done to see if the measurement can represent what this research wants to study (Hair et al., 2014). For this validity test, three things are used to measure the validity. The first one is Kaiser-Meyer-Olkin (KMO), which is used to measure the feasibility of factor analysis, which has acceptable values <0.5. The second one is Bartlett's Test of Sphericity (*sig*) which is used to determine whether the variables used are not correlated with the population used. This test has an acceptable value of less than 0.05.

Furthermore, the third one is Component Matrix, which is used to see each measurement item's value and contribution to the research model with the acceptable value >0.5. All the measurement items have passed the acceptable value for KMO and *sig*. However, one measurement item from the variable Environmental Concern, EC2, did not meet the minimum value of the component matrix with a score of 0.476. This outcome signifies that the item did not contribute well to the research model used. Nevertheless, this was only conducted on 32 respondents, so because the difference in the EC2 score is not too different from the minimum value, the item is allowed to be used in the main questionnaire in the hope that it will improve the value.

Table 2. Reliability and Validity Test Results

Variables	Measurement Items	KMO	sig	Component matrix	Cronbach's alpha
Environmental Beliefs	EB1	0,727	0,00	0,780	0,825

	EB2			0,815	
	EB3			0,635	
	EB4			0,899	
	EB5			0,647	
	EB6			0,695	
Environmental Concern	EC1	0,627	0,14	0,824	0,613
	EC2			0,476	
	EC3			0,777	
	EC4			0,622	
Perceived Usefulness	PU1	0,810	0,00	0,675	0,849
	PU2			0,761	
	PU3			0,791	
	PU4			0,814	
	PU5			0,901	
Perceived Risk	PR1	0,788	0,00	0,729	0,943
	PR2			0,737	
	PR3			0,941	
	PR4			0,921	
	PR5			0,828	
	PR6			0,958	
	PR7			0,929	
Trust	TR1	0,782	0,00	0,866	0,926
	TR2			0,919	
	TR3			0,907	
	TR4			0,857	
	TR5			0,845	
	TR6			0,751	
Intention to Use	ITU1	0,812	0,00	0,937	0,961
	ITU2			0,937	
	ITU3			0,949	
	ITU4			0,909	
	ITU5			0,932	

Structural Equation Modelling (SEM)

The Structural Equation Modelling (SEM) and Confirmatory Factor Analysis (CFA) were conducted using LISREL 8.5 software. There are two models used in SEM, the first one is the measurement model, and the second one is the structural model. In the measurement model, reliability, validity, and goodness of fit tests were done too. This validity and reliability test in the measurement model is part of the CFA. The validity test was done by checking the Standard Loading Factor (SLF) and the t-value. The SLF value has to be >0.50 or >0.70 to see if there are correlations and variances between the variables. The t-value has to be >1.96 to pass the validity. The SLF is obtained by analyzing the SEM result with LISREL software. Composite reliability (CR) and average variance extracted (AVE) are used for the reliability test. CR has acceptable values of ≥ 0.7 and AVE ≥0.5. For CR, all the variables are above 0.70; for the AVE, all the variables are above >0.50 marks. The measurement model has the Root Mean Square Error of Approximation (RMSEA) of 0.080, which is a good fit. Table 3 summarizes the test, and the equation for SEM, CR, and AVE can be seen in Appendix B.

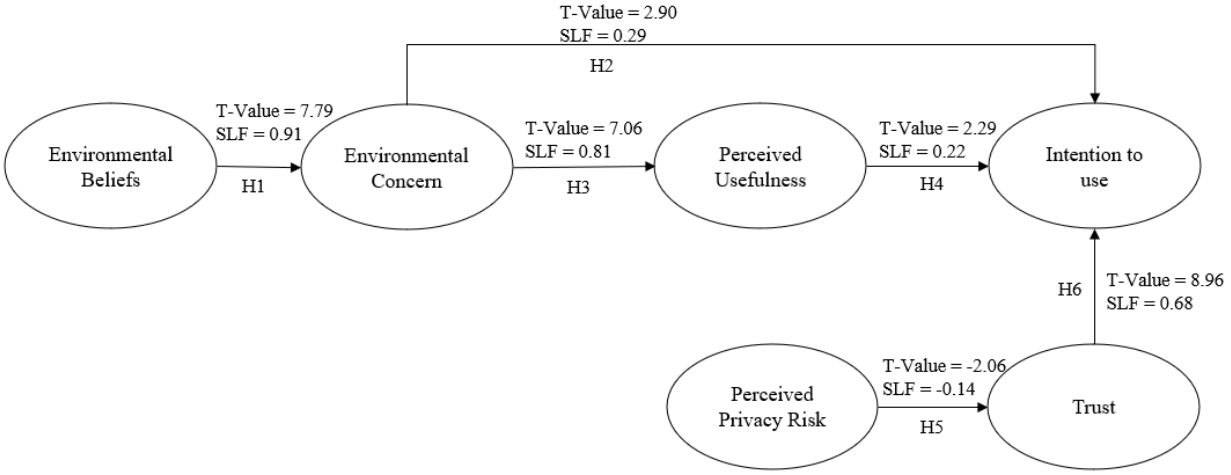
Table 3. Reliability and Validity of the Measurement Model

Variables	**Items**	**Mean**	**Std. Deviation**	**T-value**	**SLF**	**CR**	**AVE**
Environmental Beliefs	EB1	6.19	1.139	13.68	0.77	0.91	0.62
	EB2	6.16	1.277	12.14	0.71		
	EB3	6.30	1.266	13.32	0.76		
	EB4	6.47	1.057	15.91	0.85		
	EB5	6.36	1.176	16.14	0.86		
	EB6	6.35	1.163	13.37	0.76		
Environmental Concern	EC1	6.35	1.167	16.59	0.87	0.88	0.66
	EC2	6.40	1.222	16.54	0.87		
	EC3	5.82	1.352	11.76	0.69		
	EC4	6.50	1.069	14.63	0.81		
Perceived Usefulness	PU1	5.74	1.345	11.71	0.69	0.90	0.64
	PU2	5.78	1.426	15.93	0.85		
	PU3	6.02	1.346	14.53	0.80		
	PU4	5.89	1.338	14.70	0.81		
	PU5	5.94	1.192	15.31	0.83		
Perceived Risk	PR1	5.00	1.675	15.88	0.85	0.95	0.72
	PR2	4.73	1.739	12.26	0.71		
	PR3	4.88	1.820	13.75	0.77		
	PR4	5.09	1.899	17.86	0.91		
	PR5	4.88	1.818	15.15	0.82		
	PR6	5.16	1.864	16.19	0.86		
	PR7	5.09	1.831	17.79	0.91		
Trust	TR1	5.29	1.349	15.94	0.85	0.93	0.69

	TR2	5.23	1.440	14.89	0.81		
	TR3	5.03	1.469	16.32	0.86		
	TR4	5.23	1.357	15.17	0.82		
	TR5	5.19	1.474	13.31	0.75		
	TR6	5.36	1.399	16.82	0.88		
Intention to Use	ITU1	5.85	1.295	17.91	0.91	0.94	0.76
	ITU2	5.79	1.288	17.50	0.90		
	ITU3	5.85	1.343	18.82	0.93		
	ITU4	5.62	1.373	12.78	0.73		
	ITU5	5.59	1.483	15.36	0.83		

Next, the structural model was analyzed to test the research hypotheses. LISREL 8.5 was used to analyze the measurement and the structural model. For the hypotheses test, the hypothesis is accepted if the T-Value is more than the designated t-table (one-tailed) 1.645. The RMSEA for the structural model is also 0.080, which is a good fit. Figure 2 is the result of the hypothesis test for this research, and table 4 is the summary.

Figure 2. The Research Model and Result of the Hypothesis Test



Chi-square= 1528.30, df= 609, p-value= 0.00, RMSEA= 0.080

Table 4. Summary of the Hypothesis Test

Hypothesis	Relation	SLF	T-Value	Conclusion*
1	Environmental Beliefs → Environmental Concerns	0.91	7.79	Accepted
	Environmental Concern → Intention to Use	0.29	2.90	Accepted
	Environmental concern → Perceived Usefulness	0.81	7.06	Accepted

2	Perceived Usefulness → Intention to Use	0.22	2.29	Accepted
3	Perceived Privacy Risk → Trust	-0.14	-2.06	Accepted
	Trust → Intention to Use	0.68	8.96	Accepted

*Notes: The t-values threshold for the accepted hypothesis is>1.645.

DISCUSSION

The analysis indicates that Environmental Beliefs has a strong positive relationship and can directly affect Environmental Concern. Furthermore, Environmental Concern also has a positive relationship. It can increase Perceived Usefulness and Intention to Use, resulting in hypothesis 1 being accepted. Although, the effect of Environmental Concern on Perceived Usefulness is not as strong. Perceived Usefulness also has a positive relationship and can positively influence Intention to Use, resulting in hypothesis 2 being accepted. Meanwhile, Perceived Privacy Risk has a negative influence on trust. In contrast, trust can positively influence Intention to Use, making hypothesis 3 accepted.

First, the positive relationship between Environmental Beliefs and Environmental Concern indicates that the higher a person's belief in the decline of quality in the environment, such as climate change, can lead to or increase the concern for the environment, as shown in a previous study by Schill et al. (2019). This result also confirms the study by Kashi (2020), that stated his research that the higher the Environmental Beliefs, the more they can affect Environmental Concerns. The findings on the relationship between Environmental Concern and Intention to Use are also supported by the study by Schill et al. (2019). It shows that the respondents think of the smart home device as an eco-friendly device that can help reduce any harmful environmental impact. Likewise, according to Lee et al. (2014), this relationship also occurs because people with higher Environmental Concerns are more inclined to engage in an activity that they think can contribute to the environment, in this case, buying a smart home device if they think it can make changes towards the environment.

Moreover, the strong positive relationship between Environmental Concern and Perceived Usefulness suggests that consumers with higher Environmental Concerns may think that using a smart home device related to energy saving can be useful for easing up their home chores while

simultaneously saving energy. These findings were similar to the one studied by Wu et al. (2019). The positive relationship between Perceived Usefulness and Intention to Use supports the Technology Acceptance Model. The explanation is because there is a perception that the higher someone thinks the technology or the device is useful, the higher their intention to use the technology. This perception makes people want to use smart home devices because they think it is a useful technology, as the previous study supported (Hsieh & Lee, 2021; Kowalczuk, 2018; Schill et al., 2019).

Second, on the security side of the device, Perceived Privacy Risk negatively influenced trust toward the smart home device. This finding means that people's perceptions of privacy risk can restrain their trust in smart home devices (Shuhaiber & Mashal, 2019). For example, some concerns about their data being stolen or lost while using the device can reduce their trust towards the smart home device, affecting their attitude. This finding also shows that the higher the Perceived Privacy Risk that someone has, the lesser for the technology to be trustworthy (Vimalkumar et al., 2021). Lastly, as expected, trust also strongly influences the Intention to Use smart home devices because when people trust the device, they intend to use it. These findings support prior studies by Shuhaiber & Mashal (2019) and also (Vimalkumar et al. (2021). This connection is very important because potential users might decide whether to use the device or not based on whether they trust the device to be safe.

The result was also significant for the relationship on all of the mediating variables. The mediating relationship between environmental beliefs and intention to use is significant, with the t-value between the Environmental Beliefs, Environmental Concern, Perceived Usefulness, and Intention to Use being 2.09. That means that Environmental Concern and Perceived Usefulness successfully mediate the relationship between Environmental Beliefs and Intention to Use. The relationship between Environmental Beliefs, Environmental Concerns, and Intention to Use is also significant. The relationships between Perceived Usefulness, Trust, and Intention to Use are also significant, with a t-value of 2,00. These findings mean that trust can mediate the relationship between Perceived Privacy Risk and Intention to Use. Table 4 is the summary of the mediating variables.

Table 4. The relationship of the mediating variables

Direct relationship				Indirect relationship			
Relationship	Loading factor	t-values	Mediating	Loading factor	t-values	p-value	Result
EB→EC	0.91	7.79	EB→EC→PU→ITU	0.91 x 0.81 x 0.22 = 0.16	2.09	0.03	Significant
EC→PU	0.81	7.06					
PU→ITU	0.22	2.29					
EC→ITU	0.29	2.90	EB→EC→ITU	0.91 x 0.29 = 0.26	2.71	0.00	Significant
PR→TR	-0.14	-2.06	PR→TR→ITU	-0.14 x 0.68 = 0.09	2.00	0.04	Significant
TR→ITU	0.68	8.95					

CONCLUSION

This study shows that Environmental Beliefs, Environmental Concerns, Perceived Usefulness, Perceived Privacy Risk, and Trust in smart home devices can impact the intention to use smart home devices, all in line with the hypothesis based on the result of the hypothesis test. The strongest variable is the relationship of trust towards the Intention to Use of smart home devices. The variable with the weakest but still significant relationship is the relationship between Perceived Privacy Risk towards Trust. Even though it has a weak relationship, it still significantly affects the relation of the variable. This path provides the information and understanding of smart home system usage intention from the future user perspective. It can be used for smart home companies looking to successfully promote and position their product in the market. The findings also offer some information to policymakers about the security of the smart home so that it can assist the adoption of smart home devices. Smart home makers can enhance the security of the devices and be fairly transparent about their data and security towards potential buyers so that they can trust the smart home and thus increase the usage intention. In addition, this study also gives further information about the intention to use energy management smart home devices. Because the smart home device is usually only marketed by showing the function and practicality of the device, so smart home companies can promote the smart home device as an energy management and environmentally friendly device. Smart home companies can also position their smart home devices as environmentally friendly and communicate this to their future buyer by teaching them further that using the device can also save the environment. This belief can be highly effective mainly towards potential buyers with high environmental values (Schill et al., 2019) based on the relationship between Environmental Concern and Perceived Usefulness, which has the third strongest relationship.

Second, the limitation in this study was using general smart home devices that related to saving energy, not the specific device, so for future research, the specific model or device of the smart home device can be used. Next, more variables can be added to the research model for future studies, such as the price of the smart home devices and enjoyment of using the device can also be added as this can be an important characteristic for smart home device manufacturers to address. Because most of the respondents acquired in this research are women, male respondents will be the priority for future research. This gender ratio can alter the result because gender can affect how potential users view smart home devices. Next, this research can also compare the people who already use a smart home device and those who have not used the device for better understanding.

TERMINOLOGIES

Table 5. Terminologies

Term	Definition
Smart Home	Home appliances can be integrated and connected with similar devices using sensors and internet connectivity to control their home devices automatically or remotely (Rosslin & Tai-hoon, 2010).
Domestic appliance	A large piece of electrical equipment used in the home, especially in the kitchen (Cambridge, n.d.).
Electronic device	(Especially of equipment), using, based on, or used in a system of operation that involves the control of electric current by various devices (Cambridge, n.d.).
Environmental Beliefs	The belief that the probability of environmental problems or the beliefs of climate change or global warming is significant (Schill et al., 2019).
Environmental Concern	The responsibility emerges from the concern towards the environment and the actions that may worsen the surrounding environment (Schill et al., 2019).
Pro-environmental behavior	A behavior that intends to act toward saving the environment (Steg & Vlek, 2009).
Technology Acceptance Model (TAM)	A theory that looks at the extent to which technology users want to use new technology (Davis, 1989).
Perceived usefulness	The extent of consumers who believes that the technology can or may contribute to helping them solve their problems (Davis, 1989).
Perceived privacy risk	The user perception of the risk of privacy intrusion (Shuhaiber & Mashal, 2019).
Trust	Trust someone has towards the technology they want to use (Shuhaiber & Mashal, 2019).
Intention to Use	The intention to use a product or service (Nikou, 2019).

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APPENDIX A

Reliability test

$$Cronbach's\ alpha\ (\alpha) = \left(\frac{K}{K-1}\right)\left(\frac{S_y^2 - \Sigma S_i^2}{S_y^2}\right)$$

Where

K = *number of items*

ΣS_i^2 = *The sum of the variances of each item*

S_y^2 = *The variance of the total column*

APPENDIX B

Structural Equation Modelling (SEM)

$$EC = \gamma_1 EB + \boldsymbol{\zeta}_1$$

$$PU = \beta_1 EC + \boldsymbol{\zeta}_2$$

$$TR = \gamma_2 PR + \boldsymbol{\zeta}_1$$

$$ITU = \beta_3 EC + \beta_4 PU + \beta_5 TR + \boldsymbol{\zeta}_4$$

Reliability test (CR and AVE)

Construct reliability (CR)

$$\frac{(\Sigma\lambda)^2}{(\Sigma\lambda)^2 + \Sigma\text{error}} > 0.7$$

λ = Standardized Loading Factor (SLF)

The average variance extracted (AVE)

$$\frac{\Sigma\lambda^2}{\Sigma\lambda^2 + \Sigma\text{error}} > 0.5$$

λ = Standardized Loading Factor (SLF)