Enhancing energy-efficient home appliance adoption: Media publicity strategies and planned behavior theory

Andika[1]*, Muinah Fadhilah[2], Della Nanda Luthfiana[3], Nadia[4],
Malik Abd Karim Amirullah[5]

[1,3,4]Faculty of Economics and Business, Janabadra University, Yogyakarta, Indonesia
[2]Master of Management, University of Sarjanawiyata Tamansiswa, Yogyakarta, Indonesia
[5]Faculty of Islamic Economics and Business, Islamic State University Sunan Kalijaga, Yogyakarta, Indonesia

Abstract

Adopting energy-efficient home appliances is one of the critical strategies for supporting environmental protection through reducing energy consumption. This study aims to identify factors contributing to consumers' intentions to adopt energy-efficient household appliances (EEHA) in Indonesia, particularly in Java, a representative area of energy consumption in the country. Adopting the Theory of Planned Behavior (TPB) as the main theoretical framework, the study expands the model to include media publicity (MP) variables as external factors. The survey method was applied to 200 respondents, and the collected data were analyzed using the Structural Equation Modeling (SEM) technique through Smart-PLS 4. The results revealed that consumer attitudes (CA), perceived behavioral control (PBC), and subjective norms (SN) significantly affected consumers' intentions in adopting EEHA. Furthermore, the study found that MP significantly influences CA. Likewise, as we expected, MP significantly affected PBC and SN, marking the first time this relationship has been identified in the context of the adoption of EEHA. Based on these findings, we discuss some of the implications for policymakers, marketers, and environmental practitioners in promoting the adoption of EEHA to accelerate the transition to more sustainable energy consumption in households.

Introduction

In the current era of rapid technological advancements, the surge in energy consumption and its adverse impact on environmental degradation have become significant concerns within the research community (Akadiri et al., 2022). The proliferation of high-tech products, driven by technological progress and the public's eagerness to embrace these innovations, has intensified the use of specialized goods, exacerbating environmental pollution issues (Xin et al., 2022). Recent research highlights the critical role of adopting energy-efficient products in substantially reducing energy consumption, thereby supporting efforts toward environmental sustainability (Bhutto et al., 2021; Zhang et al., 2020). Studies have shown that household energy consumption, encompassing both direct and indirect usage of gasoline, electricity, food, and other necessities, constitutes a significant portion of total domestic energy consumption, with household appliances being significant contributors, especially in urban areas (Muzayanah et al., 2022; Tang & Chen, 2023). The literature consistently emphasizes that improving energy efficiency in household appliances can notably decrease CO_2 emissions, playing a vital role in preserving environmental sustainability (JinRu & Qamruzzaman, 2022; Waris et al., 2021). Nadel and Ungar (2019) reinforce this perspective, suggesting that implementing energy efficiency strategies has the potential to cut greenhouse gas emissions by 50% by 2050. This underscores the importance of adopting energy-

efficient products as a pivotal measure to mitigate energy consumption and enhance environmental sustainability initiatives.

Projections indicate that in 2035 global energy demand will rise by one-third, driven primarily by increasing consumption in Asian countries (Waris et al., 2021). This surge in energy use, as highlighted by Osobajo et al. (2020), is expected to affect climate change and the availability of energy resources profoundly. Nejat et al. (2015) point out that the domestic sector significantly contributes to global energy consumption and CO2 emissions, accounting for 27% and 17%, respectively. Rapid population growth in developing countries is a significant factor behind the rising energy demand (Li et al., 2021a; Muzayanah et al., 2022). For instance, from 2001 to 2016, India provided electricity access to 500 million people, with the domestic sector consuming 24% of the national energy supply (Waris et al., 2021). Similarly, Indonesia experienced an average annual growth of 6.5% in electricity consumption from 2010 to 2022, reaching 316 terawatt-hours (TWh) in 2022, with 40% attributed to the household sector (Enerdata, 2022). In Bangladesh, the dominance of the domestic industry is even more pronounced, constituting 52% of energy consumption and contributing significantly to carbon emissions (Ali et al., 2021). In contrast, large industries in developed countries like the United States and Germany play a crucial role in energy consumption. However, the household sector also makes a significant contribution. In 2022, of the total electricity use of 4 trillion kilowatt-hours (kWh) in the United States, the household sector contributed about 38.4% (EIA, 2023). Similarly, in Germany, the use of electrical energy in 2023 reached 465 TWh, with 28% coming from the household sector (Enerdata, 2023). These statistics highlight the global significance of domestic energy use across developing and developed nations. In response to these trends, Paneru and Tarigan (2023) emphasize the critical need for households to adopt energy-efficient appliances to mitigate the impacts of rising energy consumption. EEHA, certified for its energy efficiency and includes washing machines, fans, air conditioners, LED lights, refrigerators, and air purifiers, plays a crucial role in this effort (Singh et al., 2019).

Although the introduction of digital innovation has opened up opportunities to develop new markets and stimulate creativity in society (Kreiterling, 2023), the use of EEHA can facilitate daily tasks and have a positive effect on environmental conservation efforts (Ali et al., 2019), there is still a significant gap between the existing market potential and the actual number of users (Shin et al., 2018). Consumer acceptance of EEHA is generally limited (Waris & Hameed, 2021). In Indonesia, consumers' awareness and popularity of EEHA still need to improve, and studies on their willingness to switch to EEHA are also limited (Zahra & Astuti, 2023). As environmental issues such as climate change and the energy crisis become more urgent in Indonesia, increasing awareness and action on environmental protection from the public is becoming increasingly important. Therefore, educating the public about the benefits of energy-efficient products is crucial. The adoption of EEHA not only supports environmental conservation efforts but also paves the way for broader introduction in Society (Pernice et al., 2023). Identifying the factors influencing Indonesian consumers' desire to choose EEHA products is an important step, enabling the government and product providers to design effective promotional strategies based on understanding the factors that motivate such purchases.

In research on the adoption of innovative technology-based products and services, TPB and Technology Acceptance Model (TAM) approaches have been widely used (Cheng, 2019). This approach has effectively explored consumer preferences for technologies that support environmental sustainability (Bhutto et al., 2022). The TPB, in particular, is considered more relevant in explaining how consumers are willing to adopt EEHA devices such as washing machines, fans, air conditioners, LED lights, refrigerators, and air purifiers, certified for their energy efficiency, play a crucial role in this effort for household use (Zhang & Liu, 2022). There are efforts to integrate TPB and TAM in understanding consumer decisions to adopt technological innovations (Hua & Wang, 2019). However, the debate about the effectiveness of combining these two models points to the need for an approach that focuses more on individual factors rather than a broad combination of theories (Zhang et al., 2023). Therefore, using the TPB framework, this study will explore the factors driving consumers to adopt EEHA.

Although TPB Theory has proven effective in explaining CA toward the adoption of EEHA, there is recognition of the limitations of this model in accommodating the influence of external factors on behavioral attitudes and intentions (Wang et al., 2014). The role of the media in disseminating information, in this context, becomes critical. The accessibility and quality of information about EEHA influence consumer adoption decisions (Si-dai et al., 2021). Although more EEHA is available, more information and understanding of the benefits and applications of such equipment are needed (Hesselink & Chappin, 2019). Acknowledging this gap in the literature, this study aims to investigate the influence of external factors, particularly the role of information, in Indonesian consumers' adoption of EEHA. We propose integrating the publicity component of media into the TPB framework, hypothesizing that access to relevant and reliable information can be an essential predictor of adoption intention. The main objective of this integration is to test the extent to which increased access to information can strengthen adoption intentions and overcome TPB's limitations in considering external influences. Through this approach, this study seeks to broaden our understanding of how Indonesian consumers perceive the benefits of EEHA in the context of environmental conservation efforts. The results of this study will provide valuable insights for policymakers, companies, and individuals in designing more effective strategies to encourage the use of EEHA, contributing significantly to the literature on consumer behavior and environmental sustainability.

Literature Review and Hypotheses Development

Theory of Planned Behavior (TPB)

Consumers' purchasing decisions for EEHA are influenced by psychological states, physiological factors, and economic conditions (Lin & Dong, 2023). The Theory of Planned Behavior (TPB), developed by Ajzen (1985) as an extension of Fishbein and Ajzen's Theory of Reasoned Action (1975), has significantly influenced numerous studies on consumer behavior. This theoretical framework has been extensively used to analyze green purchasing behaviors (Andika et al., 2023a; Ashraf Fauzi et al., 2023), the adoption of renewable technologies (Ashraf Fauzi et al., 2023; Zheng et al., 2022), and preferences for eco-friendly products (Andika et al., 2023b; Luthfiana et al., 2024). Recent research has expanded TPB by incorporating social, psychological, and economic factors to understand their influence on EEHA's purchasing decisions. Despite these advancements, the literature still needs a comprehensive examination of the impact of MP on these purchasing decisions (Zhang & Liu, 2022). Addressing this gap, the current study integrates MP as a vital psychographic component within the TPB framework to predict consumer decisions regarding EEHA better. In alignment with Ajzen's criteria (1991), for any factor to be included in the TPB model, it must satisfy three conditions: first, it should be independent and not overlap with existing factors; second, it must contribute to a more rational decision-making process for consumers; and third, it should interact cohesively with other TPB elements. The integration of MP is intended to enrich the predictive power of TPB concerning EEHA purchases, thereby providing valuable insights for marketers and policymakers to craft more effective strategies to attract and retain consumers.

Consumer Attitude (CA)

Ajzen (1985) introduced the TPB as an essential framework for analyzing pro-environmental behavior and technology adoption. The TPB identifies three main behavioral intention determinants: CA, SN, and PBC (Qalati et al., 2022). Attitude refers to mental readiness learned through experience, which reflects an individual's reaction to a particular object, person, or situation (Ivancevich et al., 2008). In the TPB, CA, an individual's favorable or unfavorable assessment of behavior is demonstrated. A more positive attitude towards a specific behavior signifies that the person perceives the behavior as advantageous and worthwhile (Abrahamse, 2019). In the realm of EEHA, fostering a favorable attitude towards energy efficiency plays a crucial role in enhancing individuals' intentions to purchase and utilize such devices. Those with a positive perspective on EEHA are inclined to recognize long-term advantages, including reductions in

energy costs and beneficial environmental effects, encouraging the adoption of these technologies (Baldini et al., 2018).

Previous research has shown that positive attitudes towards EEHA increase the intention to adopt the equipment. For example, a study by Bhutto et al. (2021) in Pakistan found that CA has the most significant influence on EEHA purchase intentions, indicating that consumers in Pakistan have a constructive attitude towards EEHA and intend to purchase the equipment. Studies from Karunarathna et al. (2023) in Sri Lanka also indicated that positive attitudes increased the intention to adopt EEHA. These findings confirm that positive attitudes strongly predict increasing EEHA adoption intentions in various geographical and cultural contexts. Based on the description and findings of previous research, the hypothesis proposed is:

H_1: CA significantly influences the intention to purchase EEHA.

Perceived Behavioral Control (PBC)

PBC reflects how an individual perceives the ease or difficulty of carrying out a specific action, shaped by the availability of essential resources, time, and expertise (Ajzen & Madden, 1986). The greater the behavioral control that is felt, the higher the consumer's desire to perform certain behaviors, and vice versa (Ajzen, 1991). In the context of EEHA, PBC can be interpreted as consumers' perception of the ease or difficulty in adopting the equipment (Bamberg et al., 2007). For example, if consumers feel they have enough information about EEHA's benefits, easy access to products, and adequate financial support, they will feel better able to make these purchases. Therefore, consumers with a positive perception of their ability to purchase EEHA regarding knowledge, access, and resources tend to have a stronger intention to buy (Hossain et al., 2022).

Previous research has shown that PBC significantly influences consumers' intention to purchase EEHA. For example, research by Bhutto et al. (2022) found that PBC has a significant positive influence on EEHA purchase intention among young consumers. Similarly, the study by Liu et al. (2020b) revealed that PBC was significantly correlated with EEHA's purchase intention in Northwest China. Conversely, Wang et al. (2019) indicated that PBC adversely influenced the intention to purchase EEHA among consumers in China. This negative impact stems from the challenges in accessing precise data on energy consumption or comprehensible energy efficiency assessments, which hinder consumers from making informed decisions and feeling confident about affording energy-efficient products. The variability in these findings highlights the need for further research to validate these diverse results and offer a more thorough understanding of the influence of PBC on EEHA purchase intentions across varying contexts and demographics. Therefore, we hypothesize that:

H_2: PBC significantly influences the intention to acquire EEHA.

Subjective Norms (SN)

SN refers to the extent to which individuals feel approval or disapproval from society or individuals who are essential to them towards a particular behavior (Yang et al., 2020). In the framework of the TPB, SN represents an individual's perception of the expectations and opinions of others regarding what actions should be taken (Finlay et al., 1999). Put simply, SN reflects the societal influence individuals perceive and their interpretation of the behaviors exhibited by key reference groups like family, friends, or coworkers (Ajzen, 1991). This perception shapes consumers' views of what is or is not considered acceptable in their social environment (Gayatri et al., 2021). For example, if a consumer's friends or family support using EEHA and see it as a good and environmentally responsible choice, that consumer will be more likely to follow that behavior. Therefore, in the context of EEHA, SN can play a significant role in influencing consumers' intention to purchase EEHA (Bhutto et al., 2021).

Empirical evidence suggests a significant positive association between SN and EEHA purchase intent, emphasizing the critical impact of social influences on decision-making. For example, research by Zainudin et al. (2022) found that the support of a friend or family member had a significant positive relationship with intent to purchase EEHA. Study Li et al. (2021b) also identified that SN significantly influences EEHA purchase intention, making it an essential

predictor of EEHA purchase intention. However, research by Ali et al. (2019) and Apipuchayakul & Vassanadumrongdee (2020) found an insignificant relationship between SN and EEHA's purchase intent, implying that consumers are only sometimes easily influenced by the judgments of The inconsistency of the results of previous studies provides opportunities for further research. Therefore, we hypothesize that:

H_3: SN significantly influences the intention to purchase EEHA.

Media Publicity (MP)

In the context of EEHA, MP refers to all information about these appliances disseminated through various media platforms. The availability of this information is a crucial factor that allows consumers to make appropriate evaluations of products or services (Cattaneo, 2019). Studies have shown that consumers' lack of knowledge about a specific product or service can decrease their desire to adopt it (Daroch et al., 2021). For most consumers, EEHA is still a relatively new concept, so they are unfamiliar with and need more information about the product (Zhang & Liu, 2022). Providing consumers with information, including the benefits of using EEHA and guidance on selecting them, can increase their motivation to adopt such equipment. The effectiveness of information communication through appropriate media is essential to generate a positive response from consumers to purchase equipment that increases energy use efficiency (Zhang et al., 2010). The decision to switch to more EEHA technologies is often influenced by how product information is conveyed through various channels, including product etiquette, advertising campaigns, and awareness-raising initiatives about environmental issues (Waris et al., 2021). This suggests that the effectiveness of communication strategies in disseminating information about EEHA has a significant role in shaping perceptions and influencing consumer purchasing decisions, which in turn can contribute to adopting sustainable technologies and support for environmental impact reduction initiatives.

Previous studies show a notable relationship between MP and CA in adopting EEHA. Zhang & Liu (2022) found that disseminating information about EEHA was positively and significantly related to CAs adopting EEHA. Other studies by Zhang et al. (2021) also revealed that publicity highlighting the low-carbon benefits of EEHA has a significant positive influence on CA. These findings show that influential MPs regarding EEHA benefits and information consistently positively impact the adoption and CA of the product. Consequently, based on prior explanations and research, we propose the following hypothesis:

H_4: MP exerts a significant influence on CA in determining the purchase intention of EEHA.

Moreover, earlier studies have indicated that MP substantially influences PBC. For example, research by Liu et al. (2020a) shows that policy information conveyed in a way that consumers can easily understand and apply can improve PBC in adopting energy consumption monitoring technology. Furthermore, the study by Rizzi et al. (2020) demonstrated that prolonged exposure to general information regarding energy conservation significantly enhances PBC. In conclusion, delivering clear policy information and continuous exposure to energy conservation information significantly improves the perception of controlling consumer behavior in adopting energy-saving technologies. Based on the description and findings of previous research, we hypothesize that:

H_5: MP exerts a significant influence on PBC in determining the purchase intention of EEHA.

Furthermore, other studies also found a significant correlation between MP exposure and SN. For example, a survey by Rizzi et al. (2020) shows that long-term exposure to general information related to energy conservation significantly affects SN. In addition, Shah et al. (2023) found that MP, through the promotion of energy-saving labels, had a significant influence on SN. These findings underscore the critical role of the media in forming SN related to energy conservation. Continuous information exposure and effective promotion have increased the community's energy conservation awareness and behavior. Based on previous descriptions and research, we hypothesize that:

H_6: MP exerts a significant influence on SN in determining the purchase intention of EEHA.
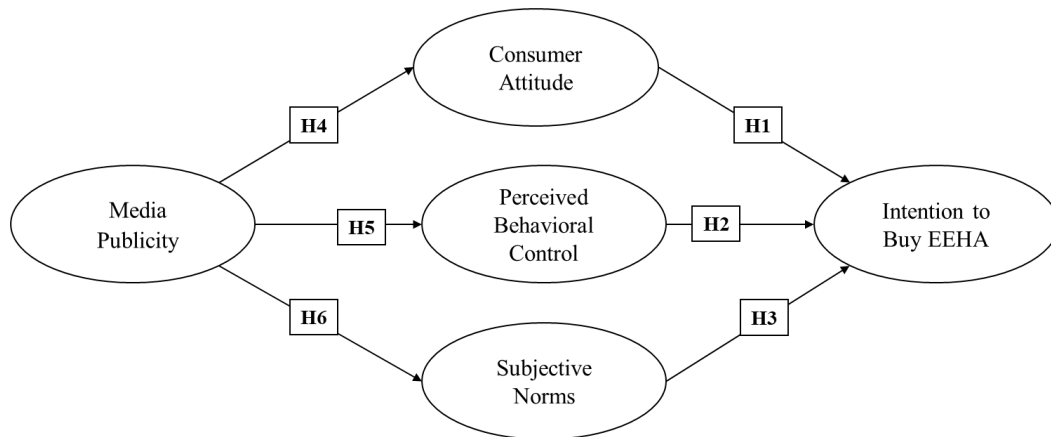
Figure 1. Conceptual Framework of this Research

Research Methods

Table 1. Research Operational Variables

Construct	Item Code	Questionnaire Items	Source
Intention to Buy	ITB1	I intend to use EEHA in the future.	(Pham & Nguyen, 2023)
	ITB2	I will consider buying these EEHA.	
	ITB3	EEHA has become more common, so I recommend using them in my home.	
	ITB4	I intend to buy EEHA for my home shortly.	
Consumer Attitude	CA1	Buying EEHA that can save energy is a good choice	(Zhang & Liu, 2022)
	CA2	I would feel happy using EEHA, which can reduce energy consumption.	
	CA3	Choosing EEHA, which can save energy, is more profitable for me than other appliances.	
Perceived Behavior Control	PBC1	I can afford EEHA.	(Zhang & Luo, 2023)
	PBC2	I have complete control over whether or not to buy EEHA.	
	PBC3	I have the resources, time, and opportunity to buy EEHA.	
Subjective Norms	SN1	My family and friends advised me to buy EEHA instead of energy-intensive ones.	(Lin & Dong, 2023; Zhao et al., 2019)
	SN2	Most of the people I care about choose to buy EEHA instead of energy-intensive ones.	
	SN3	Individuals who matter to me believe that we ought to purchase EEHA.	
Media Publicity	MP1	The information about EEHA in various media (such as TV, the Internet, and magazines) is accurate and reliable.	(Zhang & Liu, 2022)
	MP2	I can easily understand information about EEHA that I read or hear from various media.	
	MP3	The information about EEHA I found in various media is complete and includes everything I need.	

This research employs a quantitative approach through survey methods to investigate the factors influencing the adoption of EEHA among consumers in Indonesia. Given the uncertainty regarding the potential consumer base for EEHA, Chin's (1998) guidelines were utilized to determine the minimum sample size, emphasizing the necessity of statistical power analysis. Using G*Power software, it was determined that at least 193 respondents were required to achieve a statistical power of 0.80 (Kang, 2021). G*Power was chosen for its ability to accurately calculate the sample size needed to detect effects in the model being tested with a high confidence level (Kang, 2021). Compared to other methods, such as the rule of thumb or arbitrary sample sizes, G*Power provides a more precise and contextually appropriate estimation for this study. For

instance, traditional methods like Cochran's formula may not account for the specific statistical requirements of structural equation modeling (SEM), which is central to our analysis.

A purposive sampling technique was employed, targeting particular criteria: (1) respondents from Java, where electricity consumption constitutes 73.5% of the nation's total usage (Wibowo, 2023), thus making it a crucial area for studying energy consumption behaviors and preferences for EEHA; and (2) a minimum age of 17 years for participants. The survey was distributed via Google Forms from 4 January 2024 to 3 February 2024 via WhatsApp and Instagram. The questionnaire comprised 16 items adapted from previous studies (Lin & Dong, 2023; Pham & Nguyen, 2023; Zhang & Liu, 2022; Zhang & Luo, 2023; Zhao et al., 2019) and employed a four-point Likert scale ranging from "strongly disagree (1)" to "strongly agree (4)". Details of the operational variables are presented in Table 1. Out of the 200 responses collected, 88 were from male and 112 from female respondents, meeting the minimum sample size requirement. The data was analyzed using the Partial Least Squares (PLS) technique within the Structural Equation Modeling (SEM) framework, following Hair et al. (2017) guidelines. The analysis process involved four key stages: assessing the measurement model, evaluating the measurement (outer model), examining the structural (inner model), and conducting path coefficient analysis to ensure the reliability and validity of the findings.

Results and Discussion

Demographic Profile of Respondents

This research categorizes participants by gender, age, educational background, monthly earnings, and occupation. Of the 200 participants, 56% (112 people) were women, while 44% (88 people) were men. The age distribution showed that most respondents were between 17 and 26 years old, 56% (112 people). Educational backgrounds vary, with the dominance of bachelor's degree holders as much as 38% (77 people). The highest monthly income level is in the segment, with an income of less than IDR 1.5 million, amounting to 45% (89 people). Regarding professions, most respondents were students or students, as many as 42% (85 people). The detailed demographic profile of respondents is shown in Table 2.

Table 2. Profile of Respondents

Category	Subcategory	Frequency (N = 200)	Percentage (%)
Gender	Men	88	44
	Female	112	56
Age (years old)	17-26	112	56
	27-42	57	28
	43-58	27	14
	>58	4	2
Educational Level	<High School	9	5
	High School	34	17
	Diploma I-IV	26	13
	Bachelor's Degree	77	38
	Master's/Doctoral Degree	54	27
Income Level	IDR <1,500,000	89	45
	IDR 1,500,000-2,500,000	47	23
	IDR 2,500,000-3,500,000	16	8
	IDR >3,500,000	48	24
Job Type	Government/Public Services (ASN/TNI/POLRI)	6	3
	Teacher/Lecturer	32	16
	Private Employee	40	20
	Student	85	42
	Self-employed	17	9
	Others	20	10
	Total	200	100

Measurement Model Assessment

This study employed Smart-PLS version 4 for measurement and structural analysis, which is well-suited for addressing the non-normal data distribution often encountered in social science research (Hair et al., 2019). Unlike CB-SEM, which requires data to meet stringent normality assumptions, PLS-SEM is more flexible and robust when dealing with non-normal data, making it an appropriate choice for this study. The analysis begins with evaluating potential methodological biases (Waris et al., 2021; Zaato et al., 2023) and scrutinizing the interdependencies among variables to detect and mitigate collinearity problems, which can occur when data originates from a single source. An in-depth collinearity analysis is conducted using the PLS-SEM technique, addressing collinearity issues more effectively than Harmon's single-factor method suggested by Kock (2015).

Cross-regression analysis among variables is performed in this framework, with a variance inflation factor (VIF) value below 3.3 used as a threshold to confirm the absence of bias due to single-source data (Kock, 2015). The findings presented in Table 3 reveal that all VIF values are beneath the specified limit, suggesting that our analytical data is accessible from single-source bias. Additionally, this study examines the normality of data distribution by analyzing skewness and kurtosis. According to the criteria set forth by Hair et al. (2023), skewness and kurtosis values within the range of -2 to 2 indicate a normal distribution. Our findings in Table 3 show that all indicator items conform to these normality criteria, with skewness and kurtosis values well within the specified range. This adherence to normality further reinforces the reliability and robustness of our research data.

Table 3. Collinearity and Normality Test

Construct	Item	VIF	Kurtosis	Skewness
Media Publicity	MP1	1.776	0.05	-0.708
	MP2	1.876	0.008	-0.707
	MP3	1.866	-0.047	-0.464
Consumer Attitude	CA1	2.454	1.556	-1.314
	CA2	2.555	1.476	-1.356
	CA3	2.761	1.233	-1.216
Subjective Norms	SN1	2.259	0.313	-0.966
	SN2	2.814	0.317	-0.917
	SN3	2.428	0.516	-0.87
Perceived Behavior Control	PBC1	2.352	-0.09	-0.766
	PBC2	2.688	-0.084	-0.731
	PBC3	2.432	-0.08	-0.711
Intention to Buy	ITB1	1.641	2.0	-1.515
	ITB2	2.156	0.315	-0.979
	ITB3	2.109	0.881	-1.054
	ITB4	1.674	-0.487	-0.58

Outer Model Testing

In the following analysis stage, this study examines the outer model to determine the validity and reliability of the measurement tools employed. Each variable's items are subjected to outer loading checks, adhering to stringent established criteria (Hair et al., 2017). To attain optimal VIF values, items exhibiting loadings below the 0.5 threshold are excluded. As illustrated in Table 4, all indicator items exceed the minimum loading value of 0.5, verifying satisfactory measurement quality. The reliability of the variables is assessed through composite reliability (CR) values, which range from 0.892 to 0.931, significantly above the minimum threshold of 0.70, indicating high reliability (Hair et al., 2017). Additionally, convergent validity is evaluated using average variance extracted (AVE) values, with AVE scores exceeding 0.50, indicating good validity (Hair et al., 2017). According to Table 4, AVE values span from 0.675 to 0.818, signifying that the constructs explain more than half of the variance in their indicators on average. Thus, the study meets the required criteria for reliability, overall validity, and expected convergent validity.

Table 4. Loadings, CR, and AVE

Construct	Item	Description	Loadings	CR	AVE
Media Publicity	MP1	The information about EEHA in various media (such as TV, the Internet, and magazines) is accurate and reliable.	0.851	0.893	0.736
	MP2	I can easily understand information about EEHA that I read or hear from various media.	0.868		
	MP3	The information about EEHA I found in various media is complete and includes everything I need.	0.855		
Consumer Attitude	CA1	Buying EEHA that can save energy is a good choice	0.9	0.931	0.818
	CA2	I would feel happy using EEHA, which can reduce energy consumption.	0.898		
	CA3	For me, choosing EEHA, which can save energy, is more profitable than other appliances.	0.915		
Subjective Norms	SN1	My family and friends advised me to buy EEHA instead of energy-intensive ones.	0.888	0.926	0.807
	SN2	Most of the people I care about choose to buy EEHA instead of energy-intensive ones.	0.91		
	SN3	Individuals who matter to me believe that we ought to purchase EEHA.	0.897		
Perceived Behavior Control	PBC1	I can afford EEHA.	0.89	0.927	0.809
	PBC2	I have complete control over whether or not to buy EEHA.	0.908		
	PBC3	I have the resources, time, and opportunity to buy EEHA.	0.901		
Intention to Buy	ITB1	I intend to use energy-saving home appliances in the future.	0.785	0.892	0.675
	ITB2	I will consider buying these EEHA.	0.855		
	ITB3	EEHA has become more common, so I recommend using them in my home.	0.845		
	ITB4	I intend to buy EEHA for my home shortly.	0.799		

Furthermore, to evaluate the reliability of inter-item discrimination in this study, we utilized the Heterotrait-Monotrait (HTMT) ratio, an advanced measurement technique. The HTMT method was selected to overcome the limitations associated with the Fornell-Larcker criterion in reliability assessment (Fornell & Larcker, 1981). Henseler et al. (2015) proposed the HTMT matrix as a more robust tool for assessing discriminant validity by comparing HTMT correlation ratios. A value below 0.9 indicates adequate discriminant validity (Henseler et al., 2015). Our findings in Table 5 show that all HTMT values fall below the 0.9 threshold, confirming the solid discriminant validity of the constructs under investigation.

Table 5. Discriminant Validity – HTMT Ratio

Variables Used	1	2	3	4	5
Consumer Attitude (CA					
Intention to Buy (ITB)	0.85				
Media Publicity (MP)	0.738	0.819			
Perceived Behavior Control (PBC)	0.745	0.805	0.8		
Subjective Norms (SN)	0.806	0.754	0.797	0.674	

Inner Model Testing

The inner model is evaluated using Hair et al. (2019) recommendations to ensure model goodness and suitability. The assessment involves using indicators such as R Square, Q Square, Standardized Root Mean Residual (SRMR), and PLS prediction. As a measuring instrument, R Square (R^2) is

essential in assessing how significantly the independent variable affects changes in the dependent or endogenous variable. The analysis results in Table 6 show the R Square values for four endogenous variables influenced by independent variables in the context of the PLS algorithm, namely for CA, PBC, SN, and ITB, respectively, of 0.4, 0.465, 0.462, and 0.629. This indicates that the MP variable can account for 40 percent of CA variables, 46.5 percent of PBC, and 46.2 percent of SN, all of which fall into the low category. Meanwhile, CA, PBC, and SN variables can explain 62.9 percent of ITB variables, which are classified in the moderate category, according to the classification by Hair et al. (2011).

Furthermore, the Q Square indicator evaluation, as presented in Table 6, shows that the MP variables correlated with CA, PBC, and SN have Q Square values of 0.316, 0.371, and 0.36, respectively. On the other hand, the correlation between CA, PBC, and SN with ITB has a value of 0.417. Given that all these values exceed the threshold of 0.25 (Hair et al., 2019). The results suggest that the study model achieved a moderate level of predictive accuracy. Standardized Root Mean Square Residual (SRMR) was evaluated to assess conformity using PLS-SEM and avoid model specification errors. Ringle et al. (2023) recommend that an SRMR value below 0.08 indicates adequate suitability. The model estimation result, as presented in Table 6, is 0.06, meaning that the model has an acceptable level of conformity in the context of this study. Empirical data collection has confirmed the existence of significant interactions between variables in the proposed model.

Table 6. R2, Q2, and SRMR

	R²	Q²	SRMR
Consumer Attitude (CA)	0.4	0.316	0.06
Intention to Buy (ITB)	0.629	0.417	
Perceived Behavior Control (PBC)	0.465	0.371	
Subjective Norms (SN)	0.462	0.36	

Table 7. PLS Predict – Predictive Relevance of the Model

	PLS Model		Linear Regression Model	
	RMSE	MAE	RMSE	MAE
CA2	0.691	0.515	**0.694**	**0.516**
CA1	0.631	0.465	**0.632**	0.458
CA3	0.649	0.487	**0.658**	**0.488**
ITB3	0.641	0.483	**0.642**	0.466
ITB1	0.722	0.532	0.717	0.531
ITB4	0.712	0.549	**0.712**	0.523
ITB2	0.745	0.564	**0.755**	0.558
PBC3	0.652	0.463	**0.66**	0.461
PBC2	0.684	0.488	**0.694**	**0.498**
PBC1	0.718	0.512	0.717	0.509
SN1	0.668	0.499	**0.672**	0.495
SN2	0.676	0.503	**0.686**	**0.519**
SN3	0.589	0.444	**0.595**	0.438

Note. CA = Consumer attitude; ITB = Intention to buy; PBC = Perceived behavior control; SN = Subjective norms.
Bold number indicates lower RMSE and MAE of PLS model compared to linear regression model.

In the context of predictive model evaluation, this study adopts version 4 of Smart-PLS to explore its ability to predict outcomes. As a validation step, we apply the PLS-predict procedure to assess the predictive relevance of the proposed model. Recognizing PLS's superiority in predictive ability compared to linear regression models is essential. This evaluation is carried out following the recommendations given by Hair et al. (2019). It involves comparing the Root Mean Squared

Error (RMSE) and the Mean Absolute Error (MAE) generated by the PLS model with the values obtained from the linear regression model. The primary purpose of this comparison is to assess whether the PLS model presents a significantly lower prediction error. Based on the analysis presented in Table 7, it was found that most components of the PLS model indicate lower RMSE and MAE values compared to linear regression models, confirming the significant predictive effectiveness of the PLS model over linear models.

Hypothesis Testing

The conceptual framework put forward in this study comprises six hypotheses related to structural models, elaborated in Table 8. Firstly, the hypothesis (H1) demonstrates that CA significantly impacts purchase intention, evidenced by a path coefficient (β) of 0.391 and a significance level of p<0.000. This finding underscores the pivotal role of CA in shaping purchase intent, corroborating earlier research (Bhutto et al., 2021; Karunarathna et al., 2023). The second hypothesis (H2) identifies a notable effect of PBC on purchase intention, with a path coefficient (β) of 0.335 and a significance level of p<0.000, aligning with prior studies that highlight the significant influence of PBC on purchase intentions (Bhutto et al., 2022; Wang, et al., 2022). Moreover, the third hypothesis (H3) underscores the significant role of SN in influencing purchase intentions, with a β value of 0.17 and a significance level of p<0.013, thus supporting existing literature (Li et al., 2021a; Zainudin et al., 2022). Furthermore, the fourth hypothesis (H4) confirms the significant influence of MP on CA, as indicated by a path coefficient (β) of 0.633 and a significance level of p<0.000, consistent with earlier findings (Zhang et al., 2021; Zhang & Liu, 2022). Similarly, the fifth (H5) and sixth (H6) hypotheses showed a significant impact of MP on PBC (β = 0.682, p<0.002) and SN (β = 0.68, p<0.000), in line with previous research (Liu et al., 2020a; Rizzi et al., 2020; Shah et al., 2023), which further validated the model (See Figures 2).

Table 8. Hypothesis Testing

Hypothesis	Relationship	Original Sample	SD	t-statistics	p-values	Conclusion
H1	CA -> ITB	0.391	0.084	4.634	0.000***	Accepted
H2	PBC -> ITB	0.335	0.081	4.126	0.000***	Accepted
H3	SN -> ITB	0.17	0.068	2.479	0.014*	Accepted
H4	MP -> CA	0.633	0.054	11.796	0.000***	Accepted
H5	MP -> PBC	0.682	0.050	13.669	0.000***	Accepted
H6	MP -> SN	0.68	0.055	12.278	0.000***	Accepted

Note. CA = Consumer attitude; ITB = Intention to buy; PBC = Perceived behavior control; SN = Subjective norms.
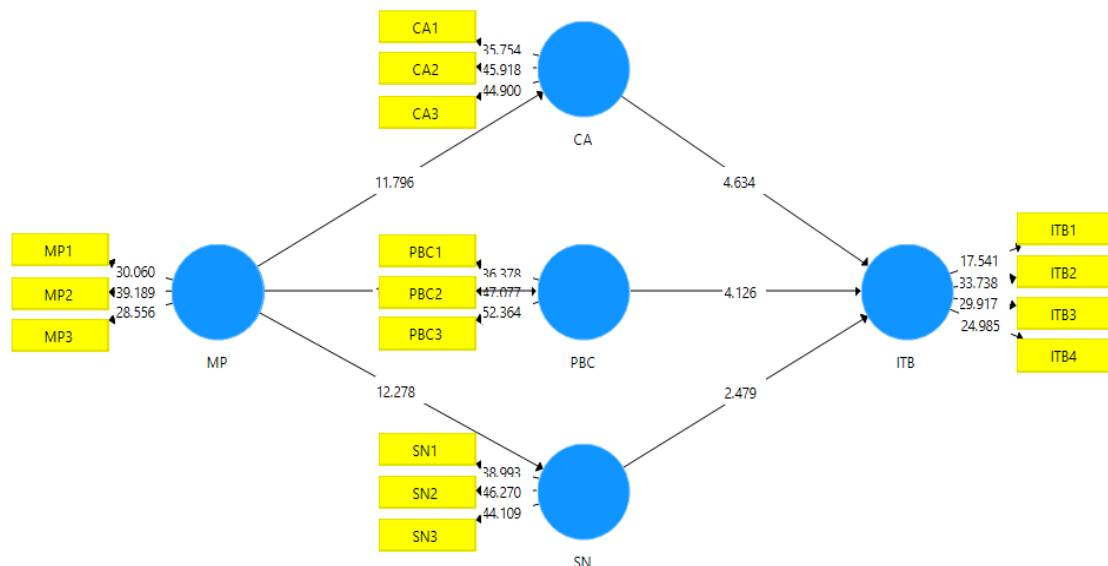***p<0.000; **p<0.01; *p<0.05.

Figure 2. Structural Model of Variables Interrelationship

Discussion

This study adopted the TPB Theory as the core conceptual framework. The adaptation was made by integrating an additional variable, the influence of MP, into existing TPB models to explore consumer adoption intentions toward using EEHA in Java, Indonesia. The results of our analysis reveal deep insights into the dynamics of the adoption of EEHA, contributing significantly to the existing literature. Our key findings underscore the critical role of CA, PBC, and SN as direct predictors of intent to adopt EEHA. This approach broadens our understanding of the mechanisms underlying adoption decisions and reaffirms the relevance of TPB theory in this context. Consistency of our findings with previous research (Bhutto et al., 2021, 2022; Karunarathna et al., 2023; Li et al., 2021b; Liu et al., 2020b; Zainudin et al., 2022) shows that factors such as CA, PBC, and SN are consistently identified as crucial determinants in the adoption of EEHA. This confirms the validity of our findings and highlights the TPB model's robustness and applicability in understanding adoption behavior in various contexts, including in Java, Indonesia. Specifically, our analysis highlights that consumers' positive attitudes towards EEHA, reflecting their belief in adopting these technologies' economic and environmental benefits, significantly increase adoption intentions. This reinforces the view that perceptions of direct benefits, whether cost savings or contributions to environmental protection efforts, play a crucial role in shaping pro-adoption attitudes. Furthermore, PBC, or individual beliefs regarding their ability to adopt, highlight the importance of internal factors such as knowledge and financial capability as drivers of intention. SN, reflecting the influence of social pressures and reference group expectations, further illustrates how external factors shape adoption decisions, affirming that individual decisions are not isolated but influenced by their social context.

The results of our analysis also provide empirical evidence confirming that MP exposure significantly influences consumers' positive attitudes toward adopting EEHA. These results align with previous literature (Zhang et al., 2021; Zhang & Liu, 2022), which shows the positive impact of media on the adoption of EEHA. Although information on EEHA is widely available, consumers' accessibility and understanding of such information is limited. Clarity and ease of understanding public information are essential in shaping consumer purchasing attitudes. As a technological innovation, consumers often need help understanding energy-saving equipment in terms of function and environmental benefits. This suggests that ignorance of this equipment may hinder their adoption. However, when the media actively disseminates relevant and easy-to-understand information, consumers become more knowledgeable and open to applying these energy-efficient technologies. Consequently, CA is becoming more positive, increasing their likelihood of adopting EEHA daily. This conclusion confirms the importance of effective communication strategies in raising public awareness and acceptance of EEHA, especially in households in Java, Indonesia.

Furthermore, according to our expectations, the analysis also found that MP significantly affected PBC and consumer SN. This finding aligns with previous studies. MP, such as social media, energy-saving labels, online advertising, and government campaigns, can influence an individual's perception of their ability to adopt EEHA. PBC refers to an individual's perception of how easy or difficult it is to perform a particular behavior. When MP highlights the ease, availability, and benefits of using EEHA, it can increase consumers' confidence that they have control over their purchasing decisions and can adopt those innovations (Thanh, 2023). Likewise, MP can influence SN by presenting the behavior of adopting EEHA as something considered good and expected by society (Tang et al., 2019). When consumers see that family, friends, or influencers endorse the use of EEHA they respect, they may feel positive social pressure to follow the trend, increasing their likelihood of adopting such appliances.

Further analysis reveals that respondent demographics, such as educational background and income level, significantly impact the intention to adopt EEHA. Specifically, individuals with higher educational attainment, such as those holding bachelor's and postgraduate degrees, tend to have more positive attitudes towards EEHA, likely due to their better comprehension of these products' economic and environmental benefits. This finding is supported by Wang et al. (2022), which indicates that higher education levels correlate with increased ecological awareness and pro-

environmental behaviors. Conversely, respondents with lower monthly incomes exhibit lower PBC, which may hinder their intentions to adopt EEHA, as financial constraints limit their ability to invest in energy-efficient appliances. Additionally, younger age groups (17-26 years old), who constitute the majority of respondents in this study, show a greater interest in new and innovative technologies like EEHA, driven by media influence and prevailing social trends. This demographic insight aligns with the findings of Haleem et al. (2022), which highlight the role of youth in driving technological adoption. These demographic insights are crucial for developing targeted marketing and educational strategies that cater to specific consumer segments, enhancing the overall adoption rate of EEHA products.

Implication and Conclusion

This study successfully expanded the application of Planned Behavior Theory (TPB) by integrating the influence variables of MP to examine consumer adoption intentions towards EEHA. The results not only provide significant new insights into the existing literature but also affirm the critical role of CA, PBC, and SN. Further, the study highlights the significant impact of MP exposure in shaping positive attitudes, reinforcing PBC, and influencing SN. It shows that when expanded with MP variables, the TPB model provides a more comprehensive understanding of the factors affecting the adoption of energy-efficient technologies. It also emphasizes the importance of effective communication through media in increasing public awareness and acceptance of these innovations.

The study's findings provide significant practical implications for interested parties, including policymakers, marketers, and environmental practitioners, in promoting the adoption of EEHA. First, effective communication strategies, which utilize MP to disseminate clear and easy-to-understand information about the benefits of EEHA, can increase consumer awareness and positive attitudes. This demonstrates the importance of developing and implementing targeted information campaigns to address knowledge gaps and strengthen EEHA's perceptions of economic and environmental benefits. Second, understanding that PBCs and SN play a crucial role in shaping adoption intentions, programs and policies should be designed to not only enhance consumers' financial capabilities and knowledge but also to create supportive social norms. This could involve financial incentives, subsidies, education programs, and leveraging influencers and online communities to build social momentum. Lastly, these results reaffirm the relevance of Planned Behavior Theory in understanding and predicting the adoption of energy-efficient technologies, suggesting that interventions designed to improve positive attitudes, PBC, and SN can effectively increase the adoption of EEHA. Thus, incorporating these findings into promotional strategies and public policies could accelerate the transition towards more sustainable household energy consumption.

Although this study provides valuable insights into adopting EEHA through the lens of TPB Theory with the integration of MP influence variables, it is nevertheless recognized as having some limitations that open up opportunities for future research. First, limitations in generalizing findings are evident due to the study's focus solely on the Java region. This geographical limitation restricts the applicability of the results to the broader Indonesian context. Therefore, future research should consider including a more diverse and extensive sample from various regions across Indonesia to enhance the generalizability of the findings. Second, exploring other variables not yet considered, such as economic, technological, and psychological factors, can provide a deeper understanding of the determinants of adoption. Third, reliance on survey data also raises questions about potential response bias and measurement errors, fueling the need for blended methodologies that combine surveys with in-depth interviews or case studies for richer insights. Fourth, the study was also limited in capturing the long-term dynamics of technology adoption, emphasizing the importance of longitudinal research to observe changes in adoption intentions and behaviors over time. Fifth, although this study highlights the significant influence of MP, measuring the specific impact of different media types requires further analysis. Future research could explore how social media, traditional media, and government campaigns contribute to adoption perceptions and behaviors and identify the most effective messages in increasing

adoption. Finally, testing theory-based interventions, including educational campaigns and financial incentives, can provide insight into the most effective strategies for promoting EEHA in various societal contexts. By addressing these limitations, research can further expand our understanding of the factors influencing the adoption of EEHA and assist in developing more effective strategies to promote the widespread use of such appliances.

References

Abrahamse, W. (2019). Understanding the Drivers of Human Behaviour. In *Encouraging Pro-Environmental Behaviour: What Works, What Doesn't, and Why* (pp. 11–25). London: Academic Press. https://doi.org/10.1016/b978-0-12-811359-2.00002-0

Ajzen, I. (1985). From Intentions to Actions: A Theory of Planned Behavior. In Kuhl J., & Beckmann, J. (Eds.), *Action Control: From Cognition to Behavior* (pp. 11-39). Berlin, Heidelberg: Springer. https://doi.org/10.1007/978-3-642-69746-3

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, *50*, 179–211. https://doi.org/10.47985/dcidj.475

Ajzen, I., & Madden, T. J. (1986). Prediction of goal-directed behavior: Attitudes, intentions, and perceived behavioral control. *Journal of Experimental Social Psychology*, *22*(5), 453–474. https://doi.org/https://doi.org/10.1016/0022-1031(86)90045-4

Akadiri, S. Saint, Adebayo, T. S., Nakorji, M., Mwakapwa, W., Inusa, E. M., & Izuchukwu, O. O. (2022). Impacts of globalization and energy consumption on environmental degradation: What is the way forward to achieving environmental sustainability targets in Nigeria? *Environmental Science and Pollution Research*, *29*(40), 60426–60439. https://doi.org/10.1007/s11356-022-20180-7

Ali, M. R., Shafiq, M., & Andejany, M. (2021). Determinants of consumers' intentions towards the purchase of energy efficient appliances in pakistan: An extended model of the theory of planned behavior. *Sustainability (Switzerland)*, *13*(2), 1–17. https://doi.org/10.3390/su13020565

Ali, S., Ullah, H., Akbar, M., Akhtar, W., & Zahid, H. (2019). Determinants of consumer intentions to purchase energy-saving household products in Pakistan. *Sustainability (Switzerland)*, *11*(5), 1–20. https://doi.org/10.3390/su11051462

Andika, Luthfiana, D. N., Nadia, & Kartinah. (2023a). Green purchase behavior: The role of green advertising, green awareness, and eco-literacy. *IOP Conference Series: Earth and Environmental Science*, *1181*(1), 1–6. https://doi.org/10.1088/1755-1315/1181/1/012025

Andika, Nadia, Najmudin, M., & Hasibuan, A. B. (2023b). Green cosmetics in Indonesia: Unraveling attitude-behavior gap and gender moderation. *Jurnal Aplikasi Bisnis*, *21*(4), 1134–1152. https://doi.org/http://dx.doi.org/10.21776/ub.jam. 2023.021.04.20.

Apipuchayakul, N., & Vassanadumrongdee, S. (2020). Factors affecting the consumption of energy-efficient lighting products: Exploring purchase behaviors of Thai consumers. *Sustainability (Switzerland)*, *12*(12), 1–16. https://doi.org/10.3390/SU12124887

Ashraf Fauzi, M., Hanis Zainal Abidin, N., Mohd Suki, N., & Mokhtar Albshir Budiea, A. (2023). Residential rooftop solar panel adoption behavior: Bibliometric analysis of the past and future trends. *Renewable Energy Focus*, *45*, 1–9. https://doi.org/https://doi.org/10.1016/j.ref.2023.02.002

Baldini, M., Trivella, A., & Wente, J. W. (2018). The impact of socioeconomic and behavioural factors for purchasing energy efficient household appliances: A case study for Denmark. *Energy Policy*, *120*(October 2017), 503–513. https://doi.org/10.1016/j.enpol.2018.05.048

Bamberg, S., Hunecke, M., & Blöbaum, A. (2007). Social context, personal norms and the use of

public transportation: Two field studies. *Journal of Environmental Psychology, 27*(3), 190–203. https://doi.org/10.1016/j.jenvp.2007.04.001

Bhutto, M. Y., Liu, X., Soomro, Y. A., Ertz, M., & Baeshen, Y. (2021). Adoption of energy-efficient home appliances: Extending the theory of planned behavior. *Sustainability (Switzerland), 13*(1), 1–23. https://doi.org/10.3390/su13010250

Bhutto, M. Y., Soomro, Y. A., & Yang, H. (2022). Extending the theory of planned behavior: Predicting young consumer purchase behavior of energy-efficient appliances (Evidence from developing economy). *SAGE Open, 12*(1). https://doi.org/10.1177/21582440221078289

Cattaneo, C. (2019). Internal and external barriers to energy efficiency: Which role for policy interventions? *Energy Efficiency, 12*(5), 1293–1311. https://doi.org/10.1007/s12053-019-09775-1

Cheng, E. W. L. (2019). Choosing between the theory of planned behavior (TPB) and the technology acceptance model (TAM). *Educational Technology Research and Development, 67*(1), 21–37. https://doi.org/10.1007/s11423-018-9598-6

Chin, W. W. (1998). The partial least squares approach to structural equation modeling. In Marcoulides, G. A. (Ed.), *Modern Methods for Business Research*. New Jersey: Lawrence Erlbaum Associates, Inc. https://doi.org/10.4324/9781410604385-10

Daroch, B., Nagrath, G., & Gupta, A. (2021). A study on factors limiting online shopping behaviour of consumers. *Rajagiri Management Journal, 15*(1), 39–52. https://doi.org/10.1108/ramj-07-2020-0038

EIA. (2023). *Electricity consumption in the United States was about 4 trillion kilowatthours (kWh) in 2022*. Retrieved from https://www.eia.gov/energyexplained/electricity/use-of-electricity.php

Enerdata. (2022). *Indonesia Energy Information*. Retrieved from https://www.enerdata.net/estore/energy-market/indonesia/

Enerdata. (2023). *Germany Energy Information*. Retrieved from https://www.enerdata.net/estore/energy-market/germany/

Finlay, K. A., Trafimow, D., & Moroi, E. (1999). The importance of subjective norms on intentions to perform health behaviors. *Journal of Applied Social Psychology, 29*(11), 2381–2393. https://doi.org/10.1111/j.1559-1816.1999.tb00116.x

Fishbein, M., & Ajzen, I. (1975). *Belief, Attitude, Intention, and Behavior: An Introduction to Theory and Research*. Reading, Massachusetts: Addison-Wesley Publishing Company.

Fornell, C., & Larcker, D. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research, 18*(1), 39–50. https://doi/abs/10.1177/002224378101800104

Gayatri, G., Alversia, Y., & Astuti, R. D. (2021). The influence of attitude and subjective norms on student's (future) intention and future decision of higher level studies: A case study of five universities with BHMN status in Indonesia. *ASEAN Marketing Journal, 2*(1), 4. https://doi.org/10.21002/amj.v2i1.1991

Hair, Hult, Ringle, & Sarstedt. (2017). *A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM), second edition*. California, USA: SAGE Publications, Inc.

Hair, J. F., Ringle, C. M., & Sarstedt, M. (2011). PLS-SEM: Indeed a silver bullet. *Journal of Marketing Theory and Practice, 19*(2), 139–152. https://doi.org/10.2753/MTP1069-6679190202

Hair, J. F., Risher, J. J., Sarstedt, M., & Ringle, C. M. (2019). When to use and how to report the results of PLS-SEM. *European Business Review, 31*(1), 2–24. https://doi.org/10.1108/EBR-11-2018-0203

Hair, J., Hair Jr, J. F., Sarstedt, M., Ringle, C. M., & Gudergan, S. P. (2023). *Advanced Issues in Partial Least Squares Structural Equation Modeling, second edition*. USA: SAGE Publications, Inc.

Haleem, A., Javaid, M., Qadri, M. A., & Suman, R. (2022). Understanding the role of digital technologies in education: A review. *Sustainable Operations and Computers*, *3*(February), 275–285. https://doi.org/10.1016/j.susoc.2022.05.004

Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the Academy of Marketing Science*, *43*(1), 115–135. https://doi.org/10.1007/s11747-014-0403-8

Hesselink, L. X. W., & Chappin, E. J. L. (2019). Adoption of energy efficient technologies by households – Barriers, policies and agent-based modelling studies. *Renewable and Sustainable Energy Reviews*, *99*(March 2018), 29–41. https://doi.org/10.1016/j.rser.2018.09.031

Hossain, I., Fekete-Farkas, M., & Nekmahmud, M. (2022). Purchase behavior of energy-efficient appliances contribute to sustainable energy consumption in developing country: Moral norms extension of the theory of planned behavior. *Energies*, *15*(13), 4600. https://doi.org/10.3390/en15134600

Hua, L., & Wang, S. (2019). Antecedents of consumers' intention to purchase energy-efficient appliances: An empirical study based on the technology acceptance model and theory of planned behavior. *Sustainability (Switzerland)*, *11*(10), 2994. https://doi.org/10.3390/su11102994

Ivancevich, J. ., Konopaske, R., & Matteson, M. (2008). *Organizational Behavior and Management, 10th edition*. United Kingdom: Irwin, McGraw-Hill Education.

JinRu, L., & Qamruzzaman, M. (2022). Nexus between environmental innovation, energy efficiency, and environmental sustainability in G7: What is the role of institutional quality? *Frontiers in Environmental Science*, *10*(May), 1–21, 860244. https://doi.org/10.3389/fenvs.2022.860244

Kang, H. (2021). Sample size determination and power analysis using the G*Power software. *Journal of Educational Evaluation for Health Professions*, *18*, 1–12. https://doi.org/10.3352/JEEHP.2021.18.17

Karunarathna, W. K. S., Jayaratne, W., Dasanayaka, S., Ibrahim, S., & Samara, F. (2023). Factors affecting household's use of energy-saving appliances in Sri Lanka: An empirical study using a conceptualized technology acceptance model. *Energy Efficiency*, *16*(3), 15. https://doi.org/10.1007/s12053-023-10096-7

Kock, N. (2015). Common method bias in PLS-SEM: A full collinearity assessment approach. *International Journal of E-Collaboration*, *11*(4), 1–10. https://doi.org/10.4018/ijec.2015100101

Kreiterling, C. (2023). Digital innovation and entrepreneurship: A review of challenges in competitive markets. *Journal of Innovation and Entrepreneurship*, *12*(1), 49. https://doi.org/10.1186/s13731-023-00320-0

Li, S., Meng, J., Zheng, H., Zhang, N., Huo, J., Li, Y., & Guan, D. (2021a). The driving forces behind the change in energy consumption in developing countries. *Environmental Research Letters*, *16*(5), 054002. https://doi.org/10.1088/1748-9326/abde05

Li, Y., Siddik, A. B., Masukujjaman, M., & Wei, X. (2021b). Bridging green gaps: The buying intention of energy efficient home appliances and moderation of green self-identity. *Applied Sciences (Switzerland)*, *11*(21), 9878. https://doi.org/10.3390/app11219878

Lin, C. C., & Dong, C. M. (2023). Exploring consumers' purchase intention on energy-efficient home appliances: Integrating the theory of planned behavior, perceived value theory, and environmental awareness. *Energies*, *16*(6), 2669. https://doi.org/10.3390/en16062669

Liu, X., Liu, X., Luo, X., Wang, M., Fu, H., Wang, B., Sun, Y., & Hu, W. (2020a). Analysis on the

influencing mechanism of informational policy instrument on adopting energy consumption monitoring technology in public buildings. *Energy Efficiency*, *13*(7), 1485–1503. https://doi.org/10.1007/s12053-020-09895-z

Liu, X., Wang, Q., Wei, H. H., Chi, H. L., Ma, Y., & Jian, I. Y. (2020b). Psychological and demographic factors affecting household energy-saving intentions: A TPB-based study in northwest China. *Sustainability (Switzerland)*, *12*(3), 1–20. https://doi.org/10.3390/su12030836

Luthfiana, D. N., Andika, A., & Bidayati, U. (2024). Unraveling the complexity of the organic food market : Indonesian consumer perspective on price and product knowledge. *Asian Management and Business Review*, *4*(1), 73–89. https://doi.org/https://doi.org/10.20885/AMBR.vol4.iss1.art5

Muzayanah, I. F. U., Lean, H. H., Hartono, D., Indraswari, K. D., & Partama, R. (2022). Population density and energy consumption: A study in Indonesian provinces. *Heliyon*, *8*(9), e10634. https://doi.org/10.1016/j.heliyon.2022.e10634

Nadel, S., & Ungar, L. (2019). Halfway There: Energy Efficiency Can Cut Energy Use and Greenhouse Gas Emissions in Half by 2050. *Report U1907 American Council for an Energy-Efficient Economy*. Washington DC: ACEEE.

Nejat, P., Jomehzadeh, F., Taheri, M. M., Gohari, M., & Muhd, M. Z. (2015). A global review of energy consumption, CO2 emissions and policy in the residential sector (With an overview of the top ten CO2 emitting countries). *Renewable and Sustainable Energy Reviews*, *43*, 843–862. https://doi.org/10.1016/j.rser.2014.11.066

Osobajo, O. A., Otitoju, A., Otitoju, M. A., & Oke, A. (2020). The impact of energy consumption and economic growth on carbon dioxide emissions. *Sustainability (Switzerland)*, *12*(19), 1–16. https://doi.org/10.3390/SU12197965

Paneru, C. P., & Tarigan, A. K. M. (2023). Reviewing the impacts of smart energy applications on energy behaviours in Norwegian households. *Renewable and Sustainable Energy Reviews*, *183*(June), 113511. https://doi.org/10.1016/j.rser.2023.113511

Pernice, G. F. A., Orso, V., & Gamberini, L. (2023). Is this right for you?: The key role of shop assistants in promoting energy-efficient household appliances. *Sustainability*, *15*(24), 16630. https://doi.org/10.3390/su152416630

Pham, L. T. T., & Nguyen, Y. T. H. (2023). An integrated framework approach to understanding Vietnamese people's intention to adopt smart home solutions. *Human Behavior and Emerging Technologies*, *2023*(1), 8882543. https://doi.org/10.1155/2023/8882543

Qalati, S. A., Qureshi, N. A., Ostic, D., & Sulaiman, M. A. B. A. (2022). An extension of the theory of planned behavior to understand factors influencing Pakistani households' energy-saving intentions and behavior: A mediated–moderated model. *Energy Efficiency*, *15*(6), 1–21. https://doi.org/10.1007/s12053-022-10050-z

Ringle, C. M., Sarstedt, M., Sinkovics, N., & Sinkovics, R. R. (2023). A perspective on using partial least squares structural equation modelling in data articles. *Data in Brief*, *48*, 109074. https://doi.org/10.1016/j.dib.2023.109074

Rizzi, F., Annunziata, E., Contini, M., & Frey, M. (2020). On the effect of exposure to information and self-benefit appeals on consumer's intention to perform pro-environmental behaviours: A focus on energy conservation behaviours. *Journal of Cleaner Production*, *270*, 122039. https://doi.org/10.1016/j.jclepro.2020.122039

Shah, R., Modi, A., Muduli, A., & Patel, J. D. (2023). Purchase intention for energy-efficient equipment appliances: Extending TPB with eco-labels, green trust, and environmental concern. *Energy Efficiency*, *16*(4), 31. https://doi.org/10.1007/s12053-023-10111-x

Shin, J., Park, Y., & Lee, D. (2018). Who will be smart home users? An analysis of adoption and diffusion of smart homes. *Technological Forecasting and Social Change*, *134*(January), 246–253. https://doi.org/10.1016/j.techfore.2018.06.029

Si-dai, G., Cheng-Peng, L., Hang, L., & Ning, Z. (2021). Influence mechanism of energy efficiency label on consumers' purchasing behavior of energy-saving household appliances. *Frontiers in Psychology*, *12*(October), 1–15. https://doi.org/10.3389/fpsyg.2021.711854

Singh, V. K., Henriques, C. O., & Martins, A. G. (2019). Assessment of energy-efficient appliances: A review of the technologies and policies in India's residential sector. *Wiley Interdisciplinary Reviews: Energy and Environment*, *8*(3), 1–19. https://doi.org/10.1002/wene.330

Tang, Z., & Chen, L. (2023). Measurement and analysis of direct and indirect household energy consumption: A case study of China. *Frontiers in Energy Research*, *11*(July), 1–13. https://doi.org/10.3389/fenrg.2023.1220207

Tang, Z., Warkentin, M., & Wu, L. (2019). Understanding employees' energy saving behavior from the perspective of stimulus-organism-responses. *Resources, Conservation and Recycling*, *140*(September 2018), 216–223. https://doi.org/10.1016/j.resconrec.2018.09.030

Thanh, N. D. (2023). The impact of media publicity and online product reviews on consumers' purchase intentions of energy-efficient appliances. *VNU University of Economics and Business*, *3*(6), 77. https://doi.org/10.57110/vnujeb.v3i6.232

Wang, Q., Niu, G., Gan, X., & Cai, Q. (2022). Green returns to education: Does education affect pro-environmental attitudes and behaviors in China? *PLoS ONE*, *17*(2 February), 1–20. https://doi.org/10.1371/journal.pone.0263383

Wang, Z., Sun, Q., Wang, B., & Zhang, B. (2019). Purchasing intentions of Chinese consumers on energy-efficient appliances: Is the energy efficiency label effective? *Journal of Cleaner Production*, *238*, 117896. https://doi.org/10.1016/j.jclepro.2019.117896

Wang, Z., Zhang, B., & Li, G. (2014). Determinants of energy-saving behavioral intention among residents in Beijing: Extending the theory of planned behavior. *Journal of Renewable and Sustainable Energy*, *6*(5), 1–18. https://doi.org/10.1063/1.4898363

Waris, I., Dad, M., & Hameed, I. (2021). Promoting environmental sustainability: The influence of knowledge of eco-labels and altruism in the purchase of energy-efficient appliances. *Management of Environmental Quality: An International Journal*, *32*(5), 989–1006. https://doi.org/10.1108/MEQ-11-2020-0272

Waris, I., & Hameed, I. (2021). An empirical study of consumers intention to purchase energy efficient appliances. *Social Responsibility Journal*, *17*(4), 489–507. https://doi.org/10.1108/SRJ-11-2019-0378

Wibowo, A. H. (2023). *Persebaran Konsumsi Listrik di Berbagai Pulau Indonesia*. Retrieved from https://data.goodstats.id/statistic/wibowoadnanhasyim/persebaran-konsumsi-listrik-di-berbagai-pulau-indonesia-qlAfd

Xin, D., Zhi Sheng, Z., & Jiahui, S. (2022). How technological innovation influences environmental pollution: Evidence from China. *Complexity*, *2022*, *2022*(1), 5535310. https://doi.org/10.1155/2022/5535310

Yang, X., Chen, L., Wei, L., & Su, Q. (2020). Personal and media factors related to citizens' pro-environmental behavioral intention against haze in China: A moderating analysis of TPB. *International Journal of Environmental Research and Public Health*, *17*(7), 2314. https://doi.org/10.3390/ijerph17072314

Zaato, S. G., Zainol, N. R., Khan, S., Rehman, A. U., Faridi, M. R., & Khan, A. A. (2023). The mediating role of customer satisfaction between antecedent factors and brand loyalty for the Shopee application. *Behavioral Sciences*, *13*(7), 1–22.

https://doi.org/10.3390/bs13070563

Zahra, F., & Astuti, Y. (2023). Government policy effect toward energy-efficient appliances purchase intention in West Java. *Journal of Humanities and Social Studies (JHSS)*, *07*(02), 343–347. https://doi.org/10.33751/jhss.v7i2.7940

Zainudin, N., Lau, J. L., & Munusami, C. (2022). Modelling household behavioural changes as an opportunity for sustainable home energy. *Environmental Economics and Policy Studies*, *24*(1), 73–97. https://doi.org/10.1007/s10018-021-00311-z

Zhang, H., Gladisch, A., Pickavet, M., Tao, Z., & Mohr, W. (2010). Energy efficiency in communications. *IEEE Communications Magazine*, *48*(11), 48–49. https://doi.org/10.1109/MCOM.2010.5621966

Zhang, J., Ma, L., & Li, J. (2021). Why low-carbon publicity effect limits? The role of heterogeneous intention in reducing household energy consumption. *Energies*, *14*(22), 7634. https://doi.org/10.3390/en14227634

Zhang, W., & Liu, L. (2022). Unearthing consumers' intention to adopt eco-friendly smart home services: An extended version of the theory of planned behavior model. *Journal of Environmental Planning and Management*, *65*(2), 216–239. https://doi.org/10.1080/09640568.2021.1880379

Zhang, W., & Luo, B. (2023). Predicting consumer intention toward eco-friendly smart home services: Extending the theory of planned behavior. *Economic Change and Restructuring*, *56*(5), 3335–3352. https://doi.org/10.1007/s10644-022-09477-2

Zhang, X., Cheng, X., & Huang, X. (2023). "Oh, my God, buy it!" Investigating impulse buying behavior in live streaming commerce. *International Journal of Human-Computer Interaction*, *39*(12), 2436–2449. https://doi.org/10.1080/10447318.2022.2076773

Zhang, Y., Xiao, C., & Zhou, G. (2020). Willingness to pay a price premium for energy-saving appliances: Role of perceived value and energy efficiency labeling. *Journal of Cleaner Production*, *242*, 118555. https://doi.org/https://doi.org/10.1016/j.jclepro.2019.118555

Zhao, C., Zhang, M., & Wang, W. (2019). Exploring the influence of severe haze pollution on residents' intention to purchase energy-saving appliances. *Journal of Cleaner Production*, *212*, 1536–1543. https://doi.org/10.1016/j.jclepro.2018.12.134

Zheng, S. Y., Liu, H., Guan, W., Yang, Y., Li, J. Y., Fahad, S., & Li, B. (2022). Identifying intention-based factors influencing consumers' willingness to pay for electric vehicles: A sustainable consumption paradigm. *Sustainability (Switzerland)*, *14*(24). https://doi.org/10.3390/su142416831