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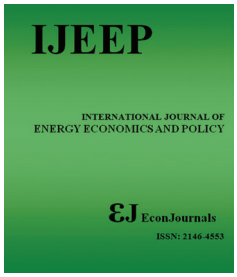

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Exploring Consumer Transition to Energy-Efficient Household Appliances in Indonesia: The Mediating Role of Curiosity in a Push-Pull-Mooring Framework

Andika Andika[1]*, Maslikhah Maslikhah[2], Nobel Kristian Tripandoyo Tampubolon[3], Danang Wahyudi[1], Titop Dwiwinarno[1], Malik Abd Karim Amirullah[4]

[1]Management Study Program, Faculty of Economics and Business, Janabadra University, Yogyakarta, 55231, Indonesia, [2]Postgraduate Program, Universitas Islam Negeri Salatiga, Central Java, 50716I, Indonesia, [3]Master's Program in Agribusiness, Faculty of Agriculture, Diponegoro University, Semarang, 50275, Indonesia, [4]Faculty of Islamic Economics and Business, Islamic State University Sunan Kalijaga, Yogyakarta, 55281, Indonesia. *Email: andika@janabadra.ac.id

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ABSTRACT

This research is motivated by the increase in energy consumption in the Indonesian household sector, especially on the island of Java, which contributes significantly to greenhouse gas emissions. Although the government has implemented an energy-saving label policy, the adoption of energy-saving appliances still needs to be higher. The main problems identified include low consumer awareness of the long-term benefits, high perception of initial costs, and lack of effective information dissemination. This study aims to analyze the factors that affect consumer intentions in switching to energy-efficient appliances using the Push-Pull-Mooring (PPM) theory. Environmental consciousness functions as a push factor, social media, energy-saving labels, Curiosity as a pull factor, and technology compatibility as a mooring factor. A quantitative survey was conducted on 310 households in Java, and the data was analyzed using PLS-SEM. The results show that environmental consciousness and Curiosity influence consumers' intention to switch, while technology compatibility strengthens adoption decisions. In addition, social media and energy labels directly increase consumer curiosity about energy-efficient appliances. The implications of this study include strategic recommendations for governments and marketers to increase awareness campaigns and financial incentives and leverage social media to accelerate the adoption of sustainable technologies in the household sector.

Keywords: Push-Pull-Mooring Framework, Energy-Efficient Household Appliances, Social Media Influence, Energy-efficient Labels
JEL Classifications: D12, F64, P18, Q42, C12

1. INTRODUCTION

Asia Pacific, which accounts for nearly 40% of global greenhouse gas emissions, is now at the forefront of international efforts to address the increasingly pressing climate crisis (Dabla-Norris et al., 2023). As one of the region's most significant contributors to emissions, Indonesia recorded a surge in household energy consumption in 2022, with the household sector accounting for 42.43% of total national electricity use (PLN, 2022). In line with this increase in energy consumption, Indonesia's reliance on coal has intensified, accounting for 40.46% of primary energy needs in 2023 (ESDM, 2024), which has exacerbated national emissions as most household electricity consumption is generated from coal-based power plants (Siahaan, 2024). In this context, IPCC Report 1.5°C (IPCC, 2019) affirms that a 45% reduction in greenhouse gas emissions is needed by 2030 compared to 2010 emission levels to keep the global temperature rise below 1.5°C. As part of its commitment to the Paris Agreement, Indonesia will independently reduce greenhouse gas emissions by 29% and up to 41% with international support—including technology assistance

and funding from developed countries—by 2030 (Reyseliani et al., 2022). This commitment affirms the household sector's critical role in national emission reduction strategies, which requires implementing more innovative and effective energy efficiency strategies.

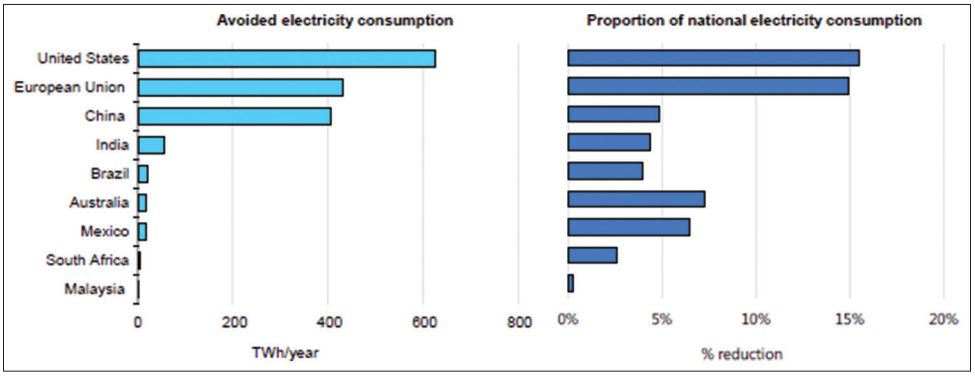
The Government of Indonesia has implemented various policies to improve energy efficiency in the household sector, such as the 10% Savings Program and the prepaid meter system, which aim to reduce energy consumption significantly (Cahyani et al., 2022). However, the effectiveness of this policy still needs to be improved because inefficient electrical appliances dominate household energy consumption (Kusnandar, 2022). CLASP estimates (2020) show that about 98% of a household's electrical energy consumption comes from several major appliances, such as rice cookers, refrigerators, and lights, which collectively account for more than 50% of total electricity consumption. In response to this challenge, the government enacted the Regulation of the Minister of Energy and Mineral Resources Number 7 of 2017 concerning the Energy Saving Mark Label Policy, which aims to provide unique labels on energy-efficient household appliances as a step to increase the adoption of such appliances among consumers (Penerapan Standar Kinerja Energi Minimum Dan Pencantuman Label Tanda Hemat Energi Untuk Peranti Pengkondisi Udara, 2017). At the beginning of its implementation, this policy only covered air conditioners, but its scope was expanded in 2021 to include other appliances, including fans, refrigerators, rice cookers, and LED lights (Permen ESDM 14 Tahun 2021 Tentang SKEM, 2021). It is hoped that this expansion can encourage consumers to prefer efficient products, which ultimately increases the effectiveness of policies in reducing energy consumption in the household sector.

Although an energy-efficient household appliance label policy has been introduced, implementation still needs to improve in Indonesia, which hinders the success of this program (Andika et al., 2024). The main challenges are low consumer awareness of the long-term benefits of these appliances and the perception of high initial costs compared to conventional appliances (Akil et al., 2020). Weak government support in the form of incentives and educational campaigns also exacerbates this condition, leading to low energy literacy among consumers (Akil et al., 2020). However, previous studies have shown that these labeling programs can attract consumer interest and encourage the purchase of energy-efficient appliances (Hossain et al., 2022; Shah et al., 2023; Waris et al., 2021). The International Energy Agency reports (IEA/4E TCP, 2021) also indicate the success of these policies in achieving energy savings and carbon emission reductions in countries such as the United States, the European Union, China, India, Brazil, and Australia (Figure 1). Therefore, more thorough policy assessments and further research are needed to overcome these barriers and achieve emissions targets more effectively.

Various studies have examined consumer behavior related to the adoption of energy-efficient household appliances in multiple countries, such as Portugal (Neves and Oliveira, 2021), Iran (Jafari, 2023), Pakistan (Waris and Hameed, 2020), China (Aziz et al., 2024), Malaysia (Jaaffar et al., 2023), Bangladesh (Hossain et al., 2022), Indonesia (Andika et al., 2024), and South Korea (Park and Woo, 2023). However, while these studies have provided important insights, there still needs to be a significant gap in understanding the specific factors influencing the adoption of energy-efficient appliances, especially in Indonesia. Although environmental consciousness and energy-saving labels are often the focus of research, the relevance of these two factors remains high in Indonesia, given the low level of consumer awareness and understanding compared to developed countries (Andika et al., 2024). In addition, research examining the role of social media in increasing consumer awareness and intention to adopt energy-efficient appliances is still limited, even though social media has evolved into a highly influential information channel (Wang et al., 2020). Previous studies have yet to fully accommodate rapid technological developments and digital trends, which often ignore the potential of social media as a tool for behavior change (Nazir and Tian, 2022). Similarly, consumer curiosity toward new technologies (Jin et al., 2021), which can be an essential driver in the adoption process, has yet to receive adequate attention. In addition, the compatibility of appliances with consumer lifestyles, as a crucial element to ensure the sustainability of adopting energy-efficient appliances, needs to be sufficiently researched (Zhang and Luo, 2023a). This study aims to fill the gap by comprehensively analyzing how these five factors—environmental consciousness, energy-efficient labels, social media, Curiosity, and appliance compatibility—interact in influencing consumers' intentions to adopt energy-efficient appliances in Indonesia, providing critical new insights for marketing strategies and public policies in the country.

This research uses the Push-Pull-Mooring (PPM) Theory (Moon, 1994) as a conceptual framework to address gaps in the literature on adopting energy-saving appliances. In contrast to the Theory of Planned Behavior (TPB), which was dominant in previous studies (Aziz et al., 2024; Hossain et al., 2022; Waris and Hameed, 2020), PPM offers a more comprehensive approach by integrating pushing factors (Push), pulling factors (Pull), and transition obstacles (Mooring) to capture broader dynamics in the process of adopting green technologies. The main advantage of PPM lies in its ability to consider internal and external factors, including the attractiveness of new technologies and existing barriers, in influencing consumer decisions. PPM has also been successfully applied in research related to other sustainable products, such as electricity management systems (Ho, 2024), Electric vehicles (Hu et al., 2023), and renewable energy technologies (Kushwah et al., 2024), which shows its relevance in studying the adoption of energy-efficient appliances. By implementing PPM for the first time in the context of Indonesia, this study is expected to provide strategic guidance for policymakers and marketers in designing more effective educational campaigns and marketing strategies to accelerate the adoption of energy-efficient appliances. Social media, energy-efficient labels, and consumer curiosity were identified as Pull factors that attracted consumer interest. At the same time, environmental consciousness served as a push factor, and appliance compatibility with lifestyle acted as a coping factor that could facilitate or inhibit the transition. The study aims to answer three key questions: (1) How do environmental consciousness, appliance compatibility, and Curiosity affect

Figure 1: Annual reduction in electricity consumption from standard and labeling programs



consumers' intention to adopt energy-efficient appliances? (2) How can social media and energy-efficient labels increase consumer curiosity? and (3) How does Curiosity mediate the influence of social media and energy-efficient labels on switching intentions in adopting energy-efficient appliances?

Furthermore, this article is compiled as follows. Part 2 reviews the literature and develops relevant hypotheses. Part 3 describes the research methodology applied. Part 4 presents data analysis and reveals critical findings. Part 5 discusses the findings that have been identified. Finally, Part 6 closes with a conclusion, discusses the implications of the study, and outlines the limitations of this study.

2. THEORETICAL BACKGROUND

2.1. Push-Pull-Mooring Framework

The Push-Pull-Mooring (PPM) framework was originally developed to explain the movement of people between geographical regions (Moon, 1994). Over time, the theory expanded into a conceptual framework to understand various forms of transition, including technological shifts and changes in consumer behavior (Lisana, 2023; Monoarfa et al., 2024; Yusfiarto et al., 2023). In the context of the transition to energy-efficient appliances, PPM provides important insights into how consumers decide to replace conventional appliances with more energy-efficient appliances (Zhang et al., 2014). The skeleton consists of three main factors: push, pull, and mooring (Chang et al., 2017). The push factor is the element that encourages individuals to abandon old conditions or technologies, usually due to dissatisfaction or increased awareness of the need for change (Nugroho and Wang, 2023). The pull factor refers to the attraction of new alternatives that offer better benefits or advantages (Fan et al., 2021). Meanwhile, mooring factors include personal, social, or environmental aspects that can facilitate or hinder the transition process, such as psychological barriers or incompatibility with lifestyle (Zhou et al., 2024).

The PPM framework has been applied in various studies to understand consumer transitions in multiple sectors, such as the adoption of digital technologies (Lisana, 2023), Changes to online payment systems (Yusfiarto et al., 2023), and migration to more innovative financial services (Monoarfa et al., 2024). PPM is also used in studies related to sustainable products, such as the adoption of renewable energy (Hu et al., 2023), Energy Efficient Management (Ho, 2024), and Electric vehicles (Kushwah et al., 2024). The mapping of these findings indicates that PPM effectively models drivers, attractions, and barriers to transform consumer behavior in a sustainable direction. Although PPM has been widely applied, its application in the transition from conventional household appliances to energy-efficient appliances has yet to be explored, making this research a significant contribution to the literature.

This study specifically applies the PPM framework to identify the factors that encourage and inhibit the adoption of energy-efficient household appliances in Indonesia. In this context, push factors include environmental consciousness that enables consumers to abandon inefficient and potentially environmentally damaging appliances. The pull factor involves the appeal of more environmentally friendly products, such as clear energy-efficient labels, positive influences from social media, and consumer curiosity. The mooring factor plays an important role in determining whether consumers will switch, considering the compatibility of the new device with their habits and preferences. This study highlights how the interaction between the three PPM factors influences consumer intention to switch and makes a new contribution to the energy-efficient appliance adoption literature. Thus, this study not only fills in the gaps in the literature but also provides strategic guidance for policymakers and marketers in accelerating the adoption of energy-efficient appliances in Indonesia.

2.2. Research Model and Hypothesis Development

2.2.1. Environmental consciousness

Various studies have agreed that changing consumer behavior toward sustainable product consumption depends highly on environmental consciousness (Rusyani et al., 2021). However, this awareness is not just knowledge of the ecological impact of everyday actions but also involves a deep commitment and courage to consistently implement sustainability practices with high dedication (Panizzut et al., 2021). In the transition towards using energy-efficient household appliances, environmental consciousness is the main foundation that shapes consumer preferences and tastes (Lin and Dong, 2023). Increased awareness of the importance of sustainability not only shapes consumer preferences but is also reflected in product choices that support energy efficiency and significantly reduce carbon footprint (Senese et al., 2024). Interestingly, the consistency in these actions is not the result of an instant process but rather the result

of deep reflection on long-term impacts, such as the reduction of greenhouse gas emissions (Liao et al., 2020). Thus, strong environmental consciousness is not only an idealism but can also be a major driver in the widespread and sustainable adoption of energy-efficient appliances.

Based on previous empirical studies, a study in South Africa by Fatoki (2020) and in China by Liao et al. (2020) in China, it shows that individuals with high environmental consciousness are more likely to adopt energy-saving appliances because of their benefits not only for themselves but also for the environment. However, research by Hossain et al. (2022) in Bangladesh showed conflicting results, where environmental consciousness had no significant influence on such intentions. These differences are due to different cultural and economic contexts, which affect consumers' perceptions of sustainability and the adoption of new technologies. These differences have been highlighted extensively in the literature, with factors such as literacy levels, access to information, and socio-economic conditions influencing the adoption of the technology (Ben Belgacem et al., 2024; Saleem et al., 2023), which is also relevant in the context of Indonesia as the location of this research. Therefore, although our hypothesis is based on the supporting theories and findings of Fatoki (2020) and Liao et al. (2020), we will continue to consider external influences in examining the relationship between environmental consciousness and the intention to adopt energy-saving appliances in Indonesia. This is intended to provide flexibility if our findings are outside the basis of the hypothesis proposed. Based on this, our initial hypothesis is:

H_1: Environmental consciousness significantly influences consumer intent to switch to EHA.

2.2.2. Curiosity

Curiosity, generally defined as the intrinsic drive to acquire new knowledge (Litman & Spielberger, 2003), is an important psychological factor that encourages individuals to seek out unknown information (Molnar and Golman, 2024). In the context of sustainable technology adoption, Curiosity not only broadens an individual's understanding of energy efficiency and the reduction of environmental degradation (Joo et al., 2023) but also plays a role in reducing uncertainty and resistance to change (Chang & Shih, 2019), which is often a major obstacle in the adoption of energy-efficient appliances (Du et al., 2014). Thus, a high level of Curiosity in individuals is assumed to impact the positive adoption of energy-efficient appliances. Previous academic literature, as disclosed by Jin et al. (2021) and Acikgoz et al. (2023), supports our hypothesis by showing that Curiosity motivates consumers to seek out the latest information regarding technological developments, ultimately driving the adoption of energy-efficient appliances. Especially in Indonesia, where energy-saving appliances are still in development (Andika et al., 2024), there are significant research opportunities to develop strategies for adopting such technologies. Therefore, we identify Curiosity as one of the important instruments in driving the adoption of energy-saving appliances in Indonesia and formulate the following hypothesis:

H_2: Curiosity significantly influences consumer intent to switch to EHA.

2.2.3. Compatibility

Compatibility is an important concept, which refers to 'the extent to which an innovation is considered to be aligned with existing consumer values, needs, and experiences' (Shi et al., 2020). In energy-efficient appliances, compatibility can influence consumer attitudes and decisions to accept or abandon such appliances (Ekim et al., 2023). According to the diffusion theory of innovation from Rogers et al. (2014), the more compatible an innovation is with consumers' daily lives, the more likely they are to accept it. However, this compatibility is not only technical but also includes alignment with cultural values and socio-economic conditions, which can significantly impede the adoption of energy-efficient appliances (Sharma and Gandhi, 2024). For example, according to Gothesen et al. (2023), consumers adopt technologies that can be integrated into their routines more readily without requiring significant adjustments. Therefore, factors such as differences in economic accessibility, education, and entrenched cultural preferences for traditional technologies may pose considerable challenges to adopting new technologies that, while technically appropriate, are incompatible with local lifestyles (Kumar et al., 2023).

Empirical research has emphasized the importance of compatibility in transitioning to new technologies. Zhang and Luo (2023b) and Yang et al. (2022) demonstrate that compatibility positively correlates with adoption intent, where consumers are more receptive to technology that fits their needs and lifestyles. Pancar and Ozkan Yildirim (2023) highlight that products compatible with consumers' routines are adopted faster because they do not interfere with their daily lives. However, socio-cultural and economic factors in Indonesia often pose challenges in ensuring full compatibility between new technologies and local contexts (Sambodo et al., 2022). This suggests that more in-depth research is needed to understand how local cultural values and customs affect consumer perceptions of compatibility and how these perceptions influence the adoption of energy-efficient technologies. Based on these findings, the hypothesis proposed is:

H_3: Compatibility significantly influences consumers' intention to switch to EHA.

2.2.4. Social media influences

Social media has emerged as a key driver of consumer behavior, especially in adopting new technologies (Maurya et al., 2022). Social media is a place to share information and an effective tool to facilitate consumers in making decisions and purchases (Palalic et al., 2020). Regarding energy-efficient appliances, social media is important in fostering consumer curiosity about more efficient and environmentally friendly technologies (Chung et al., 2020). According to Lee et al. (2024), active and informative interactions on social media can trigger cognitive and emotional engagement, increasing product curiosity. Content presented on social media, such as user reviews, brand campaigns, and recommendations from influencers, can increase consumer awareness and interest in exploring more about the benefits of the product (Agarwal et al., 2024). Previous literature has provided strong evidence of the significant effects of social media on consumer curiosity (Lee, 2024; Sheng et al., 2020). Therefore, based on these findings, our fourth hypothesis is:

H_4: Social media influence has a significant effect on consumer curiosity.

The proposed research model is presented in Figure 2, summarizing the conceptual relationships and hypotheses developed in this study.

2.2.5. Energy-saving labels

Energy-saving label is a sign or certification given to products that meet certain energy-efficiency standards to help consumers identify green and energy-saving products (Wang et al., 2021). The label provides crucial information on the energy-usage efficiency of a product, usually presented in the format of levels or scores that are easy to understand (Si-dai et al., 2021). In energy-saving appliances, the label is an important tool that helps consumers make more informed and responsible decisions (Rondoni and Grasso, 2021). Whenever consumers see the energy-saving label on certain products, they will likely be more interested in knowing how the products could reduce energy consumption, cut operational costs, and benefit the environment (Skourtos et al., 2021). Thus, energy-efficient labels not only raise consumer awareness of the importance of sustainability but also spark a deeper curiosity about the product. Previous research has shown that energy-saving labels significantly impact the consumer's Curiosity. The studies by Issock Issock and Muposhi (2023) indicate that an energy-saving label could enhance consumers' attention towards the energy efficiency of a product, especially when the information provided on the label is clear and easily understandable. In addition, research by Duan et al. (2023) revealed that products with energy-efficient labels, which signify a commitment to the environment, can satisfy consumers' Curiosity and attract their interest in innovations. However, the effectiveness of these labels can vary depending on consumer segments, especially in developing countries such as Indonesia, where levels of environmental literacy and access to information can vary greatly (Akil et al., 2020). Based on this evidence and argument, the hypothesis we put forward is:

H_5: Energy-efficient labels have a significant effect on consumer curiosity.

2.2.6. Mediator (Curiosity)

Previous research has shown mixed results regarding the direct influence of energy-efficient labels and social media on consumers' intention to adopt new technologies. Several studies reveal that energy-efficient labels and social media can increase consumer intent to switch by providing clear information about energy efficiency advantages (Adnan, 2024; Akil et al., 2023; Andika et al., 2024). However, other research shows that the direct influence of these energy-efficient labels is only sometimes significant, especially if consumers need to pay more attention or understand the information conveyed (Beck and Toulouse, 2023). In the context of social media, the study also found that marketing through social media does not directly affect the intention to switch but rather has an impact on consumers' perception of the value and benefits of the product, which then influences that intention (Vidyanata, 2022). These findings suggest that the effectiveness of social media marketing depends more on creating a positive internal response than directly leading consumers to switch.

To bridge this gap, we propose that Curiosity is a mediating variable that can reinforce the influence of energy-efficient labels and social media on consumers' intention to switch to energy-efficient appliances. Curiosity, triggered when consumers are exposed to new or interesting information, encourages them to explore more deeply and understand the product's benefits more clearly (Daume & Hüttl-Maack, 2020). In Indonesia, where energy-efficient appliances are still a new technology that is not widely known, Curiosity is key to overcoming barriers to adoption caused by a lack of information or understanding (Andika et al., 2024). When consumers see energy-efficient labels or are exposed to social media campaigns, their Curiosity can prompt them to seek out more information, explore unique features, and understand the long-term benefits of the appliances. In the context of new and unfamiliar technologies, Curiosity is a bridge that connects the external influences of social media and energy-efficient labels with consumers' internal decisions to adopt the technology (Zhang et al., 2024). By including Curiosity as a mediating variable, this study aims to provide a deeper insight into how consumers in Indonesia are encouraged to switch to energy-efficient appliances and make an important contribution to the green marketing literature and effective marketing strategies. Therefore, the hypothesis proposed is:

H_6: Curiosity mediates the influence of social media on consumers' intention to switch to EHA.

H_7: Curiosity mediates the influence of energy-efficient labels on consumers' intention to switch to EHA.

3. RESEARCH METHODOLOGY

3.1. Research Area

In Indonesia, demographic and economic differences between Java and outside Java significantly impact the shaping of energy use patterns and the adoption of energy-efficient appliances. As illustrated in Figure 3, although the island of Java covers only 7% of Indonesia's total area, it hosts 56.1% of the national population (Jayani, 2021), making it a major center of economic activity and urbanization in the country. Big cities such as Jakarta, Surabaya, Semarang, and Bandung significantly contribute to electricity consumption, where 73.5% of total national electricity consumption is on the island of Java, compared to outside Java, which is only 26.5% (Wibowo, 2023). The dominance of Java's population and economic activity makes it a highly relevant research area, primarily because the region's more advanced infrastructure facilitates access to energy-efficient technologies. In addition, the energy consumption pattern in Java reflects infrastructure disparity and is closely related to national policies that focus on improving energy efficiency. The study, which focuses on household consumers aged 17 and over on the island of Java, allows for a more in-depth analysis of the adoption of energy-efficient appliances, making Java a benchmark in implementing energy policy at the national level. Thus, this study not only provides an in-depth insight into the dynamics of energy consumption in Java but also illustrates the potential adoption of energy-efficient appliances throughout Indonesia, which is essential to strengthen sustainable energy policies in the country.

3.2. Sampling and Data Collection

This study applies a quantitative approach because of its advantages in collecting data systematically, analyzing it with appropriate statistical techniques, and allowing the generalization

of findings to a wider population. The questionnaire was compiled in the United Kingdom and translated into Indonesian to ensure respondents' understanding. Before the large-scale distribution, a pilot survey was conducted on 30 respondents to validate the questionnaire instrument. The results of this trial were used to refine the choice of words and the flow of the questions. After the necessary revisions, the instrument is retested for validity and reliability to ensure consistency and accuracy in measuring research variables.

The data were collected using a non-probability purposive sampling technique, which was chosen due to limitations in obtaining a complete sampling framework. Although this technique reduces the ability to generalize, selecting respondents who meet certain criteria increases the representativeness of the data. The selected respondents were individuals over 17 years old and domiciled on the island of Java. Data is collected through questionnaires compiled using Google Forms and disseminated through social media platforms like Instagram and WhatsApp to reach a wider audience. Since there is no exact data on the number of respondents interested in energy-saving appliances, the determination of sample size uses the recommendations of Hair et al. (2017), with a ratio of ten respondents per questionnaire item, so that for 22 items, a minimum of 220 respondents are needed. 350 questionnaires were distributed between January and March 2024, with a return rate of 90.86%, resulting in 318 questionnaires collected. After a screening process to remove incomplete and outlier data, the final sample number used for analysis was 310 respondents.

3.3. Measures

The questionnaire instrument in this study consists of two main parts: first, to collect respondents' demographic data, and second, to evaluate constructs relevant to the research objectives. Each questionnaire item is carefully adapted from previous studies that have proven validity and reliability and then adapted to the specific context of this study to ensure the relevance and accuracy of the measurement. The study used a four-point Likert scale, ranging from one ("strongly disagree") to four ("strongly agree"). Energy-saving label-related measurements were carried out with four items adapted from Shah et al. (2023), while environmental consciousness was measured using four items from a scale developed by Xu et al. (2020). The influence of social media is measured by three items adapted from Pop et al. (2020) and Gunawan and Huarng (2015), compatibility is measured by three items from Zhang and Luo (2023a), Curiosity is measured through four items from Zanzaizman et al. (2023), and the intention to switch to energy-efficient home appliances is measured by four items from Pham and Nguyen (2023). These scales are selected based on their relevance and suitability to the study's main objectives, ensuring that each constructed measure is supported by a strong theoretical foundation appropriate to the study context. All measurement items are presented in Table 1.

3.4. Data Analysis

This study applies the Partial Least Squares Structural Equation Modeling (PLS-SEM) approach to test the hypothesis model, a method widely used in consumer behavior research (Elangovan et al., 2024; Waris et al., 2021). PLS-SEM was chosen for its ability to handle complex structural models (Richter et al., 2022), especially when theories and models are still developing. This approach works exceptionally well for studies with smaller sample sizes. It effectively handles issues when data does not follow normal distribution patterns, significantly improving the results' accuracy (Hair and Alamer, 2022). In addition, PLS-SEM focuses on predictive capabilities and theory development (Hair and Alamer, 2022), which makes it ideal for exploring new factors influencing consumer intent to switch. PLS-SEM is the right method to evaluate the interaction between social media influence, energy-saving labels, and Curiosity in the context of a theoretical model that still needs to be fully established. Therefore, applying PLS-SEM in this study is relevant and appropriate for testing and developing the proposed theoretical model.

4. FINDINGS

4.1. Profile of Respondents

Of the total 310 responses obtained, 42% were female, and 58% were male, with the majority aged between 17 and 26 (69%). Most have a bachelor's degree (55%) and regularly use the social media platform Instagram (40%). The most dominant is a monthly income below IDR 1,500,000 (52%). In addition, 39% of the respondents are from D.I. Yogyakarta, followed by East Java (30%), Central Java (15%), West Java (10%), and Jabodetabek (6%). The overall respondent profile is presented in Table 2.

4.2. Common Method Bias (CMB)

The potential for common method bias can arise if the data used in the study are collected from the same source, using uniform instruments, or measured simultaneously (Jordan and Troth, 2020). To assess the presence of potential bias in this study, a collinearity test was conducted, presented in detail in Table 1. Based on the guidelines from Hair et al. (2019), a variance inflation factor (VIF) value below 3.0 indicates that common method bias is not significant. In this study, all VIF values for the measured constructs are below the recommended threshold of 3.0, so it can be concluded that the data are free from common method bias.

4.3. Measurement Model

This study uses the PLS-SEM approach by applying a two-stage analysis procedure following Nunnally's recommendations (1975). In the first stage, we analyze the measurement model to evaluate the reliability and validity of the Internal. We analyze the structural model in the second stage to test the hypothetical relationships. The results of the measurement model analysis, as presented in Table 1, show that the composite reliability has a value in the range of 0.869 to 0.918, which all exceed the threshold of 0.70 (Hair et al., 2019), thus confirming the reliability of the data. In addition, the loading factor value ranged from 0.738 to 0.905, which exceeded the threshold of 0.60, as recommended by Hair et al. (2019). Likewise, the average variance extracted (AVE) values for all constructs ranged from 0.624 to 0.789, all exceeding the minimum threshold of 0.50. These findings validate the validity of the convergent sufficiently.

Furthermore, the validity of discrimination is evaluated using the Fornell and Larcker (1981) criterion by comparing the AVE

Table 1: Measurement items and assessment results of C.R., CA, AVE, Outer Loading and VIF

Construct	Measurement Items	CR	CA	AVE	Outer	VIF
Intention to Switch	ITB_1: I intend to use energy-efficient household appliances in the future.	0.869	0.799	0.624	0.800	1.551
	ITB_2: I would consider buying this energy-efficient home appliance				0.803	1.835
	ITB_3: If energy-efficient household appliances are common, consider using them in your home.				0.815	1.847
	ITB_4: Soon, I will buy energy-efficient household appliances				0.738	1.431
Curiosity	CRS_1: I would like to know what energy-efficient home appliances are	0.905	0.860	0.705	0.826	1.886
	CRS_2: I am willing to try to use energy-efficient household appliances in the future				0.840	2.031
	CRS_3: Quality is important when choosing the household appliances I want to use.				0.880	2.562
	CRS_4: Quality expectations are important for me when trying new home appliances.				0.811	1.891
Compatibility	CPB_1: Energy-efficient home appliances support my lifestyle.	0.918	0.866	0.789	0.859	1.908
	CPB_2: Energy-efficient home appliances according to the way I manage household needs.				0.905	2.575
	CPB_3: Energy-efficient home appliances fit my habits in using appliances at home.				0.899	2.591
Social Media Influences	SMI_1: My involvement in social media influenced my decision to buy energy-efficient home appliances.	0.887	0.810	0.724	0.845	1.726
	SMI_2: I use social media to find information about energy-efficient home appliances.				0.868	1.777
	SMI_3: I believe in content about energy-efficient home appliances on social media.				0.839	1.810
Energy-saving Label	ESL_1: I understand what an 'energy saving' label is.	0.914	0.874	0.726	0.849	2.299
	ESL_2: I am interested in household appliances that have an energy-saving label.				0.879	2.746
	ESL_3: Home appliance marketers should promote the environmental benefits of their products.				0.889	2.626
	ESL_4: The government should require energy-saving labels on all household appliances				0.788	1.804
Environmental Consciousness	EC_1: I was worried about a lack of energy.	0.884	0.824	0.656	0.773	1.551
	EC_2: I am worried about air pollution from carbon.				0.852	2.227
	EC_3: I am worried about climate change.				0.843	2.230
	EC_4: I am ready to do my best to protect the environment.				0.768	1.494

Table 2: Profile of respondent

Category	Subcategory	Frequency
Gender	Male	131
	Female	179
Age	17~26	214
	27~42	55
	43~58	33
	>58	8
Education Level	< High School	99
	Bachelor's degree	172
	Master/Doctoral	39
Income Level	IDR<1.500.000	160
	IDR 1.500,000~2.500.000	60
	IDR 2.500.000~3.500.000	27
	IDR>3.500.000	63
Regularly used social media platforms.	Facebook	112
	Instagram	123
	TikTok	36
	Youtube	12
	Twitter/X	20
	Other	7
Respondent's Province of Origin	Jawa Timur	92
	D.I Yogyakarta	121
	Jawa Tengah	46
	Jawa Barat	32
	Jabodetabek	19
Total		310

value of each construct with the correlation between constructs (Henseler et al., 2014). As a result, the square root of the AVE for all constructs is greater than the highest correlation between constructs, which confirms the validity of adequate discrimination. In addition, the Heterotrait-Monotrait ratio (HTMT) approach was also implemented to assess the validity of discrimination, with results showing the HTMT value below the threshold of 0.9 (Hair et al., 2019), ranging from 0.628 to 0.896 (Table 3). This further supports the validity of the discrimination of this research model. Thus, the measurement model proved reliable, making it possible to proceed to the second structural model analysis stage to test the hypothesized relationships.

4.4. Structural Model Assessment and Path Analysis

The assessment of the structural model includes several important steps, namely the evaluation of the significance of the path coefficient (β), the assessment of the R^2 value, the predictive relevance (Q^2), the SRMR assessment, and the PLS Predict test. To evaluate the path coefficient, a bootstrapping procedure of 5,000 times was applied, as recommended by Hair et al. (2017). The results of the assessment showed that the determination coefficient (R^2) explained 49.7% of the variance in predicting consumer curiosity (low category) and 65.2% of the variance

in predicting consumer intention to switch to energy-efficient household appliances (moderate category) (Hair et al., 2019). The Q^2 value for the curiosity variable was recorded at 0.344, while the intention to switch was 0.395. These values ranged from 0.25 to 0.50, indicating moderate predictive relevance (Hair et al., 2019). In addition, the SRMR assessment yielded a value of 0.66, below the threshold of 0.85, which indicates adequate model fit (Henseler et al., 2014). Finally, to ensure the feasibility of PLS as a prediction tool in this study, PLS is compared with linear regression (L.M.) through the PLS Predict test (Hair et al., 2019). The test results showed that most of the RMSE and MAE scores in PLS were lower than L.M., confirming that PLS was more suitable for this study. The full results of all these assessments can be seen in Table 4.

The path coefficient and significance value are crucial in determining whether the proposed theoretical relationship is accepted or rejected. This study proposes five hypotheses of direct relationship and two mediating effects, all of which are supported in the analysis. The coefficient value and t-value show that EC → ITB (β=0.113, t=2.087, p<0.037); CRS → ITB (β=0.492, t=9.145, p<0.000); and CPB → ITB (β=0.311, t=4.798, p<0.000) had a positive and significant effect. Thus, H1, H2 and H3 are supported. Similarly, SMI→CRS (β= 0.128, t= 2.217, p<0.027) and ESL→CRS (β=0.615, t=11.769, p<0.000) also had significant positive effects, so H4 and H5 were supported. In addition, consumer curiosity can also positively and significantly mediate the influence of social media (SMI→CRS→ITB, β= 0.063, t=2.083, p<0.037) and energy-saving labels (SMI→CRS→ITB, β= 0.302, t=6.959, p<0.000) on consumer switching intentions, so that H6 and H7 are supported. The overall results are presented in Table 5 and Figure 4.

5. DISCUSSION

The main objective of this study is to empirically analyze the factors that influence consumers' intention to switch from conventional household appliances to energy-efficient appliances. This study adopts the Push-Pull-Mooring (PPM) theoretical framework, which integrates push, pull, and mooring factors to understand consumer decision-making when adopting new technologies.

The study results show that environmental consciousness significantly influences the intention of consumers in Java to adopt energy-efficient household appliances. These findings support previous studies, such as those conducted by Fatoki (2020) and Liao et al. (2020), highlighting the importance of environmental consciousness in consumers' decisions to switch to energy-efficient home appliances. Especially in Java, high levels of urbanization and industrialization have raised serious environmental degradation concerns, making consumer awareness of environmental issues even more critical. For example, Wagianto et al. (2024) show that

Table 3: Discriminant validity assessment results (Fornell and Larcker and HTMT)

	Fornell–Larcker criterion						HTMT criterion					
	CPB	CRS	EC	ESL	ITB	SMI	CPB	CRS	EC	ESL	ITB	SMI
CPB	**0.888**											
CRS	0.61	**0.84**					0.705					
EC	0.665	0.605	**0.81**				0.784	0.716				
ESL	0.717	0.698	0.721	**0.852**			0.824	0.802	0.847			
ITB	0.686	0.75	0.618	0.662	**0.79**		0.825	0.896	0.756	0.786		
SMI	0.663	0.53	0.581	0.654	0.599	**0.851**	0.792	0.628	0.707	0.774	0.742	

Table 4: Assessment results of R2, Q2, SRMR and PLS predict

Item	PLS		LM		R2	Q2	SRMR
	PLS-SEM_RMSE	PLS-SEM_MAE	LM_RMSE	LM_MAE			
CRS1	0.641	**0.466**	0.654	0.461	0.497	0.344	0.066
CRS2	0.558	0.41	0.568	0.417			
CRS3	0.612	0.436	0.614	0.443			
CRS4	0.634	0.477	0.655	0.484			
ITB1	0.58	0.424	0.592	0.424	0.652	0.395	
ITB2	0.706	0.505	0.737	0.528			
ITB3	0.62	0.44	0.639	0.45			
ITB4	**0.699**	**0.557**	0.697	0.519			

Table 5: Results of hypothesis analysis (direct and indirect)

Hypothesis	Path	Beta (*β*)	Std deviation	T Value	P values	Supported (Yes/No)
Evaluation of direct relationships						
H1	EC→ITB	0.113	0.054	2.087	0.037	Yes
H2	CRS→ITB	0.492	0.054	9.145	0.000	Yes
H3	CPB→ITB	0.311	0.065	4.798	0.000	Yes
H4	SMI→CRS	0.128	0.058	2.217	0.027	Yes
H5	ESL→CRS	0.615	0.052	11.769	0.000	Yes
Evaluation of indirect relationships						
H6	SMI→CRS→ITB	0.302	0.043	6.959	0.000	Yes
H7	ESL→CRS→ITB	0.063	0.03	2.083	0.037	Yes

Figure 2: Research Model

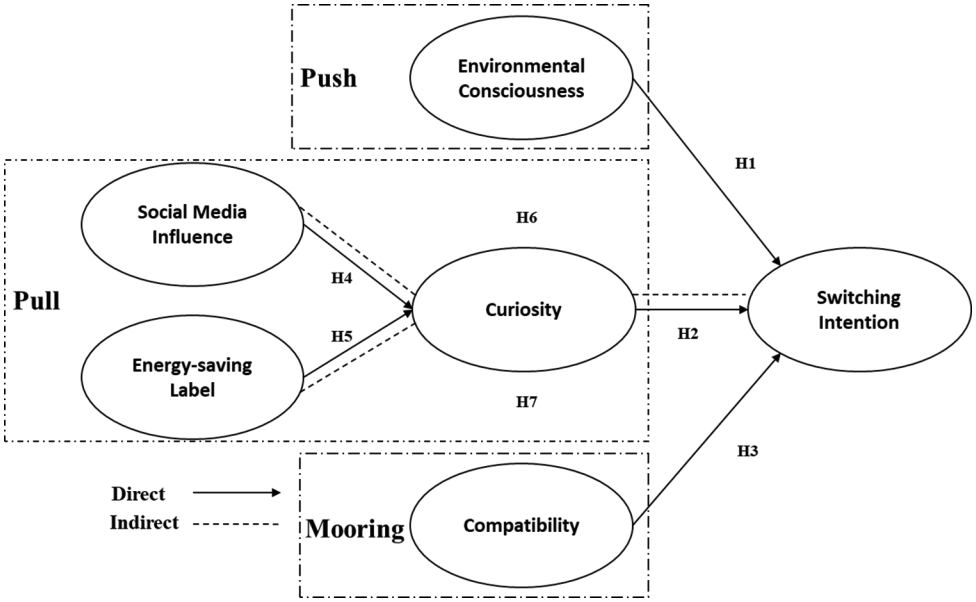


Figure 3: Java Island, Indonesia

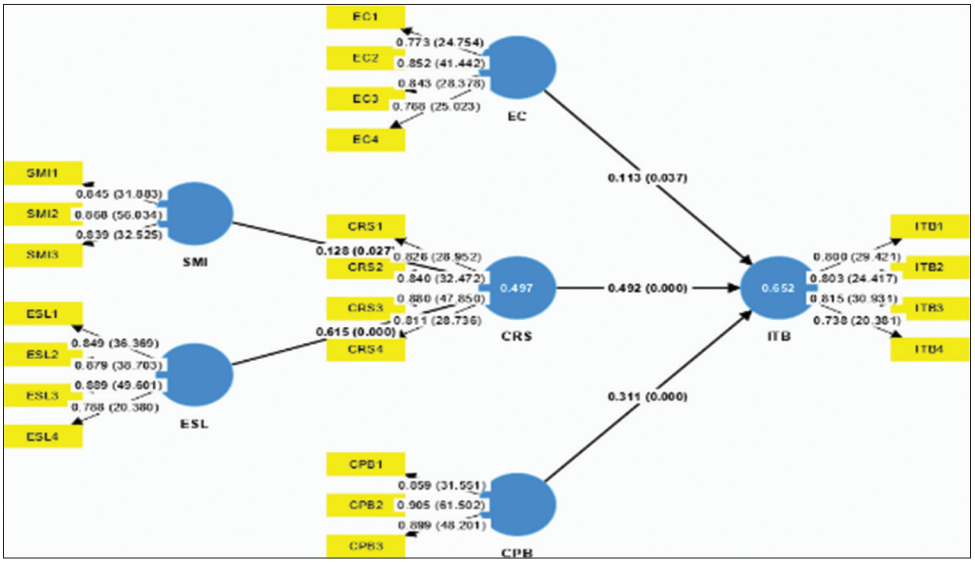
some major cities, such as those on the island of Java, are now facing various pollution levels, including water, air, and land, that have reached alarming levels. This has sparked public awareness of the urgency to reduce their carbon footprint (Andika et al., 2024). Thus, environmental consciousness acts as a powerful push factor, encouraging consumers to abandon less efficient conventional household appliances and switch to more environmentally friendly energy-efficient appliances. These findings confirm that increasingly real environmental challenges encourage consumers to take more proactive actions in choosing sustainable products, especially in densely populated areas like Java.

In addition, the study found that consumers' Curiosity about new technologies has an important role in strengthening their intention to switch to energy-efficient appliances. In line with previous research, such as Jin et al. (2021) and Acikgoz et al. (2023), Curiosity was identified as a key element that motivated consumers to dig deeper into the benefits of new technologies, particularly in sustainability. As a push factor, Curiosity not only increases consumer interest but also encourages deeper cognitive engagement, where consumers actively seek information about energy-efficient products. This Curiosity seems very important in Indonesia, especially on the island of Java, considering that energy-saving technology is still relatively new and not widely known (Andika et al., 2024). Curiosity is an internal trigger that accelerates a consumer's decision to switch, especially when supported by accurate and relevant information. These findings reinforce the theory of PPM by showing how Curiosity can serve as a significant boost in encouraging consumers to not only be interested but also take real action in adopting sustainable technologies, which may previously have been considered complex or difficult to access.

On the other hand, the compatibility of technology with consumers' lifestyles was found to influence consumers' switching intentions significantly. These findings are consistent with previous research that states that when new technologies are considered to fit the needs and consumption patterns of consumers, adoption is more likely to occur (Pancar and Ozkan Yildirim, 2023; Yang et al., 2022; Zhang & Luo, 2023b). As a mooring factor within the framework of PPM, compatibility acts as a counterweight that reduces psychological and cognitive barriers, allowing consumers to feel more comfortable and confident in deciding to switch. In Java, experiencing rapid urbanization and modernization, these socio-economic factors play an important role in creating an environment that supports adopting new technologies. For example, an increasingly dynamic and efficiency-oriented urban lifestyle makes energy-efficient technologies more relevant and aligned with consumer needs. Therefore, compatibility not only facilitates the adoption of the technology but also strengthens consumers' intention to switch, especially when the technology is considered to fit their daily energy needs.

Furthermore, social media and energy-efficient labels are a "Pull" factor that influences consumer curiosity. In line with previous studies, social media is a key platform that expands consumer awareness regarding energy-saving technologies (Lee, 2024; Sheng et al., 2020). At the same time, energy-efficient labels act as validation, providing consumers with assurances about the efficiency and reliability of the product (Duan et al., 2023; Issock Issock and Muposhi, 2023). In the context of PPM, social media and energy labels are attractions that fuel consumers' Curiosity to

Figure 4: Bootstrapping Result



explore these new technologies further. This Curiosity is driven by two factors, namely consistent exposure to information on social media and the credibility of energy labels that convince consumers of the benefits of the technology. In Java, with the high penetration of social media and the growing awareness of sustainability issues, the synergy between easily accessible information and trusted labels is an important element that strengthens consumers' Curiosity and, ultimately, influences their intention to switch to energy-efficient appliances.

Finally, this study confirms that consumer curiosity significantly mediates the influence of social media and energy-saving labels on consumer switching intentions in Java. As a relatively new technology, Curiosity is crucial in increasing consumer awareness and interest (Andika et al., 2024; Daume & Hüttl-Maack, 2020). Without a strong curiosity, the influence of social media and energy-efficient labels on switching intentions will not be optimal. Curiosity allows consumers to delve deeper into the benefits of energy-efficient technologies, strengthening their engagement with information disseminated through social media and their belief in energy-efficient labels (Zhang et al., 2024). As such, Curiosity serves as a cognitive bridge that allows consumers to respond more effectively to external information and, ultimately, make more informed decisions to switch to more efficient and environmentally friendly products.

6. 6. CONCLUSION AND IMPLICATIONS

6.1. Conclusion

This study uses the Push-Pull-Mooring (PPM) theory to analyze the factors that affect the intention of consumers in Java to switch to energy-efficient household appliances. The study results show that environmental consciousness plays a significant role as a push factor in encouraging the adoption of energy-saving appliances in this region. Social media and energy-saving labels act as pull factors, expanding information exposure and increasing consumer confidence in the efficiency and benefits of energy-saving appliance products. These two factors directly increase consumers' Curiosity about new technologies, affecting their intention to switch to energy-efficient appliances. Curiosity also plays an important role as a mediator, reinforcing social media's and energy-efficient labels' influence on consumer switching intentions. Technology compatibility with lifestyle has also been found to be a mooring factor that facilitates the transition to new technologies by reducing cognitive barriers. Overall, this study contributes to the literature on adopting energy-saving technologies and offers practical insights for stakeholders in promoting energy-efficient products in Indonesia.

6.2. Theoretical Implication

The theoretical implications of this study extend the application of the Push-Pull-Mooring (PPM) framework in the context of the adoption of energy-efficient home appliances in Indonesia, providing new insights into how drivers (environmental consciousness), pullers (social media, energy-efficient labels, and consumer curiosity), as well as inhibitors (technology compatibility with lifestyle) simultaneously influence consumer intent to switch. Environmental consciousness has proven significant in encouraging consumers to abandon less efficient conventional appliances, especially in urban areas that face serious environmental challenges, such as Java. Pulling factors like social media and energy-efficient labels increase consumer access to information and product trust. At the same time, Curiosity drives consumers to be more engaged in the exploration of new technologies. On the other hand, the compatibility of technology with the lifestyle of consumers helps to reduce psychological and cognitive barriers, thus facilitating the adoption of energy-efficient appliances. The main contribution of this research is the application of PPM in the context of developing countries, which has yet to be explored. It shows how specific factors, such as environmental consciousness levels and socio-economic dynamics, can modify PPM theory.

6.3. Managerial Implication

This study provides in-depth insights into the key factors influencing consumers' intentions in Java to switch to energy-efficient household appliances. Based on these findings, several

relevant managerial implications exist for companies and policymakers to apply to encourage the adoption of energy-efficient appliances.

First, environmental consciousness plays a significant role in motivating consumers to switch to energy-efficient appliances. Therefore, companies and policymakers should focus on comprehensive and sustainable environmental consciousness campaigns. The campaign should highlight pressing environmental issues, such as urban air and land pollution, that are relevant to consumers' daily lives. Environmental education programs involving local communities, schools, and companies can effectively raise this awareness. Social media must be used strategically, utilizing narratives that touch consumer emotions and invite them to play a role in reducing their carbon footprint. In addition, government incentive programs such as subsidies and discount schemes on energy-efficient products can encourage consumers to take action faster.

Second, Curiosity about new technologies has strongly influenced consumers' intention to switch. Therefore, marketers must develop an education-based strategy that is engaging and informative, using social media as the primary platform. Companies can increase consumer engagement through interactive content, such as educational videos, product reviews from influencers, and simulations of the benefits of energy-efficient technology. Additionally, energy-efficient labels should be clearly and prominently displayed on the product, giving consumers assurance about the efficiency and environmental benefits offered. Augmented reality (A.R.) or virtual reality (V.R.) technology can also provide an interactive experience for consumers to understand the benefits of this technology. Thus, consumers' Curiosity will develop into beliefs that drive them to take action.

Third, the findings suggest that technology compatibility with consumer lifestyles is important in driving adoption. Companies must ensure that energy-efficient products are not only efficient but also easy to integrate into consumers' daily routines. In dynamic urban areas like Java, product marketing should emphasize how this technology can meet the needs of modern consumers who want efficiency without sacrificing convenience. For example, energy-efficient appliances compatible with home smart devices can add value to consumers who want seamless technology integration. By highlighting these compatibility aspects, companies can overcome psychological and cognitive barriers, reinforcing consumers' intentions to switch to more efficient and environmentally friendly technologies.

6.4. Limitations and Suggestions for Future Research

While this study's findings provide important insights into the factors influencing consumers' intention to switch to energy-efficient home appliances, some limitations must be considered to provide a broader context for interpreting the results. These limitations open up opportunities for further research that can deepen the understanding of the future adoption of energy-efficient technologies.

First, one of the main limitations of this study is the geographical focus on consumers in Java. While it provides valuable insights into Indonesia's densely populated and highly industrialized regions, these findings may need to be more generalizable to other regions with different levels of urbanization, environmental consciousness, or socio-economic conditions. The impact of this geographic specificity limits the wider applicability of the results. Further research should expand the scope to include other regions in Indonesia or even conduct cross-country comparisons to capture variations in consumer behavior across different environmental and cultural contexts. *Second*, the study relied on self-reported data, which could lead to social desire bias, where respondents may have exaggerated their environmental consciousness or intention to adopt energy-efficient appliances. This can affect the results and overestimate the influence of these factors. Future research may reduce this bias by using longitudinal designs that track real consumer behavior over time or by incorporating objective measures of the adoption rate of energy-efficient appliances.

Third, the study has highlighted compatibility as a significant mooring factor, showing that the compatibility of technology with consumers' lifestyles can influence their intention to switch to energy-efficient appliances. However, the study has yet to explore other factors that may hinder adopting new technologies, such as financial constraints or lifestyle inertia. Further research can delve further into these inhibiting factors to provide a more comprehensive understanding of how different aspects of mooring can influence consumers' decisions to adopt energy-efficient technologies. *Fourth*, although this study examined the mediating role of Curiosity between media exposure and adoption intent, it has not explored other psychological constructs, such as risk perception or trust in technology, which may also mediate or mediate. Future research may explore how these additional psychological factors interact with the drivers, pullers, and inhibitors, thus enriching the PPM framework in the context of technology adoption. *Finally*, this study uses only one theoretical framework, the Push-Pull-Mooring (PPM) model, which, although comprehensive, limits the exploration of other theories that may be relevant, such as the Technology Acceptance Model (TAM) or the Diffusion of Innovation (DOI) theory. Further research can integrate these frameworks to provide a multi-theoretical perspective, thus offering a richer analysis of consumer adoption behavior towards energy-efficient technologies. Hopefully, this expanded framework can improve understanding of the drivers and inhibitors of sustainable technology adoption.

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