IJSSR
International Journal of Social Service and Research
Vol. 04, No. 03, March 2024
e-ISSN: 2807-8691 | p-ISSN: 2807-839X

Examining Indonesian Consumer Willingness to Adopt Solar PV: The Effect of Green Consumption, Price Value, Social Influence, and Facilitating Conditions

Ancilla Mathilda[1], Gabriella Theodora[2], Ruth Srininta Tarigan[3*]
Petra Christian University, Surabaya, East Java, Indonesia[1,2,3]
Email: ruth.tarigan@petra.ac.id[3*]

Keywords
Facilitating Condition, Green Consumption Value, Price Value, Social Influence.

ABSTRACT
Existing research on solar energy in Indonesia often explores the macroeconomic factors influencing the slow adoption of solar photovoltaic (PV) systems. In contrast, this study places a specific emphasis on the individual consumers' inclination to embrace the technology. The primary research objectives involve examining the impact of price value, green consumption value, social influence, and facilitating conditions on behavioral intention. Data were gathered from a final sample of 210 valid respondents through simple random sampling and subsequently analyzed using PLS-SEM. The results indicate that price value, green consumption value, and facilitating conditions significantly and positively contribute to the intention to adopt solar panels. Conversely, social influence plays an insignificant role in the decision-making process. These findings offer valuable insights that can inform policy initiatives and enhance marketing strategies for promoting renewable energy solutions in Indonesia.

INTRODUCTION

Following the increasing awareness of global warming, countries worldwide are transitioning from fossil fuels to clean, renewable energy (RE), one of them being solar energy. Indeed, the adoption of solar photovoltaic (PV) technologies has observed remarkable progress. For instance, solar capacity in the US has increased by 94.3% since the last decade (Tabassum et al., 2021), while European countries have installed 41.4GW of solar power capacity or equivalent to electricity for 12.4 million houses in 2022 (SolarPower Europe, 2022).

Considering the growing global concern over climate change and the subsequent shift towards cleaner, renewable energy sources, such as solar energy, it is imperative to understand the factors influencing the adoption of solar photovoltaic (PV) technologies. While significant progress has been observed in countries like the US and Europe, Indonesia lags in solar panel adoption despite its abundant solar radiation as a tropical country (Tarigan, 2020). The solar industry in Indonesia has grown by only 6.4% in the last decade, a comparatively slow pace compared to neighbouring countries like India and Sri Lanka (Abdullah et al., 2023; Burke et al., 2019; Sovacool, 2018). This reflected the lack of research as well- while numerous studies on green technology have been done in the context of developed nations (Dharshing, 2017; Roldán Fernández et al., 2021), research on green purchase intention in Indonesia is still at a nascent stage (Kurniawan et al., 2022).

Extant solar PV studies in Indonesia generally focus on technical and socio-regulatory factors (Abdullah et al., 2023; Sumarsono et al., 2022; Xu et al., 2023). Institutions and powerful stakeholders impeding the country's transition from coal to renewable energy (Burke et al., 2019; Setyawati, 2020). This research highlighted macroeconomic factors slowing down the adoption rate of solar PV. However,

https://doi.org/10.46799/ijssr.v4i03.740

there is a gap in research using a microeconomic approach (i.e. examining the intention to adopt solar PV among households). Solar panel usage needs to expand to individual household levels if Indonesia wishes to grow its meagre solar PV adoption rate. By studying factors influencing consumers' intention to adopt solar PV, this paper contributes to green marketing in Indonesia and addresses the research gap.

Ajzen (2005) suggested that three elements shape behavioral intention: personal factors (including values and attitudes that influence the individual's assessment of the behavior), societal influences (arising from expectations within social groups), and control aspects (comprising self-efficacy and external elements that affect the simplicity of executing the behavior). To investigate factors affecting behavioral intention towards solar panels, four factors are chosen: (1) price value and (2) green consumption value (GCV), to reflect the individual attitude and evaluation of solar panels; (3) social influence, to reflect normative beliefs on solar panel adoption; and (4) facilitating conditions, to reflect the consumer's perceived control over adoption of solar panels.

In consumer behavior studies, price is an essential component, often seen as a significant aspect of a consumer's perceived value (Parasuraman & Grewal, 2000). On the other hand, studies focusing on eco-friendly products and services typically include environmental concern or consciousness as a precursor to the intention to purchase green products (Risitano et al., 2023; Sun et al., 2020). Indeed, a complex interrelationship between price and environmental values shapes an individual's disposition towards green products. For instance, a sociocultural investigation into frugality and ecological consciousness conducted by Chen et al. (2019) discovered that environmental awareness influences an individual's assessment of whether a product's monetary cost is justified. Consequently, while previous research has evaluated these elements individually, our work aims to explore their combined impact specifically within the Indonesian context.

This study will also leverage normative and control belief aspects, specifically focusing on social influence and facilitating conditions. The theoretical framework for these two elements was developed by Venkatesh et al. (2003), who drew upon prior technology acceptance theories by eminent researchers such as Ajzen (1991), Thompson et al. (1991), and Moore et al. (1991). These two consolidated variables are chosen due to their enhanced predictive capabilities compared to previous models (Rondan-Cataluña et al., 2015). Furthermore, Venkatesh et al. (2012) have enriched their paper by introducing a series of measurement items that can assist in forming the research design.

The twofold aim of our study is to contribute to the literature on green behavioral intention, particularly in the context of a developing country, and to provide practical insights for businesses and policymakers in promoting solar PV adoption among Indonesian consumers. The subsequent sections of this paper will delve into the theoretical background, research hypotheses, research methodology, results, implications, limitations, and recommendations.

METHODS

A cross-sectional research design with a quantitative approach was utilized. Data from the intended participants was gathered through online questionnaires made in Google Forms and shared through various social media platforms. This study employed a cross-sectional research design with a quantitative approach. Data collection involved using online questionnaires created in Google Forms and distributed across various social media platforms. The targeted participants were selected based on specific criteria, including being above 20 years old, residing in a house, graduating from middle school, and earning a monthly income exceeding Rp10M. The criteria were strategically set to identify individuals with the purchasing power for solar PV systems and the physical capacity to install solar panels on their roofs. The participants were chosen through a simple random sampling method, ensuring a fair representation of the broader population meeting the defined criteria.

The study employed a Likert scale ranging from 1 (strongly disagree) to 6 (strongly agree) to measure respondents' opinions on various constructs. The Likert scale was applied to assess variables such as Behavioral Intention, Green Consumption Value, Price Value, Social Influence, and Facilitating Condition. Table 1 provides the operational definitions of these variables, and it is noteworthy that items PV 4 & PV 5 in the Price Value section are reversed questions.

Table 1. Operational Definition of the Variables

Behavioral Intention (Alam et al., 2021) 1. I am willing to purchase solar PV technology 2. I plan to purchase solar PV technology in the future 3. I would highly recommend PV Solar technology for other people to use
Green Consumption Value (Risitano et al., 2023) 1. It is important to me that the products I use do not harm the environment 2. I consider the potential environmental impact of my actions when making many of my decisions 3. My purchase habits are affected by my concern for our environment. 4. I am concerned about wasting the resources of our planet 5. I would describe myself as environmentally responsible 6. I am willing to be inconvenienced in order to take actions that are more environmentally friendly
Price Value (Lau et al., 2020) 1. Solar PV system is reasonably priced 2. Solar PV system has good value for money 3. Solar PV system is a good investment for future generations 4. Cost of investment in solar PV is higher than the benefits it can generate 5. Investment in solar PV system is not worth it 6. Solar PV system is less expensive compared to conventional electricity consumption 7. Solar PV system installation should be made cheaper to encourage usage 8. Maintenance of solar PV system is affordable
Social Influence (Aggarwal et al., 2019) 1. I always ask a friend about his/her experience with a new product before I buy it 2. If people around me has a positive experience with solar PV, I will be inclined to buy it as well 3. People who matter to me (friends, families, neighbors) think that I should install solar PV 4. I value the opinions of people who matter to me
Facilitating Condition (Lau et al., 2020) 1. I have the resources (money, time, effort) necessary to use the solar PV system 2. I have the knowledge necessary to support the use of solar PV system 3. I have the knowledge and expertise necessary to maintain the solar PV system 4. I would heavily rely on after-sales service to maintain my solar PV system 5. I think that using solar PV system fits into my living environment 6. I know where to seek assistance if I were to use solar PV system 7. I am given timely assistance If I were to use solar PV system 8. I can get assistance from others when I have difficulties using the solar PV system

The data analysis process comprised several systematic stages. The self-administered questionnaire was structured into two main sections: gathering respondents' profiles and evaluating each construct through designated items. The initial section included filtering questions (age, housing tenure, last education, and monthly income) and introductory questions (gender and monthly electricity bill).

Subsequently, the questionnaire underwent a pilot phase involving 10 respondents to enhance its quality based on their feedback. After incorporating the pilot respondents' suggestions, the finalized questionnaire was disseminated to the broader sample. The data collected were subjected to Partial Least Squares (PLS) structural equation modelling using Smart PLS Version 4. The analysis involved

convergent validity, discriminant validity, and reliability testing for each construct. The overall process included three critical steps: model specification, outer model evaluation, and inner model evaluation, as per the methodology outlined by Hair, Hult, and Ringle (2017). In the structural model, Green Consumption Value, Price Value, Social Influence, and Facilitating Conditions served as exogenous constructs, while Behavioral Intention was considered an endogenous construct.

RESULTS

Out of the 247 responses collected, 210 fulfilled the criteria above and became the final sample size. Table 2 shows the 20 retained items of the final model, which passed the 0.707 cutoff value Sarstedt (2022) and met the minimum threshold value of 0.500 for the average variance extracted (AVE) (Barclay et al., 1995). Five items were excluded from the final model due to insufficient factor loadings: one from social influence (SI 4), three from price value (PV 3, PV 4, PV 5), and one from facilitating conditions (FC 4). Furthermore, the composite reliability of each construct exceeded the recommended 0.700 cutoff value, affirming the model's convergent validity.

Table 2. Convergent Validity (n = 210)

Construct	Items	Outer Loadings	Cronbach's Alpha	AVE	rho A	rho C	VIF
Behavioral Intention	BI1	0.868	0.805	0.719	0.808	0.885	1.851
	BI2	0.855					1.872
	BI3	0.820					1.587
Green Consumption Value	GCV1	0.756	0.867	0.600	0.879	0.900	1.974
	GCV2	0.814					2.306
	GCV3	0.840					2.375
	GCV4	0.757					1.907
	GCV5	0.745					1.751
	GCV6	0.727					1.514
Price Value	PV1	0.806	0.771	0.518	0.803	0.841	2.176
	PV2	0.828					2.265
	PV6	0.682					1.424
	PV7	0.606					1.403
	PV8	0.651					1.480
Social Influence	SI1	0.523	0.626	0.560	0.770	0.785	1.146
	SI2	0.786					1.392
	SI3	0.887					1.314
Facilitating Condition	FC1	0.661	0.898	0.623	0.905	0.920	1.565
	FC2	0.744					2.341
	FC3	0.768					2.482

	FC5	0.786			1.987
	FC6	0.879			3.927
	FC7	0.829			2.755
	FC8	0.838			2.887

Table 3. HTMT Criterion Result

Construct	FC	GCV	BI	PV	SI
FC					
GCV	0.569				
BI	0.890	0.646			
PV	0.732	0.519	0.862		
SI	0.546	0.530	0.621	0.545	

Table 2 presents the quantitative findings for the convergent validity of the hypotheses, involving the constructs Behavioral Intention, Green Consumption Value, Price Value, Social Influence, and Facilitating Condition. The table includes items, outer loadings, Cronbach's Alpha, Average Variance Extracted (AVE), rho A, rho C, and Variance Inflation Factor (VIF).

Table 3 displays the Heterotrait-Monotrait (HTMT) criterion results, indicating that the HTMT for each construct is below 0.85, confirming discriminant validity. The statistical analyses utilized include outer loadings (an indicator of convergent validity), Cronbach's Alpha (a measure of internal consistency), AVE (average variance extracted), rho A and rho C (construct reliability measures), and VIF (an indicator of multicollinearity).

Discriminant validity is measured using cross-loadings, Fornell and Larcker criterion, and the Heterotrait-Monotrait (HTMT) criterion. Each item's cross-loading value was at least 0.100, smaller than its factor-loading value. Moreover, this study aligns with Fornell et al. (1981) recommendation that the square root of the AVE for each construct should be greater than the correlation values.Table 3 shows that the HTMT for each construct was below 0.85 confirming discriminant validity (Clark & Watson, 1995; Kline, 2023).

Based on the findings' structural model, three variables were found to influence Behavioral Intention positively and significantly, namely: Price Value (beta = 0.321, $p < .01$), Green Concern Value (beta = 0.155, $p < .01$), and Facilitating Condition (beta = 0.436, $p < .01$). However, the direct effects of Social Belief (Beta = 0.77, $p = 0.296$) on Behavioral Intention was not significant. Meanwhile, ANOVA results reveal R^2 of 0.683 and R^2 adjusted of 0.677.

Discussion

Aligned with our first hypothesis, price value positively impacts consumers' intention to adopt solar PV technology. This finding confirms Lau et al. (2020) and Kilani et al. (2023) findings. A report by Arora (2022) states that Indonesian consumers are highly price sensitive. This is despite the country's increasing average income levels. Indonesians are known to hunt for bargains and are often influenced by promotional offers. Practically, this also suggests that implementing the right pricing strategies is very important. Promotional pricing or attractive instalment schemes could be utilized to increase the perceived affordability of solar PV technology.

Next, GCV positively impacts solar PV adoption which supports H2. This finding is aligned with Risitano et al. (2023) and Chatterjee et al. (2022), meaning consumers with more concern for the environment are more willing to adopt solar PV. In this case, raising consumers' awareness about the scarcity of non-renewable energy and educating people about the negative impact of using coal to generate electricity will positively influence Indonesia's solar PV adoption rate.

H3 is unsupported as social influence does not significantly affect Indonesian consumers' intention to adopt solar PV technology. This unexpected finding that social influence displays a weak effect in a collectivist country like Indonesia provides intriguing theoretical implications. One plausible explanation is the limited peer adoption in the status quo- Indonesia's solar PV adoption rate has decreased by 78% since 2020 (Kurniawan et al., 2022). Hence, social influence may be undermined by the uncertainty or scepticism around the technology due to household solar PV's lack of success stories. Future research could further investigate why social influence did not significantly impact intention by studying people who have adopted solar PV as their sample.

Lastly, results show that facilitating conditions positively impact the intention to adopt solar PV, supporting H4. This confirms the results of Akroush et al. (2019), Lau et al. (2020), and Tanveer et al. (2021). The result suggests that facilitating conditions like high accessibility to solar PV sellers or getting the support needed when having problems with the system will encourage people to try out solar PV. Solar PV system sellers should emphasize highlighting their after-sales services and guarantees. Future research could identify what kind of facilitating condition impacts customers' willingness to adopt solar PV the most.

CONCLUSION

This research aims to investigate consumer intentions towards adopting solar PV, examining the impact of four variables: green consumption value, price value, social influence, and facilitating conditions. Through the analysis of 210 valid responses using PLS-SEM, the study reveals that price value, green consumption, and facilitating conditions significantly and positively influence the intention to purchase solar PV. However, social influence does not have a significant impact on Indonesian consumers. These findings offer managerial implications, suggesting that discounted or special offers can enhance affordability and attractiveness. Collaboration with government agencies for financial incentives, flexible payment options, and increased awareness through campaigns and educational programs are recommended strategies to boost national solar technology adoption. Despite these valuable insights, the research acknowledges limitations, such as potential response bias due to self-reported data, particularly in green consumption value. The study's restricted geographic focus on East Java limits generalizability, prompting future researchers to enhance robustness by expanding the sample size and replicating the study across diverse Indonesian regions. Additionally, comparative studies among different demographic groups with moderating variables such as age, education, and income would enrich the existing literature.

REFERENCES

Abdullah, I., Warviyan, D., Safrina, R., Utama, N. A., Tirta, A., Veza, I., & Irianto, I. (2023). Green Fiscal Stimulus in Indonesia and Vietnam: A Reality Check of Two Emerging Economies. *Sustainability*, *15*(3), 2174. https://doi.org/10.3390/su15032174

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, *50*(2), 179–211. https://doi.org/10.1016/0749-5978(91)90020-T

Ajzen, I. (2005). *Attitudes, personality and behaviour*. McGraw-hill education (UK).

Akroush, M. N., Zuriekat, M. I., Al Jabali, H. I., & Asfour, N. A. (2019). Determinants of purchasing intentions of energy-efficient products. *International Journal of Energy Sector Management*, *13*(1), 128–148. https://doi.org/10.1108/IJESM-05-2018-0009

Arora, T., Jusi, I., Kartawidjaja, A., & Potia, A. (2022). Survey: Indonesian consumer sentiment during the coronavirus crisis. *McKinsey & Company: Retail Practice. Retrieved December*, *29*, 2022.

Barclay, D., Higgins, C., & Thompson, R. (1995). *The partial least squares (PLS) approach to casual modeling: personal computer adoption ans use as an Illustration*.

Burke, P. J., Widnyana, J., Anjum, Z., Aisbett, E., Resosudarmo, B., & Baldwin, K. G. H. (2019). Overcoming barriers to solar and wind energy adoption in two Asian giants: India and Indonesia. *Energy Policy*, *132*, 1216–1228. https://doi.org/10.1016/j.enpol.2019.05.055

Chatterjee, S., Sreen, N., Sadarangani, P. H., & Gogoi, B. J. (2022). Impact of Green Consumption Value, and Context-Specific Reasons on Green Purchase Intentions: A Behavioral Reasoning Theory Perspective. *Journal of Global Marketing*, *35*(4), 285–305. https://doi.org/10.1080/08911762.2021.1996670

Chen, K., Ren, C., Gu, R., & Zhang, P. (2019). Exploring purchase intentions of new energy vehicles: From the perspective of frugality and the concept of "mianzi." *Journal of Cleaner Production*, *230*, 700–708. https://doi.org/10.1016/j.jclepro.2019.05.135

Clark, L. A., & Watson, D. (1995). Constructing validity: Basic issues in objective scale development. *Psychological Assessment*, *7*(3), 309–319. https://doi.org/10.1037/1040-3590.7.3.309

Dharshing, S. (2017). Household dynamics of technology adoption: A spatial econometric analysis of residential solar photovoltaic (PV) systems in Germany. *Energy Research & Social Science*, *23*, 113–124. https://doi.org/10.1016/j.erss.2016.10.012

Fornell, C., & Larcker, D. F. (1981). Structural Equation Models with Unobservable Variables and Measurement Error: Algebra and Statistics. *Journal of Marketing Research*, *18*(3), 382. https://doi.org/10.2307/3150980

Kline, R. B. (2023). *Principles and practice of structural equation modeling*. Guilford publications.

Kurniawan, I., Ichwani, R., Fionasari, R., Batubara, A., & Huda, A. (2022). Indonesia's Renewable Energy Outlook: What to Expect in The Future Renewable Energy of Indonesia. A Brief Review. *Elkawnie*, *8*(2), 298. https://doi.org/10.22373/ekw.v8i2.18738

Lau, L.-S., Choong, Y.-O., Wei, C.-Y., Seow, A.-N., Choong, C.-K., Senadjki, A., & Ching, S.-L. (2020). Investigating nonusers' behavioural intention towards solar photovoltaic technology in Malaysia: The role of knowledge transmission and price value. *Energy Policy*, *144*, 111651. https://doi.org/10.1016/j.enpol.2020.111651

Moore, G. C., & Benbasat, I. (1991). Development of an Instrument to Measure the Perceptions of Adopting an Information Technology Innovation. *Information Systems Research*, *2*(3), 192–222. https://doi.org/10.1287/isre.2.3.192

Parasuraman, A., & Grewal, D. (2000). The Impact of Technology on the Quality-Value-Loyalty Chain: A Research Agenda. *Journal of the Academy of Marketing Science*, *28*(1), 168–174. https://doi.org/10.1177/0092070300281015

Risitano, M., Romano, R., La Ragione, G., & Quintano, M. (2023). Analysing the impact of green consumption values on brand responses and behavioural intention. *Business Ethics, the Environment & Responsibility*, *32*(3), 1096–1112. https://doi.org/10.1111/beer.12543

Roldán Fernández, J. M., Burgos Payán, M., & Riquelme Santos, J. M. (2021). Profitability of household photovoltaic self-consumption in Spain. *Journal of Cleaner Production*, *279*, 123439. https://doi.org/10.1016/j.jclepro.2020.123439

Rondan-Cataluña, F. J., Arenas-Gaitán, J., & Ramírez-Correa, P. E. (2015). A comparison of the different versions of popular technology acceptance models. *Kybernetes*, *44*(5), 788–805. https://doi.org/10.1108/K-09-2014-0184

Sarstedt, M., Ringle, C. M., & Hair, J. F. (2022). Partial Least Squares Structural Equation Modeling. In *Handbook of Market Research* (pp. 587–632). Springer International Publishing. https://doi.org/10.1007/978-3-319-57413-4_15

Setyawati, D. (2020). Analysis of perceptions towards the rooftop photovoltaic solar system policy in Indonesia. *Energy Policy*, *144*, 111569. https://doi.org/10.1016/j.enpol.2020.111569

Sovacool, B. K. (2018). Success and failure in the political economy of solar electrification: Lessons from World Bank Solar Home System (SHS) projects in Sri Lanka and Indonesia. *Energy Policy*, *123*, 482–493. https://doi.org/10.1016/j.enpol.2018.09.024

Sumarsono, N., Wahyuni, S., & Sudhartio, L. (2022). A paradigm shift of energy sources: Critical review on competitive dynamics of solar PV industry in Indonesia. *Renewable Energy Focus*, *41*, 236–245. https://doi.org/10.1016/j.ref.2021.12.001

Sun, P.-C., Wang, H.-M., Huang, H.-L., & Ho, C.-W. (2020). Consumer attitude and purchase intention toward rooftop photovoltaic installation: The roles of personal trait, psychological benefit, and government incentives. *Energy & Environment*, *31*(1), 21–39. https://doi.org/10.1177/0958305X17754278

Tabassum, S., Rahman, T., Islam, A. U., Rahman, S., Dipta, D. R., Roy, S., Mohammad, N., Nawar, N., & Hossain, E. (2021). Solar Energy in the United States: Development, Challenges and Future Prospects. *Energies*, *14*(23), 8142. https://doi.org/10.3390/en14238142

Tanveer, A., Zeng, S., Irfan, M., & Peng, R. (2021). Do Perceived Risk, Perception of Self-Efficacy, and Openness to Technology Matter for Solar PV Adoption? An Application of the Extended Theory of Planned Behavior. *Energies*, *14*(16), 5008. https://doi.org/10.3390/en14165008

Tarigan, E. (2020). ROOFTOP PV SYSTEM POLICY AND IMPLEMENTATION STUDY FOR A HOUSEHOLD IN INDONESIA. *International Journal of Energy Economics and Policy*, *10*(5), 110–115. https://doi.org/10.32479/ijeep.9539

Thompson, R. L., Higgins, C. A., & Howell, J. M. (1991). Personal Computing: Toward a Conceptual Model of Utilization. *MIS Quarterly*, *15*(1), 125. https://doi.org/10.2307/249443

Venkatesh, Morris, Davis, & Davis. (2003). User Acceptance of Information Technology: Toward a Unified View. *MIS Quarterly*, *27*(3), 425. https://doi.org/10.2307/30036540

Venkatesh, Thong, & Xu. (2012). Consumer Acceptance and Use of Information Technology: Extending the Unified Theory of Acceptance and Use of Technology. *MIS Quarterly*, *36*(1), 157. https://doi.org/10.2307/41410412

Xu, A., Awalin, L. J., Al-Khaykan, A., Fard, H. F., Alhamrouni, I., & Salem, M. (2023). Techno-Economic and Environmental Study of Optimum Hybrid Renewable Systems, including PV/Wind/Gen/Battery, with Various Components to Find the Best Renewable Combination for Ponorogo Regency, East Java, Indonesia. *Sustainability*, *15*(3), 1802. https://doi.org/10.3390/su15031802

Zaid Kilani, A. A.-H., Kakeesh, D. F., Al-Weshah, G. A., & Al-Debei, M. M. (2023). Consumer post-adoption of e-wallet: An extended UTAUT2 perspective with trust. *Journal of Open Innovation: Technology, Market, and Complexity*, *9*(3), 100113. https://doi.org/10.1016/j.joitmc.2023.100113