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Green Marketing Mix and Eco-Labeled Product Behavior: The Mediating Role of Environmental Knowledge

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Abstract
Purpose: This research investigates how the green marketing mix, which includes green product, green price, and green people, influences green consumer behavior towards eco-labeled goods, with environmental knowledge acting as a mediating factor.
Research Methodology: A quantitative method was utilized through purposive sampling. Data were gathered via questionnaires from 200 participants knowledgeable about eco-labeled products. The examination was performed using Partial Least Squares Structural Equation Modeling (PLS-SEM) in SmartPLS 3.3.
Results: The results indicate that environmental knowledge significantly and positively influences green consumer behavior. Although the direct effects of green marketing mix dimensions are not uniformly significant, their indirect effects via environmental knowledge are significant, supporting its mediating role.
Conclusions: The results highlight the importance of integrating green marketing strategies with efforts to improve environmental knowledge in fostering sustainable consumption behavior. Effective marketing of eco-labeled products requires both strategic alignment and consumer awareness development.
Limitations: This study is limited by the relatively small sample size and the use of purposive sampling, which may restrict the generalizability of the findings.
Contributions: This study contributes theoretically by explained the mediating role of environmental knowledge in the green marketing–behavior relationship. Practically, it offers insights for firms to develop integrated strategies that align marketing initiatives with environmental education to promote the adoption of eco-labeled products.

Keywords: *Eco-labeling, Environmental Knowledge, Green Purchase Behavior, Green Marketing Mix*

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1. Introduction

Global environmental challenges, including climate change, pollution, and excessive waste generation, have intensified the urgency of promoting sustainable consumption. Rapid industrialization and technological advancement, while contributing to economic growth, have also accelerated environmental degradation. Consequently, consumers are increasingly encouraged to adopt environmentally responsible behavior, prompting firms to integrate sustainability into their marketing strategies (Le, Tran, Lam, Tra, & Uyen, 2024; Pretner, Darnall, Testa, & Iraldo, 2021). In this context, green marketing has emerged as a strategic approach that emphasizes environmentally friendly product

development, pricing, and communication to influence consumer behavior (Dangelico & Vocalelli, 2017; Papadas, Avlonitis, Carrigan, & Piha, 2019). Green marketing is commonly operationalized through the green marketing mix, which extends traditional marketing concepts by incorporating environmental considerations. Key dimensions of this framework include green product, green price, and green people. Green products are designed to minimize environmental harm, while green pricing reflects the environmental costs embedded in production and distribution processes. Green people represent organizational actors who communicate and reinforce environmental values. These elements are expected to shape consumer perceptions and foster environmentally responsible purchasing behavior (Khan, Atlas, Arshad, Akhtar, & Khan, 2022; Yadav & Pathak, 2017).

However, as emphasized by Kousar, Afzal, Ahmed, and Bojnec (2022), the effectiveness of green marketing strategies is not solely determined by marketing stimuli. Instead, consumer cognition particularly environmental knowledge—plays a crucial role in shaping how individuals interpret and respond to green marketing efforts. Environmental knowledge enhances consumers' ability to evaluate product attributes, reduces uncertainty, and strengthens pro-environmental attitudes. In addition, eco-labels serve as credible informational tools that reduce information asymmetry and increase consumer trust in environmentally friendly products (Proi, Dudinskaya, Naspetti, Ozturk, & Zanoli, 2023). Despite the growing body of literature, several important gaps remain. First, prior studies tend to examine green marketing variables in isolation, limiting the ability to capture their combined effects (Papadas et al., 2019). Second, most research focuses on direct relationships between green marketing and consumer behavior, while overlooking the mediating role of cognitive factors such as environmental knowledge (Nekmahmud & Fekete-Farkas, 2020). Third, empirical evidence is predominantly derived from developed countries, leaving developing markets such as Indonesia underexplored (Pretner et al., 2021). Furthermore, recent studies suggest that green purchase behavior is strongly influenced by psychological and contextual factors, including trust, perceived value, and environmental concern. Nekmahmud and Fekete-Farkas (2020) conclude that environmental concern and perceived value are the primary drivers of green purchase behavior, while trust functions as a reinforcing factor that strengthens consumers' confidence in environmentally friendly products. Similarly, Jaiswal and Kant (2018) find that green purchase behavior is shaped by the combined influence of attitude, perceived value, and trust, indicating that both cognitive and affective factors play a critical role in sustainable consumption decisions.

However, existing studies predominantly emphasize psychological determinants at the individual level and tend to overlook how external marketing stimuli such as the green marketing mix are cognitively processed and subsequently translated into actual behavior. More importantly, the underlying mechanism that links marketing strategies to behavioral outcomes through environmental knowledge remains insufficiently explored, particularly in the context of eco-labeled products in developing countries. This gap highlights the need for a more integrative approach that connects marketing inputs, cognitive processes, and behavioral outcomes within a unified framework. This study addresses these gaps by proposing an integrative model that examines the influence of the green marketing mix comprising green product, green price, and green people on green consumer behavior toward eco-labeled products, with environmental knowledge as a mediating variable. The uniqueness of this research lies in three main aspects. First, in terms of the model, this study integrates multiple dimensions of the green marketing mix into a unified framework. Second, in terms of context, it focuses on eco-labeled products in a developing country setting, providing insights beyond the dominant developed country perspective. Third, in terms of analytical approach, this study employs Partial Least Squares Structural Equation Modeling (PLS-SEM) to analyze both direct and indirect relationships, offering a robust understanding of mediation effects (Hair et al., 2021).

By emphasizing the mediating role of environmental knowledge, this study contributes to the advancement of green marketing and consumer behavior literature. It provides a deeper explanation of how marketing strategies are translated into behavioral outcomes through cognitive processes. Practically, the findings offer valuable insights for firms to design more effective green marketing strategies by integrating educational initiatives that enhance consumer environmental awareness and promote sustainable consumption.

2. Literature Review and Hypotheses Development

2.1 Green Products and Their Effects on Green Consumer Behavior

Green products represent the tangible manifestation of sustainability by incorporating environmentally friendly materials, eco-efficient production processes, and reduced environmental impact. Meiliyah, Melan Susanty, and Kurnia Sari (2023) argue that product attributes significantly shape perceived environmental value, while Khan et al. (2022) find that trust in green product attributes enhances purchase intention. These findings are consistent with the Stimulus–Organism–Response (SOR) theory, which posits that external stimuli (e.g., product attributes) influence internal cognitive states, ultimately leading to behavioral responses. However, empirical evidence remains inconsistent. Sun, Li, and Wang (2022) report a strong positive relationship between green product attributes and behavior, whereas Di Foggia (2021) suggests that product attributes alone may not be sufficient without adequate consumer understanding. This indicates that the effectiveness of green products depends on consumers' cognitive evaluation, particularly their level of environmental knowledge. Thus, environmental knowledge acts as an intervening mechanism that translates product-related stimuli into meaningful behavioral outcomes.

H_1: Green products have a positive and significant effect on green consumer behavior

H_5: Green products have a positive and significant effect on green consumer behavior through environmental knowledge

2.2 Eco-Friendly Pricing and Consumer Reaction to Green Product Costs

Green price reflects the economic value of sustainability embedded in products. Al-Oqla (2023) highlights that environmentally friendly product often involve higher production costs, resulting in premium pricing. According to Value Perception Theory, consumers evaluate price based on perceived benefits rather than absolute cost. Supporting this, Pretner et al. (2021) demonstrate that consumers with strong environmental awareness are more willing to pay a premium for green products. Nevertheless, Shi and Jiang (2023) show that price sensitivity may reduce purchase intention, particularly among less environmentally aware consumers. This suggests that environmental knowledge plays a crucial role in shaping how consumers interpret price fairness and value. Consumers with higher knowledge levels are more likely to perceive green price as justified, thereby strengthening both direct and indirect effects on behavior.

H_2: Green price has a positive and significant effect on green consumer behavior

H_6: Green price has a positive and significant effect on green consumer behavior through environmental knowledge

2.3 Green People and Their Role in Encouraging Green Consumption Behavior

Green people emphasize the role of human actors such as employees, marketers, and organizations in communicating and reinforcing sustainability values. Nelson, Junaidi, and Sentoso (2025) highlight that organizational actor play a critical role in embedding environmental awareness within business practices. Similarly, Gravelines, Banytė, Dovalienė, and Gadeikienė (2022) demonstrate that individuals with strong environmental identities are more likely to engage in sustainable consumption. From the perspective of Social Influence Theory, human interaction and communication significantly shape consumer perceptions and behaviors. Despite this, prior studies often treat green people as a secondary factor. This study positions green people as a central driver that influences consumer cognition and behavior, both directly and indirectly through environmental knowledge, by enhancing awareness and trust in sustainability messages.

H_3: Green people have a positive and significant effect on green consumer behavior

H_7: Green people have a positive and significant effect on green consumer behavior through environmental knowledge

2.4 Environmental Knowledge as a Determinant of Environmentally Friendly Consumption Behavior

Environmental knowledge is a critical cognitive determinant of pro-environmental behavior. Kousar et al. (2022) argue that knowledge enhances consumers' ability to evaluate environmental consequences, while Alamsyah, Othman, Bakri, Udjaja, and Aryanto (2021) confirm that informed consumers are

more likely to engage in sustainable consumption. Additionally, Erhabor (2022) highlights that environmental awareness plays a crucial role in shaping pro-environmental attitudes. More importantly, Shadevaningrat and Parasari (2025) demonstrate that environmental knowledge functions as a mediating mechanism linking external stimuli and behavioral responses. In the context of eco-labeled products, knowledge enables consumers to interpret environmental signals, thereby strengthening behavioral intention and actual purchasing decisions. This aligns with the SOR framework, where cognition acts as a bridge between stimuli and responses.

H_4: Environmental knowledge has a positive and significant effect on green consumer behavior

Based on the critical review above, several theoretical gaps can be identified. Earlier studies frequently evaluate the green marketing mix in a fragmented manner, neglecting to integrate green product, green price, and green people into a unified framework. Second, the role of green people as a strategic dimension remains underrepresented in empirical research. Third, the mediating function of environmental knowledge in linking marketing strategies and consumer behavior has not been comprehensively explored, especially regarding eco-labeled items in developing markets. Therefore, this study proposes an integrative model that examines the simultaneous effects of green product, green price, and green people on green consumer behavior, with environmental knowledge as a mediating variable. The theoretical contribution of this research lies in strengthening the linkage between marketing stimuli and behavioral outcomes through a cognitive mechanism, providing a more holistic understanding of sustainable consumption behavior. From a methodological perspective, Utilizing Partial Least Squares Structural Equation Modeling (PLS-SEM) allows for the examination of intricate relationships between variables. Practically, the findings offer strategic insights for firms to design effective green marketing strategies by combining product innovation, pricing strategies, and human-driven communication with efforts to enhance consumer environmental knowledge.

3. Methodology

This study employs a quantitative research design to examine the influence of the green marketing mix comprising green product, green price, and green people on green consumer behavior, with environmental knowledge serving as a mediating variable. A quantitative approach is appropriate as it enables systematic measurement of latent constructs and rigorous hypothesis testing through statistical analysis. As emphasized by Hair et al. (2021), quantitative methods are particularly suitable for analyzing complex relationships among multiple constructs and for testing mediation models within behavioral research contexts. The population of this study consists of consumers in Medan City who have experience with or knowledge of eco-labeled products. This population is considered relevant as it reflects individuals exposed to environmentally oriented consumption practices. According to Sekaran (2016), a population refers to a group of individuals sharing specific characteristics aligned with the research objectives. This study applies a purposive sampling technique to ensure that respondents meet criteria relevant to the research objectives.

The sampling criteria include: (1) individuals who have used eco-friendly products, (2) individuals who are aware of eco-labels, and (3) individuals aged between ≤ 25 and ≥ 56 years. This approach is consistent with Ilker, Sulaiman Abubakar, and Rukayya Sunusi (2016), who argue that purposive sampling is appropriate when respondents must meet predefined characteristics. A total of 200 respondents were selected, which exceeds the minimum sample size requirement recommended for Structural Equation Modeling. Hair et al. (2021) suggest that the sample size should be at least 10 times the number of indicators or structural paths, ensuring sufficient statistical power and model robustness. Primary data were collected through a structured questionnaire distributed to respondents who met the sampling criteria. All constructs were measured using a 5-point Likert scale (1 = strongly disagree; 5 = strongly agree). Specifically, the indicators for green product, green price, and green consumer behavior were adapted from Zhang and Wang (2018), environmental knowledge indicators were adapted from Kousar et al. (2022), while green people indicators were adapted from (Nekmahmud & Fekete-Farkas, 2020). The adaptation process involved contextual refinement to align with eco-labeled product settings while maintaining the original conceptual meaning, as recommended by (Hair et al., 2021).

Table 1. Operationalization of variables

Construct	Definition	Dimensions	Number of Items	Source
Green Product	Product designed with minimal environmental impact, using sustainable materials, processes, and eco-friendly attributes.	Environmental Attributes, Certification & Safety, Sustainability Orientation.	3 Item	(Dangelico & Vocalelli, 2017)
Green Price	A pricing strategy reflecting environmental value, including consumers' willingness to pay for sustainable benefits.	Price Perception, Value Evaluation	4 Item	(Zhou, Hu, & Huang, 2016)
Green People	Organizational actors who promote and communicate environmental values through sustainable practices.	Environmental Awareness, Sustainability Communication, Awareness of environmental issues, sustainability practices	4 Item	(Nelson et al., 2025)
Environmental Knowledge	The level of consumer understanding regarding environmental issues and the impact of products on the environment.	Knowledge Application, Environmental Understanding, Sustainability Awareness.	4 Item	(Kousar et al., 2022)
Green Consumer Behavior	Consumer actions that prioritize environmentally responsible purchasing and consumption decisions.	Purchase Behavior, Consumption Practice, Sustainability Support	3 Item	(Alamsyah et al., 2021)

The data used is primary data obtained through a questionnaire based on the Likert scale. Questionnaires were distributed to respondents who met the characteristics of the sample through the survey method. Each variable is measured with indicators adapted from previous theories and research. The independent variable consists of green product, green price, green people, and environmental knowledge, while the dependent variable is green consumer behavior. Data analysis is conducted in two primary phases, specifically:

1. Descriptive Analysis
   Descriptive analysis was employed to outline the traits of respondents and the spread of responses concerning the research variables. This analysis includes the calculation of average values, percentages, and data distribution to understand general patterns of respondents' behavior and perceptions.
2. Validity and Reliability Tests
   a) Validity Test
      The convergent and discriminant validity are tested to ensure that each indicator is capable of measuring the construct in question. The tool is considered valid if it satisfies the requirements of > 0.70 and AVE > 0.50 (Haji-Othman & Yusuff, 2022).
   b) Reliability Test
      The reliability of the construct is tested using the Composite Reliability and Cronbach's Alpha values. The instrument is declared reliable if the value of both is above 0.70. This test ensures the consistency of respondents' answers to variable indicators.

Furthermore, this study employs Structural Equation Modeling based on Partial Least Squares (SEM-PLS) to analyze both direct and indirect relationships among variables. The use of SEM-PLS is justified for several reasons. First, SEM-PLS is particularly suitable for predictive and exploratory research models involving multiple latent constructs and mediation effects (Hair et al., 2021). Second, it does not require strict normality assumptions, making it appropriate for behavioral data that often exhibit non-normal distributions. Third, SEM-PLS allows for the simultaneous estimation of complex structural relationships, including mediation paths, thereby providing a comprehensive understanding of the relationships among variables. Finally, SEM-PLS is widely recommended for research aimed at theory development and variance explanation (R^2), particularly in emerging fields such as green marketing and sustainable consumer behavior.

4. Results and Discussions

4.1 Outcomes of Questionnaire Distribution

Data gathering was conducted by distributing Google Form-based surveys to 200 participants residing in the city of Medan. The distribution of questionnaires was carried out through social media using random sampling techniques. The questionnaire method was chosen because it was able to collect perception data systematically and efficiently, in accordance with the recommendations (Taherdoost, 2021). Participating respondents consisted of individuals who had or had not used eco-labeled products, so that the representation of public perception could be maintained. The traits of the respondents gathered included sex, age, job, and level of education. The characteristics of the respondents are displayed in the table 2 below.

Table 2. Respondents by gender

Gender	Frequency	Percentage (%)
Male	108	54
Female	92	46
Total	200	100

Based on Table 2, the composition of respondents by gender shows a higher proportion of men, which is 54 percent. However, this distribution is still representative for the analysis of general perceptions of eco-labeled products because both gender groups are adequately represented.

Table 3. Respondents by age

Age Category	Frequency	Percentage (%)
≤ 25 Years	31	15.5
26–35 Years	58	29
36–45 Years	45	22.5
46–55 Years	43	21.5
≥ 56 Years	23	11.5
Total	200	100

Based on Table 3, the age group of 26–35 years is the largest group (29%), followed by the age group of 36–45 years (22.5%). The dominance of the productive age is important because this age group is known to have a higher awareness of sustainability issues and preferences for environmentally friendly products, especially the millennial generation.

Table 4. Respondents by occupation

Occupation	Frequency	Percentage (%)
Student	28	14
Entrepreneur	37	18.5
Private Sector	59	29.5
SOEs	45	22.5
Civil Servant	31	15.5
Total	200	100

Table 5. Respondents by educational background

Education Level	Frequency	Percentage (%)
Senior High School	53	26.5
Diploma (D-3)	32	16
Bachelor (S-1)	75	37.5
Master (S-2)	40	20
Total	200	100

Table 5 shows the majority of respondents came from the highly educated group (S-1 and S-2), which illustrates that respondents have a level of literacy relevant to the understanding of eco-label concepts and sustainable consumption behavior. This supports the validity of the response because consumers who are literate about environmental issues tend to have a more stable perception.

4.2 Data Analysis

4.2.1 Measurement Model (Outer Model)

Outer models are employed to examine the connection between indicators and latent constructs. Since all variables in this research are reflective, the indicators should demonstrate a strong correlation with the construct. The testing process was carried out using the PLS Algorithm. All indicators in the variables Green Product, Green Price, Green People, Environmental Knowledge, and Green Consumer Behavior show a loading factor value above 0.70, which means that it meets the convergent validity requirements. Thus, these indicators are considered consistent in measuring the construct in question.

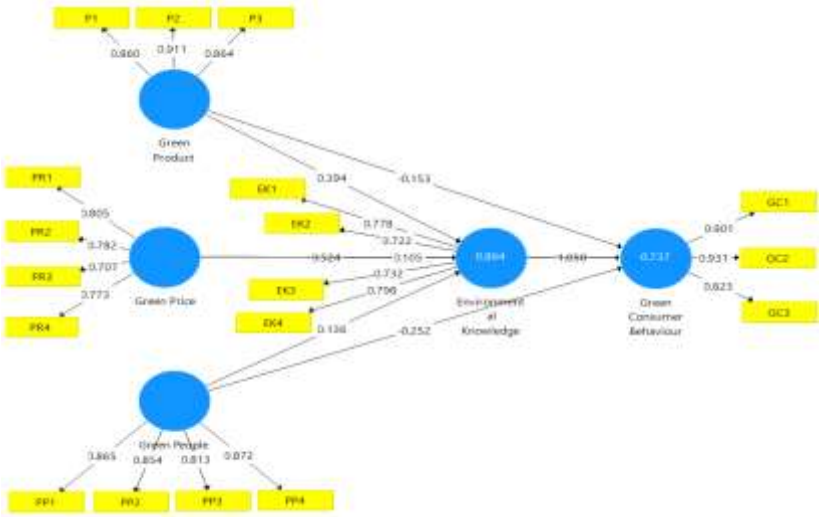

Figure 1. Outer model planning

4.2.2 Discriminant Validity

Discriminant validity is evaluated through the Fornell-Larcker Criterion to ensure that each construct has a higher AVE root value than the correlation between other constructs.

Table 6. Fornell-Larcker Criterion

Construct	European Championships	GCB	GPPL	GPRI	GPROD
Environmental Knowledge	0.758				
Green Consumer Behaviour	0.837	0.886			
Green People	0.724	0.500	0.851		
Green Price	0.866	0.738	0.717	0.768	
Green Product	0.792	0.607	0.539	0.619	0.879

Table 6 shows constructs have met the Fornell-Larcker criteria, so that each construct is able to distinguish itself from other constructs in the model.

4.2.3 Construct Reliability

The reliability of the construct was tested using Cronbach's Alpha, rho_A, and Composite Reliability values.

Table 7. Construct reliability and validity

Construct	Cronbach's Alpha	rho_A	Composite Reliability	AVE
Environmental Knowledge	0.755	0.763	0.844	0.575
Green Consumer Behaviour	0.861	0.869	0.916	0.785
Green People	0.873	0.880	0.913	0.725
Green Price	0.766	0.767	0.851	0.589
Green Product	0.853	0.864	0.910	0.772

Table 7 show constructs are validated for reliability with a Composite Reliability value exceeding 0.70. AVE also shows that the model has good convergent validity.

4.2.4 Inner Model

The inner model is employed to assess the connections among latent variables. Evaluation of structural models is conducted in various stages:

Table 8. Model fit summary

Index	Saturated Model	Estimated Model
SRMR	0.10	0.10
d_ULS	2.871	2.871

Table 8 show the SRMR value = 0.10 indicates that the model is still within the acceptable fit limit according to (Sathyanarayana & Mohanasundaram, 2024).

Table 9. R-Square

Construct	R-Square	R-Square Adjusted
Environmental Knowledge	0.864	0.862
Green Consumer Behaviour	0.737	0.731

Table 9 show the R^2 value of Environmental Knowledge = 0.864 indicates that 86.4% of the variation in environmental knowledge is explained by Green Product, Green Price, and Green People. Simultaneously, the factors in the model explain 73.7% of the differences in Green Consumer Behavior. This value indicates an excellent level of explanation.

Table 10. Direct effect (p-value)

Pathway	Or	M	STDEV	T-Statistics	P-Values
Environmental Knowledge → GCB	1.050	1.054	0.124	8.464	0.000
Green People → EK	0.136	0.144	0.068	1.996	0.046
Green People → GCB	-0.252	-0.252	0.092	2.731	0.007
Green Price → EK	0.524	0.509	0.065	8.037	0.000
Green Price → GCB	0.105	0.101	0.101	1.040	0.299
Green Product → EK	0.394	0.398	0.057	6.900	0.000
Green Product → GCB	-0.153	-0.150	0.101	1.521	0.129

So it can be concluded based on the results of Table 10 as follows:

1. Hypothesis 1: The results of the study showed that the original sample value was negative of –0.153 with a P-Values of 0.129. Thus, it can be concluded that Green Products do not have a positive effect and do not have a significant influence on Green Consumer Behavior.
2. Hypothesis 2: The results of the study showed that the original sample value was positive of 0.105 with a P-Values of 0.299. Thus, it can be concluded that Green Price has a positive effect but does not have a significant influence on Consumer Behavior.

3. Hypothesis 3: The results of the study showed that the original sample value was negative of –0.252 with a P-Values of 0.007. Thus, it can be concluded that Green People have a negative influence and have a significant influence on Consumer Behavior.
4. Hypothesis 4: The results of the study show that the original sample value is positive at 1,050 with a P-Values of 0,000. Thus, it can be concluded that Environmental Knowledge has a positive effect and has a significant influence on Consumer Behavior.

Table 11. Indirect effect

Pathway	Or	M	STDEV	T-Statistics	P-Values
Green People → EK → GCB	0.143	0.151	0.074	1.936	0.053
Green Price → EK → GCB	0.550	0.537	0.092	5.999	0.000
Green Product → EK → GCB	0.413	0.421	0.083	4.983	0.000

According to the findings presented in Table 11 above, we can draw the following conclusions:
1. Hypothesis 5: The results of the study showed a positive value of 0.413 with a P-Values of 0.000. Therefore, it can be inferred that Green Products positively impact and significantly affect Green Consumer Behavior through Environmental Knowledge.
2. Hypothesis 6: The results of the study show that the original sample value is positive of 0.550 with a P-Values of 0.000. Thus, it can be concluded that Green Price has a positive effect and has a significant influence on Consumer Behavior through Environmental Knowledge.
3. Hypothesis 7: The findings of the research indicated that the initial sample value was positive at 0.143 with a P-Value of 0.053. Consequently, it can be inferred that Green People positively influence but do not greatly alter Consumer Behavior through Environmental Knowledge.

4.3 Discussion

The results demonstrate strong explanatory power, with R^2 values of 0.864 for environmental knowledge and 0.737 for green consumer behavior. These findings indicate that the green marketing mix substantially explains variations in consumer cognition and behavior. From a theoretical perspective, this supports the Stimulus–Organism–Response (SOR) framework Vidyanata (2022), where marketing stimuli influence internal cognitive states such as environmental knowledge which subsequently shape behavioral responses. The findings reveal that green product does not have a significant direct effect on green consumer behavior but shows a significant indirect effect through environmental knowledge. This suggests that environmentally friendly product attributes are not inherently sufficient to drive purchasing decisions. Consumers may lack the necessary understanding to interpret eco-label information, resulting in weak direct behavioral responses. This result aligns with recent findings by Zhu, Zhang, Siddik, Zheng, and Sobhani (2023), which emphasize that the effectiveness of green products depends on consumers' ability to recognize and evaluate environmental benefits. Similarly, Joshi and Rahman (2017) argue that a lack of environmental knowledge limits the translation of pro-environmental attitudes into actual behavior.

These findings reinforce the notion that environmental knowledge functions as a cognitive mediator, enabling consumers to assign meaning to green product attributes. Without such knowledge, eco-labels may fail to differentiate products effectively in the minds of consumers. Furthermore, recent research by Trong Nguyen et al. (2023) confirms that product-related sustainability information significantly influences behavior only when consumers possess sufficient environmental awareness. A similar pattern is observed in the relationship between green price and green consumer behavior. The direct effect is insignificant, while the indirect effect through environmental knowledge is significant. This indicates that consumers do not automatically perceive premium prices of eco-labeled products as justified. Instead, their evaluation depends on their understanding of environmental value. This finding is consistent with Shoaeinaeini, Govindan, and Rahmani (2022), who highlight that willingness to pay for green products is strongly influenced by sustainability awareness. In line with this, recent studies by Khor and Mah (2020) demonstrate that consumers with higher environmental knowledge are more likely to perceive green price as an indicator of product quality and ethical commitment rather than merely a cost factor.

This finding is further supported by the Value Belief Norm (VBN) theory proposed by Stren (2002), which explains that pro-environmental behavior is driven by personal values and beliefs shaped by knowledge. Thus, environmental knowledge plays a critical role in transforming price perception into environmentally responsible purchasing behavior. An interesting and contrasting result is observed in the relationship between green people and green consumer behavior, where a negative direct effect and an insignificant indirect effect are identified. This finding deviates from previous studies that typically report a positive influence of human factors on sustainable behavior. One plausible explanation is the emergence of green skepticism, where consumers perceive environmental claims as exaggerated or lacking credibility. Recent research by Zhang and Wang (2018) indicates that skepticism toward green marketing communication can significantly reduce consumer trust and purchase intention. Additionally, the insignificant mediating effect suggests that green people may not effectively transfer environmental knowledge to consumers. This may be due to ineffective communication strategies or a mismatch between message delivery and consumer expectations. Supporting this argument, Sun et al. (2022) find that the effectiveness of sustainability communication depends heavily on message clarity, credibility, and cultural relevance.

Therefore, the negative relationship observed in this study likely reflects implementation issues rather than theoretical inconsistencies. It highlights the importance of improving communication strategies and strengthening trust in human-driven green marketing efforts. In contrast, environmental knowledge shows a strong and significant direct effect on green consumer behavior, confirming its central role in shaping sustainable consumption. This finding is consistent with recent studies by Chaihanchanchai and Anantachart (2023), which identify environmental knowledge as a key determinant of environmentally responsible behavior. Furthermore, this result aligns with the Theory of Planned Behavior (TPB) developed by Ajzen (2020), which emphasizes that cognitive factors significantly influence behavioral intentions and actions. Environmental knowledge enhances consumers' ability to evaluate product attributes, understand environmental consequences, and make informed decisions. Overall, the findings suggest that the effectiveness of the green marketing mix is predominantly indirect and mediated by environmental knowledge. While green product, green price, and green people remain important components, their impact largely depends on how effectively consumers understand and internalize environmental values. Therefore, firms should integrate green marketing strategies with educational initiatives, transparent communication, and credible eco-labeling systems. By strengthening consumer knowledge, companies can enhance the effectiveness of marketing efforts and promote consistent green consumer behavior.

5. Conclusions

5.1 Conclusion

This study demonstrates that the effectiveness of the green marketing mix in influencing green consumer behavior is primarily indirect rather than direct. Green product and green price do not significantly affect behavior on their own but become influential when mediated by environmental knowledge. In contrast, green people show a negative direct effect and no significant mediating role. Notably, environmental knowledge emerges as the most critical determinant, highlighting its central role in translating marketing stimuli into environmentally responsible behavior. This study contributes to the development of green marketing literature by reinforcing the importance of cognitive mechanisms in shaping consumer behavior. Specifically, it extends the Stimulus Organism Response (SOR) framework by demonstrating that environmental knowledge functions as a key mediating variable linking marketing stimuli and behavioral outcomes. The findings also address inconsistencies in prior research by showing that green marketing elements are not inherently effective without consumer understanding, thereby offering a more integrative perspective on the relationship between marketing strategies and sustainable consumption behavior. From a managerial perspective, the findings suggest that firms should not rely solely on green product attributes or pricing strategies to influence consumer behavior. Instead, companies need to prioritize educational and informational initiatives that enhance consumers' environmental knowledge. Clear communication of eco-labels, transparency in environmental claims, and consumer awareness campaigns are essential to increase trust and perceived value.

5.2 Research Limitations

This study has several limitations. First, the use of self-reported data may introduce response bias. Second, the purposive sampling technique limits the generalizability of the findings. Third, variations in respondents' familiarity with eco-labeled products may affect response consistency.

5.3 Suggestions and Directions for Future Research

Future studies are encouraged to employ more representative sampling techniques and larger sample sizes to enhance generalizability. Longitudinal or experimental designs may provide deeper insights into causal relationships. Additionally, further research should explore the role of green people and green product in greater depth, particularly to understand their limited direct effects. Expanding the model by incorporating variables such as trust, perceived value, or green skepticism is also recommended to provide a more comprehensive understanding of green consumer behavior. The key contribution of this study lies in revealing that without sufficient environmental knowledge, green marketing strategies risk becoming ineffective signals, thus emphasizing the necessity of integrating marketing initiatives with consumer education to achieve sustainable behavioral outcomes.

Author Contributions

The distribution of responsibilities among the research team was clearly defined to ensure transparency and accountability. HMD was responsible for reviewing and critically evaluating the manuscript to ensure its conceptual coherence, methodological rigor, and academic quality. KETN prepared the initial draft of the manuscript and carried out all revisions, including responding to reviewers' comments and refining the theoretical and empirical discussions. MLP and FSS conducted the data collection and performed data processing, including data coding, tabulation, and preliminary statistical analysis to guarantee precision and uniformity of the research results. YDS managed data administration, including data organization, documentation, archiving, and ensuring compliance with research data management standards. All authors have read and approved the final version of the manuscript and agree to be accountable for all aspects of the work.

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