



The Effect of Innovation Barrier and Trust on The Loyalty of Electric Motorcycle User: The Moderating Role of Environmental Concern and Incentive Policy

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ABSTRACT

The transition toward environmentally friendly transportation has encouraged the adoption of electric motorcycles; however, their usage remains relatively low due to consumer resistance to innovation. This study aims to examine the effects of traditional barrier, image barrier, and trust on the loyalty of electric motorcycle users in the Special Region of Yogyakarta, as well as the moderating roles of environmental concern and incentive policy, grounded in the Innovation Resistance Theory (IRT). An explanatory quantitative approach was employed. Data were collected through questionnaires from 400 electric motorcycle users selected using a purposive sampling technique, and analyzed using Structural Equation Modeling-Partial Least Squares (SEM-PLS) with SmartPLS. The results show that traditional barrier ($\beta = -0.235$) and image barrier ($\beta = -0.277$) have a negative and significant effect on loyalty, with image barrier being the strongest inhibitor, whereas trust ($\beta = 0.360$) has a positive and significant effect and serves as the most dominant predictor. Environmental concern significantly moderates all relationships in the model, while incentive policy is not proven to be a moderator despite having a positive direct effect on loyalty. The model explains 50.8% of the variance in loyalty (adjusted $R^2 = 0.508$) with good predictive relevance ($Q^2 = 0.477$). Theoretically, this study extends the application of IRT from adoption intention to post-purchase loyalty and distinguishes the roles of internal and external moderators.

INTRODUCTION

The environmental crisis has become one of the major global challenges, marked by climate change, air pollution, and ecosystem degradation. The transportation sector is the largest contributor to greenhouse gas emissions, accounting for nearly 24% of total global

emissions, with fossil-fuel vehicles as the primary source (Saber et al., 2025). This condition drives the need for more environmentally friendly transportation innovations, and electric vehicles emerge as a solution capable of reducing dependence on fossil fuels and lowering carbon emissions (Hardman et al., 2018).

In Indonesia, motorcycles play a dominant role in people's mobility, with more than 140 million conventional vehicle units in operation that contribute substantially to national carbon emissions (Permana et al., 2023). The government has demonstrated its commitment through various policies, including Presidential Regulation No. 55 of 2019 concerning the Acceleration of the Battery-Based Electric Motor Vehicle Program. Nevertheless, despite their widely recognized benefits, the adoption rate of electric motorcycles remains relatively low compared with their market potential. This gap indicates the presence of innovation barriers perceived by consumers, which are not only technical but also psychological and behavioral (Rezvani et al., 2015).

Based on the Innovation Resistance Theory (IRT) proposed by Ram and Sheth (1989), consumer resistance to innovation arises from both functional and psychological barriers. In the context of electric motorcycles, these barriers are reflected in consumers' attachment to the habit of using conventional vehicles (traditional barrier) and negative perceptions of the product image (image barrier). Beyond barriers, trust in the technology, product, and manufacturer is a crucial determinant of consumer decisions and the formation of long-term loyalty.

Most previous studies employing the IRT framework have focused on adoption intention (intention to use), whereas research on user loyalty at the post-purchase stage remains very limited, particularly for electric motorcycles in the Special Region of Yogyakarta. Xue et al. (2024) examined the moderating role of policy in electric vehicle adoption in China without integrating the trust variable, while Kaur et al. (2020) applied IRT in the context of mobile payment rather than green transportation. Thus, a gap remains in simultaneously integrating psychological barriers, trust, and the moderating roles of internal and external factors within a single model focused on loyalty.

This study fills that gap by comprehensively examining the effects of traditional barrier, image barrier, and trust on loyalty, as well as the moderating roles of environmental concern as an internal psychological factor and incentive policy as an external policy factor among electric motorcycle users in the Special Region of Yogyakarta. The contribution of this study lies in extending the application of IRT from the context of adoption intention to post-purchase loyalty, and in distinguishing the working mechanisms of internal and external moderators.

LITERATURE REVIEW

Innovation Resistance Theory (IRT)

The Innovation Resistance Theory developed by Ram and Sheth (1989) is an approach to understanding why consumers reject or postpone the adoption of innovations. Resistance arises not because the innovation lacks benefits, but because consumers already possess established habits, perceptions, values, and beliefs that are perceived to be disrupted by the innovation. Ram and Sheth classified innovation barriers into functional barriers (usage, value, risk) and psychological barriers (traditional and image barriers). This study focuses on psychological barriers, which are more relevant in explaining resistance to products that demand behavioral change, such as electric motorcycles (Kishore & Raghavendra, 2024).

Traditional Barrier and Loyalty

A traditional barrier arises when an innovation conflicts with the habits, values, and norms long held by consumers (Ram & Sheth, 1989). Consumers accustomed to fossil-fuel motorcycles tend to feel uncomfortable with changes in energy charging, maintenance, and riding characteristics. When this barrier persists at the post-purchase stage, consumers experience

cognitive dissonance that reduces their intention to recommend or repurchase (Heidenreich & Handrich, 2015; Musyaffi et al., 2022).

H1: Traditional Barrier has a negative effect on loyalty

Image Barrier and Loyalty

An image barrier relates to negative impressions of an innovation (Lian & Yen, 2014). For electric motorcycles, this barrier emerges as the perception that the product has low performance, is less prestigious, or is experimental in nature. Loyalty is built not only on function but also on ownership pride, so a negative image lowers emotional attachment and willingness to recommend the product (Claudy et al., 2015; Noppers et al., 2014).

H2: Image barrier has a negative effect on loyalty.

Trust and Loyalty

Trust is the consumer's confidence in the integrity, competence, and reliability of the technology, product, and manufacturer (Mayer et al., 1995). Drawing on the Commitment-Trust Theory (Morgan & Hunt, 1994), trust is a primary prerequisite for loyalty; without trust, long-term commitment is difficult to form. The higher the trust in quality, safety, after-sales service, and battery life, the higher the user loyalty (Rezvani et al., 2015).

H3: Trust has a positive effect on loyalty.

The Moderating Role of Environmental Concern

Environmental concern is the degree of an individual's care about environmental issues (Schultz, 2001; Dunlap et al., 2000). Consumers with high environmental concern possess strong intrinsic motivation, making them more tolerant of innovation barriers and viewing electric motorcycles as a means of contributing to sustainability (Rehman et al., 2024; Chen et al., 2018). Environmental concern is expected to weaken the negative impact of barriers while strengthening the positive effect of trust on loyalty.

H4a: Environmental concern moderates the effect of traditional barrier on loyalty.

H4b: Environmental concern moderates the effect of image barrier on loyalty.

H4c: Environmental concern moderates the effect of trust on loyalty.

The Moderating Role of Incentive Policy

Incentive policy refers to government policies in the form of financial and non-financial incentives designed to encourage innovation adoption (Gallagher & Muehlegger, 2011; Sierzchula et al., 2014). From the IRT perspective, incentive policy lowers the value barrier by increasing the performance-to-price ratio, thereby making electric motorcycles more competitive (Yin Lam et al., 2004). This policy is expected to weaken the negative effect of barriers and strengthen the effect of trust on loyalty.

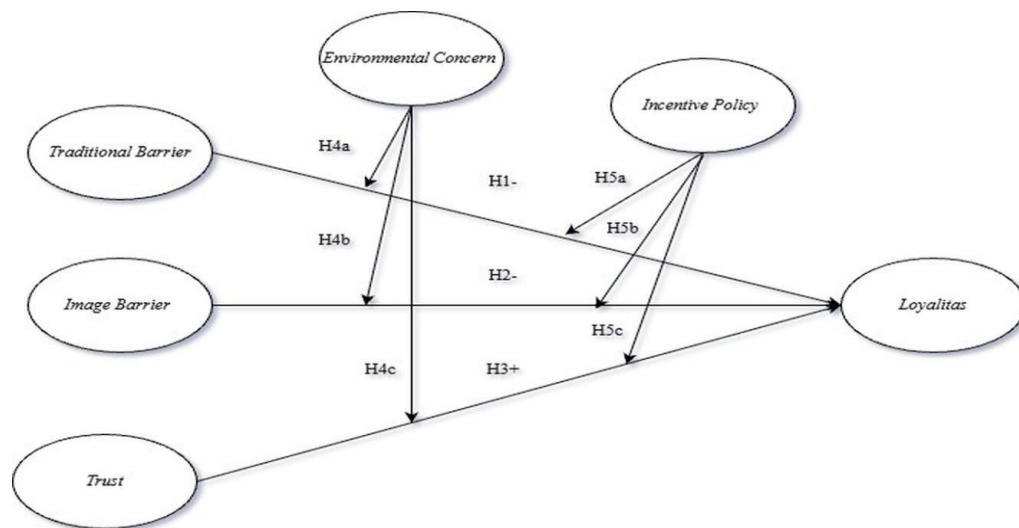
H5a: Incentive policy moderates the effect of traditional barrier on loyalty.

H5b: Incentive policy moderates the effect of image barrier on loyalty.

H5c: Incentive policy moderates the effect of trust on loyalty.

Research Framework

Based on the hypothesis development, the research framework positions traditional barrier, image barrier, and trust as independent variables affecting loyalty as the dependent variable, with environmental concern and incentive policy as moderating variables. The model is adapted and extended from Xue et al. (2024) by adding the trust variable and distinguishing two types of moderators.

Figure 1. Research Framework

METHODS

This study uses an explanatory quantitative approach to explain the causal relationships among variables and to test moderation effects (Creswell, 2014). The study population comprises all electric motorcycle users in the Special Region of Yogyakarta. Because the exact population size is unknown, the sampling technique employs non-probability sampling with the purposive sampling method, applying the following criteria: domiciled in the Special Region of Yogyakarta, being an electric motorcycle user, at least 18 years of age, and having used an electric motorcycle for at least three months.

The sample comprised 400 respondents, satisfying the requirements of PLS-SEM analysis based on the 10-times rule and the recommendations of Hair et al. (2019). Data were collected through online and direct questionnaires. All variables were measured using a five-point Likert scale, each through five indicators adapted from Xue et al. (2024) and Morgan & Hunt (1994). The data were analyzed using SEM-PLS with SmartPLS through two stages, namely the evaluation of the measurement model (outer model) and the structural model (inner model). Moderation effects were estimated using a two-stage approach, and the significance of the hypotheses was tested through bootstrapping with 5,000 subsamples.

RESULTS

Respondent Profile

Respondents were predominantly male (96.75%), mostly over 36 years of age (55%), and highly educated (bachelor's and master's degrees reaching 62.5%). Most worked as private employees (32.5%) and state-owned enterprise employees (22.5%), with 70% earning above IDR 6,000,000 per month. The most common brands were Alva (35%), Viar (27.5%), and Polytron (22.5%), with respondents concentrated in Sleman Regency (32.5%) and Yogyakarta City (25%).

Measurement Model Evaluation (Outer Model)

All indicators had outer loading value above 0.93 and AVE value between 0.896 and 0.927 (above 0.50), so convergent validity was met. Discriminant validity was satisfied through the cross-loading, Fornell-Larcker, and HTMT criteria (the highest HTMT value was only 0.346). All constructs were reliable, with Cronbach's Alpha, rho_A, and Composite Reliability values between 0.971 and 0.985 (Table 1).

Table 1. summary of Validity and Reliability Tests

Variable	Ave	Cronbach's Alpha	Composite Reliability	Description
Traditional Barrier	0.902	0.973	0.979	Valid & Reliable
Image Barrier	0.901	0.973	0.979	Valid & Reliable
Trust	0.896	0.971	0.977	Valid & Reliable
Environmental Concern	0.902	0.973	0.979	Valid & Reliable
Incentive Policy	0.908	0.975	0.980	Valid & Reliable
Loyalty	0.927	0.980	0.985	Valid & Reliable

Source: Primary data processed with SmartPLS, 2026

Structural Model Evaluation (Inner Model)

All VIF values were in the range of 1.014–1.047 (below 5.00), so the model was free of collinearity. The Adjusted R-Square value of 0.508 indicates that the model explains 50.8% of the variance in loyalty (moderate category). The predictive relevance (Q-Square) of 0.477 exceeded the 0.35 threshold, and the model fit test produced an SRMR of 0.021 and an NFI of 0.962, confirming a very good model fit (Table 2).

Tabel 2. Summary of Structural Model Evaluation

Criterion	Value	Cronbach's Alpha
R-Square Adjusted (Loyalty)	0.508	Moderate
Q-Square (Loyalty)	0.477	Good Predictive relevance
SRMR	0.021	Fit (<0.08)
NFI	0.962	Fit (≥ 0.90)
VIF (range)	1.014-1.047	No Collinearity

Source: Primary data processed with SmartPLS, 2026

Hypothesis Testing

Of the nine hypotheses tested, six were supported (H1, H2, H3, H4a, H4b, H4c) and three were not supported (H5a, H5b, H5c). The complete results are presented in Table 3. Both moderator variables also had a significant direct effect on loyalty: environmental concern ($\beta = 0.191$; $T = 5.158$; $p = 0.000$) and incentive policy ($\beta = 0.224$; $T = 6.134$; $p = 0.000$).

Tabel 3. Hypothesis testing Result (path Coefficients)

Relationship	β	STDEV	T-Stat	P-Value	Conclusion
TB $\rightarrow$ Loyalty (H1)	-0.235	0.037	6.398	0.000	Supported
IB $\rightarrow$ Loyalty (H2)	-0.277	0.035	7.909	0.000	Supported
Trust $\rightarrow$ Loyalty (H3)	0.360	0.036	9.991	0.000	Supported
TB $\times$ EC $\rightarrow$ Loyalty (H4a)	0.175	0.035	4.989	0.000	Supported
IB $\times$ EC $\rightarrow$ Loyalty (H4b)	0.277	0.032	8.614	0.000	Supported
T $\times$ EC $\rightarrow$ Loyalty (H4c)	0.237	0.032	7.355	0.000	Supported
TB $\times$ IP $\rightarrow$ Loyalty (H5a)	-0.014	0.035	0.417	0.677	Not Supported
IB $\times$ IP $\rightarrow$ Loyalty (H5b)	-0.037	0.036	1.021	0.308	Not Supported
T $\times$ IP $\rightarrow$ Loyalty (H5c)	-0.046	0.036	1.292	0.197	Not Supported

Source: Primary data processed with SmartPLS, 2026

DISCUSSION

The Effect of Traditional Barrier and Image on Loyalty

The negative effect of traditional barrier (H1) is consistent with IRT (Ram & Sheth, 1989): a traditional barrier emerges when an innovation demands changes to well-established habits. Users' attachment to fuel-charging patterns and servicing at general workshops fosters resistance that reduces loyalty, consistent with Xue et al. (2024) and Chen et al. (2018). Image barrier (H2) had the largest negative coefficient ($\beta = -0.277$), making it the strongest inhibitor. Highly educated users who are sensitive to social symbolism tend to perceive electric motorcycles as unproven products or as less representative of their self-image, making the management of image perception crucial in building loyalty (Claudy et al., 2015).

The Effect of Trust on Loyalty

Trust was the most dominant predictor (H3, $\beta = 0.360$). At the post-purchase stage, direct experience related to battery reliability, actual range, and performance consistency becomes the primary source of trust formation. In line with the Commitment-Trust Theory (Morgan & Hunt, 1994), trust functions as an enabler that neutralizes the negative effect of psychological barriers, so that consumers who trust their product remain loyal even when facing certain resistance.

The Moderating Role of Environmental Concern and Incentive Policy

Environmental concern moderated all relationships (H4a–H4c) with positive coefficients: environmental concern weakened the negative impact of barriers while strengthening the positive impact of trust. For users with high environmental concern, electric motorcycles are interpreted as a means of realizing ecological values, shifting the focus from barriers toward environmental benefits (Xue et al., 2024). In contrast, incentive policy was not proven to moderate (H5a–H5c), despite having a positive direct effect ($\beta = 0.224$). This is because the study focuses on post-purchase loyalty—incentives are more relevant at the pre-purchase stage—and most respondents were in the middle-to-upper income bracket with low sensitivity to price incentives. This finding enriches IRT by distinguishing the internal moderator (environmental concern), which effectively modifies the resistance mechanism, from the external moderator (incentive policy), which works as a direct stimulus.

CONCLUSION

Traditional barrier and image barrier have a negative and significant effects on the loyalty of electric motorcycle users in the Special Region of Yogyakarta, with image barrier being the strongest inhibitor. Conversely, trust has a positive effect and is the most dominant predictor. Environmental concern significantly moderates all relationships in the model, whereas incentive policy is not proven to be a moderator despite having a positive direct effect. Theoretically, this study extends the application of IRT from adoption intention to post-purchase loyalty, integrates trust as an enabler of loyalty, and distinguishes the mechanisms of internal and external moderators. Practically, manufacturers are advised to prioritize trust-building and product-image management, while policymakers need to combine financial incentives with programs that cultivate environmental awareness.

LIMITATION

This study is limited to the Special Region of Yogyakarta, with a respondent composition dominated by males and the middle-to-upper income group, so generalization of the results requires caution. The study used only two of the five barrier dimensions in IRT (traditional and image barriers) and explained 50.8% of the variance in loyalty. Future research is advised to

broaden the geographic scope, include all barrier dimensions, add relevant variables such as price perception and customer satisfaction, and consider a more balanced respondent composition and a mixed-methods approach

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