Greening the Road: An Analysis of Factors Influencing Consumer Decisions to Convert from Conventional Vehicles to Electric Vehicles

Dwi Asri Siti Ambarwati[*1], Achmad Yahya Teguh[2], Lidya Ayuni Putri[1]

[1] Faculty of Economics and Business, University of Lampung
[2] Faculty of Engineering, University of Lampung
E-mail: dwi.asri@feb.unila.ac.id

Article Info	Abstract
	This research aims to reveal the factors that play a central role in influencing consumers' decisions to convert conventional vehicles to electric vehicles, presenting a research context that focuses on consumer dynamics in adopting environmentally friendly technologies. By integrating the perspectives of innovation theory, consumer behaviour, and sustainability, this research analyses critical variables that shape consumer attitudes, intentions, and behaviour regarding vehicle conversion. It is hoped that the results of this research will provide in-depth insight to stakeholders and the general public about the dynamics of consumers involved in the vehicle conversion process. Thus, this research makes a significant contribution in driving the transformation towards sustainable and low-carbon mobility.

INTRODUCTION

Indonesia has committed to supporting the reduction of greenhouse gases (GHG) to mitigate the effects of global warming, as agreed upon in the Paris Agreement and outlined in Law No. 16 of 2016. This commitment was initially stated in the Nationally Determined Contribution (NDC), which specifies that by 2030, Indonesia aims to reduce GHG emissions by 29% unconditionally (through independent efforts) and by 41% conditionally (with adequate international support) (Herawan & Redi, 2022). As part of the realization of this commitment, Indonesia is making efforts to increase the use of electric vehicles domestically, including through Ministry of Transportation Regulation PM 39/2023, which governs the conversion of internal combustion engine motorcycles into battery-powered electric motorcycles.

The conversion referred to here involves modifying the propulsion system of motorcycles owned by the public through official conversion workshops so that the motorcycles no longer use gasoline-powered internal combustion engines but instead operate on battery-based electric motors (Habibie et al., 2020). This policy aims to reduce exhaust emissions from gasoline motorcycles without requiring the public to purchase new electric motorcycles. However, the implementation of this policy has encountered challenges. Of the 2023 target to convert 50,000 units, fewer than 1,000 units were achieved (cnbcindonesia.com, 15/01/2024). For 2024, the target is even higher, at 150,000 units, with a total target of 13 million units by 2030.

The ambitious target mentioned above clearly requires appropriate strategies, both in terms of providing supporting facilities and in raising public awareness through government outreach programs. On the other hand, the public's motivation to convert their motorcycles into electric motorcycles remains unclear. Previous studies have predominantly focused on consumers' motivation to purchase electric motorcycles or other electric vehicles (Dharmowijoyo et al., 2022; Yuniaristanto et al., 2022), rather than their motivation to undertake the conversion process. Yet, understanding the motivational factors of the public as consumers is crucial for the success of this program. Therefore, a scientific study is needed to examine the factors that can stimulate public motivation to convert their motorcycles.

The increasing global concern about environmental sustainability has driven the adoption of environmentally friendly technologies, including electric vehicles (EVs). Various studies worldwide have examined consumer motivation that influences changes in consumer attitudes and behavior toward adopting electric vehicles. Understanding these motivations is crucial to facilitate the transition

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from conventional vehicles to electric vehicles, which aligns with the global commitment to reducing carbon emissions and dependence on fossil fuels.

Several previous studies have explored consumer motivation regarding electric vehicle adoption. For instance, Bockarjova and Steg (2014), in their study titled *"Can Motivation Protection Theory Predict Behavior? Explaining the Adoption of Electric Vehicles in the Netherlands,"* focused on consumer motivation using the Protection Motivation Theory. Their findings indicated that the primary barriers to electric vehicle adoption are the high costs and the perceived benefits compared to conventional vehicles. Additionally, environmental risks are more influential in predicting short-term adoption indicators, while energy security risks are more significant for long-term adoption.

Similarly, Lanbroek et al. (2016), in their study *"The Effect of Policy Incentives on Electric Vehicle Adoption,"* applied the Transtheoretical Model of Change (TTM) and the Protection Motivation Theory (PMT). They found that policy incentives significantly increase electric vehicle adoption by reducing the associated costs, making the transition more appealing to consumers.

Barisa et al. (2014), in their research titled *"Introducing Electric Mobility in Latvian Municipalities: Results of a Survey,"* focused on technical information, consumer attitudes, and behaviors toward electric vehicles. Their survey revealed that the main obstacles to adoption are inadequate infrastructure, while the strongest motivation is consumer concern for environmental sustainability.

Additionally, Sajjad et al. (2014), in their study *"Between Green and Gray: Smog Risk and Rationale Behind Vehicle Switching,"* integrated the Push-Pull-Mooring model from migration theory and Institutional Theory to analyze consumer intentions to switch to electric vehicles. The results demonstrated that Pull and Mooring factors are more effective than Push factors in influencing consumers' switching intentions. Moreover, the Mooring factor moderates the relationship between several Push and Pull factors and the intention to switch to electric vehicles.

While these studies provide valuable insights into consumer motivation for electric vehicle adoption, they primarily focus on regions outside Indonesia. Given the Indonesian government's current efforts to promote electric vehicle use through policy incentives such as tax subsidies, it is essential to examine consumer motivation within the Indonesian context. This study aims to fill this research gap by providing a comprehensive understanding of the factors influencing consumer motivation for adopting electric vehicles in Indonesia.

METHODS

This study employs a mixed-methods approach, specifically using the exploratory sequential design (Creswell, 2012; Mackey & Gass, 2016). In this design, quantitative and qualitative data are collected sequentially. The first stage involves collecting and analyzing quantitative data, followed by the collection and analysis of qualitative data, which is built upon the initial quantitative findings. This study emphasizes the quantitative method, while the qualitative data serves to explain and support the quantitative results. The combination of these methods provides a more comprehensive understanding of the research problem compared to using a single method alone. The study is conducted in Lampung Province, with research subjects comprising owners of motor vehicles, particularly two-wheeled vehicles. The target for the first stage of quantitative data collection is 200 respondents. In the second stage, which involves qualitative data collection, the research subjects are electric vehicle owners.

Quantitative data is collected through an online questionnaire distributed via Google Forms to motor vehicle owners. The questionnaire is adapted from Vogt & Tsagari (2014) and Fulcher (2012) and modified to suit the research needs. It consists of 87 items, covering general information and assessment of motivational factors. Following the quantitative analysis, qualitative data is collected through interviews with electric vehicle owners. Ten participants who voluntarily agree to participate will be interviewed to explore their motivations for owning electric vehicles. Semi-structured interviews are conducted using an interview protocol to ensure the discussion remains focused on the research objectives. Each interview is expected to last approximately 20-30 minutes. Quantitative data is analyzed using Confirmatory Factor Analysis (CFA) with SPSS software. CFA is a multivariate analysis method used to confirm hypothesized models and identify relationships between variables through correlation testing. Additionally, CFA assesses the validity and reliability of the research instrument.

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Qualitative data is analyzed through three stages: transcription, coding, and interpretation, allowing a deeper exploration of the participants' perspectives and motivations.

RESULTS AND DISCUSSION
A. Result
1. Respondent Characteristics

Table 1. Respondent Characteristics by Gender

Gender	Frequency	Percentage (%)
Male	120	43%
Female	159	57%
Total	279	100%

Source: Processed Data (2024)

Based on Table 1. out of 279 respondents, 120 (43%) were male and 159 (57%) were female. This indicates that the interest in electric vehicle conversion is relatively balanced between males and females.

Table 2. Respondent Characteristics by Age

No.	Age Group	Frequency	Percentage (%)
1	17-20 years	140	50.2%
2	21-25 years	67	24%
3	26-30 years	12	4.3%
4	31-35 years	13	4.7%
5	36-40 years	11	3.9%
6	> 41 years	36	12.9%
	Total	**279**	**100%**

Source: Processed Data (2024)

The majority of respondents were aged 17-20 years, accounting for 140 people (50.2%), indicating that the interest in electric vehicle conversion is dominated by the younger generation.

Table 3. Respondent Characteristics by Education Level

No.	Education Level	Frequency	Percentage (%)
1	Elementary School (SD)	0	0%
2	Junior High School (SMP)	0	0%
3	Senior High School (SMA)	46	16.5%
4	Bachelor's Degree (S1)	189	67.7%
5	Master's Degree (S2)	32	11.5%
6	Doctorate Degree (S3)	12	4.3%
	Total	**279**	**100%**

Source: Processed Data (2024)

The majority of respondents hold a bachelor's degree (S1) with 189 individuals (67.7%), indicating that the interest in electric vehicle conversion is predominantly among highly educated individuals.

Table 4. Respondent Characteristics by Electric Vehicle Ownership

Electric Vehicle Ownership	Frequency	Percentage (%)
Owns	24	8.6%
Does Not Own	255	91.4%
Total	**279**	**100%**

Source: Processed Data (2024)

A total of 91.4% of respondents do not own an electric vehicle, indicating a need for further encouragement to boost conversion interest.

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Table 5. Respondent Characteristics by Monthly Expenditure

No.	Monthly Expenditure	Frequency	Percentage (%)
1	< Rp1.000,000,00	126	45.2%
2	Rp1.000.001,00 - Rp5.000,000,00	103	36.9%
3	Rp5.000.001,00 - Rp10.000.000,00	34	12.2%
4	Rp10.000.001,00 - Rp15.000.000,00	7	2.5%
5	Rp15.000.001,00 - Rp20.000.000,00	1	0.4%
6	> Rp20.000.000,00	8	2.9%
	Total	**279**	**100%**

Source: Processed Data (2024)

Most respondents (45.2%) have a monthly expenditure of less than Rp 1,000,000.00, indicating that the majority of enthusiasts come from the lower-middle economic class.

2. Validity and Reliability

The validity test aims to measure whether the research instrument can accurately measure the intended variables. Based on the validity test results using the KMO Measure of Sampling Adequacy and the Loading Factor values, all indicators have a value greater than 0.50, meaning all items are declared valid. The reliability test is conducted to measure the consistency of the measuring instrument. The results show that all variables have a Cronbach's Alpha value greater than 0.60, meaning all indicators in this study are reliable.

3. Hypothesis Test Results

The hypothesis test aims to determine the influence of independent variables on the dependent variable.

Table 6. R Square Calculation Results

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.655	0.430	0.421	1.792

Source: Processed Data (2024)

The R Square value of 0.430 indicates that independent variables affect consumer intention to convert vehicles to electric by 43%, while the remaining 57% is influenced by other variables not examined.

Table 7. ANOVA Test Results

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	662.873	4	165.718	51.588	.000
Residual	880.187	274	3.212		
Total	1543.061	278			

Source: Processed Data (2024)

The ANOVA results show a significance value of 0.000 ($p < 0.05$), meaning that the regression model significantly predicts consumer intentions to convert vehicles to electric.

B. Discussion

This study explored the influence of the Transtheoretical Model (TTM), Protection Motivation Theory (PMT), migration theory, and institutional theory on individuals' intentions to convert conventional vehicles into electric vehicles. The results revealed significant contributions from PMT, migration theory, and institutional theory to conversion intentions, while TTM showed no significant effect. These findings provide valuable insights into the psychological and contextual factors influencing the adoption of electric vehicles and suggest actionable implications for policymakers and stakeholders.

Theoretical Implications

The strong empirical support for PMT in this study aligns with previous research highlighting the role of perceived threat and self-efficacy in motivating preventive behaviors. PMT's relevance in this

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context underscores that individuals are more likely to engage in environmentally friendly actions, such as vehicle conversion, when they perceive climate change and pollution as imminent threats and believe they possess the capability to mitigate these threats through their actions. Policymakers and stakeholders can leverage these insights by emphasizing the environmental consequences of inaction and reinforcing public confidence in their ability to transition to electric vehicles.

Migration theory's significant impact further emphasizes the importance of social norms and environmental influences in shaping individual decisions. This aligns with existing literature that identifies social acceptance and peer influence as critical motivators for adopting sustainable practices. Campaigns that showcase positive examples of vehicle conversion and promote a culture of sustainability within communities can amplify the normative pressures encouraging individuals to adopt electric vehicles.

Institutional theory's significance highlights the pivotal role of government and institutional support in driving behavioral change. Regulatory frameworks, financial incentives, and the provision of necessary infrastructure are essential in reducing barriers to adoption. The findings affirm the necessity for robust institutional engagement to make the transition to electric vehicles a feasible and attractive option for the public.

In contrast, the insignificant findings related to TTM suggest that the staged behavioral change process may not adequately capture the complexity of decision-making involved in converting vehicles. It is possible that the adoption of electric vehicles involves external influences and immediate practical considerations that fall outside TTM's framework. Future research could investigate additional psychological or situational factors, such as economic constraints or technological literacy, to complement the insights provided by TTM.

Practical Implications

The findings of this study offer several actionable recommendations for policymakers and practitioners. First, policies that enhance public perception of environmental threats, such as the effects of climate change and air pollution, can foster stronger motivation for vehicle conversion. Public awareness campaigns should incorporate evidence-based information on the benefits of electric vehicles, including their environmental, health, and economic advantages. Highlighting success stories of individuals who have converted their vehicles can further inspire and normalize this behavior. Second, addressing financial barriers through incentives such as tax reductions, purchase subsidies, or conversion grants can significantly enhance the feasibility of vehicle conversion for the general public. Non-financial incentives, such as access to priority lanes or reduced toll fees, can also provide additional motivation for individuals to make the transition. Third, the development of charging infrastructure is critical for promoting widespread adoption. A well-established and accessible charging network reduces range anxiety and increases the practicality of using electric vehicles. Collaboration between the government and private sector is essential to ensure the infrastructure meets the demands of a growing electric vehicle population.

Finally, this study highlights the need for integrated campaigns that draw from PMT, migration theory, and institutional theory. Such campaigns should address individual perceptions of threat and self-efficacy, leverage social influence and norms, and emphasize the role of institutional support. By combining these elements, policymakers can create a comprehensive strategy to drive public interest and participation in electric vehicle conversion.

CONCLUSIONS AND SUGGESTIONS
A. Conclusion

This study contributes to the growing body of literature on sustainable transportation by identifying the significant roles of PMT, migration theory, and institutional theory in shaping individuals' intentions to convert vehicles into electric models. These findings underscore the importance of addressing psychological, social, and institutional factors in promoting environmentally sustainable behavior. By implementing targeted strategies that align with these theories, policymakers and stakeholders can accelerate the transition to electric vehicles, contributing to broader environmental and public health goals.

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B. Suggestion

Although this study provides valuable insights, several limitations must be acknowledged. First, the insignificant results for TTM warrant further exploration. Future studies could investigate whether alternative behavioral theories, such as the Theory of Planned Behavior or Value-Belief-Norm theory, offer better explanations for conversion intentions. Additionally, this study primarily focused on individual motivations without extensively considering external barriers, such as financial constraints or technological accessibility, which may also influence conversion decisions. Future research should adopt a multidisciplinary approach to address these gaps, integrating insights from psychology, economics, and technology. Longitudinal studies examining changes in public attitudes and behavior over time could provide deeper insights into the dynamics of electric vehicle adoption. Furthermore, comparative studies across different cultural and regulatory contexts could enhance the generalizability of the findings.

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