THE ROLE OF POLICY AWARENESS IN PREDICTING INTENTION TO USE ELECTRIC MOTORCYCLES: AN EXTENSION OF TPB MODEL

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Abstract - The growing reliance on gasoline-powered motorcycles has exacerbated air pollution in many urban areas. Electric motorcycles have emerged as a sustainable alternative, yet consumer adoption remains limited. This study extends the Theory of Planned Behavior (TPB) by incorporating policy awareness to explain better the intention to use electric motorcycles. Using data from 525 non-users in Da Nang City, Vietnam, analyzed via Partial Least Squares Structural Equation Modeling (PLS-SEM), the results show that personal norms and perceived behavioral control significantly influence the intention to use electric motorcycles. These findings highlight the importance of policy awareness, psychological determinants, and perceived value in fostering electric motorcycle adoption and developing effective environmental strategies.

Key words - Developing country; PLS-SEM; intention to use electric motorcycle; TPB; Da Nang

1. Introduction

Motorcycles have long served as the primary mode of transportation in many low- and middle-income countries (LMICs), with Southeast Asia being a prominent example due to its exceptionally high motorcycle density. According to statistics, by 2020, the region had over 235 million motorcycles in circulation, making it the area with the highest per capita motorcycle ownership globally [1]. Vietnam is no exception, where motorcycles play a crucial role in the national transportation system. As of 2020, more than 70 million motorcycles had been registered, with approximately 55 million actively in use [2]. This rapid increase is largely attributed to the affordability, low maintenance costs, and high flexibility of conventional motorcycles. However, the widespread use of fossil fuel-powered motorcycles has posed serious sustainability challenges, particularly in relation to environmental degradation and public health concerns. Internal combustion engines emit CO_2 and other harmful pollutants that contribute significantly to air pollution and climate change, especially in densely populated urban areas [3]. In response to these concerns, the transition to lower-emission modes of transport, such as electric motorcycles (EMs), has attracted increasing attention. EMs are considered a more sustainable alternative that aligns well with the existing infrastructure and travel behaviors in developing countries. At the 2021 United Nations Climate Change Conference (COP26), Vietnam officially committed to achieving net-zero carbon emissions by 2050, underscoring its strong determination to reduce greenhouse gas emissions, particularly in the transportation sector [4]. A range of domestic policies and initiatives have since been introduced to encourage the shift from conventional motorcycles to electric ones, including tax incentives, vehicle replacement support programs, and investment in charging infrastructure. Nevertheless, the adoption rate of electric motorcycles remains relatively low due to several barriers. These include limitations in battery technology, high initial costs, a lack of charging station infrastructure, and consumer hesitation toward unfamiliar technologies. In 2022, electric motorcycles accounted for less than 1% of the 10.6 million motorcycles sold across Southeast Asia. Vietnam has emerged as a positive outlier, with an adoption rate exceeding 10%, a figure significantly higher than neighboring countries but still far below its actual market potential [5]. These figures highlight the reality that promoting a sustainable transport transition, particularly in the electric motorcycle segment, requires not only strong governmental support but also a deeper understanding of consumer behavior and the underlying factors that influence the acceptance of green technologies.

In recent years, research on electric motorcycles has received growing attention, particularly as countries strive to meet sustainability goals and reduce greenhouse gas emissions [6]. One widely used theoretical framework in this domain is the Technology Acceptance Model (TAM), which emphasizes key factors such as perceived usefulness and perceived ease of use as core determinants of consumers' acceptance of new technologies [7, 8]. These studies have shed light on the role of individual perceptions in evaluating and adopting environmentally friendly modes of transport. Other research has expanded the scope by examining environmental factors, including concern for air quality, climate change, and personal environmental responsibility [9, 10]. These elements are often found to significantly influence pro-environmental attitudes and behaviors, including the decision to adopt electric motorcycles. Furthermore, various studies have identified potential barriers in the transition from conventional to electric motorcycles, such as concerns about performance, durability, driving range, battery replacement costs, and the lack of adequate charging infrastructure [11]. Among the theoretical approaches used, the Theory of Planned Behavior (TPB) has been increasingly adopted by scholars due to its flexibility and effectiveness in explaining human behavior [12, 13]. TPB enables a comprehensive analysis of individual attitudes, perceived social pressures (subjective norms), and perceived behavioral control, providing insights into how intentions and actual behaviors are shaped in the context of adopting new transportation technologies. The application of TPB not only offers a

holistic understanding but also aligns well with the psychological and cultural characteristics of consumers in developing countries like Vietnam.

This study aims to investigate the key factors influencing the intention to use electric motorcycles in a country where motorcycles are deeply embedded in everyday life. The focus on behavioral intention is grounded in its established predictive power in social psychological theories. Accordingly, this research extends the original TPB model by incorporating additional constructs, namely Personal Norms and Awareness of Government's Subsidy Policies and Initiatives. Furthermore, the model includes Perceived Value as a moderating variable to better understand the interactions between the core constructs. The findings from this study are expected to contribute meaningfully to the theoretical literature on consumer behavior and technology acceptance in the domain of sustainable transportation. At the same time, the results provide practical implications for shaping effective marketing strategies and designing supportive public policies to promote the adoption of electric motorcycles, thereby contributing to environmental protection and the advancement of sustainable urban mobility.

2. Theoretical background and research hypotheses

2.1. Theory of Planned Behavior (TPB)

The Theory of Planned Behavior (TPB), developed by Ajzen in the late 20th century, is regarded as an extension and refinement of the Theory of Reasoned Action (TRA). TPB has become one of the most widely adopted and influential theoretical frameworks for understanding human behavior and behavioral intentions across various domains, particularly in consumer behavior research [14]. According to TPB, an individual's intention to perform a specific behavior is determined by three core components: Attitude toward the behavior, Subjective Norms, and Perceived Behavioral Control. Specifically, attitude refers to an individual's positive or negative evaluation of a behavior, reflecting their level of willingness to perform or avoid it. Subjective norms represent the perceived social pressure exerted by family, friends, or the broader community to engage in or refrain from the behavior. Meanwhile, perceived behavioral control refers to the extent to which individuals believe they have control over performing the behavior, considering perceived barriers or available resources [14].

TPB has demonstrated strong applicability in various real-world contexts and has gained particular prominence in research on environmental behavior and sustainable development. In recent years, it has been widely used to explore the determinants of consumers' intention to transition to environmentally friendly transportation modes such as electric bicycles, electric motorcycles, and electric cars. Numerous empirical studies have confirmed TPB's effectiveness in predicting the intention to adopt electric motorcycles, owing to its ability to capture the underlying psychological motivations that drive transportation choices [9]. To enhance explanatory power, some scholars have extended the original TPB framework by incorporating constructs from other models, such as the Technology Acceptance Model (TAM). This integrated approach has provided deeper insights into the role of cognitive and perceptual factors in shaping individual behavioral intentions [15].

Building upon these well-established theoretical foundations, this study adopts an extended TPB model by integrating two additional constructs that remain underexplored in the Vietnamese context: (1) Perceived Value, and (2) Awareness of Government's Subsidy Policies and Initiatives related to green transportation. The inclusion of these constructs not only enriches the theoretical framework but also offers practical value in understanding the motivational mechanisms behind consumer behavior change - particularly the transition from traditional motorcycles to sustainable alternatives such as electric motorcycles. The findings from this research are expected to provide valuable insights for policymakers in designing more effective strategies to promote the widespread adoption of green vehicles in the future.

2.2. Research hypotheses

Attitude is one of the central constructs in the Theory of Planned Behavior (TPB), reflecting an individual's evaluation of a specific behavior as either favorable or unfavorable. In other words, attitude expresses the degree to which a person supports or opposes engaging in a behavior [14]. This factor encompasses not only cognitive but also emotional dimensions, as many scholars define attitude as a psychological state representing an individual's emotional response to a behavior, which can be measured through perceptions or feelings [16]. Numerous empirical studies have confirmed that individuals with a more positive attitude toward a behavior are more likely to form stronger intentions to carry out that behavior in practice [17]. In the context of sustainable transportation, especially regarding electric motorcycles, attitude plays a pivotal role in shaping usage intention. Consumers who hold positive perceptions of electric motorcycles - such as viewing them as environmentally friendly, cost-saving, or modern - tend to exhibit a higher likelihood of adoption [15]. Therefore, this study proposes the following hypothesis:

H1: Attitude has a positive effect on the intention to use electric motorcycles.

Subjective norms refer to an individual's perception of the expectations, desires, or social pressure from others regarding the performance of a specific behavior. This construct reflects the degree to which individuals feel they should or should not engage in a behavior based on social consensus, cultural norms, or the influence of relevant individuals in their social environment [14]. Such social pressures may lead an individual to act or refrain from acting - according to perceived social expectations [14]. Previous studies have shown that subjective norms significantly influence the intention to use electric motorcycles, including the influence of close social contacts [18], social pressure, and broader community influence [19]. Within the domain of sustainable vehicle adoption, subjective norms are considered a key

determinant of behavioral intention. Prior research has demonstrated that encouragement or approval from important others, awareness of societal trends, and the influence of one's environment can all enhance individuals' intentions to adopt electric motorcycles [20]. Hence, the following hypothesis is proposed:

H2: Subjective norms have a positive effect on the intention to use electric motorcycles.

Perceived behavioral control (PBC) refers to the extent to which an individual believes they can easily or difficultly perform a particular behavior. It reflects a person's perceived capability or control over their behavior, considering available resources, prior experience, and potential obstacles [14]. In other words, when individuals perceive that they have the necessary capabilities, knowledge, time, finances, or supportive conditions, they are more likely to form stronger behavioral intentions. In the context of sustainable mobility, especially with electric motorcycles, perceived behavioral control has been identified as a key factor influencing consumers' decisions. Those who perceive using electric motorcycles as feasible (e.g., easy access, convenient charging, reasonable cost, or supportive policies) tend to show higher adoption intention [21, 22]. Therefore, the following hypothesis is proposed:

H3: Perceived behavioral control has a positive effect on the intention to use electric motorcycles.

Awareness of government subsidy policies and initiatives plays a crucial role in promoting sustainable consumption behavior, especially in facilitating the transition from conventional to green transportation such as electric motorcycles. When consumers are well informed about government support, such as purchase subsidies, registration fee waivers, or investments in public charging infrastructure, they are more likely to feel confident and motivated to choose electric motorcycles. Financial incentives and policy clarity can shape individuals' attitudes and significantly influence their behavioral intentions [16]. Government policies serve as an important driver of consumers' intention to adopt electric vehicles [22]. Clear policy communication not only enhances perceived feasibility (e.g., affordability, convenience), but can also reinforce positive attitudes, strengthen subjective norms through social endorsement, increase perceived behavioral control through greater access, and promote personal norms related to environmental responsibility. Therefore, this study proposes that policy awareness influences multiple components of the extended TPB model, which in turn shape consumers' intentions to adopt electric motorcycles:

H4: Awareness of government policies and initiatives positively influences attitude.

H5: Awareness of government policies and initiatives positively influences subjective norms.

H6: Awareness of government policies and initiatives positively influences perceived behavioral control.

H7: Awareness of government policies and initiatives positively influences personal norms.

H8: Awareness of government policies and initiatives positively influences the intention to use electric motorcycles.

Personal norms are defined as an individual's sense of moral obligation to perform a specific behavior [23]. From another perspective, personal norms represent internal standards shaped by an individual's values, rather than social expectations or the behavior of the general population. Simply put, personal norms are self-generated for specific behaviors perceived as relevant. Schwartz [24] posited that people decide whether to act in certain situations based on their internalized values. Bortoleto [25] further explained that social norms can be internalized and transformed into personal norms, which then exert direct influence on behavior. Individuals tend to conform to these norms to avoid feelings of guilt and to uphold their sense of moral responsibility. In the domain of pro-environmental behavior, prior studies have identified personal norms as a strong predictor of various green behaviors, including the purchase of environmentally friendly products [26]. Accordingly, the following hypothesis is proposed:

H9: Personal norms have a positive effect on the intention to use electric motorcycles.

2.3. Moderating Role of Perceived Value

Perceived value refers to the consumer's overall assessment of a product's usefulness, based on a comparison between the benefits received and the costs or effort incurred to obtain it [27]. This construct reflects not only functional aspects, but also emotional and social value attached to the product. Many studies have shown that perceived value plays a vital role in shaping behavioral decisions, both before and after purchase [28]. In the context of green transportation, perceived value is considered a key factor driving the intention to use electric motorcycles. When consumers perceive that the benefits of using electric motorcycles, such as fuel savings, environmental benefits, or positive personal image, outweigh costs such as purchase price, maintenance, or range limitations, they are more likely to develop a favorable intention. According to Chen, et al. [29] perceived value directly influences behavioral intention regarding the use of electric motorcycles.

Based on this reasoning, this study proposes that perceived value serves as a moderating variable, influencing the strength of the relationships between the three core TPB components - attitude, subjective norms, and perceived behavioral control - and behavioral intention. Incorporating this moderator extends the TPB framework and clarifies how psychological factors interact to influence sustainable consumption behavior.

H10: Perceived value moderates the relationship between attitude and the intention to use electric motorcycles.

H11: Perceived value moderates the relationship between subjective norms and the intention to use electric motorcycles.

H12: Perceived value moderates the relationship between perceived behavioral control and the intention to use electric motorcycles.

H13: Perceived value moderates the relationship between personal norms and the intention to use electric motorcycles.

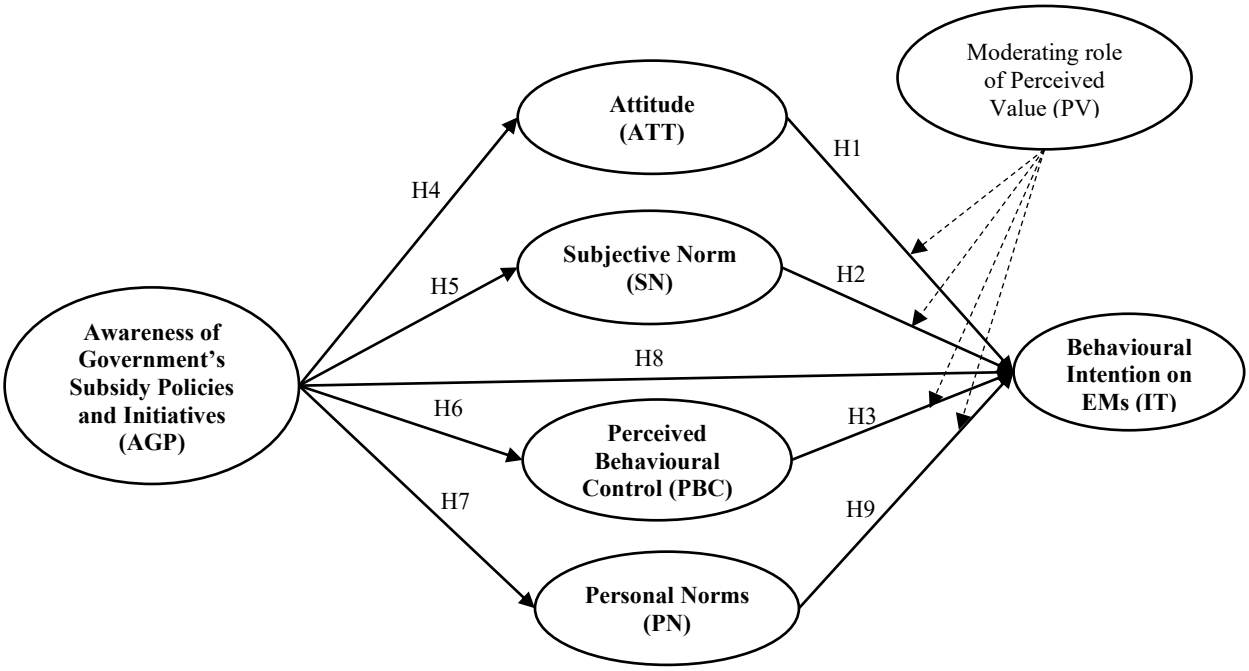

Figure 1. *Conceptual framework of the study*

3. Research Methodology

3.1. Data Collection

The research data were collected at various public locations in Da Nang, including shopping centers, parks, cafés, and bus stations, places selected to reach a demographically diverse population in terms of age, occupation, and income. The survey process was conducted by a team of well-trained research assistants to ensure adherence to standard procedures and ethical research practices. Prior to participation, respondents were fully informed about the purpose of the study and only completed the questionnaire on a voluntary basis. The questionnaires were distributed in person, and participants could request assistance from the survey team if needed. To improve the response rate, each participant who completed the questionnaire received a small incentive (30,000 VND). At the same time, research assistants were compensated based on the number of valid responses they collected, thereby ensuring both motivation and procedural compliance. The target respondents were individuals who did not own electric motorcycles, selected through specific screening criteria. Out of over 600 responses collected, 557 completed questionnaires were obtained. After data screening and cleaning, removing incomplete or inconsistent responses, a total of 525 valid responses were retained for further analysis.

3.2. Data Analysis

In structural equation modeling (SEM), two widely used approaches are Covariance-Based SEM (CB-SEM) [30] and Partial Least Squares SEM (PLS-SEM) [31]. Both serve as powerful tools in social science research but differ in purpose and methodological orientation. The choice of approach depends on the nature of the research model, analytical goals, and characteristics of the collected data. CB-SEM is typically employed in confirmatory studies that test theoretically established models. This method requires data to follow a normal distribution and usually necessitates a large sample size to ensure accurate parameter estimation. Its primary goal is to assess how well the proposed theoretical model fits the observed data. By contrast, PLS-SEM is more suitable for exploratory studies or the development of new theoretical models where the relationships between constructs are still being examined. It does not require normally distributed data, performs well with smaller sample sizes, and is particularly advantageous in analyzing complex models that include multiple latent and observed variables. Additionally, PLS-SEM enables simultaneous evaluation of the measurement model and structural model, allowing researchers to assess both the reliability and validity of measurement scales as well as the relationships among constructs [32].

Given the main objective of this study, to explore and analyze the factors influencing consumers' intention to use electric motorcycles, a relatively novel research area in Vietnam, PLS-SEM was selected as the analytical method. The research model is developed by extending the Theory of Planned Behavior (TPB) to include additional constructs such as Perceived Value and Awareness of Government's Subsidy Policies. Therefore, PLS-SEM is deemed appropriate for testing the proposed model and the relationships among variables based on the collected survey data, as well as for identifying the extent to which each factor affects consumers' behavioral intentions toward electric motorcycle usage.

4. Results

4.1. Descriptive Statistics

Table 1 presents the demographic characteristics of the sample. The gender distribution was relatively

balanced, with 50.4% male and 49.6% female respondents, reflecting gender diversity in data collection. In terms of age, the 25–39 age group comprised the largest segment (36.17%), consistent with the core working-age population, followed by the 40 – 54 group (29.84%) and the 16–24 group (21.94%). The oldest age group (55+) represented only 12.06%, indicating a lower participation rate among older individuals. Most respondents were married (61.46%), which may influence how they assess factors related to spending, purchasing behavior, and transportation priorities. Regarding education, the majority held a university degree (55.93%), followed by high school graduates (23.52%) and those with college/vocational education (10.47%), indicating a relatively high education level in the sample - suitable for analyzing consumer decision-making behaviors toward new technologies such as electric motorcycles. In terms of occupation, entrepreneurs/self-employed (18.38%), students (17.98%), and private-sector employees (14.23%) made up notable portions of the sample, demonstrating occupational diversity. Lastly, with regard to monthly income, the largest group earned between 10–20 million VND (29.45%), while 24.90% reported incomes above 30 million VND, indicating a relatively affluent sample. This demographic diversity enhances the representativeness of the dataset and supports in-depth analyses of how demographic characteristics relate to the intention to adopt electric motorcycles.

4.2. Measurement model evaluation

4.2.1. Measurement model evaluation

In this study, Confirmatory Factor Analysis (CFA) was employed to evaluate the reliability and validity of the latent constructs in the proposed model. To assess the quality of the measurement model, three main criteria were applied: internal consistency reliability, convergent validity, and discriminant validity [33]. As shown in Table 1, both Cronbach's Alpha (CA) and Composite Reliability (CR) values for all constructs exceeded the recommended threshold of 0.7 [34], indicating good internal consistency across the measurement scales. Additionally, convergent validity was assessed through factor loadings and Average Variance Extracted (AVE). Most factor loadings were above 0.7, and all AVE values surpassed the threshold of 0.5 [34], demonstrating that the observed indicators adequately captured the underlying constructs they were intended to measure.

Furthermore, to test the discriminant validity between the constructs, the study uses the HTMT (Heterotrait-Monotrait ratio) index proposed by Henseler, et al. [35]. As presented in Table 2, the HTMT values range from 0.253 to 0.609, which are lower than the recommended threshold of 0.85, indicating that the constructs in the model are clearly distinct from each other. Overall, the analysis results confirm that the measurement scales in the model meet the requirements for reliability and validity, providing a solid foundation for the subsequent analysis steps in the study.

Table 1. *First-order measurement model evaluation*

Constructs		Loadings	CA	CR	AVE
AGP			0.838	0.903	0.756
	AGP1	0.850			
	AGP 2	0.878			
	AGP 3	0.879			
PBC			0.807	0.885	0.720
	PBC1	0.884			
	PBC 2	0.880			
	PBC 3	0.778			
ATT			0.828	0.886	0.662
	ATT 1	0.782			
	ATT 2	0.875			
	ATT 3	0.872			
	ATT 4	0.716			
SN			0.840	0.903	0.756
	SN 1	0.880			
	SN 2	0.876			
	SN 3	0.852			
PN			0.822	0.881	0.651
	PN 1	0.836			
	PN 2	0.852			
	PN 3	0.795			
	PN 4	0.738			
AGI			0.838	0.903	0.756
	AGI1	0.849			
	AGI 2	0.881			
	AGI 3	0.878			
IT			0.807	0.886	0.722
	IT1	0.840			
	IT2	0.886			
	IT3	0.821			

Note: CA = Cronbach's Alpha, CR = Composite Reliability; AVE = Average Variance Extracted.

Table 2. *Heterotrait-Monotrait Ratio (HTMT)*

Constructs	ATT	AGP	IT	PBC	PV	PN	SN
ATT							
AGP	0.253						
IT	0.456	0.271					
PBC	0.445	0.103	0.363				
PV	0.609	0.180	0.620	0.356			
PN	0.557	0.347	0.458	0.438	0.499		
SN	0.522	0.366	0.393	0.437	0.457	0.419	

4.3. Structural model evaluation

a. Direct effects

The relationship between the variables in the research model is assessed through path coefficients and statistical significance levels. These coefficients are tested based on the t-value, with three commonly used thresholds: 1.65 (significant at the 10% level), 1.96 (significant at the 5% level), and 2.57 (significant at the 1% level) [32]. When

multiple variables have similar path coefficients, the variable with the higher t-value is considered to have a stronger and more reliable influence in the model.

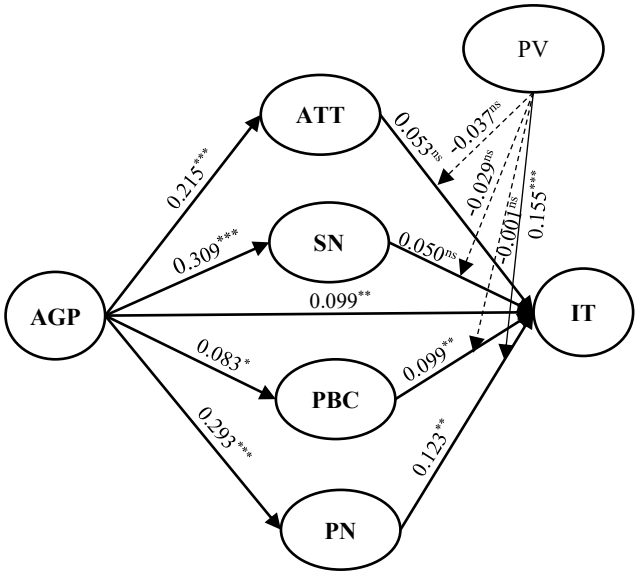

Figure 2. *Results of PLS-SEM*

Table 3. *Direct effects*

Path	ß	SD	t-values	p-values
ATT -> IT	0.053ns	0.054	0.983	0.326
SN -> IT	0.050 ns	0.056	0.894	0.371
PBC -> IT	0.099**	0.049	2.011	0.045
AGP -> ATT	0.215***	0.05	4.343	<0.001
AGP -> SN	0.309***	0.042	7.420	<0.001
AGP -> PBC	0.083*	0.048	1.721	0.086
AGP -> PN	0.293***	0.048	6.037	<0.001
AGP -> IT	0.099**	0.042	2.370	0.018
PN -> IT	0.123**	0.049	2.543	0.011

*Notes: ns non-significant, ***p < 0.01, **p < 0.05, *p < 0.1.*

According to the results presented in Table 3, personal norms are the strongest factor influencing the intention to use electric motorcycles, with the path coefficient $\beta_{PN \to IT}$ = 0.123 (t = 2.543, p =0.011). Next, perceived behavioral control also shows a positive effect on intention, with the path coefficient $\beta_{PBC \to IT}$ = 0.099 (t = 2.011, p =0.045). Furthermore, the factor related to the awareness of government's subsidy policies and initiatives also significantly influences the intention to use, with ($\beta_{AGP \to IT}$ = 0.099, t = 2.370, p =0.018). Additionally, the analysis results indicate that the awareness of government's subsidy policies and initiatives not only directly affects intention but also positively influences other mediating factors. Specifically, this factor has a strong effect on attitude ($\beta_{AGP \to AT}$ = 0.215, t = 4.434, p<0.001), perceived behavioral control ($\beta_{AGP \to SN}$ = 0.309, t = 7.420, p<0.001), subjective norm ($\beta_{AGP \to PBC}$ = 0.083, t = 1.721, p=0.086) and personal norms ($\beta_{AGP \to PN}$ = 0.293, t = 6.037, p<0.001).

b. Indirect Effects

Table 4 presents the results of analyzing the indirect relationships in the research model. Among the relationships tested, only the indirect relationship between the perception of government policies and initiatives and the intention to use electric motorcycles reached statistical significance. Specifically, personal norms serve as a mediating variable in this relationship, with a path coefficient β = 0.036 (t = 2.223, p = 0.027). This result suggests that the indirect effect adds to the direct effect, and both are in the same direction. This implies that the influence of the perception of policies not only directly affects intention but is also reinforced through the mediating factor – personal norms [36].

Table 4. *Indirect Effects*

Path	ß	SD	t-values	p-values
AGP -> ATT -> IT	0.011 ns	0.013	0.892	0.373
AGP -> PBC -> IT	0.008 ns	0.007	1.22	0.223
AGP -> PN -> IT	0.036**	0.016	2.223	0.027
AGP -> SN -> IT	0.015 ns	0.018	0.867	0.386

*Notes: ns non-significant, ***p < 0.01, **p < 0.05, *p < 0.1.*

c. Moderation effect

Table 5 presents the results of the moderation analysis examining the role of perceived value (PV) in the relationships leading to the intention to use electric motorcycles (IT). Among the four relationships tested, only one showed a statistically significant moderating effect of perceived value. Specifically, subjective norm is the only factor whose relationship with usage intention is significantly moderated by perceived value, with a path coefficient of β = 0.155 (t = 3.219, p = 0.001). This indicates that when consumers perceive a high value in using electric motorcycles, the influence of subjective norms (e.g., expectations from family and friends) on their intention to adopt becomes stronger.

In contrast, the remaining three relationships - between perceived value and attitude, perceived behavioral control, and personal norm - did not reach statistical significance. This suggests that perceived value does not play a meaningful moderating role in these relationships.

Table 5. *Results of direct and moderating effects of Perceived Value*

Path	ß	SD	t-values	p- values
ATT (PV -> IT)	-0.037ns	0.044	0.843	0.400
PBC (PV -> IT)	-0.029 ns	0.048	0.600	0.549
PN (PV -> IT)	-0.010 ns	0.045	0.222	0.824
SN (PV -> IT)	0.155 ***	0.048	3.219	0.001

d. Predictive capability evaluation

The structural model was evaluated using two key indicators: the coefficient of determination (R^2) and the predictive relevance (Q^2). Specifically, R^2 reflects the extent to which the independent variables explain the variance of the dependent variable in the model [33]. In this study, the R^2 value for the "intention to use electric motorcycles" variable is 0.333, indicating that the model explains approximately 33.3% of the variance in usage intention. This suggests that the model has a certain degree of applicability, although there remains room for

improvement in terms of explanatory power. In addition, the Q^2 statistic was used to assess the model's predictive relevance through the blindfolding procedure [33]. With a Q^2 value of 0.224, the results indicate that the model possesses acceptable predictive capability, as the value exceeds 0 - the minimum threshold to confirm predictive relevance. However, the level of prediction remains moderate, suggesting that while the model has forecasting ability, it is not particularly strong.

5. Discussion

5.1. Theoretical implications

Climate change has become a global existential threat, underscoring the necessity of adopting green transportation modes. The development of electric motorcycles contributes to sustainable development goals, especially in countries with high levels of motorcycle usage, such as Vietnam. While previous research has primarily focused on electric vehicle adoption intentions in high-income countries, studies exploring this issue in low- and middle-income countries remain limited. To address this gap, the present study proposes an extended framework based on the Theory of Planned Behavior (TPB) to explain the intention to use electric motorcycles.

The research findings indicate that among the three main components of the Theory of Planned Behavior (TPB), only Perceived Behavioral Control has a statistically significant and positive influence on the intention to use electric motorbikes. This result is not entirely consistent with previous studies, which generally suggest that all three factors - Attitude, Subjective Norms, and Perceived Behavioral Control - significantly affect behavioral intention. For example, the study by Murtiningrum, et al. [9] in Indonesia confirmed that all three TPB components positively predict the adoption of electric vehicles. Similarly, research conducted in the Vietnamese context also found that all three factors of the TPB model influence the intention to use electric motorbikesc [37]. However, in the current study, Attitude and Subjective Norms did not show statistically significant relationships with behavioral intention. This discrepancy may be explained by specific contextual characteristics. First, electric motorbikes are still relatively new products in the market, and concerns about performance, durability, or charging infrastructure may prevent consumers from translating positive attitudes into actual behavioral intentions. Second, the influence of social norms may not yet be strong enough at this early stage of behavioral transition, especially when electric motorbikes have not become a popular trend or widely appreciated by the community. The current findings suggest that individuals who perceive a higher level of behavioral control, such as having sufficient financial resources, confidence, and the belief that using electric motorbikes is within their capabilities, are more likely to intend to adopt electric motorbikes in the future [12]. Therefore, at this stage, enhancing individuals' perception of accessibility and ease of use may play a key role in promoting the behavioral shift toward electric motorbike adoption.

In addition, Personal Norms (PN) were identified as a significant predictor of electric motorcycle adoption intention. This finding aligns with Schwartz [23] argument that personal norms play a vital role in promoting pro-environmental behaviors. It suggests that a sense of personal responsibility toward the environment is a meaningful factor in consumer decision-making in Vietnam. Therefore, this study emphasizes the importance of raising public awareness regarding moral responsibility toward the environment, potentially through educational initiatives and awareness campaigns [18, 19].

Awareness of government policies and initiatives was also found to have a positive effect on the intention to use electric motorcycles. This finding supports Dutta and Hwang [22] study, which indicates that government incentives can significantly reinforce consumer purchase decisions. Moreover, the results show that policy awareness influences not only intention directly but also indirectly through personal norms. Government incentives and clear environmental commitments can shape both attitudes and behaviors within the public, thereby encouraging a broader transition to electric motorcycle usage [15].

Finally, the analysis shows that Perceived Value (PV) plays a significant moderating role in the relationship between subjective norms and intention to use electric motorcycles. Specifically, when consumers perceive greater benefits from using electric motorcycles, such as cost savings, convenience, or environmental friendliness, the influence of social referents (e.g., family, friends) on their intention becomes stronger. This implies that the impact of subjective norms on adoption intention is amplified when perceived value is high. Conversely, if perceived value is low, social support alone is unlikely to convert into actual behavioral intention. This highlights a synergistic effect between social influence and individual perceptions of product benefits, suggesting that communication strategies should emphasize both the practical advantages of electric motorcycles and community endorsement to maximize adoption intention.

5.2. Practical implications

The study yields useful insights for government bodies and electric motorcycle manufacturers to design effective development strategies aligned with local realities. Based on the key findings, several feasible, resource-appropriate solutions can be proposed to promote the acceptance and adoption of electric motorcycles. The analysis identified several critical factors affecting behavioral intention, laying the foundation for policy and intervention design to boost public interest and adoption.

First, Personal Norms emerged as the strongest predictor of adoption intention. Several policy implications can be drawn to enhance individuals' sense of environmental responsibility. Specifically, the government and relevant agencies should strengthen public campaigns that emphasize each individual's role in reducing emissions and protecting the environment through the choice of eco-friendly vehicles like electric motorcycles. Integrating environmental education and ethical responsibility into

school curricula can also help shape personal norms from an early age. Furthermore, programs that recognize, reward, or support individuals demonstrating sustainable consumption behavior, such as adopting electric motorcycles, should be implemented. Social organizations and community groups should be encouraged to take part in mobilization efforts, awareness-raising, and inspiration-building around environmental responsibility [38].

Second, since Perceived Behavioral Control was shown to influence adoption intention positively, policies should aim to reduce perceived barriers and enhance individuals' confidence in switching to electric motorcycles. This includes developing infrastructure such as public charging stations, priority parking, and accessible maintenance systems. In addition, training programs or user guides, especially targeting middle-aged and elderly consumers, can improve user competence and reduce psychological resistance to shifting from conventional motorcycles [39]. Providing clear information on cost, long-term benefits, and available financial support would also improve perceived behavioral control and encourage wider adoption. From a consumer perspective, financial incentives such as subsidies and tax reductions may further stimulate interest in adopting electric motorcycles for daily transportation needs [5].

Finally, to effectively leverage the role of policy awareness and government initiatives in enhancing both intention and personal norms, communication strategies should be transparent, accessible, and widely disseminated. The government should collaborate with social organizations, educational institutions, and businesses to deliver information via various channels - television, social media, community workshops, and mobile outreach campaigns. Integrating policy information into environmental education programs would further enhance public awareness and personal accountability. When individuals clearly understand the positive impacts of these policies and feel they are part of a collective effort to protect the environment, they are more likely to actively transition to sustainable transportation modes such as electric motorcycles.

6. Conclusions

This study extends the Theory of Planned Behavior (TPB) to investigate the determinants of consumers' intention to use electric motorcycles in Vietnam, a country where motorcycles dominate urban mobility. By integrating policy awareness into the TPB framework, the model provides a more comprehensive understanding of both psychological and contextual mechanisms that drive sustainable transport behavior.

The findings highlight that personal norms and perceived behavioral control are the strongest predictors of the intention to use electric motorcycles, underscoring the roles of moral obligation and perceived feasibility in shaping pro-environmental behavior. Furthermore, awareness of government policies and initiatives not only directly enhances the intention to use but also exerts indirect effects through personal norms, indicating that well-communicated and transparent policy interventions can strengthen moral motivation among consumers. The moderating role of perceived value also shows that when individuals perceive greater benefits from using electric motorcycles, the influence of personal norms on the intention to use electric motorcycles becomes stronger. Theoretically, this research contributes to the TPB literature by demonstrating how contextual and psychological factors jointly influence behavioral intention in emerging markets as Vietnam. Practically, the study emphasizes that policymakers and manufacturers should focus on strengthening environmental responsibility, enhancing infrastructure and affordability, and improving public understanding of government incentives.

Despite its contributions, this study is limited to a single urban area and a cross-sectional dataset, which may restrict the generalizability of its findings. Future studies could expand and compare across different cities, and incorporate additional factors such as risk perception or actual usage behavior to gain deeper insights into electric motorcycle adoption. By integrating moral, social, and policy-driven approaches, Vietnam and similar developing economies can accelerate the transition toward sustainable mobility and achieve broader environmental goals.

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