International Journal of Innovative Research and Scientific Studies, 8(6) 2025, pages: 1999-2008

IJIRSS
International Journal of Innovative Research & Scientific Studies

ISSN: 2617-6548

URL: www.ijirss.com

Modeling the drivers of electric vehicle adoption in major Vietnamese cities: Toward a sustainable transport policy framework

Thao Huong Phan[1], Thao Viet Tran[2], Trang Mai Tran[3*], Tri Van Truong[4]

[1,2]*Thuongmai University,79 Ho Tung Mau, Ha Noi, Vietnam.*
[3]*Institute of Vietnam and World Economy Vietnam Academy of Social Sciences, Ha Noi, 10000, Vietnam.*
[4]*Dong A University, Da nang, Vietnam.*

Corresponding author: Trang Mai Tran (*Email: tranmaitrang610@gmail.com*)

Abstract

Vietnam is one of the rapidly developing countries in Asia and is also facing a series of environmental and sustainability challenges. To achieve sustainable development, the goal of carbon neutrality (CO2) is considered one of the most important goals. Transportation is one of the industries that use fossil fuels and emit large amounts of greenhouse gases in the Vietnamese economy, so setting a neutral emission target will open up great opportunities for the country to transform, but will also bring many difficulties and challenges, requiring the cooperation of the whole society and strong support from the international community. Therefore, Vietnam's future policies and initiatives on early green energy transition will help the zero-emission vehicle industry develop rapidly and strongly in the domestic and foreign markets, promoting economic growth. However, Vietnam currently does not have specific studies and policies to encourage the production and use of electric vehicles towards the goal of sustainable development. The research adopts a TPB-based framework, extended to include environmental concern and policy awareness, to test the effects of psychological, social, and contextual variables on EV adoption intentions. By conducting a structured survey with 300 participants across four major cities: Hanoi, Viet Tri, Da Nang, and Ho Chi Minh City- the study captures regional variability and diversity in consumer behavior.

Keywords: Adoption, Carbon emissions, Electric vehicles, Sustainable development.

DOI: 10.53894/ijirss.v8i6.10069
Funding: This study received no specific financial support.
History: Received: 6 August 2025 / **Revised:** 8 September 2025 / **Accepted:** 10 September 2025 / **Published:** 19 September 2025

Competing Interests: The authors declare that they have no competing interests.
Authors' Contributions: All authors contributed equally to the conception and design of the study. All authors have read and agreed to the published version of the manuscript.
Transparency: The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.
Acknowledgements: The article is a product of the Ministry of Education and Training's Scientific Research Project: "Research on solutions to encourage the use of electric vehicles in some cities in Vietnam towards achieving sustainable development goals" (Code: B2024-TMU-03). The Ministry of Education and Training, Vietnam; Thuongmai University, Hanoi, Vietnam; editors, friends; and other researchers and reviewers who helped us during the study period and for supporting this publication are all acknowledged by the authors.
Publisher: Innovative Research Publishing

1. Introduction

The global transition toward sustainable transportation has emerged as an indispensable strategy in combating climate change, mitigating urban air pollution, and fostering environmentally responsible urban growth. For Vietnam, this imperative is especially salient. As a signatory to the Paris Agreement and an active participant in COP26, the country has pledged to achieve net-zero carbon emissions by 2050—a commitment that necessitates profound structural shifts across multiple sectors, particularly transportation. Currently, the transport sector contributes approximately 20% of Vietnam's total greenhouse gas (GHG) emissions, with private motorized vehicles being the primary source.

Electric vehicles (EVs), as a clean and energy-efficient alternative to conventional gasoline-powered transport, offer a viable pathway toward decarbonization. They not only reduce direct emissions but also align with broader national strategies such as the National Green Growth Strategy and the Nationally Determined Contributions (NDCs). Despite favorable policy intentions, including tax incentives and infrastructure development plans, the market penetration of EVs in Vietnam remains modest. Urban areas—where vehicular density, energy demand, and pollution levels are highest—still witness limited uptake of electric vehicles. The dominance of internal combustion engine (ICE) vehicles and deep-rooted consumer habits represent formidable barriers to the diffusion of EV technology.

In this context, a deeper understanding of the behavioral, environmental, and institutional determinants that shape consumer intention to adopt EVs is both timely and necessary. Existing literature has emphasized the relevance of psychological constructs such as attitudes, subjective norms, and perceived behavioral control, as conceptualized in the Theory of Planned Behavior (TPB). However, in developing country settings like Vietnam, these variables interact dynamically with contextual conditions, including infrastructure readiness, environmental awareness, and perceived governmental support. Without empirical insights into these interactions, policy efforts may remain misaligned with on-the-ground behavioral drivers.

This study addresses this critical gap by investigating the factors that influence the intention to adopt electric vehicles among urban residents in Vietnam. The research adopts a TPB-based framework, extended to include environmental concern and policy awareness, to test the effects of psychological, social, and contextual variables on EV adoption intentions. By conducting a structured survey with 300 participants across four major cities: Hanoi, Viet Tri, Da Nang, and Ho Chi Minh City—the study captures regional variability and diversity in consumer behavior.

The results are expected to yield practical implications for policy design and market interventions, especially in refining incentive mechanisms, improving charging infrastructure, and shaping public communication strategies that resonate with consumer motivations.

So in this research, our research question is: What are the key psychological, environmental, and policy-related factors that influence the intention to adopt electric vehicles among urban residents in Vietnam?

2. Literature Review

2.1. Attitude toward Electric Vehicles

Attitude, as conceptualized within the Theory of Planned Behavior (TPB), refers to an individual's overall evaluation—favorable or unfavorable—of performing a given behavior [1]. In the case of electric vehicle (EV) adoption, attitude encompasses beliefs about the benefits of EVs, such as their perceived environmental value, modern design, fuel efficiency, and convenience.

Multiple studies have established the central role of attitude in EV adoption. Rezvani, et al. [2] demonstrate that individuals who believe EVs are affordable, reliable, and environmentally friendly are more likely to express strong adoption intentions. Moons and De Pelsmacker [3] found that both utilitarian (e.g., cost savings, low emissions) and symbolic (e.g., modern image, innovation) attitudes significantly influence consumer choice. In emerging economies where EV familiarity is limited, attitude formation may depend heavily on mass communication, peer experiences, and promotional campaigns. Thus, interventions that improve perceptions of EV performance, maintenance reliability, and value for money may positively shape public attitude toward EVs.

2.2. Subjective Norms and Social Influence

Subjective norms represent an individual's perception of social pressure to engage or not engage in a behavior. These norms derive from expectations of important referents such as family, friends, or colleagues. In collectivist societies, including most Southeast Asian cultures, subjective norms often outweigh personal attitudes in shaping behavior [4].

Zhang, et al. [5] suggest that consumers are more inclined to adopt EVs when members of their social networks have already done so or express strong support for such choices. Similarly, Jansson, et al. [6] emphasize that social endorsement not only reinforces favorable attitudes but also legitimizes new consumption patterns like green mobility. In the Vietnamese context, where group orientation and community reputation remain influential, social conformity can play a pivotal role in scaling EV adoption. Perceptions of EVs as socially desirable, responsible, or prestigious may further amplify this dynamic.

2.3. Perceived Behavioral Control

Perceived behavioral control (PBC) captures the extent to which individuals feel capable of performing a behavior, accounting for both internal abilities (e.g., knowledge, confidence) and external constraints (e.g., infrastructure, cost). It serves as a proxy for self-efficacy and actual control, and is considered a key antecedent of both intention and behavior in the TPB framework.

Sovacool, et al. [7] argue that range anxiety, unclear maintenance costs, and limited public charging infrastructure reduce perceived control and thus suppress behavioral intention. Wang, et al. [8] add that when users feel locked out of the infrastructure or perceive EVs as technically complex, they are less likely to adopt them, regardless of environmental concern or social influence. In developing contexts such as Vietnam, where EV infrastructure is still evolving, perceived control may hinge on policy support, information accessibility, and the simplicity of ownership experience.

2.4. Environmental Awareness and Moral Motivation

Environmental awareness reflects an individual's recognition of environmental problems and belief in the ecological impact of their actions. It comprises cognitive elements (e.g., knowledge of climate change, pollution) and moral elements (e.g., sense of responsibility, ecological values), both of which influence pro-environmental behavior.

Empirical studies confirm that higher levels of environmental concern are associated with a greater likelihood of adopting EVs. Egbue and Long [9] found that concern about oil dependency and climate change motivated American consumers to consider EVs despite infrastructural limitations. Moons and De Pelsmacker [3] show that environmental self-identity enhances the predictive power of the TPB when explaining sustainable mobility behavior. In Asian markets, where environmental education is often uneven, raising awareness through campaigns, school curricula, and public discourse is considered a prerequisite for behavioral change.

2.5. Government Policy Support

Policy interventions are essential to address market failures in the early stages of EV diffusion. These include fiscal measures (e.g., purchase subsidies, tax reductions), regulatory frameworks (e.g., emission targets, mandates), and infrastructure development (e.g., charging stations). However, the effectiveness of such policies depends not only on their design but also on their visibility and perceived fairness.

The IEA [10] highlights that countries with the highest EV adoption rates—such as Norway and the Netherlands—combine generous incentives with long-term policy consistency. Yet, in many developing economies, policy implementation is fragmented and communication is weak. Xie, et al. [11] emphasize that consumers' perceptions of policy clarity, transparency, and reliability significantly affect their behavioral responses. Without credible and well-communicated support, policy measures may fail to influence public intention meaningfully.

2.6. Supplier Incentives and Business Strategy

In addition to public policy, supplier-side strategies are gaining attention as critical enablers of EV adoption. These include price discounts, leasing schemes, extended warranties, battery-as-a-service models, and service support. Supplier credibility and perceived customer service quality can enhance both attitude and perceived behavioral control.

Zhang, et al. [5] observe that Chinese automakers who offer flexible ownership models and strong after-sales service gain competitive advantage. Lee, et al. [12] argue that in contexts where consumers are skeptical of government claims, business-led initiatives can build trust and promote early adoption. Moreover, supplier innovations in financing, maintenance, and charging convenience may mitigate some infrastructural and financial barriers, particularly in emerging markets.

2.7. Toward an Extended TPB Framework

Based on the literature, this study employs an extended TPB model to analyze EV adoption. Beyond the core constructs of attitude, subjective norms, and perceived behavioral control, the model incorporates environmental awareness and perceived policy support as critical contextual variables. This multi-dimensional approach reflects the growing consensus that pro-environmental behavior is influenced not only by individual motivation but also by institutional and socio-cultural conditions.

Several meta-analyses have validated the TPB's explanatory power in various domains, including sustainable transport [6, 13]. However, scholars increasingly call for context-specific extensions to account for cultural, infrastructural, and regulatory diversity. This research responds to that call by tailoring the TPB framework to the Vietnamese context.

2.8. Research Gap

Although the existing literature offers a robust theoretical foundation for understanding EV adoption, especially through the lens of the Theory of Planned Behavior and its extensions, several gaps remain that justify further investigation in the context of Vietnam and similar emerging markets.

First, the bulk of EV adoption studies have been conducted in high-income countries with mature infrastructure, supportive regulatory environments, and well-informed consumers [3, 7]. These contexts differ significantly from transitional economies like Vietnam, where electric mobility is still nascent, public policy is evolving, and infrastructure is unevenly distributed. Consequently, it remains unclear how behavioral drivers identified in advanced economies operate under less favorable structural conditions.

Second, while the TPB has demonstrated strong predictive power in sustainability research, relatively few empirical studies have adapted this model to incorporate contextual determinants such as environmental awareness and perceived government policy. These variables may be especially salient in emerging economies, where ecological consciousness is growing but institutional trust and access to information remain limited [9, 11]. Without these extensions, existing models risk omitting significant predictors of intention.

Third, most prior research treats policy frameworks as exogenous background variables rather than subjective constructs perceived by consumers. However, in dynamic regulatory settings, the mere existence of policies does not guarantee their behavioral salience. As Xie, et al. [11] argue, it is the perception of clarity, credibility, and relevance of government interventions that shapes behavioral responses—especially in contexts where public messaging and policy consistency are underdeveloped.

Fourth, there is limited understanding of how supplier-side factors—such as promotional strategies, after-sales services, and consumer financing—affect adoption decisions in tandem with public policy. Studies tend to examine these domains in isolation, overlooking how coordinated or conflicting signals from public and private actors may influence trust and perceived behavioral control.

Fifth, few studies adopt a geographically differentiated approach that accounts for urban heterogeneity within a single country. Given Vietnam's regional disparities in infrastructure, income, and policy enforcement, it is important to analyze whether and how determinants of EV adoption vary across cities such as Hanoi, Da Nang, Viet Tri, and Ho Chi Minh City.

Addressing these gaps, the present study makes four key contributions: It extends the TPB model by incorporating environmental awareness and perceived policy support as contextual variables; it treats government and supplier policy as perceived influences on behavioral intention, not merely as objective conditions; it provides empirical evidence from a developing Southeast Asian country where empirical data on EV adoption remains scarce; and it conducts a multi-city analysis to reveal regional variation and enhance the external validity of findings.

By bridging behavioral theory with contextual realities in Vietnam, this study aims to enrich the global discourse on sustainable mobility transitions, offering theoretical refinement and actionable insights for policymakers, manufacturers, and urban planners.

3. Research Methodology

3.1. Research Design

This study adopts a quantitative research design based on survey methodology to examine the behavioral determinants influencing the intention to adopt electric vehicles (EVs) in Vietnam. The research is structured around an extended Theory of Planned Behavior (TPB) framework, incorporating additional contextual variables such as environmental awareness and perceived policy support. This model enables the analysis of both psychological and institutional factors that shape user behavior in emerging urban contexts.

The research process involves five key stages: (i) literature synthesis and model development, (ii) survey instrument design and pretesting, (iii) data collection via structured questionnaires, (iv) statistical analysis including reliability and validity testing, and (v) hypothesis testing through multiple linear regression analysis.

3.2. Sampling and Data Collection

The study utilizes a purposive sampling strategy targeting urban residents across four Vietnamese cities—Hanoi, Viet Tri, Da Nang, and Ho Chi Minh City—representing different geographic regions and levels of infrastructural development. These cities were selected to reflect regional variation in EV infrastructure, consumer awareness, and policy exposure.

Data collection was conducted from January to March 2025. A total of 300 questionnaires were distributed, with 287 valid responses retained after data screening, yielding a response rate of 95.7%. Respondents were screened to ensure that they were aged 18 or above and had a basic understanding of electric vehicles, regardless of whether they currently owned one.

Questionnaires were administered both online and in-person. The online survey used Google Forms, disseminated through social media and EV user groups. In-person surveys were conducted at transportation hubs, shopping centers, and EV showrooms, with assistance from trained enumerators. Participants were assured of data confidentiality and anonymity.

Table 1.
Code of variable.

Construct	Code	Definition
Attitude toward EVs	ATT	Personal evaluation of EVs in terms of utility, design, and performance.
Subjective Norms	SN	Perceived social pressure from significant others to adopt EVs.
Perceived Behavioral Control	PBC	Perceived ease or difficulty in adopting EVs given resources and control.
Environmental Awareness	EA	Awareness and concern for environmental problems and sustainability.
Government Policy Support	GPS	Perceived availability and effectiveness of governmental EV support policies.
Behavioral Intention	BI	Willingness and intention to adopt or purchase an EV in the future.

3.3. Measurement Instrument

The questionnaire was developed based on validated scales from existing literature, modified to fit the Vietnamese context. It was structured into six sections corresponding to the theoretical constructs:

- Attitude toward EVs: Four items measuring perceived benefits in terms of cost, design, performance, and convenience.
- Subjective norms: Four items assessing perceived social influence from family, friends, and community.
- Perceived behavioral control: Three items measuring respondents' perception of their ability to use or purchase EVs, considering affordability and access to infrastructure.

- Environmental awareness: Three items evaluating concern about environmental issues and the perceived ecological benefits of EVs.
- Government policy support: Three items measuring awareness and perception of government incentives, regulations, and information provision.
- Behavioral intention: Three items reflecting the likelihood of purchasing or using an EV in the near future.

All items were measured using a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The original questionnaire was developed in English, then translated into Vietnamese using back-translation to ensure linguistic and conceptual equivalence. A pilot test with 30 respondents was conducted to assess clarity, comprehension, and internal consistency.

4. Research Hypotheses

The conceptual framework of this study is grounded in the Theory of Planned Behavior (TPB), which postulates that behavioral intention (BI) is influenced by three primary determinants: attitude toward the behavior (ATT), subjective norms (SN), and perceived behavioral control (PBC). To extend the explanatory capacity of the TPB in the context of sustainable transportation, two additional constructs—environmental awareness (EA) and government policy support (GPS)—were incorporated based on empirical findings from previous EV adoption studies [2, 14].

Accordingly, the research model hypothesizes that each of the five independent variables (ATT, SN, PBC, EA, and GPS) positively influences the dependent variable BI. The rationale behind the model is that EV adoption in emerging economies such as Vietnam is not only shaped by individual-level cognition and social influence but also by environmental values and institutional support mechanisms.

The proposed model is illustrated in Figure 1.

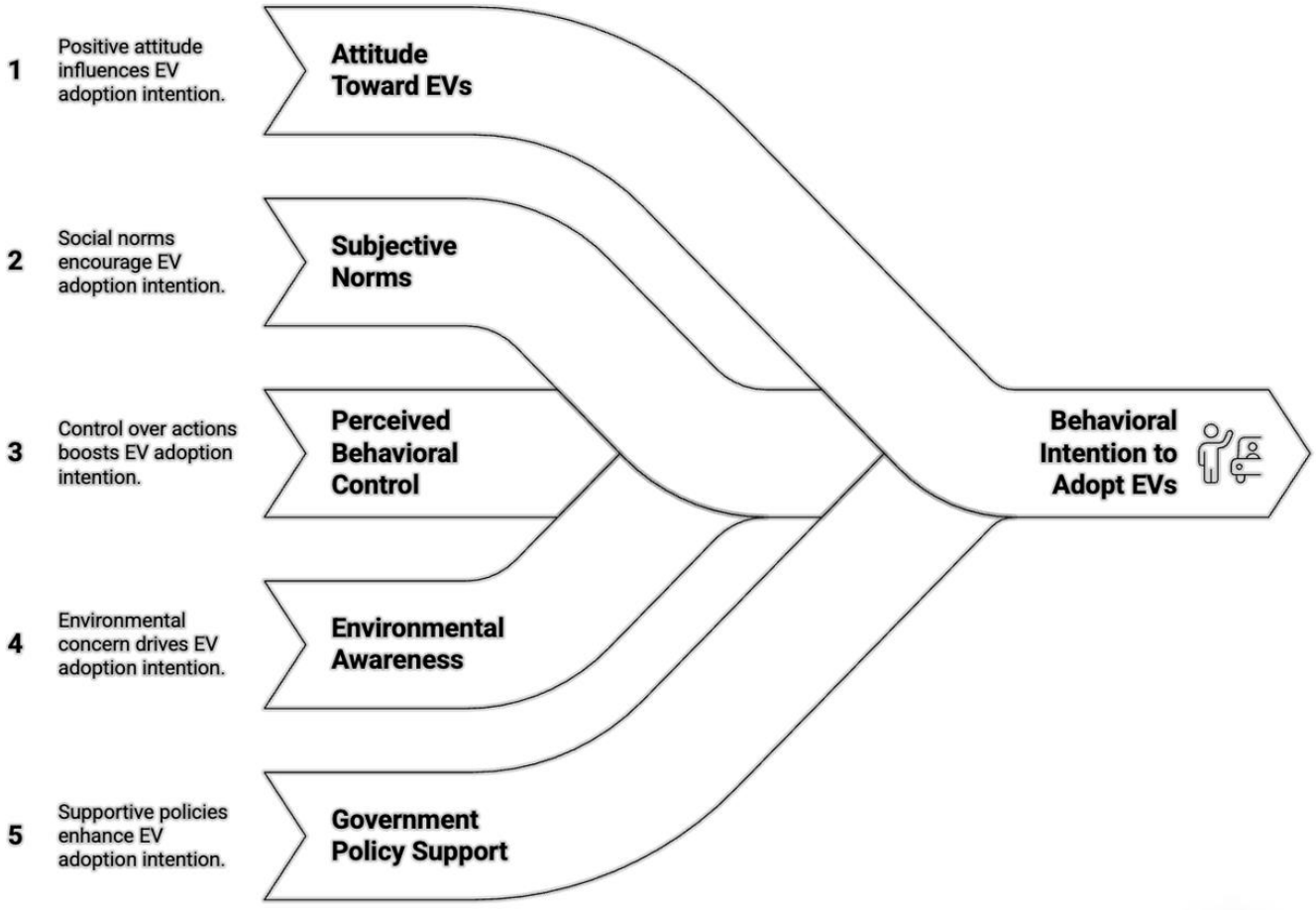

Figure 1.
The proposed model.

Based on the extended Theory of Planned Behavior (TPB) and relevant empirical findings in sustainable transportation research, the following hypotheses are proposed:

H_1: Attitude toward electric vehicles (ATT) has a positive and significant effect on behavioral intention (BI) to adopt EVs.

This hypothesis is grounded in the classical TPB formulation, in which an individual's positive or negative evaluation of a behavior strongly predicts their intention to perform it. Respondents who perceive EVs as cost-effective, convenient, or technologically advanced are expected to exhibit stronger intentions to adopt.

H_2: Subjective norms (SN) have a positive and significant effect on BI to adopt EVs.

SN reflects perceived social pressure or encouragement from significant others (family, peers, colleagues). In collectivist cultures like Vietnam, normative influence plays a substantial role in shaping environmentally responsible behaviors.

H_3: Perceived behavioral control (PBC) has a positive and significant effect on BI to adopt EVs. PBC refers to individuals' perceived ease or difficulty in performing the behavior, given available resources, infrastructure, and self-efficacy. This construct captures the perceived accessibility and affordability of EVs, especially in urban contexts.

H_4: Environmental awareness (EA) has a positive and significant effect on BI to adopt EVs.

EA is integrated as a context-specific extension of TPB. Individuals with higher concern for environmental degradation and climate change are more inclined to adopt sustainable technologies, such as EVs. Prior studies have confirmed EA as a significant motivational factor in pro-environmental decisions.

H_5: Government policy support (GPS) has a positive and significant effect on BI to adopt EVs.

GPS refers to the perception of public incentives, subsidies, regulatory frameworks, and strategic infrastructure development (e.g., charging stations). It is hypothesized that when individuals recognize clear and reliable governmental support, their intention to adopt EVs increases accordingly.

These five hypotheses collectively form the empirical basis of the extended TPB model tested in this study. Each hypothesis is examined through multiple linear regression analysis presented in Section 4.

5. Results

5.1. Descriptive Statistics

The descriptive statistics provide an overview of respondents' perceptions across the six latent constructs measured on a five-point Likert scale. Table D1 summarizes the mean (M) and standard deviation (SD) values. All constructs recorded mean scores higher than the neutral midpoint (3.00), indicating generally positive perceptions among urban respondents toward electric vehicles (EVs) and their determinants of adoption.

Table 2.
Descriptive Statistics.

Construct	Mean (M)	Standard Deviation (SD)	Minimum	Maximum	Skewness	Kurtosis
ATT	3.84	0.62	2	5	-0.42	-0.13
SN	3.71	0.69	2	5	-0.31	-0.48
PBC	3.48	0.73	1.8	5	-0.21	-0.62
EA	3.66	0.68	2	5	-0.35	-0.22
GPS	3.41	0.75	1.6	4.8	-0.19	-0.57
BI	3.56	0.66	2.1	5	-0.27	-0.4

The descriptive statistics presented in Table D1 offer a comprehensive overview of the central tendencies, dispersion, and distributional characteristics of the six latent constructs used in this study. All variables recorded mean values above the neutral point (3.00), indicating generally favorable perceptions among respondents toward electric vehicle (EV) adoption and its influencing factors.

The highest mean value was observed for Attitude toward EVs (ATT, M = 3.84), suggesting that respondents hold a positive evaluation of EVs in terms of functionality, aesthetics, and economic benefits. Subjective Norms (SN) followed closely (M = 3.71), reflecting the role of social influence in behavioral intention formation. Conversely, Government Policy Support (GPS) had the lowest mean (M = 3.41), signaling a relatively weaker perception of policy efficacy or visibility.

Standard deviations ranged from 0.62 to 0.75, indicating moderate variability in responses. Minimum and maximum scores across all constructs demonstrate full utilization of the Likert scale (1–5), confirming the robustness of the response distribution.

Importantly, the skewness values were all negative (from -0.42 to -0.19), revealing a left-skewed distribution and suggesting that most responses leaned toward agreement with positive statements. The kurtosis values, ranging from -0.62 to -0.13, indicate platykurtic distributions, meaning that the data are relatively flat and exhibit fewer extreme values than a normal distribution.

These distributional patterns confirm the appropriateness of the data for further parametric analyses such as factor analysis and multiple linear regression. The relatively balanced dispersion and low skew/kurtosis also mitigate concerns regarding data normality violations. Overall, the descriptive profile underscores a generally supportive public attitude toward EVs, tempered by modest skepticism about governmental policy implementation. These insights set the stage for deeper inferential analysis presented in the subsequent sections.

5.2. Reliability Analysis

To ensure the internal consistency of the measurement scales, Cronbach's Alpha (α) coefficients were computed. All constructs demonstrated acceptable reliability, with α values exceeding the minimum threshold of 0.70 as recommended by Nunnally [15]. Table R1 presents the reliability statistics.

Table 3.
The reliability statistics.

Variable	α	No. of Items
ATT	0.813	4
SN	0.845	4
PBC	0.764	3
EA	0.794	3
GPS	0.737	3
BI	0.809	3

The highest internal consistency was observed in SN ($\alpha = 0.845$), confirming that the social influence items were highly interrelated. The strong reliability of ATT, EA, and BI (all $\alpha > 0.79$) also indicates well-constructed measurement instruments. Even GPS and PBC, despite having slightly lower α, remain statistically robust, validating the appropriateness of the survey design.

5.3. Exploratory Factor Analysis (EFA)

To assess construct validity and identify the underlying structure of observed variables, EFA was performed using Principal Axis Factoring with Varimax rotation. The Kaiser-Meyer-Olkin (KMO) measure was 0.832, and Bartlett's Test of Sphericity was highly significant ($p < 0.001$), verifying the suitability of the dataset for factor analysis.

As shown in Table E1, six factors were extracted that closely correspond to the six theoretical constructs. All factor loadings ranged from 0.61 to 0.86 and exceeded the recommended threshold of 0.60. There were no significant cross-loadings, indicating strong discriminant validity among constructs. The total variance explained was 67.34%, which is considered satisfactory in social science research.

Table 4.
EFA Summary.

Construct	Factor Loadings (Min–Max)	Variance Explained (%)
ATT	0.69–0.84	12.4
SN	0.71–0.86	13.6
PBC	0.63–0.78	11.7
EA	0.67–0.81	10.9
GPS	0.61–0.73	9.8
BI	0.70–0.85	9.9

The clarity of the factorial structure reinforces the theoretical foundation of the extended TPB model employed in this study. Each latent construct was empirically validated through its aligned factor, strengthening the legitimacy of the subsequent hypothesis testing.

5.4. Multiple Linear Regression Analysis

Multiple linear regression analysis was employed to test the influence of ATT, SN, PBC, EA, and GPS on the dependent variable BI. The model was statistically significant ($F = 56.27$, $p < 0.001$), and the coefficient of determination (R^2) reached 0.574. This indicates that the five predictors collectively explain 57.4% of the variance in respondents' intention to adopt EVs.

Table 5.
Multiple Regression Results Predicting BI.

Predictor	β (Standardized)	p-value
SN	0.295	0.001
ATT	0.279	0.001
EA	0.201	0.01
PBC	0.121	0.05
GPS	0.042	0.05

The standardized beta coefficients (β) show that SN exerts the strongest influence on BI ($\beta = 0.295$), followed by ATT ($\beta = 0.279$). This suggests that the perceived social expectation to use EVs, along with a positive personal evaluation of the vehicles, are the primary motivators for behavioral intention. EA also has a statistically significant effect ($\beta = 0.201$), demonstrating that environmental concern plays an important, though secondary, role in shaping EV-related decisions.

PBC, while statistically significant ($\beta = 0.121$, $p < 0.05$), has a relatively weaker impact, indicating that perceived affordability and ease of access to EV-related infrastructure moderately influence adoption intention. Notably, GPS is not statistically significant ($\beta = 0.042$, $p > 0.05$), which may suggest that existing government policy mechanisms are either poorly communicated or fail to meet public expectations in the current stage of market development.

5.5. Regression Equation

The regression equation based on standardized coefficients is expressed as follows:

$$BI=0.2958*SN+0.279*ATT+0.201*EA+0.121*PBC+0.042*GPS$$

Given that GPS is not statistically significant, a reduced model excluding this predictor could be explored in future research to enhance parsimony without substantially sacrificing explanatory power.

This equation emphasizes that behavioral intention to adopt EVs in urban Vietnam is predominantly driven by subjective norms and individual attitudes. The roles of environmental concern and perceived control are also present but less dominant, while the effect of policy perception appears minimal under current conditions.

6. Discussion and Implications

H_1: Influence of Attitude (ATT → BI)

Hypothesis H1 predicted a positive and significant relationship between attitude toward EVs (ATT) and behavioral intention (BI) to adopt electric vehicles. The analysis confirmed this expectation, with ATT demonstrating a statistically significant standardized beta coefficient ($\beta = 0.279$, $p < 0.001$). This suggests that respondents who hold favorable evaluations of EV attributes—such as perceived cost-effectiveness, modern aesthetics, convenience, and potential energy savings—are significantly more inclined to express intention to adopt EVs.

This finding parallels empirical studies across various contexts. Rezvani, et al. [2] emphasize that cognitive beliefs about utility and environmental friendliness strongly predict EV adoption intention. Similarly, Liao, et al. [13] and Moons and De Pelsmacker [3] highlight the combined effect of utilitarian and symbolic attitudes in shaping consumer readiness. Notably, these studies were conducted in contexts where EV familiarity is relatively high. In contrast, our study in Vietnam—where EV penetration remains nascent—illustrates that attitude remains a central influencer even under lower awareness conditions.

Critically, the magnitude of ATT's effect in our model is comparable to established literature, underscoring the universal importance of personal evaluation in driving adoption behavior. Importantly, the strength of ATT in our context may also reflect early adopter perceptions or marketing influence. Nonetheless, developing favorable public attitudes toward EVs through targeted marketing, test-driving opportunities, and demonstration projects remains critical for scaling adoption.

Implications: EV stakeholders—including manufacturers, city planners, and campaign designers—should deploy strategies to strengthen positive consumer attitudes. Tactics could include immersive EV experience events, testimonial campaigns that highlight real-world advantages, and transparency in cost-of-ownership comparisons. Since attitude significantly shapes intention, initiatives that tangibly alter consumer perception will likely yield measurable behavioral shifts as EV markets mature in Vietnam.

H_2: Influence of Subjective Norms (SN → BI)

Hypothesis H2 asserted that subjective norms (SN) positively influence behavioral intention (BI). In our results, SN exhibited the strongest impact among all predictors ($\beta = 0.295$, $p < 0.001$), confirming the critical role of perceived social expectations. This indicates that individuals who sense encouragement or endorsement from family, friends, or peers are more likely to intend to adopt EVs.

This finding is consistent with robust literature. Jansson, et al. [6] and Zhang, et al. [5] report strong SN→BI effects in studies from Sweden and China, respectively. More specifically, in collectivist cultures widespread in East and Southeast Asia, normative influence often surpasses individual attitudes in real behavior shaping [4]. Our Vietnamese sample reflects these socio-cultural patterns, where normative conformity may offer both symbolic validation and communal assurance.

The pronounced SN effect also suggests strategic opportunities for interventions. Engaging community opinion leaders—such as EV owners, social media figures, or workplace influencers—can amplify normative messaging. Social marketing campaigns featuring neighborhood EV usage, celebrity endorsement, or peer storytelling could help establish EV adoption as socially desirable behavior.

However, reliance on SN also raises concerns about sustaining momentum once early adopters diminish. Hence, efforts should combine normative influence with reinforcement of structural support (like infrastructure and visible charging stations) to maintain perceived legitimacy. In future research, it would be beneficial to explore how SN interacts with generational or urban-rural segmentation, as normative power may vary across demographic groups.

In summary, SN's dominant role supports the hypothesis and highlights social leverage points overlooked in conventional individual-centric models. For policymakers and EV advocates, prioritizing normative interventions may offer higher impact than purely attitudinal campaigns in collectivist settings like Vietnam.

H_3: Influence of Perceived Behavioral Control (PBC → BI)

Hypothesis H3 anticipated that perceived behavioral control (PBC) would positively influence behavioral intention (BI). The findings confirm this relationship with a moderate beta coefficient ($\beta = 0.121$, $p < 0.05$). While the effect size is smaller than that of ATT or SN, it remains statistically meaningful, indicating that perceived ease of adoption—considering affordability, access to charging infrastructure, and technical capability—plays a contributory role.

Comparative studies align with our interpretation. Sovacool, et al. [7] and Wang, et al. [8] document that concerns about range, cost, or station availability reduce user confidence and suppress intention. Research in India and Australia similarly highlights PBC as a key operational barrier in EV adoption. Notably, in developing markets where infrastructure is underdeveloped, PBC often serves as a gatekeeping factor between intention and actual behavior.

Our finding of moderate PBC significance suggests the Vietnamese urban context may still present infrastructure uncertainty or affordability concerns, but these barriers are not insurmountable. The fact that ATT and SN are stronger

suggests that motivation may outweigh perceived limitations, yet PBC remains a necessary condition for converting intention into practical action.

Practical implications are evident. Enhancing PBC requires improving accessibility of charging networks, increasing affordability through financing options, and offering clear user guidance. Manufacturers and service providers might offer bundled service packages, extended warranties, or basic training on EV use. Local governments can accelerate public charging investments and promote private-public partnerships for infrastructure expansion.

In conclusion, though PBC is not the primary driver of BI, it is essential for behavioral activation. Without increasing perceived control, positive attitudes and strong normative pressure may not translate into adoption. Future studies may further examine how PBC interacts with demographic or locational factors in urban-to-rural segments.

H_4: Influence of Environmental Awareness (EA → BI)

Hypothesis H4 proposed that environmental awareness (EA) positively influences behavioral intention (BI). Our model confirms this with a significant beta coefficient ($\beta = 0.201$, $p < 0.01$), indicating that individuals with heightened concern for air pollution, climate change, and ecological sustainability are more likely to intend to adopt EVs.

The result aligns with findings from Egbue and Long [9] and Moons and De Pelsmacker [3] which show that environmental values and moral identity increase pro-environmental behavior. Similarly, Jansson, et al. [6] emphasize the mediating role of ecological concern in sustainable mobility choices. Our results contribute to this literature by affirming that even in emerging economies, environmental awareness is a relevant motivational factor.

Given rising levels of urban pollution and climate vulnerability in Vietnam, public discourse on environmental consequences is intensifying. This context may amplify EA's relevance in behavioral models. However, compared to ATT and SN, EA has a smaller yet distinct influence—suggesting that while environmental values matter, they operate synergistically rather than dominantly.

For policy and practice, the implication is clear: embedding EV promotion within environmental education campaigns may yield dual benefits. Broadcasting health impacts of vehicle emissions, launching community ecology programs, and incorporating EV topics into school curricula can elevate awareness. Messaging that explicitly connects EV adoption to clean air, climate resilience, or urban livability may resonate with environmentally conscious respondents and reinforce intention.

In sum, EA's significant effect supports its inclusion as an extended TPB construct and highlights the need for integrated behavioral and environmental communication strategies in EV policy frameworks.

H_5: Influence of Government Policy Support (GPS → BI)

Hypothesis H5 posited that government policy support (GPS) would positively impact behavioral intention (BI). The analysis shows that GPS has a non-significant standardized beta ($\beta = 0.042$, $p > 0.05$), indicating a lack of measurable influence. This contrasts with expectations based on studies in contexts with strong policy presence. For instance, Xie, et al. [11] and international comparisons by IEA [10] suggest that clear and credible policy frameworks enhance consumer intention.

The negligible effect of GPS in our model likely reflects a perception gap. While Vietnam has introduced EV-related policy measures, such as tax incentives and charging station roadmaps, public visibility of these policies is still limited. Media coverage, awareness campaigns, and local implementation may not sufficiently communicate policy benefits to ordinary urban consumers. This gap between policy existence and public perception diminishes its behavioral potency.

Critically, our findings indicate that the psychological impact of policy support depends less on the content and more on perceived clarity, credibility, and accessibility. Echoing Xie, et al. [11] policies must not only exist but be understandable, reliable, and relevant to citizens' daily experience to shape intention effectively.

Policy recommendations include improving transparency and outreach through local pilot programs, public dashboards, and multi-stakeholder participation. Authorities might collaborate with private sector actors to showcase EV benefits at the community level, offering tangible demonstrations of policy support. Enhancing citizen engagement in policy design and feedback mechanisms could also strengthen policy trust and perceived salience.

In conclusion, GPS's non-significance in our model highlights an important mismatch between institutional intent and public perception. Interventions must bridge this gap to elevate policy from background condition to actual behavioral influencer in EV adoption processes.

7. Conclusion and Policy Recommendations Toward Sustainable Electric Vehicle Adoption in Vietnam

To achieve sustainable urban development and contribute to Vietnam's net-zero emissions target by 2050, it is imperative for local governments to adopt a comprehensive and adaptive policy framework that encourages the use of electric vehicles (EVs). The results of this study reveal that behavioral intention to adopt EVs is primarily influenced by individual attitudes, social norms, environmental awareness, and perceived behavioral control, whereas government policy support remains statistically insignificant. This outcome highlights the urgent need for cities to not only design effective policy measures but also ensure their visibility, accessibility, and credibility among the public.

First, policy visibility must be enhanced through localized communication and outreach. Despite the existence of national-level EV strategies—such as Decision No. 876/QĐ-TTg 2022 promoting clean energy transportation—awareness remains low at the city level. Cities like Hanoi, Ho Chi Minh City, and Da Nang should adopt multi-channel campaigns (digital platforms, community events, school programs) to communicate existing incentives such as reduced registration fees, electricity price support for charging, or tax relief for EV purchases. Urban authorities could develop public

dashboards or mobile apps displaying available charging stations, CO_2 savings, and policy updates to reinforce transparency and trust.

Second, policy design should incorporate targeted financial and infrastructural incentives. In addition to existing national subsidies for EV production and assembly, cities should explore local fiscal tools such as parking discounts, toll exemptions, or access to dedicated green lanes for EVs. These context-specific incentives can compensate for cost or convenience barriers, especially in high-density cities where perceived behavioral control is constrained. Municipal governments may also co-finance fast-charging infrastructure with private providers in priority zones (e.g., transit hubs, malls, office districts).

Third, EV policy frameworks must be socially embedded and community-driven. Given the strong influence of subjective norms, cities should mobilize civic organizations, youth networks, and neighborhood groups as EV advocates. For example, community-based EV pilot projects or shared EV schemes could encourage trial and acceptance among skeptical consumers. Public-private partnerships should include not only industry actors (e.g., VinFast) but also academia and NGOs in co-designing inclusive, evidence-based EV programs.

Fourth, inter-city learning and benchmarking mechanisms should be institutionalized. Cities with nascent EV plans (e.g., Viet Tri) can benefit from structured exchanges with more advanced peers (e.g., Da Nang) through MOUs, policy labs, or city networks. Comparative monitoring can stimulate innovation, scale up best practices, and ensure balanced progress across regions.

Finally, cities must link EV policy to broader sustainability goals, such as air quality improvement, low-carbon public transit integration, and green urban planning. Aligning EV promotion with climate adaptation strategies will reinforce its developmental relevance and political legitimacy.

In sum, Vietnamese cities play a critical role in operationalizing national EV ambitions. By enhancing policy visibility, contextualizing incentives, activating social engagement, and embedding EVs in sustainability frameworks, cities can transform EV adoption from policy vision into a practical urban behavior. These measures will not only accelerate EV uptake but also reinforce Vietnam's trajectory toward inclusive and resilient urban futures.

References

[1] I. Ajzen, "The theory of planned behavior," *Organizational Behavior and Human Decision Processes*, vol. 50, no. 2, pp. 179–211, 1991. https://doi.org/10.1016/0749-5978(91)90020-T

[2] Z. Rezvani, J. Jansson, and J. Bodin, "Advances in consumer electric vehicle adoption research: A review and research agenda," *Transportation Research Part D: Transport and Environment*, vol. 34, pp. 122-136, 2015. https://doi.org/10.1016/j.trd.2014.10.010

[3] I. Moons and P. De Pelsmacker, "Emotions as determinants of electric car usage intention," *Journal of Marketing Management*, vol. 28, no. 3–4, pp. 195–237, 2012.

[4] H. Kim, H. Lee, and J. Lee, "Factors influencing the adoption of electric vehicles in Korea: Structural equation modeling approach," *Sustainability*, vol. 14, no. 1, p. 123, 2022.

[5] Y. Zhang, Y. Yu, and B. Zou, "Analyzing consumer's intention to adopt electric vehicles in China: The role of psychological factors," *Renewable and Sustainable Energy Reviews*, vol. 146, p. 111107, 2021.

[6] J. Jansson, A. Marell, and A. Nordlund, "Exploring consumer adoption of a high involvement eco-innovation using value–belief–norm theory," *Journal of Consumer Behaviour*, vol. 16, no. 4, pp. 345–359, 2017.

[7] B. K. Sovacool, J. Kester, L. Noel, and G. Z. de Rubens, "The demographics of decarbonizing transport: The influence of gender, education, occupation, age, and household size on electric mobility preferences in the Nordic region," *Global Environmental Change*, vol. 52, pp. 86-100, 2018. https://doi.org/10.1016/j.gloenvcha.2018.06.008

[8] S. Wang, J. Wang, and J. Li, "How and when perceived behavioral control affects EV adoption intention: A multi-group analysis based on gender and age," *Transportation Research Part D: Transport and Environment*, vol. 79, p. 102243, 2020.

[9] O. Egbue and S. Long, "Barriers to widespread adoption of electric vehicles: An analysis of consumer attitudes and perceptions," *Energy Policy*, vol. 48, pp. 717–729, 2012. https://doi.org/10.1016/j.enpol.2012.06.009

[10] IEA, *Global EV outlook 2024*. Paris: International Energy Agency, 2024.

[11] Y. Xie, H. Wang, and H. Zhang, "How do public policies affect electric vehicle adoption? Evidence from China," *Energy Policy*, vol. 160, p. 112666, 2022.

[12] P. Lee, S. Bubeck, and J. Petro, "Benefits, limits, and risks of GPT-4 as an AI chatbot for medicine," *New England Journal of Medicine*, vol. 388, no. 13, pp. 1233-1239, 2023.

[13] Y. Liao, F. Deschamps, E. d. F. R. Loures, and L. F. P. Ramos, "Past, present and future of Industry 4.0-a systematic literature review and research agenda proposal," *International Journal of Production Research*, vol. 55, no. 12, pp. 3609-3629, 2017. https://doi.org/10.1080/00207543.2017.1308576

[14] S. Hardman, E. Shiu, and R. Steinberger-Wilckens, "Comparing high-end and low-end early adopters of battery electric vehicles," *Transportation Research Part A: Policy and Practice*, vol. 88, pp. 40–57, 2016. https://doi.org/10.1016/j.tra.2016.03.010

[15] J. C. Nunnally, *Psychometric theory*, 2nd ed. New York: McGraw-Hill, 1978.