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Research on Factors Influencing the Intention of Residents in Hanoi to Switch to Electric Vehicles

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Abstract— *The rapid increase in internal combustion engine (ICE) vehicles has contributed to worsening environmental pollution and greenhouse gas emissions in major Vietnamese cities. As the country moves toward its net-zero target for 2050 and pushes for a shift to sustainable transportation, electric vehicles (EVs) are increasingly seen as a promising alternative. This study aims to identify and assess the factors that influence Hanoi residents' intention to switch to EVs, drawing on an integration of the Theory of Planned Behavior (TPB), the Technology Acceptance Model (TAM), and the Diffusion of Innovation (DOI) theory. The proposed model incorporates six core constructs — Attitude, Social Influence (Subjective Norm), Environmental Awareness, Economic Benefits, Technological Risk, and Charging Infrastructure — along with two additional constructs, Habit and Prior Experience. A mixed-methods approach was adopted, combining qualitative and quantitative techniques, with data collected from 308 valid survey responses and analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) in SmartPLS 4. The results confirm that "Attitude toward EVs" is the strongest and most direct predictor of switching intention, alongside meaningful contributions from "Social Influence," "Prior Experience," and "Habit." Notably, "Environmental Awareness" emerged as the most important driver of a favorable consumer attitude, while "Technological Risk" and the direct effect of "Government Incentives" were not found to be statistically significant in this study. These findings offer valuable empirical evidence to help policymakers and industry practitioners shape effective policy, expand charging infrastructure, and design strategies that support the shift toward green mobility and sustainable transportation.*

Keywords— *Electric vehicles (EVs), EV switching intention, Hanoi.*

I. OVERVIEW

A. Context of the Problem

The transportation sector is currently one of the largest sources of greenhouse gas emissions and a major contributor to declining air quality, further compounding the effects of climate change. Alongside accelerating urbanization and the rapid growth in private vehicle ownership, the pressure to cut transport-related emissions in Vietnam has become increasingly urgent. At the same time, transport electrification is regarded as one of the central strategies for achieving Vietnam's net-zero target by 2050. The shift toward green transportation is also expected to improve environmental quality and support sustainable development.

In recent years, Hanoi has faced mounting challenges from traffic congestion and pollution driven by the rapid growth in private vehicle ownership, placing considerable strain on the capital's transport infrastructure and causing serious environmental damage: Hanoi has repeatedly ranked among the world's most air-polluted cities. In addition, persistent traffic congestion has become a growing concern in both Hanoi and Ho Chi Minh City.

B. Solution

Against this backdrop, electric vehicles (EVs) are seen as an important solution for cutting emissions, improving energy efficiency, and accelerating the shift to a more sustainable transportation system. Many countries have pushed forward transport electrification through supportive policy and infrastructure investment. According to [1], the drivers and barriers to EV adoption have drawn growing interest from researchers and policymakers alike, with environmental awareness, economic benefits, infrastructure, and psychological factors all playing an important role in consumers' decision-making.

C. Market Context

In Vietnam, the EV market is expanding rapidly and is projected to keep growing in the years ahead as manufacturers scale up production and consumer demand rises [2] similarly notes that Vietnam is entering an accelerated phase of transport electrification, with the country's EV market now among the fastest-growing in Southeast Asia. The Hanoi city government, for its part, is developing policies to help residents switch from fossil-fuel vehicles to EVs as part of its broader push for green transportation.

D. Research Overview

In recent years, the development of green transportation has drawn considerable scholarly attention, particularly research on EV adoption behavior and usage intention. Much of this earlier work has drawn on established behavioral theories such as the Theory of Planned Behavior (TPB) [3], the Technology Acceptance Model (TAM) [4], and the Diffusion of Innovation (DOI) theory [18], typically extended with additional constructs to reflect the specific characteristics of green vehicles and the research context.

Prior studies have shown that the intention to adopt or purchase EVs is shaped by a range of factors. Psychological and behavioral constructs, including attitude, subjective norm, and perceived behavioral control, have consistently been shown to play a key role in shaping behavioral intention ([3], [5], [6]). Product and technology - related factors such as perceived usefulness, perceived risk, product quality, innovativeness, and relative advantage have likewise been identified as significant influences on EV adoption ([7], [8];, [9]). Environmental awareness and economic benefits, meanwhile, are widely regarded as key drivers pushing consumers toward more environmentally friendly modes of transportation ([10], [7], [11]).

Beyond individual - level factors, a number of studies also emphasize the role of external factors: infrastructure, government support policies, social influence, and market conditions,… in driving the shift to EVs ([12]; [13]; [1]). More recently, some studies have approached EV usage from a behavioral - transition perspective, showing that prior experience, habit, and other accumulated behavioral factors can influence consumers' decision to switch from conventional vehicles to EVs [14]. Overall, the literature agrees that EV adoption intention results from the combined effect of psychological, economic, technological, environmental, and social factors.

E. Research Gap

While EVs are widely regarded as an important solution for reducing emissions and promoting sustainable transportation, research in Vietnam has so far focused mainly on general EV purchase or adoption intention [15], leaving Hanoi's specific context, marked by high vehicle density, persistent congestion, and severe air pollution, still largely unexplored. Most prior studies have also relied primarily on the traditional constructs of the Theory of Planned Behavior ([3], [5], [7], [6]), while behavioral factors such as habit and prior experience, shown elsewhere to significantly affect EV switching behavior, remain underexamined [14]. Furthermore, earlier research has typically applied TPB, TAM, or DOI separately to explain EV adoption behavior ([4], [18], [7], [9]), so the integration of all three frameworks remains limited. Building on these gaps, this study proposes an integrated model combining TPB, TAM, and DOI, adding habit and prior experience as two extended constructs, to provide empirical evidence on the factors shaping Hanoi residents' intention to switch to EVs - thereby supporting policymakers in driving a more effective transition toward green transportation.

F. Theoretical and Practical Contributions

Theoretically, this study helps extend the integrated application of TPB, TAM, and DOI to the context of green-transportation transition in Vietnam. Practically, the findings provide a useful reference for EV manufacturers and distributors in shaping marketing strategy, while also supporting policymakers in developing regulation and infrastructure to promote EV adoption - contributing to Vietnam's broader goals of sustainable transportation development and emissions reduction.

I. Theoretical Background

Given the need to shift toward a sustainable transportation system and reduce greenhouse gas emissions, electric vehicles are emerging as an effective alternative to conventional fossil-fuel vehicles. Studying consumers' intention to switch to EVs matters both for predicting consumer behavior and for advancing transport electrification.

A number of theories have been developed to explain EV-switching behavior, drawing on research in consumer behavior and technology acceptance. Among them, the Theory of Planned Behavior (TPB), developed by [3] from the Theory of Reasoned Action (TRA), remains one of the most widely used frameworks. It holds that behavioral intention directly determines actual behavior, and is shaped by three core factors: attitude toward the behavior, subjective norm, and perceived behavioral control. Owing to its strong explanatory power for voluntary behavior, TPB has been widely applied to research on green consumer behavior and EV adoption ([5], [7]).

While traditional TPB is generally considered a reliable predictor of behavioral intention, many studies argue that its three core constructs are not sufficient to explain the more complex behaviors involved in adopting new technologies and sustainable consumption. Researchers have therefore extended TPB with additional exogenous constructs to strengthen its explanatory power. In the EV context, constructs such as environmental awareness, economic benefits, technological risk, usage habits, and government support policy are commonly incorporated into the extended TPB model to better capture consumers' decision-making process ([7], [11], [1]). This extension helps the model fit the context of EV-switching research more closely and improves its ability to explain behavioral intention.

In addition, the Diffusion of Innovation (DOI) theory, proposed by [18], offers a further perspective on how technological innovations spread and get adopted within a society. It holds that adoption of a new product depends on five core innovation attributes: relative advantage, compatibility, complexity, trialability, and observability. DOI also classifies consumers into different adopter categories based on their readiness to take up new technology, ranging from early adopters to laggards [18]. In the EV context, this theory helps explain how consumers come to adopt and switch to a new type of vehicle, clarifying the roles that technological, economic, and environmental factors play in that process ([8], [1]). Combining TPB, extended TPB, and DOI therefore provides a comprehensive theoretical foundation for explaining consumers' intention to switch to EVs within the present research context.

II. Theoretical Framework and Research Hypotheses

This study adopts the Theory of Planned Behavior (TPB) as its central theoretical foundation. To address the limitations of the original model and strengthen its explanatory power in the context of electric vehicles (EVs), the model is extended with exogenous constructs including environmental awareness, economic benefits, perceived risk, habit, and government support policy. The study also draws on the Diffusion of Innovation (DOI) theory, using innovation attributes such as relative advantage, compatibility, and complexity to help explain how attitudes toward EVs are formed.

Attitude toward EVs is one of the core constructs in the TPB model, capturing how positively or negatively consumers view the prospect of switching to EVs. Attitude is shaped by an individual's belief system and their weighing of the benefits and

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drawbacks of a given behavior - it is not purely affective but also reflects prior experience and knowledge [3]. A number of studies show that attitude has a direct, substantial effect on EV-switching intention, particularly when consumers clearly recognize the economic benefits and technological novelty of EVs [14]. A more favorable attitude is therefore expected to strengthen the intention to switch.

H1: Attitude toward EVs positively affects consumers' intention to switch to electric vehicles.

Research on consumer attitudes toward EVs shows that attitude does not form in isolation - it is shaped by a range of cognitive and contextual factors, including environmental awareness, economic benefits, technological risk, and charging infrastructure.

Environmental awareness refers to the degree to which an individual is concerned about pollution, greenhouse gas emissions, and the environmental consequences of consumption [6]. Studies show that environmental awareness positively affects attitude toward EVs, by strengthening perceptions of their environmental benefits and reducing perceived risk [7]. Environmental awareness is therefore considered an important antecedent of a favorable attitude toward EVs.

H2a: Environmental awareness positively affects attitude toward electric vehicles.

The economic benefits of EVs mainly stem from lower operating, fuel/energy, and maintenance costs relative to ICE vehicles. When consumers clearly recognize these long-term financial advantages, they tend to evaluate EVs more favorably and show a stronger intention to switch. Economic benefits are therefore hypothesized to have a positive effect on attitude toward EVs.

H2b: Economic benefits positively affect attitude toward electric vehicles.

Technological risk reflects consumers' concerns about the durability, safety, and reliability of EVs, particularly those relating to battery performance and vehicle systems [8]. Studies show that technological risk weakens positive attitudes toward EVs due to concerns over charging time, driving range, and technological maturity [1]. Technological risk is therefore expected to have a negative effect on attitude toward EVs.

H2c: Perceived technological risk negatively affects attitude toward electric vehicles.

Charging infrastructure refers to the availability and convenience of charging facilities, including their density, coverage, and accessibility. Research shows that well-developed charging infrastructure reduces usage barriers and improves consumers' evaluation of EVs [1]. Charging infrastructure is therefore hypothesized to positively affect attitude toward EVs.

H2d: Charging infrastructure positively affects attitude toward electric vehicles.

Subjective norm reflects the social pressure exerted by influential individuals: family, friends, colleagues - on a person's decisions [3]. Since EVs remain a relatively new technology, social influence plays a particularly important role in helping consumers reduce uncertainty and perceived risk by drawing on the experience of those around them [8]. As EV use becomes more socially accepted and is seen as a form of sustainable consumption aligned with prevailing social values, individuals become more likely to adjust their own behavior to match those expectations, thereby strengthening their intention to switch [10].

H3: Social influence positively affects consumers' intention to switch to electric vehicles.

Government incentives in this model include financial support measures: subsidies, tax and fee exemptions - as well as non-financial policies such as expanded charging infrastructure and dedicated traffic lanes. These policies directly affect consumers' perceived behavioral control by lowering ownership costs, improving accessibility, and making EV use more feasible [16]. Consistent government support not only helps overcome major barriers around cost and infrastructure, but also builds public confidence in, and satisfaction with, transport electrification [1].

H4: Government incentives positively affect residents' intention to switch to electric vehicles.

Habitual use of gasoline vehicles reflects the extent to which consumers have settled into routines built around conventional vehicles - quick refueling, easy maintenance, and the like. These habits create a form of behavioral anchoring, making individuals more likely to stick with their current mode of transport rather than switch to a new technology such as EVs [16].

In the EV context, differences in the user experience - longer charging times, the need to plan around driving range - increase the perceived inconvenience, giving rise to a psychological barrier to switching [9]. The more deeply gasoline-vehicle habits are embedded in a person's lifestyle, the more likely they are to view EVs as less convenient and the less willing they are to adopt this new behavior.

H5: Habitual use of gasoline vehicles negatively affects the intention to switch to electric vehicles.

Prior experience reflects how much direct exposure consumers have had to EVs, through activities such as test drives, charging, and actual use. According to the Diffusion of Innovation (DOI) theory, the ability to try out a product reduces uncertainty and increases the likelihood of adopting new technology [17]. Direct experience with EV characteristics such as quiet operation, smooth acceleration, and lower running costs helps build confidence and fosters a more favorable attitude toward EVs [12]. Conversely, a lack of hands-on experience can increase uncertainty and delay the decision to switch.

H6: Prior experience with electric vehicles positively affects the intention to switch to electric vehicles.

III. RESEARCH METHODOLOGY

A. Research Design

This study investigates the factors affecting the intention of Hanoi people to change to electric vehicles (EVs). The poll is aimed at persons who are living and working in Hanoi and are either the users of personal vehicles or have the potential and interest to switch to EVs. The data was collected from 25 November 2025 to 20 January 2026.

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The study is designed as a mixed-method study, integrating qualitative and quantitative research. In the qualitative phase the research team evaluated related works to construct theoretical framework, define the research variables and complete the suggested model. From this review a preliminary questionnaire was produced, discussed with the supervising teacher, and pilot-tested on 15 vehicle users to determine the clarity, logical coherence, and relevance of the observed factors before the major survey was carried out.

To test the study model and proposed hypotheses in the quantitative phase, data were collected using the finished questionnaire .

Specifically, the research process was structured according to the following steps:

- Theory and literature review of EVs and EV-switching intention.
- Choice of research method and research design.
- Development of research paradigm and survey administration.
- Interpreting the survey results, and policy consequences.

The measurement scales were adapted from previous studies and adjusted to meet the Vietnamese setting. All observed factors were measured on a 5-point Likert scale (1 = Strongly disagree to 5 = Strongly agree). Before the main survey, the questionnaire was piloted to modify the questionnaire for clarity and reliability of the measuring instrument.

B. Investigative Methodology

The study employed convenience sampling, mixing online and face-to-face surveys. The quiz was made using Google Forms and posted on social networks such as Facebook, Zalo. In an effort to improve the diversity of the sample, the research team also interviewed car users in person in Hanoi and other adjacent places. To avoid over-representation of any one place, no more than five respondents were interviewed at the same spot.

The data collection period was just over a month and resulted in 348 responses; the study discarded invalid responses, leaving 308 valid responses for processing.

Data were analyzed using SmartPLS, a software that applies Partial Least Squares Structural Equation Modeling (PLS-SEM). The measurement model was initially examined using factor loadings, Cronbach's Alpha, composite reliability, average variance extracted (AVE), Fornell-Larcker criterion, and HTMT ratio to determine the reliability and validity of the scales. The structural model was then assessed using the variance inflation factor (VIF), the coefficient of determination (R^2), predictive relevance (Q^2), effect size (f^2), and path coefficients. Hypotheses were considered supported if the p-value was less than 0.05.

Sample information:

- Format: Online (using Google Forms) and offline interview questionnaires.
- Scale: 5-point Likert scale, ranging from 1 (Strongly disagree) to 5 (Strongly agree).
- Period: 25 November 2025 – 20 January 2026.
- Participants: Residents of Hanoi who are using personal methods of transportation.

The questionnaire content was developed from previous studies on the research issue; the team collated, reviewed and localized these items (translated into Vietnamese for survey administration) to meet the research context, as presented below:

Code	Question 5	Source:
EA	In my opinion, the environmental problems have become increasingly serious these years.	[7], [19], [20]
	I believe that EVs should be used since they are an environmentally beneficial way of living that encourages sustainable social development.	
	Current environmental legislation is in line with uptake of green vehicles (e.g. EVs).	
	EVs are cleaner than internal combustion engine vehicles (e.g. gasoline cars).	
	Protect the environment using environmentally friendly automobiles (such as EVs).	
EB	The price of an EV will be cheaper than that of a gasoline automobile.	[7], [19]
	I get more economic gain when I drive an EV than I do when I drive a gas car.	
	The cost of fueling and maintaining EVs will be less than gasoline cars.	
	I'll buy an EV when I can afford one.	
TR 1.	I forget stuff, therefore I tend to forget to charge my EV, and charging outside the home takes up a lot of my time.	[21], [12]
	This makes me concerned about the possibility of losing a lot of money if the vehicle does not last very long.	
	The EV I want to buy is rather pricey even if incentive measures are applied. This makes me worry about the potential of losing a big amount of money if the vehicle doesn't live very long.	
	Long excursions with an EV are tough because there aren't charging facilities on the route.	
INF	I live in a city with decent EV charging facilities.	[9]
	I work or live at or near a place where I can charge an EV.	
	If we had better charging facilities I would prefer to buy an EV.	
	EV charging infrastructure is available in my location.	
AT&T	Investing in an EV is worth the effort.	[12], [14]
	The upside to buying an EV is clear.	
	Purchasing an EV is a good move.	
	Selecting an EV is a major decision.	
	Proud EV owner here.	
SI	I think eco-friendly vehicles are in accord with the present social trend.	[7], [19]
	If I utilize an environment friendly vehicle, I think people around me will think I am ahead of them.	
	Family members of mine would sway my decision to acquire an EV.	
	My friends' suggestions are a major factor in my decision to acquire an EV.	
	When I select the same type of EV as everyone else nearby, it gives me a feeling of connectedness.	
GOV.	I believe the current government support is beneficial when purchasing an EV.	[14]
	I think present tax policies impact the decision to buy an EV.	
	I understand the current government backing for charging expenses.	
	"The government is investing in charging station infrastructure now, and that is a boon for me."	
1AAB	I've driven a normal (gas) car.	[15]
	I prefer to drive a normal (gasoline) car.	

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Code	Question 5	Source:
	Gasoline cars are better in terms of repair and maintenance services, more convenient.	
	I find it more convenient to refuel a gasoline motorbike than to charge an EV.	
	I'm not interested in changing my existing use of vehicles.	
STORY EXP	It's fun to drive an EV.	[14]
	I can experience a lot of EVs by driving them myself.	
	My own driving experience can help me to better grasp operating intricacies of EVs (such as charging, maintenance etc.).	
	Driving an EV has made me more interested in knowing more about EVs.	
INT.	I tend to use electric vehicles more.	[14]
	I'm thinking of utilizing my EV more and cutting back on my fuel car.	
	I will suggest EVs to friends or family members.	
	If I could, I'd trade my current car for an EV.	
	I am committed to go electric.	

IV. Discuss The Research Results

The survey was carried out from November 25, 2025 to January 20, 2026 through an online questionnaire on digital platforms with the participation of 348 consumers in Hanoi. After removing the invalid questionnaires, data analysis was conducted on 308 valid questionnaires. The majority of respondents were female, making up 59.7% of the total. Most of the respondents (75.3%) were aged 18 and below 25 years old, belonging to Generation Z, a generation known for the rapid adoption of new consumption trends. Most of the respondents were college/university graduates (85.4%) because Hanoi is one of the biggest cities with the highest density of universities in Vietnam. The majority of respondents had an income of less than 10 million VND per month (76.0%). Most of the respondents lived in the urban areas of Hanoi (67.5%) compared to the suburban areas (32.5%).

The primary mode of personal transportation was the gasoline-powered motorcycle, used by 75.3 percent of respondents. Other modes of transportation were less prevalent, including electric motorcycles (8.4%), electric cars (3.2%), gasoline-powered vehicles (6.5%), public transit (2.6%), and walking (3.9%). The majority of the respondents had an average daily travel distance of less than 5 km (33.8%) followed by 5–10 km per day (33.1%). The group with a daily distance of >20 km had the lowest percentage (11.0%). The majority of the respondents (91.2%) had previous experience with electric vehicles, whereas only 8.8% have never used an electric vehicle. The majority of respondents (58.1%) said that they were thinking about buying an electric vehicle. Also, 28.2% of the respondents said that they were ambivalent and only 13.6% reported that they had not considered the purchase of an electric vehicle.

Data analysis and results

The alignment between the survey data and the conceptual model was assessed using Partial Least Squares Structural Equation Modeling (PLS-SEM), in addition to the evaluation of the research hypotheses. Data analysis was done through SmartPLS 4.0 and SPSS 27.0. In the PLS analysis, two models were used: the measurement model and the structural model. We used the measurement model to assess the reliability and validity of the constructs. Then, the relationships among the proposed constructs were explored and finally the structural model was assessed.

TABLE I. Demographic characteristics of the research sample.

Variable	Choice	Frequency	Percentage (%)
Gender	Male	124	40.3
	Female	184	59.7
Age	18 – 25 years old	232	75.3
	26 – 35 years old	30	9.7
	36 – 45 years old	27	8.8
	46 – 55 years old	14	4.5
	Over 55 years old	5	1.6
Job	Student	219	71.1
	Office worker	30	9.7
	Civil servant / Public official	29	9.4
	Manual laborer	18	5.8
	Others	12	3.9
Education	High school or below	20	6.5
	College / Bachelor's degree	263	85.4
	Postgraduate	25	6.1
Monthly income	Below 10 million VND	234	76.0
	10 – 20 million VND	47	15.3
	20 – 30 million VND	12	3.9
	Over 30 million VND	15	4.9
Area of Residence	Urban Hanoi (Inner city)	208	67.5
	Suburban Hanoi (Outer city)	100	32.5
Primary Mode of Transportation	Gasoline motorcycle	232	75.3
	Electric motorcycle	26	8.4
	Gasoline car	20	6.5
	Electric car	10	3.2
	Public transportation	8	2.6
	Walking	12	3.9
Daily Travel Distance	Below 5km	104	33.8
	5 – 10 km	102	33.1
	10 – 20 km	68	22.1
	Over 20 km	34	11.0
Electric Vehicle Experience	Experienced	281	91.2
	Inexperienced	27	8.8
Electric Vehicle Consideration	Yes	179	58.1
	No	42	13.6
	Undecided	87	28.2

Descriptive statistics provides the mean assessment of respondents on the measurement scale, minimum value, maximum value, and standard deviation for each observed variable. A smaller standard deviation means that there is less variability in the respondents' answers and a larger standard deviation indicates more variation in the views of respondents. All standard deviation values are lower than 1, showing a low dispersion of the responses. In the present study we concentrate on the analysis of mean values, which are the most important measures in descriptive statistics.

According to Hair et al. (2017), an outer loading of 0.7 or higher indicates that an indicator has satisfactory reliability. Indicators with outer loadings below 0.40 should be removed from the model. For indicators with outer loadings ranging from 0.40 to below 0.70, the decision to retain or remove them depends on the researcher's judgment, taking into account other

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measurement quality indicators such as Composite Reliability (CR) and Convergent Validity (e.g., the Average Variance Extracted (AVE)) of the corresponding construct.

- If the CR or AVE value is below the recommended threshold and removing an indicator with an outer loading below 0.70 improves the CR or AVE to an acceptable level, that indicator should be eliminated.
- If both CR and AVE have already met the recommended thresholds, and an indicator with an outer loading between 0.40 and below 0.70 is considered theoretically important to the study, it may be retained.

The results of the outer loadings of the measurement scales are presented in the following table:

TABLE II. Reliability and validity analysis

Constructs	Items	Outer loadings	Cronbach's alpha	Composite reliability	AVE
Government Incentive (CP)	CP1	0.784	0.835	0.89	0.669
	CP2	0.801			
	CP3	0.839			
	CP4	0.847			
Infrastructure (HT)	HT1	0.71	0.742	0.834	0.558
	HT2	0.766			
	HT3	0.721			
	HT4	0.788			
Perceived Economic Benefit (KT)	KT1	0.67	0.673	0.8	0.502
	KT2	0.764			
	KT3	0.732			
	KT4	0.661			
Environmental Awareness (MT)	MT1	0.751	0.838	0.886	0.609
	MT2	0.769			
	MT3	0.846			
	MT4	0.703			
	MT5	0.823			
Technological Risk (RR)	RR1	0.742	0.793	0.865	0.617
	RR2	0.831			
	RR3	0.759			
	RR4	0.806			
Prior driving experience (TN)	TN1	0.75	0.8	0.869	0.624
	TN2	0.812			
	TN3	0.793			
	TN4	0.803			
Gasoline vehicle usage habit (TQ)	TQ1	0.796	0.821	0.853	0.55
	TQ2	0.706			
	TQ3	0.839			
	TQ4	0.861			
	TQ5	0.416			
Attitude (TĐ)	TĐ1	0.746	0.822	0.876	0.586
	TĐ2	0.791			
	TĐ3	0.754			
	TĐ4	0.848			
	TĐ5	0.678			
Social Influence (XH)	XH1	0.775	0.739	0.833	0.556
	XH2	0.766			
	XH3	0.715			
	XH4	0.724			
Switching behavior (YD)	YD1	0.811	0.845	0.89	0.618
	YD2	0.794			
	YD3	0.813			
	YD4	0.736			
	YD5	0.774			

Source: Data processing on SmartPLS 4

Note: AVE = average variance extracted. CP = Government Incentive; HT = Infrastructure; KT = Perceived Economic Benefit; MT = Environmental Awareness: TĐ = Attitude; RR= Technological Risk; TQ = Gasoline vehicle usage habit; XH = Social influence; TN = Prior driving experience; YD = Switching behavior

The table shows that the outer loadings of most of the indicators are greater than 0.70. Only KT1, KT4, TQ5 and TĐ5 present outer loadings lower than 0.70, respectively 0.670, 0.661, 0.416 and 0.698. KT4 was dropped since its deletion improved the CR and/or AVE to acceptable threshold. The other measures were retained because of their theoretical relevance to the study.

Composite Reliability (CR) is evaluated the same way as Cronbach's Alpha, ranging from 0 to 1; the closer to 1, the higher the internal consistency reliability. Chin (1998) also states that a Composite Reliability (CR) of 0.60 and above is acceptable for exploratory research and a CR of 0.70 is acceptable for confirmatory research ([22], [23], [24], [25]). Values of CR between 0.70 and 0.90 are considered as the best, while values above 0.95 may indicate that there are redundancies among the indicators. The results indicate that all three measurements of internal consistency reliability for the constructs are in the recommended range of 0.70-0.90 except for Composite Reliability (rho_a) and Cronbach's Alpha for the KT construct which are between 0.60 and 0.70 and are still acceptable. Therefore, the measurement scales used in this study are considered reliable.

TABLE III. Discriminant validity by Heterotrait-Monotrait Ratio (HTMT).

	CP	HT	KT	MT	RR	TN	TQ	TĐ	XH	YD
CP										
HT	0.674									
KT	0.590	0.564								
MT	0.699	0.580	0.587							
RR	0.513	0.437	0.439	0.683						
TN	0.729	0.599	0.632	0.714	0.627					
TQ	0.505	0.414	0.322	0.525	0.534	0.469				
TĐ	0.633	0.665	0.576	0.699	0.311	0.629	0.386			
XH	0.681	0.577	0.585	0.663	0.571	0.715	0.496	0.634		
YD	0.665	0.522	0.615	0.549	0.310	0.763	0.231	0.667	0.714	

Source: Data processing on SmartPLS 4

Note: CP = Government ; HT = Infrastructure; KT = Perceived Economic Benefit; MT = Environmental Awareness: TĐ = Attitude; RR= Technological Risk; TQ = Gasoline vehicle usage habit; XH = Social influence; TN = Prior driving experience; YD = Switching behavior

The results of the data analysis show that all HTMT values are below 0.90, indicating that discriminant validity is established. Most HTMT values are below 0.85, suggesting that discriminant validity is well established. Only one HTMT value is greater than 0.85 but less than 0.90 (0.896), which is still within the acceptable threshold.

The evaluation of the PLS-SEM structural model involves assessing the model's ability to predict the variance of the dependent variables [23]. Therefore, after establishing reliability and validity, the structural model is evaluated based on the assessment of multicollinearity, the estimation and significance of the effect size (f^2) and path coefficients and the coefficient of determination (R^2) ([26], [27]).

TABLE IV. Multicollinearity Assessment.

Constructs	VIF
CP -> YD	2.003
HT -> TĐ	1.375
KT -> TĐ	1.372
MT -> TĐ	1.818
RR -> TĐ	1.408
TN -> YD	2.068
TQ -> YD	1.207
TĐ -> YD	1.913
XH -> YD	1.961

Source: Data processing on SmartPLS 4

Note: CP = Government ; HT = Infrastructure; KT = Perceived Economic Benefit; MT = Environmental Awareness: TĐ = Attitude; RR= Technological Risk; TQ = Gasoline vehicle usage habit; XH = Social influence; TN = Prior driving experience; YD = Switching behavior

The results presented in the table above show that the Variance Inflation Factor (VIF) values of all independent variables are below 3, with the lowest VIF value being CP → YD (1.207) and the highest VIF value being TN → YD (2.068). Therefore, the research model does not exhibit multicollinearity.

TABLE V. Coefficient of Determination (R^2).

Constructs	R-square	R-square adjusted
TĐ	0.464	0.457
YD	0.535	0.527

Source: Data processing on SmartPLS 4

The R^2 and adjusted R^2 values of the two dependent variables are presented in the table above. The adjusted R^2 value of TĐ is 0.457, indicating that the independent variables MT, KT, RR, and HT explain 45.7% of the variance in TĐ. The adjusted R^2 value of YD is 0.527, indicating that the independent variables TĐ, XH, CP, TQ, and TN explain 52.7% of the variance in YD.

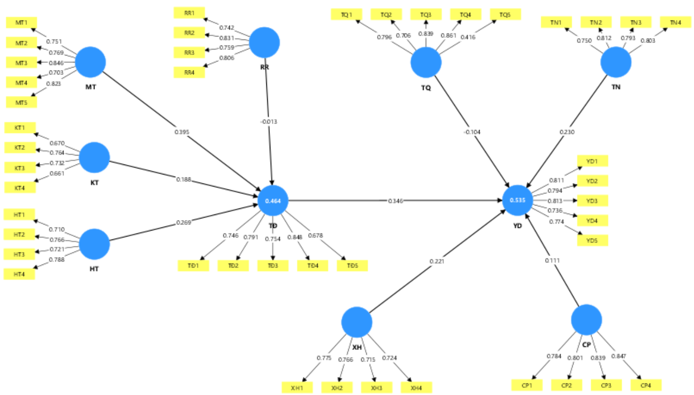

Figure 1. Results of the Structural Model

Bootstrapping Analysis

The significance of the path coefficients was assessed using the non-parametric bootstrapping procedure in SmartPLS 4 with 5,000 bootstrap resamples based on 308 valid observations. A significance level of 5% ($\alpha = 0.05$) was adopted to test the proposed hypotheses [23].

Table VI displays the results of the structural model. The two hypothesized relationships, CP → YD ($\beta = 0.111$, $p = 0.124$) and RR → TĐ ($\beta = -0.013$, $p = 0.787$), were not statistically significant ($p > 0.05$). All the other relations were statistically significant at 5% level of significance.

H1 was supported. TĐ had a positive effect on YD ($\beta = 0.346$, $t = 4.658$, $p < 0.001$). For antecedents of TĐ, MT had the most positive effect ($\beta = 0.395$, $t = 7.018$, $p < 0.001$) followed by HT ($\beta = 0.269$, $t = 4.608$, $p < 0.001$) and KT ($\beta = 0.188$, $p = 0.001$). Conversely, RR did not have a significant effect on TĐ ($\beta = -0.013$, $p = 0.787$), rejecting H2c.

TABLE VI. Hypothesis Testing Results

Constructs	Original sample (O)	T statistics (|O/STDEV|)	P values	Result
HT -> TĐ	0.269	4.608	0.000	Supported
MT -> TĐ	0.395	7.018	0.000	Supported
TĐ -> YD	0.346	4.658	0.000	Supported
KT -> TĐ	0.188	3.312	0.001	Supported
XH -> YD	0.221	3.264	0.001	Supported
TN -> YD	0.230	3.137	0.002	Supported
TQ -> YD	-0.104	1.986	0.047	Supported
CP -> YD	0.111	1.540	0.124	Not Supported
RR -> TĐ	-0.013	0.271	0.787	Not Supported

Source: Data processing on SmartPLS 4

Note: CP = Government ; HT = Infrastructure; KT = Perceived Economic Benefit; MT = Environmental Awareness: TĐ = Attitude; RR= Technological Risk; TQ = Gasoline vehicle usage habit; XH = Social influence; TN = Prior driving experience; YD = Switching behavior

The determinants of YD were found to be XH ($\beta = 0.221$, $p = 0.001$), TN ($\beta = 0.230$, $p = 0.002$) and TQ ($\beta = -0.104$, $p = 0.047$). CP had no significant effect on YD ($\beta = 0.111$, $p = 0.124$). H2a, H2b, H2d, H3, H5, and H6 were supported while H2c and H4 were not supported.

V. CONCLUSION

A. Discussion

In the study entitled *"Research on the Factors Affecting the Intention to Switch to Electric Vehicles among Residents in Hanoi"*, the authors identified 39 observed variables forming 9 factors that have both direct and indirect effects on residents' intention to switch to electric vehicles in Hanoi. After conducting the survey, the results indicate that four factors significantly influence purchase intention, namely *"Attitude", "Social influence", "Gasoline vehicle usage habit", and "Driving experience"*. In addition, "Environmental awareness", "Perceived economic benefit", and "Infrastructure" also have an impact on consumers' attitudes toward electric vehicles. Based on these findings, the research team concludes with the following final research model:

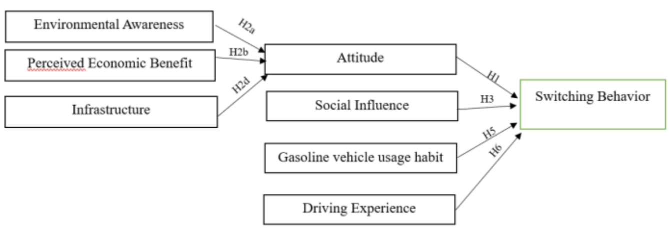

Figure 2. The model obtained from the research

Nguyen Quoc Khanh, Nghiem Tho Minh Hao, Vu Thi Phuong Uyen, Pham Mai Linh, and Ngo Huong Giang, "Research on Factors Influencing the Intention of Residents in Hanoi to Switch to Electric Vehicles," *International Research Journal of Advanced Engineering and Science*, Volume 11, Issue 3, pp. 27-35, 2026.

B. Policy Recommendations

1. For Businesses

Strengthen communication on the total cost of ownership and the long-term investment value of electric vehicles.

This can be considered one of the key priorities, as the biggest barrier for consumers at present remains the relatively high upfront purchase price. Businesses should provide more tools that allow consumers to compare the costs of electric vehicles and gasoline vehicles over their entire lifecycle. In addition, they should clearly communicate the benefits of lower fuel expenses, reduced maintenance and servicing costs, together with the stable lifespan of the product. Once consumers are able to see the overall picture of the long-term economic benefits, their attitudes toward electric vehicles are more likely to become positive, and their purchase intention will gradually increase.

Expand chances for driving experience while building a comprehensive electric vehicle ecosystem.

At present, many consumers have never test-driven or experienced an electric vehicle, so promoting electric vehicle test drive programs, short-term rental services, and professional after-sales service could have much impact. Direct experience helps users to overcome hesitation about electric vehicle performance, range per charge, and daily convenience. This could accelerate the transition from gasoline-powered to electric vehicles.

2. For Consumers

Evaluate vehicles based on the total cost of ownership rather than focusing solely on the initial purchase price.

This is a basic approach for consumers because it shifts the way they evaluate transportation choices. Rather than just looking at the initial purchase price, people should try to see the whole, wider situation, including every relevant cost that shows up during the vehicle's lifetime, like electricity consumption, maintenance, repair expenses, and residual value, or in other words, the long-term usefulness. When decisions are made around the total cost of ownership, they often become more objective and sensible, and that helps to cut down emotional bias during the buying phase.

Enhance understanding of electric vehicles, particularly battery technology and warranty policies.

The goal is to enhance understanding of electric vehicles, particularly regarding battery technology and the associated warranty rules. The battery is still one of the most significant reasons many consumers feel hesitant, even when they want to fully switch to electric vehicles. If buyers actually take the time to dig into battery lifespan, capacity degradation as the years pass, what replacement can cost when it becomes necessary, and how manufacturers frame their warranty policies, then a lot of the fear that comes from hearsay, or plain misinformation, can be lowered quite a bit. So in the end, consumers tend to feel more secure, their trust in the vehicle grows, and the whole decision process for buying an electric vehicle becomes less tangled, with fewer perceived obstacles in the way.

3. For the Government

Develop a clear and feasible roadmap to gradually restrict and eventually phase out gasoline-powered vehicles.

This is one of the strongest strategic policy directions available at the moment. A clear roadmap will help citizens and businesses actively prepare their transition plans, while also providing a relatively strong and credible signal to support the development of the electric vehicle market. As Hanoi continues to consider solutions to reduce air pollution and greenhouse gas emissions, such a policy seems to be timely and practical.

Expand charging infrastructure and the overall electric vehicle ecosystem.

In addition to the policy direction, the government should focus on investment and at the same time encourage the growth of charging station networks and maintenance and repair services. A well-rounded infrastructure system will directly tackle the consumers' concerns about battery charging and practical use of electric vehicles, thus creating the favorable environment for people to gradually transition toward the greener modes of transportation.

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