GRADUATE SCHOOL OF BUSINESS AND ADVANCED TECHNOLOGY MANAGEMENT

Co-hosted by RCBS, BSSS INSTITUTE of Advanced Studies, CHARUSAT

Au Hybrid International Conference 2024
Entrepreneurship and Sustainability in the Digital Era
Assumption University of Thailand
April 26, 2024

Investigating Factors Influencing the Purchasing Intention of Electric Vehicles among Rural Thai Consumers

Nutthanan Ariyamongkolcharoen[1]; Tayakorn Prachansit[2]; Chompu Nuangjamnong[3]

Abstract

Purpose – The purpose of this research is to analyze the significant influence of environmental concern, social influence, performance expectancy, and attitude toward EV innovation on purchasing intention for EV cars. Design/Methodology/Approach – The research employs primary and secondary data collection methods to conduct an analysis of factors influencing EV car purchasing intentions. The data were collected from 390 respondents who are interested in EV cars and live in the upcountry of Thailand. This research references three theoretical frameworks from previous studies to develop a new conceptual framework. Findings – This research investigates the factors influencing the purchasing intention of Electric Vehicles among Thai people in upcountry areas. The findings of this research reveal that environmental concern, social influence, and performance expectancy are related to attitude toward EV innovation. Furthermore, attitude toward EV innovation directly influences EV car purchase intention. Research Limitations/Implications – The limitations of the research include several elements that constrain the factors influencing the purchasing intention of Electric Vehicles among Thai people in upcountry areas. The scope of this study is limited to the purchasing intentions of Thai people in upcountry areas. Additionally, this research focuses on individuals who have experience with electric cars and an interest in electric cars. Originality/value – This research focuses on the significant factors influencing the purchasing intention of Electric Vehicles among Thai people in upcountry areas.

Keywords – Environmental concern, Purchase intention, Social influence, Performance expectancy and attitude toward EV innovation

JEL classification code – O13, O18, O32

1. Introduction

1.1 Background of study

This study examines relevant factors influencing the electric car purchasing intention of Thai people in the upcountry toward EV innovation, social influence, performance expectancy, and environmental concern. The automotive industry has shifted towards electric cars. Electric cars are becoming more popular because they help reduce harmful emissions and make the air cleaner (Statista, 2023). This is important because a big chunk of the pollution comes from vehicles driving in big cities (Statista, 2023). In 2023, research projects the electric car market to generate approximately $457.60 billion in revenue (Statista, 2023), with an expected annual growth rate of around 17.02%. Nowadays, social influence has an impact on consumers. Social media, as well as other influences from friends and family, have a significant impact on what people buy. This is particularly important for electric car businesses because understanding how social influences work could help them sell to people who may not have

[1] Nutthanan Ariyamongkolcharoen; Master of Business Administration, Graduate School of Business and Advanced Technology Management, Assumption University of Thailand. Email: gyms_kkg4042@hotmail.com

[2] Tayakorn Prachansit; Master of Business Administration, Graduate School of Business and Advanced Technology Management, Assumption University of Thailand. Email: meantayakorn@hotmail.com

[3] Chompu Nuangjamnong; Graduate School of Business and Advanced Technology Management, Assumption University of Thailand.

initially planned to buy (Deutsch & Gerard, 1955; Park & Lessig, 1977; Bearden et al., 1989; Hsu and Lu, 2004; Kulviwat et al., 2009).

Moreover, studies have shown that people with a positive attitude toward EV innovation are more likely to change their purchasing intentions for electric cars. Since the performance of electric cars is important for consumers, there are two main concerns: driving range and recharge time. Most electric cars can travel more than 300 km on a single charge, with some models capable of traveling 400–500 km (Wilkinson, 2023). However, fully recharging the battery pack can take anywhere from 3 to 12 hours, though fast charging to 80% capacity can take as little as 30 minutes (Wilkinson, 2023). We aim to investigate how the decision to buy electric cars affects people who are interested in new technology. We hypothesize that individuals who are enthusiastic about trying new things are more likely to be interested in purchasing an electric car. Additionally, we seek to explore whether people's beliefs about the environmental benefits of electric cars influence their purchasing intentions. Understanding how these attitudes influence people's decisions to buy electric cars can help businesses develop effective marketing strategies, particularly in Thailand's upcountry. Therefore, the goal of this study is to investigate the significant factors influencing Thai people's intention to purchase electric cars in upcountry areas.

1.2 Problem statements

The electric vehicle (EV) market has experienced substantial growth, with a revenue of US$457.60 billion in 2023 and an annual growth rate of 17.02%. Despite this growth, issues such as consumer perceptions of EV disadvantages, limited driving range, higher upfront costs, and inadequate charging infrastructure persist. These factors influence rural Thai consumers' purchasing intentions. Understanding the factors influencing the adoption of EVs among rural Thai consumers is crucial for promoting sustainable transportation practices and supporting the growth of the EV industry in upcountry areas. As a result, this study aims to investigate the factors that influence rural Thai consumers' purchasing intentions for electric vehicles. By identifying these factors, electric car dealers and policymakers can develop effective strategies to promote EV adoption in rural areas.

1.3 Objectives of study

(1) To assess the influence of environmental concern on attitude toward EV innovation and its impact on the purchase intention of EV cars.

(2) To examine the influence of social influence on attitudes towards EV innovation and its effect on the purchase intention of EV cars.

(3) To analyze the influence of performance expectancy on attitude towards EV innovation and its relationship with the purchase intention of EV cars.

(4) To investigate the influence of attitude towards EV innovation on the purchase intention of EV cars.

1.4 Research questions

(1) Does environmental concern significantly influence attitudes toward EV innovation and purchase intentions for EV cars?

(2) Is social influence a significant factor in shaping attitudes toward EV innovation and the purchase intention of EV cars?

(3) Does performance expectancy significantly affect attitudes toward EV innovation and purchase intentions for EV cars?

(4) Is attitude towards EV innovation a significant predictor of purchase intention for EV cars among rural Thai consumers?

1.5 Significance of the study

This research holds significance in both academic and practical contexts for several key reasons. The study contributes to the academic literature by providing empirical evidence and insights into the factors influencing Thai people's purchasing

intentions for electric cars in upcountry areas. By systematically examining variables such as environmental concerns, social influence, performance expectancy, and attitude toward EV innovation, this research adds depth to our understanding of consumer behavior in the context of sustainable transportation. While previous studies have explored electric car adoption in various contexts, there is a notable gap in understanding the specific dynamics at play in upcountry regions of Thailand. This research addresses this gap by focusing specifically on this demographic group, shedding light on their unique preferences, perceptions, and challenges regarding electric vehicle adoption. As such, it contributes nuanced insights that complement and extend existing knowledge in the field.

The findings of this study have practical implications for policymakers, urban planners, electric car manufacturers, and other stakeholders involved in promoting sustainable transportation initiatives. By identifying influential factors shaping purchasing intentions, such as environmental concerns and social influence, this research provides actionable insights for designing targeted interventions, policy frameworks, and marketing strategies aimed at accelerating electric car adoption in upcountry areas. Sustainable transportation, including the widespread adoption of electric vehicles, is integral to achieving environmental sustainability and mitigating climate change. By elucidating the determinants of electric car purchasing intentions among upcountry residents, this study contributes to the broader goal of promoting sustainable mobility solutions. Its findings can inform efforts to reduce greenhouse gas emissions, improve air quality, and enhance overall environmental sustainability in Thailand and beyond.

The methodology and findings of this study serve as a foundation for future research endeavors in the fields of sustainable transportation and consumer behavior. Scholars may build upon this research by exploring additional variables, investigating different geographical contexts, or employing alternative research methodologies. By stimulating further inquiry and knowledge generation, this study contributes to the ongoing scholarly discourse on electric vehicle adoption and sustainable mobility. This study's significance lies in its contribution to academic knowledge, its practical implications for policymakers and practitioners, and its alignment with broader sustainability objectives. By illuminating the factors shaping electric car purchasing intentions among upcountry residents, this research informs efforts to promote sustainable transportation solutions and advance environmental stewardship.

2. Literature Review and Hypotheses Development

2.1 Environmental Concerns and Attitude toward EV Innovation

Environmental concern plays a pivotal role in the decision-making processes aimed at preserving natural environments and green spaces by opting for environmentally friendly products. Some individuals consider and aspire to uphold environmental values when comparing various choices (Roger & Rohini, 2017; Huang & Nuangjamnong, 2022). With the emergence of electric cars as a new innovation promoting sustainability, they have the potential to positively influence attitudes toward EVs in the transportation-sharing market (Haider et al., 2021). Environmental concern refers to public awareness of environmental pollution caused by driving cars, which emit exhaust. Individuals who are intensely concerned about environmental issues are inclined to maintain and protect nature for their well-being (Jaeyoung et al., 2021). Kropfeld et al. (2018) observed that environmentally concerned individuals tend to reduce the consumption of goods they believe have a substantial ecological impact. Changes in purchasing behavior become evident as environmental concerns continue to rise (Alessandro et al., 2023). Consequently, one of the significant factors influencing intentions to purchase electric vehicles, considered environmentally friendly products, could be influenced by customers' sustainable

environmental awareness (Haider et al., 2021; Huang & Nuangjamnong, 2022). Yadav and Pathak (2016) assert that environmental concern has become a critical predictor of behavior regarding green items. Therefore, to explore the impact of environmental concern and attitudes toward EV innovation, the following hypothesis is presented:

Hypothesis 1 (H1): There is no significant influence of environmental concern on attitudes toward EV innovation among the purchase intentions of Thai people in the upcountry.

2.2 Performance Expectancy and Attitude toward EV Innovation

Personal beliefs entail the expectation that electric car technology will become integrated into everyday life. This belief is rooted in the anticipation of improved efficiency, as electric cars eliminate the need for gasoline, resulting in cost savings for travel (Manutworakit & Choocharukul, 2022). The characteristic definition of performance expectancy is the level of benefits that electric vehicles offer in response to consumers' needs in daily life, such as traveling to various places for work, leisure, or other purposes (Jaeyoung et al., 2021). Although innovative cars represent new technology, it has been suggested that investing primarily in electric cars yields better performance compared to conventional vehicles, according to current users (Haider et al., 2021). Additionally, Indra et al. (2022) found that individuals perceive electric vehicles as cost-saving and productivity-enhancing, which contributes to positive perceptions of the product. The performance of electric vehicles also plays a crucial role in clients' attitudes when selecting modern technology goods, contributing to the upward trend of electric car adoption (Haider et al., 2022). Attitude toward EV innovation is considered the main driving force of EV purchase intention in this study and refers to people's attitudes involving the assessment and decision-making responses toward products, brands, or judgments. This attitude serves as a predictor of intention preceding actual behavior (Subhash et al., 2022). When an attitude stems from the innovative image of a product, it leads to the development of purchase intentions (Subhash et al., 2022). Concerns regarding EV innovation may arise due to uncertainties about adequate charging stations and repair facilities. However, considering the benefits such as nature conservation, travel cost savings, and the advantages of electric cars, these factors clearly influence attitudes toward EV innovation (Simona & Silvia, 2018). Conversely, negative customer satisfaction may lead to resistance in attitudes toward EV innovation, diminishing confidence in new choices (Nadine & Sebastian, 2013). Customers' attitudes toward electric cars tend to align with their perceptions of performance, based on observations of previous users and test results (Mohammed et al., 2023). Therefore, an individual's satisfaction can be gauged by the performance of the product, with better products eliciting more positive attitudes (Indra et al., 2022; Kapoor & Nuangjamnong, 2021). Consequently, we formulate the following hypothesis:

Hypothesis 2 (H2): There is no significant influence of social influence on attitudes toward EV innovation among the purchase intentions of Thai people in the upcountry.

2.3 Social Influence and Attitude toward EV Innovation

Social influence encompasses peripheral factors that can influence users' behavior and decisions, often manifesting through interactions with family and friends (Manutworakit & Choocharukul, 2022; Nuangjamnong, 2021). On the other hand, individuals can perceive themselves as environmentally friendly by using electric cars (Mohammed et al., 2023). Social influence can be defined as the extent to which individuals perceive acceptance and importance based on others' confidence in an innovation that has not occurred in the past (Haider et al., 2021). Influence from certain groups of individuals, such as friends,

relatives, and parents, can affect customers' decisions to prefer electric cars over gasoline cars (Manutworakit & Choocharukul, 2022). Furthermore, the use of electric vehicles for city transportation continues to yield positive results, indicating that this aspect remains a significant factor in purchasing intentions (Jaeyoung et al., 2021). Furthermore, social influence plays a pivotal role in shaping attitudes. When individuals perceive support for electric car usage from friends and influential figures, coupled with the widespread adoption of electric vehicles for transportation in some countries, it significantly impacts attitudes (Jaeyoung et al., 2021). Therefore, the following hypothesis is presented:

Hypothesis 3 (H3): There is no significant influence of social influence on attitudes toward EV innovation among the purchase intentions of Thai people in the upcountry.

2.4 Attitude toward EV Innovation and Purchase Intentions

If an individual maintains a positive attitude toward electric cars and engages in resource conservation practices, they are likely to perceive these vehicles as valuable tools in both personal and social contexts within their daily lives. This perception is expected to influence their intention to purchase electric cars (Mohammed et al., 2023). Considering the multitude of situational and personality factors that can positively influence purchasing decisions (Roger & Rohini, 2017; Dowpiset & Nuangjamnong, 2021; Xu & Nuangjamnong, 2022), it is essential to acknowledge potential confounding factors. Johnstone and Hooper (2016), for instance, highlighted factors such as peer pressure, limited product information, and product availability as potential influencers. Purchase intentions refer to the willingness or feasibility with which a customer would decide to purchase an electric car, which are specific products that refer to the openness of ideas a person has about a certain product before actually purchasing it in the near future (Subhash et al., 2022). According to the behavioral intentions of starting to use EV, in the context mentioned, "it is a very useful statistic" due to consumers' behavior changing all the time and being difficult to predict (Dk. & Nisal, 2019). Furthermore, EV's behavioral intentions have been clearly indicated as product factors and also individual or social factors of real behavior (Ade, 2021). Consequently, buyers are advised to gather comprehensive information to mitigate uncertainties (Roger & Rohini, 2017). Based on these premises, the following hypothesis is proposed:

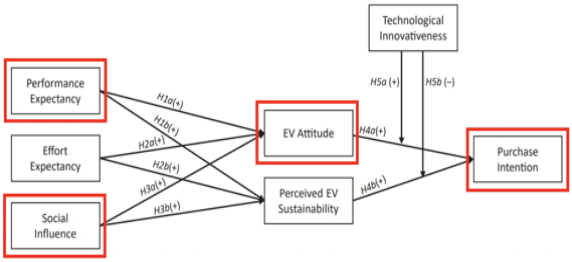
Hypothesis 4 (H4): There is no significant influence of attitude toward EV innovation and purchase intentions among Thai people in the upcountry.

2.5 Theoretical Frameworks

In the theoretical framework presented, four key stimuli are outlined as influential factors leading to purchase intention. These stimuli include performance expectation, effort expectation, social influence, and technological innovation. Derived from the study "Drivers of electric vehicle adoption: the moderating role of technological innovativeness," the framework elucidates the relationships depicted in Figure 1. Specifically, it highlights how performance expectancy and social influence interact through EV attitude, ultimately impacting purchase intention (Mohammed et al., 2023).

Figure 1.

Drivers of electric vehicle adoption: the moderating role of technological innovativeness

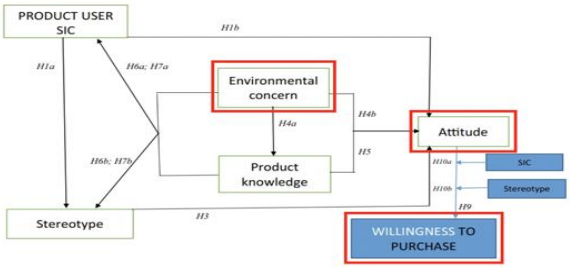


Source: Mohammed et al. (2023).

2.3.2 Roger and Rohini (2017) present the second theoretical framework, which focuses on the relationship between environmental concern and willingness to purchase. Illustrated in Figure 2, this framework explores the impact of various environmental factors on attitudes, ultimately influencing the willingness to purchase electric vehicles positively.

Figure 2.

Consumer attitudes towards electric vehicles: Effects of product user stereotypes and self- image congruence

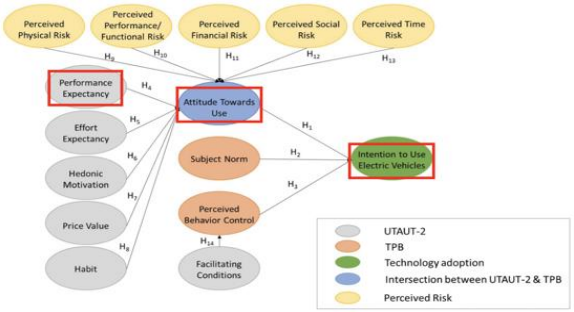


Source: *Roger and Rohini (2017).*

2.3.3 The third theoretical framework, depicted in Figure 3, is derived from the study "Determinants of Customer Intentions to Use Electric Vehicles in Indonesia: An Integrated Model Analysis" (Indra et al., 2022). This empirical investigation primarily focuses on examining attitudes toward the use of electric vehicles to identify factors influencing the intention to use such vehicles. The study endeavors to substantiate the relationship between the performance expectancy associated with using electric vehicles and attitudes, ultimately leading to the intention to use electric vehicles.

Figure 3.

Determinants of customer intentions to use electric vehicle in Indonesia: An integrated model analysis



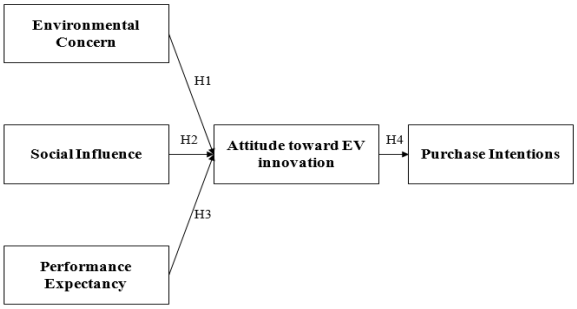
Source: *Indra et al. (2022).*

2.6 Conceptual Framework

The conceptual framework is constructed based on previous studies, theoretical concepts, and empirical evidence, elucidating the relationships among various independent variables. Environmental concern is identified as an independent variable that influences both attitudes toward EV innovation and purchase intentions. Another factor, social influence, is found to impact attitudes toward EV innovation, subsequently affecting intentions to purchase. The final independent variable, performance expectancy, operates through attitude toward EV innovation and intentions to purchase. The conceptual framework aims to delineate the factors influencing purchase intentions, as depicted in Figure 4 below:

Figure 4.

The Conceptual Framework of Factors Influencing Electric Car Purchasing Intention of Thai People in Upcountry



Source: *Constructed by authors*

3. Research Methodology

3.1 Research design

This research aims to identify the factors influencing electric car purchase intentions among Thai people residing in upcountry areas, with a specific focus on environmental concern, social influence, performance expectancy, and attitude toward EV innovation. Additionally, the study aims to assess the degree of influence these factors have on electric car purchase intentions among this demographic. The research adopts a quantitative approach, employing statistical analyses such as Cronbach's alpha, multiple linear regression, simple linear regression, and descriptive statistics to analyze each variable.

The target population consists of Thai individuals residing outside Bangkok who have expressed interest in purchasing an electric car when deciding between a gasoline car and an electric car. The total population outside Bangkok was approximately 66.09 million as of 2022 (Workpoint Today, 2023). Given the large population size, the researchers employ a sample size estimation approach, determining that 385 respondents would adequately represent the population. However, we acknowledge that fluctuations in the number of Thai people in upcountry areas outside Bangkok may necessitate occasional adjustments to the sample size.

The questionnaire consists of three sections, each containing a total of 27 questions. These questions cover five variables outlined in the research conceptual framework, including three screening questions, 17 questions related to measuring variables, and seven questions concerning demographic aspects.

We employ a non-probability sampling method, specifically convenience sampling, to collect data, ensuring alignment with the research objectives within the limited time available for data collection. We conduct a pilot test with a small group of 50 participants to evaluate the reliability of the measuring variables and assess comprehension, ensuring the questionnaire's reliability and clarity.

We utilize Multiple Linear Regression (MLR) to examine the combined influence of environmental concern, social influence, and performance expectancy on attitudes toward EV innovation. Additionally, we employ simple linear regression (SLR) to predict the influence of attitudes toward EV innovation on purchase intentions.

Furthermore, this study incorporates secondary data obtained from reliable sources, including articles, journals, books, and previous studies, to supplement the primary data collected through the questionnaire.

3.2 Validity and Reliability

The Item Objective Congruence (IOC) Index evaluates the content validity of the questionnaire items in this study. We tasked a single expert to review the questionnaire items in relation to the research objectives, providing comments and ratings for each item to determine its content validity score. For all items, the IOC scores exceeded 0.5, indicating a high level of congruence between the items and the research objectives, ensuring their suitability for distribution to the respondents.

To ensure the reliability of the questionnaire variables, a pilot test was conducted with 50 respondents selected for this purpose. Cronbach's alpha was employed as a technique for assessing consistency. According to Cronbach (1951) and Schweizer (2011), Cronbach's alpha (CA) is widely utilized by researchers to test reliability, and it offers a scale of interpretation where values greater than 0.6 are considered acceptable. Specifically, $\alpha > 0.9$ indicates excellent reliability, $0.8 < \alpha < 0.9$ indicates good reliability, $0.7 < \alpha < 0.8$ indicates acceptable reliability, $0.6 < \alpha < 0.7$ indicates questionable reliability, $0.5 < \alpha < 0.6$ indicates poor reliability, and $\alpha < 0.5$ indicates unacceptable reliability.

The reliability analysis was conducted for each variable in this study, with a sample size of 50 respondents. Cronbach's Alpha coefficients were

calculated to assess the internal consistency of the variables. The results indicate good reliability for all variables, with Cronbach's Alpha values ranging from .821 to .897. These values exceed the threshold of 0.6, suggesting satisfactory internal consistency for each variable.

Therefore, the pilot test results in Table 1 confirm that all constructs show internal consistency, indicating the reliability of the questionnaire for further distribution to the target respondents.

Table 1. *The Value of Reliability Analysis of Each Variable in this Study (n=50)*

Variables	Cronbach's Alpha	Interpreted	N. of items
Environmental concern	.897	Good	3
Attitude toward EV innovation	.867	Good	2
Social influence	.877	Good	5
Performance expectancy	.821	Good	3
Purchase intentions	.853	Good	3

4. Results

4.1 Descriptive analysis of Demographic Data

Target respondents interested in EV cars residing in Thailand's upcountry between February 2024 and March 2024 responded to the questionnaire, accounting for 110% of the sample size. We then excluded 50 respondents, leaving 390 eligible respondents, or 97.5% of the initial sample size, for data analysis. The questionnaire included inquiries about demographic information such as gender, age, income, nationality, frequency of visits to gas stations, expected car range, and preferred car brand. We descriptively analyzed these demographic variables to characterize the target respondents.

Table 2 illustrates the frequency distribution and percentage of demographic information from the sample of 390 respondents, as follows:

Gender: Among the 390 respondents, 220 were male (56.40% of all respondents), 168 were female (43.10% of all respondents), and 2 respondents did not specify their gender (0.50% of all respondents).

Age: The largest age group among the respondents was 31–40 years old, comprising 173 individuals (44.40% of all respondents). This was followed by the 20–30 age group with 106 respondents (27.20% of all respondents), the 41–50 age group with 68 respondents (17.40% of all respondents), and those over 50 years old with 43 respondents (11.00% of all respondents).

Income: The majority of respondents (41.0% or 160 individuals) reported an income between 20,001 and 50,000 THB, followed by 37.7% (147 individuals) with an income between 10,001 and 20,000 THB, 12.1% (47 individuals) with an income lower than 10,000 THB, and 9.2% (36 individuals) with an income exceeding 50,000 THB.

Nationality: All 390 respondents were Thai citizens (100% of all respondents), with no non-Thai citizens included in the sample.

Frequency of Visits to Gas Stations: The majority of respondents (51.0%, or 199 individuals) visited gas stations 8–12 times per month. This was followed by 27.2% (106 individuals) who visited gas stations less than 8 times per month, 19.0% (74 individuals) who visited gas stations 12–16 times per month, and 2.8% (11 individuals) who visited gas stations more than 16 times per month.

Expected Car Range: Most respondents (61.0%, or 238 individuals) expected their car to have a range of 501–600 km. This was followed by 21.8% (85 individuals) expecting a range of 401–500 km, 8.7% (34 individuals) expecting a range of 301–400 km, 3.3% (13 individuals) expecting a range of 100–300 km, and 5.2% (20 individuals) with other expectations.

Preferred Car Brand: Out of the 390 respondents, 29.7% (116 individuals) chose BYD as their preferred car brand, followed by TESLA with 26.9% (105

individuals), ORA with 14.9% (58 individuals), MG with 13.8% (54 individuals), NETA with 8.7% (34 individuals), and other brands with 6.0% (23 individuals).

Table 2. *Demographic information analysis by using frequency distribution and percentage (n=390)*

Demographic Factors	Frequency	Percentage
Gender		
Male	220	56.40%
Female	168	43.10%
Not Specified	2	0.50%
Total	**390**	**100%**
Age		
20 - 30 years old	106	27.20%
31 - 40 years old	173	44.40%
41 - 50 year old	68	17.40%
Over 50 years old	43	11.00%
Total	**390**	**100%**
Income		
Lower than 10,000 Baht	47	12.10%
10,001 - 20,000 Baht	147	37.70%
20,001 - 50,000 Baht	160	41.00%
More than 50,000 Baht	36	9.20%
Total	**390**	**100%**
Nationality		
Thai	390	100%
Non-Thai	0	0%
Total	**390**	**100%**
Entering gas station frequency		
Less than 8 times per month	106	27.20%
8 -12 times per month	199	51.00%
12 -16 times per month	74	19.00%
More than 16 times per month	11	2.80%
Total	**390**	**100%**
Distance expectancy		
100 - 300 km	13	3.30%
301 - 400 km	34	8.70%
401 - 500 km	85	21.80%
501 - 600 km	238	61.00%
Others	20	5.20%
Total	**390**	**100%**
Car brand		
TESLA	105	26.90%
BYD	116	29.70%
ORA	58	14.90%
MG	54	13.80%
NETA	34	8.70%
Others	23	6.00%
Total	**390**	**100%**

4.2 Descriptive Analysis with Mean and Standard Deviation

The summary of the mean and standard deviation for each group variable consisted of environmental

concern, social influence, performance expectancy, attitude toward EV innovation, and purchase intentions. The following criteria for evaluating the mean scores were adapted from Imsaard et al. (2021). The criteria for the interpretation of mean scores are as follows: 4.21 - 5.00 represents "strongly agree," 3.41 - 4.20 represents "agree," 2.61 - 3.40 represents "neutral," 1.81 - 2.60 represents "disagree," and 1.00 - 1.80 represents "strongly disagree."

The mean and standard deviation of environmental concern in Table 3 represent the results among 390 respondents, with 0 missing respondents. The highest mean of environmental concern was "An electric car will reduce pollution," which equals 4.04. On the other hand, the lowest mean was "Renewable energy is very important for me to choose an electric car," which equals 3.96. Furthermore, the highest deviation was "An electric car will reduce harmful emissions," which equals 0.818. Nevertheless, the lowest deviation was "An electric car will reduce pollution," which equals 0.755.

The mean and standard deviation of attitude toward EV innovation in Table 3 indicate the results among 390 respondents, with 0 missing respondents. The highest mean of attitude toward EV innovation was "An electric car system no longer needs gasoline," which equals 3.64. On the other hand, the lowest mean was "An electric car makes them a part of nature conservation," which equals 3.53. Furthermore, the highest deviation was "An electric car system no longer needs gasoline," which equals 0.907. Nevertheless, the lowest deviation was "An electric car makes them a part of nature conservation," which equals 0.874.

The mean and standard deviation of social influence in Table 3 show the results among 390 respondents, with 0 missing respondents. The highest mean of social influence was "an electric car would be positive for society," which equals 3.58. In the meantime, the lowest mean was "Their family and friends would be upset if they did not adopt an electric car," which equals 2.96. For the standard deviation, the highest was "People who are important to them think that they should use an electric car," which equals 1.124. On the other hand, the lowest deviation was "Using an electric car would be positive for society," which equals 0.832.

The mean and standard deviation of performance expectancy in Table 3 provide the results among 390 respondents, with 0 missing respondents. The highest mean of performance expectancy was "Using an electric car would be more cost-effective," which equals 3.56. In contrast, the lowest mean was "Using an electric car enables them to reach their destination more quickly," which equals 3.02. Moreover, the highest deviation was "Using an electric car enables them to reach their destination more quickly," which equals 1.143. However, the lowest deviation was "Using an electric car would be more cost-effective," which equals 0.836.

The mean and standard deviation of purchase intentions in Table 3 present the results among 390 respondents, with 0 missing respondents. The highest mean of purchase intentions was "It is very certain to purchase an electric car in the future," which equals 3.46. Meanwhile, the lowest mean was "They expect to drive an electric car in the near future," which equals 3.46. For the standard deviation, the highest was "They expect to drive an electric car in the near future," which equals 1.060. Nevertheless, the lowest deviation was "It is very certain to purchase an electric car in the future," which equals 0.987.

***Table 3**. The result of Mean and Standard Deviation*

Item No.	Measurement Items	Mean	S.D.	Interpretation
EC1	Renewable energy is very important for me to choose an electric car.	3.96	0.771	Agree
EC2	Using an electric car will reduce pollution.	4.04	0.755	Agree
EC3	Using an electric car will reduce harmful emissions.	3.97	0.818	Agree
Environmental concern (EC)		**3.99**		**Agree**
AEI2	When I move to use an electric car, it makes me feel good because I am a part of nature conservation.	3.53	0.874	Agree
AEI3	Because the electric car system no longer needs gasoline, I could save more on travel costs.	3.64	0.907	Agree
Attitude toward EV innovation (AEI)		**3.58**		**Agree**
SI1	Using an electric car would be positive for society.	3.58	0.832	Agree
SI2	I would use an electric car if a number of other people use it.	3.45	0.891	Agree
SI3	People who influence my behavior think that I should use an electric car.	3.2	1.035	Neutral
SI4	My family and friends would be upset if I did not adopt an electric car.	2.96	1.109	Neutral
SI5	People who are important to me think that I should use an electric car.	3.05	1.124	Neutral
Social influence (SI)		**3.25**		**Neutral**
PE1	Using an electric car would be more cost effective.	3.56	0.836	Agree
PE2	Using an electric car enables me to reach my destination more quickly.	3.02	1.143	Neutral
PE3	Using an electric car will serve as a good alternative to conventional vehicles.	3.5	0.912	Agree
Performance expectancy (PE)		**3.36**		**Neutral**
PI1	It is very certain that I will purchase an electric car in the future.	3.46	0.987	Agree
PI2	I expect to drive an electric car in the near future.	3.21	1.06	Neutral
PI3	I intend to adopt an electric car because it is environmentally friendly.	3.39	0.953	Neutral
Purchase intentions (PI)		**3.36**		**Neutral**

4.3 Hypothesis Testing Results

To analyze the hypothesis testing results, the researcher utilized linear regression as part of the statistical analytical methodology. This method was employed to examine the significant impact among variables, including the significant influence of environmental concern on attitude toward EV innovation, the significant influence of social influence and performance expectancy on attitude toward EV innovation, and the significant influence of attitude toward EV innovation on purchase intentions. In conducting linear regression analysis, the researchers employed multiple linear regression analysis to assess the R-square, which indicates the proportion of variance in the dependent variables explained by the independent variables. Additionally, this study utilized simple linear regression to evaluate the level of factors influencing purchase intentions. Ringle et al. (2015) emphasized the importance of analyzing the significant impact between dependent and independent variables in regression analysis, stating that independent variables should be considered acceptable if the variance inflation factor value is less than 5, with R-square indicating the proportion of variance in the dependent variable explained by the independent variables.

4.3.1 Result of Multiple Linear Regression of H1, H2, H3

Statistical Hypothesis

H_0: There is no significant influence of environmental concern (H1), social influence (H2) and performance expectancy (H3) on attitude toward EV innovation among purchase intentions of Thai people in upcountry.

H_1: There is a significant influence of environmental concern (H1), social influence (H2) and performance expectancy (H3) on attitude toward EV innovation among purchase intentions of Thai people in upcountry.

Table 4 presents the results of multiple linear regression analysis for hypotheses 1, 2, and 3, which examine the significant influences of environmental concern, social influence, and performance expectancy on attitudes toward EV innovation. The analysis reveals significant positive relationships between environmental concern ($\beta = 0.392$, $p < .001$), social influence ($\beta = 0.152$, $p < .001$), performance expectancy ($\beta = 0.419$, $p < .001$), and attitude toward EV innovation. The standardized betas indicate the relative strength of these relationships, with performance expectancy having the strongest influence.

Additionally, the table provides information on the unstandardized coefficients (B), standard error (SE B), t-values, and p-values for each predictor variable. We also include the Variance Inflation Factor (VIF) to assess multicollinearity, and all VIF values fall below the acceptable threshold of 5, indicating no significant multicollinearity issues.

The overall model demonstrates substantial explanatory power, with an R^2 value of 0.682, suggesting that approximately 68.2% of the variance in attitude toward EV innovation can be explained by the combined influence of environmental concern, social influence, and performance expectancy. The adjusted R^2 value (0.680) indicates that this model's predictive ability remains robust even after accounting for the number of predictors.

Table 4*. Multiple Linear Regression Analysis Summary for Hypotheses 1, 2 and 3*

Variables	B	SE B	β	t	p-value	VIF	Null Hypothesis
Environmental concern	0.467	0.0419	0.392	11.15	<.001*	1.5	Rejected
Social influence	0.149	0.0422	0.152	3.52	<.001*	2.26	Rejected
Performance expectancy	0.412	0.042	0.419	9.79	<.001*	2.23	Rejected

Note: $R^2 = 0.682$, *Adjusted* $R^2 = 0.680$, **p-value < 0.05. Dependent Variable = Attitude toward EV innovation.*

B: Unstandardized coefficients B | SE B: The standard error for the unstandardized beta | β: The standardized beta | t: t-value | p: p-value | VIF: Variance Inflation Factor

4.3.2 Result of Simple Linear Regression of H4

Statistical Hypothesis

H_0: There is no significant influence of attitude toward EV innovation on purchase intentions among Thai people in upcountry.

H_1: There is a significant influence of attitude toward EV innovation on purchase intentions among Thai people in upcountry.

Table 5 presents the results of a simple linear regression analysis for hypothesis 4, which examines the significant influence of attitudes toward EV innovation on purchase intentions. The analysis reveals a significant positive relationship between attitude toward EV innovation and purchase intentions ($\beta = 0.686$, $p < .001$). The standardized beta (β) indicates the strength and direction of this relationship, with a value of 0.686 suggesting a strong positive association.

Additionally, the table provides information on the unstandardized coefficient (B), standard error (SE B), t-value, and p-value for the predictor variable. We also include the Variance Inflation Factor (VIF) to

assess multicollinearity, with a value of 1.00 indicating no significant multicollinearity issues.

The overall model demonstrates moderate explanatory power, with an R^2 value of 0.471, suggesting that approximately 47.1% of the variance in purchase intentions can be explained by attitude toward EV innovation. The adjusted R^2 value (0.470) indicates that this model's predictive ability remains robust even after accounting for the number of predictors.

Table 5. *Simple Linear Regression Analysis Summary for Hypotheses 4*

Variables	B	SE B	β	t	p-value	VIF	Null Hypothesis
Attitude toward EV innovation	0.769	0.0414	0.686	18.58	<.001*	1.00	Rejected

Note: $\square^2 = 0.471$, *Adjusted* $\square^2 = 0.470$, **p-value < 0.05. Dependent Variable = Purchase Intentions*

B: Unstandardized coefficients B | SE B: The standard error for the unstandardized beta | β: The standardized beta | t: t-value | p: p-value | VIF: Variance Inflation Factor

5. Conclusion and Recommendations

5.1 Summary of Research Intentions

The research objectives and questions serve as fundamental focal points in this section. The analysis aims to explore the relationships among five variables influencing the intention to purchase electric cars among Thai people in rural areas. Here is an outline of the research questions:

Does environmental concern have a significant influence on attitudes toward EV innovation and, consequently, the intention to purchase EV cars?

Does social influence have a significant impact on attitudes toward EV innovation and, consequently, the intention to purchase EV cars?

Does performance expectancy significantly affect attitudes toward EV innovation and, subsequently, the intention to purchase EV cars?

Does the attitude toward EV innovation have a significant impact on the intention to purchase EV cars?

This research utilized a quantitative method based on data collected from Thai individuals residing in rural areas. Krejcie and Morgan's (1970) sample size table determined the sample size of 390 respondents, using a non-probability convenience sampling method for participant selection. We designed the questionnaire with closed-ended questions and conducted reliability testing using the Item Objective Congruence (IOC) and Cronbach's alpha methods to ensure its validity and reliability.

Analysis of demographic data revealed that the majority of respondents were male (56.4%), aged between 31 and 40 years old (44.4%), with an average monthly income of 20,001 to 50,000 Baht (41.0%). Additionally, most respondents were of Thai nationality (100%), visited gas stations 8-12 times per month (51.0%), and expected a car range of 501-600 km (61.0%). The most preferred car brand among respondents was BYD (29.7%).

The mean and standard deviation of variables indicated that environmental concern had the highest mean ($\bar{x} = 3.99$, SD = 0.682), followed by attitude toward EV innovation ($\bar{x} = 3.58$, SD = 0.815), purchase intention for EV cars ($\bar{x} = 3.36$, SD = 0.912), performance expectancy ($\bar{x} = 3.36$, SD = 0.830), and social influence ($\bar{x} = 3.25$, SD = 0.831).

Table 6 summarizes the results of hypothesis testing conducted to investigate the factors influencing the purchasing intentions of electric vehicles (EVs) among rural Thai consumers. All p-values obtained from the hypothesis testing were less than 0.001, indicating strong evidence to reject the null hypotheses. The decision results column confirms that all null hypotheses were not true. This suggests that consumers in rural Thailand are very affected by

environmental concerns, social pressure, performance expectations, and attitudes toward new electric vehicles. These findings underscore the importance of considering these factors in promoting EV adoption and developing effective strategies to encourage the uptake of electric vehicles in rural areas of Thailand.

Table 6. *Summary of the hypothesis testing results.*

Statement of Null Hypothesis	p-value	Decision Results
H1o : There is no significant influence of environmental concern on attitude toward EV innovation among purchase intentions of Thai people in upcountry.	<.001*	Rejected Ho
H2o : There is no significant influence of social influence on attitude toward EV innovation among purchase intentions of Thai people in upcountry.	<.001*	Rejected Ho
H3o : There is no significant influence of performance expectancy on attitude toward EV innovation among purchase intentions of Thai people in upcountry.	<.001*	Rejected Ho
H4o : There is no significant influence of attitude toward EV innovation on purchase intentions among Thai people in upcountry.	<.001*	Rejected Ho

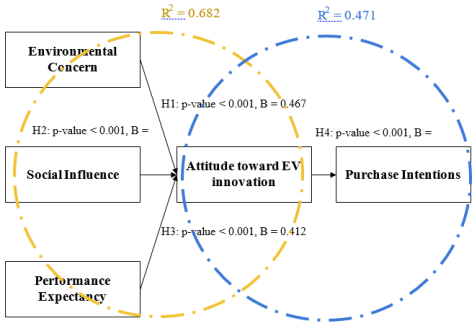
The researchers aimed to classify the ranking among variables based on the strength levels of factors influencing EV car purchasing intention among Thai people in the upcountry. The strongest significant factor influencing purchase intentions is the attitude toward EV innovation ($\beta = 0.686$). In terms of the dependent variable, attitude toward EV innovation, performance expectancy ($\beta = 0.419$) occupies the first rank, followed by environmental concern ($\beta = 0.392$) in the second rank, and social influence is positioned in the third rank ($\beta = 0.152$), as shown in Table 7.

Table 7. *Summary strengths of influencing factors of each dependent variable.*

Dependent Variable	Rank	Independent Variable	Standardized Coefficient (β)
Purchase Intentions	-	Attitude toward EV innovation	0.686
Attitude toward EV innovation	2nd	Environmental concern	0.392
	1st	Performance expectancy	0.419
	3rd	Social influence	0.152

5.2 Discussion based on Findings

Based on the hypothesis testing results presented in the previous chapter, it can be concluded that attitude toward EV innovation positively influences purchase intentions. In other words, the attitude toward EV innovation is influenced by environmental concern, social influence, and performance expectancy factors, as depicted in Figure 5.



Source. *Constructed by authors*

Figure 5.

Structural Model Results

Attitude toward EV innovation and Purchase Intentions

The findings of this study reveal a significant and positive association between attitudes toward EV innovation and purchase intentions. The analysis demonstrates that the significance level of the relationship between attitude toward EV innovation and electric car purchase intentions is less than 0.001, meeting the threshold significance level of less than 0.05. Furthermore, the standardized coefficient (β) for attitude toward EV innovation and purchasing intentions for electric cars is 0.686, indicating the strongest relationship among all independent variables in this study. Based on this result, it can be concluded that attitude, particularly influenced by environmental concern, is the most significant driver affecting the purchase intentions of Thai people living in upcountry areas outside Bangkok. This conclusion is consistent with previous studies, which also noted a strong significance between attitude and Thai people's purchasing intentions (Mohammed et al., 2023; Dowpiset & Nuangjamnong, 2021, Xu & Nuangjamnong, 2022,).

The study suggests that a shift in attitude toward EV innovation may be a key factor influencing Thai people's purchasing intentions regarding electric cars. Citizens may increasingly realize the benefits of transitioning to electric cars instead of gasoline cars. In other words, drivers are relevant for purchase intentions by motivating a favorable attitude based on self-benefits, which is the most important aspect of their perceptions of EV sustainability (Mohammed et al., 2023).

The continuous evolution of electric car batteries has been ongoing, leading to more efficient and cost-effective batteries. This development could lower vehicle costs, making electric vehicles more accessible to a wider range of consumers. Additionally, advancements in battery technology could increase the driving range of electric cars, making them comparable to gasoline cars (Fayez, 2023).

In this simple linear regression model, it is indicated that the proportion of variance in electric car purchasing intentions, or R-square, impacted by attitude toward EV innovation is 47.1%. This means that the model explains at least 47.1% of the variance in the dependent variable.

Environmental Concern, Social Influence, Performance Expectancy and Attitude toward EV innovation

The results of hypothesis 1 testing regarding the relationship between environmental concern and attitude toward EV innovation reveal a significant level of less than 0.001. This indicates that the significant value of this hypothesis, which should be less than 0.05, is acceptable. Therefore, it can be concluded that customers' attitudes toward electric car purchasing are influenced when they have confidence in the environmental aspects of electric cars. Additionally, the standardized coefficient (β) of environmental concern and attitude toward EV innovation in this study is 0.392. This suggests that among the variables in this research, the relationship between environmental concern and attitude toward EV innovation is the second strongest, following the relationship between attitude toward EV innovation and purchasing intentions. Supporting this conclusion, previous research by Roger and Rohini (2017) also found a similar relationship between environmental concern and attitude, emphasizing customers' belief in the environmental aspects of electric car purchasing. Customers' attitudes may diminish if they do not perceive a significant impact on environmental conservation or a reduction in emissions.

Meanwhile, the testing result of the relationship between social influence and attitude toward EV innovation from Hypothesis 2 also yields a significant value of less than 0.001. This indicates a significant attitude in this study, as the significant value exceeds the target of less than 0.05. From this result, the standardized coefficient (β) of social influence on attitude toward EV innovation is 0.419. The researchers can conclude that the relationship between social influence and attitude toward EV innovation is the least strong among all independent variables in the research. This finding aligns with

Mohammed et al. (2023), who highlighted the significance of social influence on Thai people's attitude toward EV innovation based on survey questionnaire analysis.

Moreover, the study of hypothesis 3 testing results in the relationship between performance expectancy and attitude toward EV innovation also indicates a significant level of less than 0.001. According to this significant value criterion, the hypothesis is accepted. Additionally, the standardized coefficient (β) of performance expectancy and attitude toward EV innovation is 0.152. Therefore, the result suggests that performance expectancy ranks third among the variables influencing the electric car purchasing intentions of Thai people outside Bangkok. This conclusion is supported by a previous study by Indra et al. (2022), which found that performance expectancy is a significant factor influencing electric car purchases in upcountry areas.

Analyzing the variance proportion, or R-square, of this multiple linear regression model, the R-square value is 68.2%. This indicates that the model fits the data well and has a strong influence on the outcome.

5.3 Recommendations based on Findings

In this section, the researchers aim to provide recommendations to support the significant relationships identified among the research hypotheses. The conclusions section highlighted four significant relationships between variables influencing the electric car purchasing intentions of Thai people in the upcountry, including the significant influence of environmental concern, social influence, and performance expectancy on attitude toward EV innovation and purchasing intentions of EV cars.

Attitude toward EV innovation and Purchase Intentions

To positively influence and change customers' attitudes, the study recommends that marketing management, sales clerks, or dealers intensify their advertising and service promotion efforts, whether online or onsite, to target every generation of customers who show interest in and are likely to purchase an electric car in the near future. Innovative presentations of customer-relevant internal policies and the company's objectives regarding the sale of innovative cars, which are unfamiliar products in today's customer lifestyle, are also recommended. Highlighting the necessity of long-distance travel and the time-saving aspects of refueling can further persuade potential customers. Moreover, emphasizing the benefits or advantages of electric cars compared to gasoline cars, such as travel cost per kilometer, environmental conservation, and noise levels during operation, is crucial. Continuous training of sales staff is essential to ensure they are well-informed about these factors, as the cost of travel, environmental preservation, and performance expectations significantly affect customers' daily lives, contributing to cost savings, health considerations, and driving satisfaction.

Environmental Concern, Social Influence, Performance Expectancy and Attitude toward EV innovation

The study recommends that management enhance and support environmental concerns, emphasizing their personal and social benefits. While the zero carbon dioxide emissions of electric cars may not need detailed explanations, promotions should highlight other benefits that resonate with customers' situations. For example, electric cars offer a pleasant driving experience for picnics compared to gasoline cars, which emit odors and have negative health effects. Advertising should focus on highlighting these benefits to attract more customers across various demographics.

Regarding social influence, the study suggests providing incentives to motivate customers' attitudes toward purchasing electric cars. Peer influence, whether from family members, celebrities, or other influencers, plays a significant role in persuading potential customers. Therefore, companies and dealerships should tailor their advertising to resonate with every generation and collaborate with

influencers to endorse electric cars as trustworthy and reliable choices.

Performance expectancy, being an internal aspect of electric cars, poses challenges in marketing. However, the study recommends focusing on technological advancements to enhance performance, such as improving the efficiency of electric motors to match gasoline cars' speed without compromising consumer experience. Additionally, advancements in battery technology to increase the driving range of electric cars can be highlighted to reassure potential customers about the practicality and reliability of electric vehicles.

These recommendations collectively aim to position electric cars as viable alternatives to conventional vehicles, addressing various concerns and preferences of potential customers.

5. 4 Implications based on findings and theories

The theoretical implications of the findings suggest the integration of the Unified Theory of Acceptance and Use of Technology (UTAUT), risk perception, and the results percentage to forecast Thai people's interest in adopting electric cars as an innovation in the present. These key theoretical implications can be summarized and deduced as follows:

Firstly, the findings of this research contribute to a broader understanding of sustainable innovation acceptance and electric vehicle (EV) acceptance. Building upon the UTAUT model, the conceptual framework developed considers environmental concern, social influence, and performance expectancy as factors influencing consumers' purchase intentions regarding EVs (Indra et al., 2022).

Moreover, our research expands upon the conceptual model by incorporating perceived EV sustainability as a mediating attitudinal factor alongside EV attitude. Our findings emphasize the importance of this aspect in understanding consumers' technology acceptance decisions, as they seek to balance personal and societal benefits (Trang et al., 2020; White et al., 2019; White and Peloza, 2009). This is particularly relevant in research focusing on consumer perceptions of sustainable technologies.

5.5 Limitations of the study

Despite the valuable insights gained from this research, several limitations must be acknowledged to provide a balanced interpretation of the findings.

Firstly, the study primarily focuses on the perceptions and intentions of Thai people residing in upcountry areas, excluding urban populations. This limited geographical scope may restrict the generalizability of the findings to a broader population.

Secondly, the research relies on self-reported data obtained through questionnaires, which are subject to response bias and social desirability effects. Participants may provide answers that they perceive as favorable or socially acceptable, leading to potential inaccuracies in the data.

Additionally, the study adopts a cross-sectional design, capturing data at a single point in time. As a result, it is challenging to establish causality or infer long-term trends from the observed relationships between variables.

Furthermore, the measurement of variables, such as environmental concern and social influence, may lack comprehensive depth and specificity. Different interpretations or understandings of these constructs among participants could influence the validity of the results.

Moreover, while efforts were made to ensure sample representativeness through sampling techniques, the sample size may still be relatively small compared to the target population. This could affect the statistical power of the analysis and limit the generalizability of the findings.

Lastly, the study's reliance on existing theoretical frameworks, such as the Unified Theory of Acceptance and Use of Technology (UTAUT), may overlook other relevant factors or nuances specific to the context of electric vehicle adoption in Thailand.

In light of these limitations, future research endeavors should aim to address these shortcomings by employing larger and more diverse samples, utilizing longitudinal designs, and employing mixed-method approaches to provide a more comprehensive understanding of the factors influencing electric vehicle adoption in Thailand.

5.6 Further Studies

Based on the hypothesis testing results indicating the significant influence of environmental concern, social influence, performance expectancy, and attitude toward EV innovation on purchasing intention for electric cars, several avenues for future research emerge.

Firstly, given the increasing global concern about environmental issues and the urgent need to address climate change, future studies should delve deeper into the role of environmental concern in shaping attitudes and behaviors toward electric vehicle adoption. Specifically, researchers could explore how different messaging strategies and interventions aimed at raising environmental awareness influence consumers' perceptions and intentions regarding electric cars. Additionally, investigating the effectiveness of environmental policies and incentives in promoting electric vehicle adoption would be valuable.

Secondly, there is a need for comprehensive research on battery electric vehicles (EVs), particularly focusing on battery performance and its impact on consumer perceptions and adoption behavior. Studies could investigate aspects such as battery life cycle, charging infrastructure, range per charge, charging time, and maintenance costs, as these factors significantly influence consumers' decisions to adopt electric vehicles. Furthermore, understanding the role of social influence, particularly through electronic word-of-mouth (eWOM) on social media platforms, in shaping consumer attitudes and intentions towards EVs warrants further investigation. Researchers could explore how online reviews and user-generated content on platforms like Facebook, Instagram, and Twitter influence consumer perceptions and purchasing decisions regarding electric cars.

Moreover, future research should focus on the sustainable disposal and recycling of EV batteries to mitigate the environmental impacts associated with their end-of-life management. Investigating innovative recycling technologies and sustainable practices for battery disposal, such as those employed by Fortum in Finland, could provide valuable insights into addressing the environmental challenges posed by EV batteries.

Overall, future studies should adopt interdisciplinary approaches and utilize mixed-method research designs to comprehensively examine the multifaceted factors influencing electric vehicle adoption. By addressing these research gaps, policymakers, industry stakeholders, and consumers can make informed decisions to accelerate the transition toward sustainable transportation systems.

References

Ade, F. (2021, November 12). *Predicting Purchase Intention towards Battery Electric Vehicles: A Case of Indonesian Market*. Mdpi. https://www.mdpi.com/2032-6653/12/4/240

Alessandro, L., Susana, S. C., & Paulo, D. (2023, March 31). *The role of environmental concern and technology show-off on electric vehicles adoption: the case of Macau*. Emerald. https://www.emerald.com/insight/content/doi/10.1108/IJOEM-10-2021-1637/full/pdf?title=the-role-of-environmental-concern-and-technology-show-off-on-electric-vehicles-adoption-the-case-of-macau

Blink Charging Co. (2024). *How EVs Are Reducing Carbon (CO2) Emissions*. Blink. https://blinkcharging.com/how-evs-are-reducing-carbon-co2-emissions/#:~:text=As%20one%20MIT%20report%20found,create%20a%20substantial%20positive%20effect

Cronbach, L. J. (1951). *Coefficient alpha and the internal structure of tests*. Psychometrika. https://doi.org/10.1007/bf02310555

Carley, S., Krause, R., Lane, B., & Graham, J. (2013). Intent to purchase a plug-in electric vehicle: a survey of early impressions in large US cites. Transportation Research. https://doi.org/10.1016/j.trd.2012.09.007

Dk., T., & Nisal, G. (2019). *The effect of perceived risk on the purchase intention of electric vehicles: an extension to the technology acceptance model*. Researchgate. https://www.researchgate.net/profile/Thilina-Dk-2/publication/364199656_The_effect_of_perceived_risk_on_the_purchase_intention_of_electric_vehicles_an_extension_to_the_technology_acceptance_model/links/635b98d16e0d367d91d42a5b/The-effect-of-perceived-risk-on-the-purchase-intention-of-electric-vehicles-an-extension-to-the-technology-acceptance-model.pdf?_sg%5B0%5D=started_experiment_milestone&origin=journalDetail&_rtd=e30%3D

Dowpiset, K., & Nuangjamnong, C. (2021). An Investigation of Factors Affecting Intention to Comply Thailand PDPA with E-Services in Private University towards Social Media. *International Journal of Economics and Business Administration, IX*(2), 374–393. https://doi.org/10.35808/ijeba/709

Elena, C. H., Vedant, S., Virender, S., & Francisco, C. L. (2023). *Factors affecting adoption intention of electric vehicle: a cross-cultural study*. Springerlink. https://link.springer.com/article/10.1007/s10668-023-03865-y

Fayez, A. (2023, May 13). *Electric Vehicles: Benefits, Challenges, and Potential Solutions for Widespread Adaptation*. Mdpi. https://doi.org/10.3390/app13106016

Fortum. (2024). *Lithium-ion Battery Recycling Technology*. Fortum. https://www.fortum.com/services/battery-recycling/lithium-ion-battery-recycling-technology

Haider, A. A., Satirenjit, J. K., Zullina, S. BH., Wajiha, M., Muhammad, M., Muhammad, M. A., Rafiq, W., Farooqi, A. S., & Borovkov. (2021, November 4). *Consumer Motivation by Using Unified Theory of Acceptance and Use of Technology towards Electric Vehicles*. Mdpi. https://www.mdpi.com/2071-1050/13/21/12177

Haider, A. A., Zullina, S. H., & Wajiha, M. (2021). *Consumer Motivation to Enhance Purchase Intention Towards Electric Vehicles in Malaysia*. SHS Web of Conferences. https://www.shs-conferences.org/articles/shsconf/pdf/2021/35/shsconf_icmesh2020_09003.pdf

Haider, A. A., Satirenjit, J. K., Wajiha, M., Muhammad, M., & Haleema, A. Z. (2022). *Procurement of Electric Vehicles to Reduce Transport Emission: An Empirical Study of Consumer Motivation towards Purchase Intention*. Jonuns. http://www.jonuns.com/index.php/journal/article/viewFile/1032/1026

Huang, N., & Nuangjamnong, C. (2022). Green Residential Buildings Purchase Intention in Thai Perspective. *Global Scientific and Academic Research Journal of Economics, Business and Management, 1*(2(December)), 27–41. https://gsarpublishers.com/abstract-207/

Trang, S., Trenz, M., Weiger, W.H., Tarafdar, M., Christy, M., & Cheung, K. (2020). "One app to trace them all? Examining app specifications for mass acceptance of contact-tracing apps". *European Journal of Information Systems*, 29(4), 415-428.

Imsa-ard, P., Wichamuk, P., & Chuanchom, C. (2021). *Muffled Voices from Thai Pre-Service Teachers: Challenges and Difficulties during Teaching Practicum*. Shanlax International Journal of Education. https://doi.org/10.34293/education.v9i3.3989

Indra, G., Anak, R. A., Ahmad, S. A., Meilinda, M. F., Andante, P. H., & Adji, K. C. (2022, February 9). *Determinants of customer intentions to use electric vehicle in Indonesia: An integrated model analysis*. Mdpi. https://www.mdpi.com/2071-1050/14/4/1972

Johnstone, M., & Hooper, S. (2016, June 13). *Social influence and green consumption behaviour: a need for greater government involvement*. Journal of Marketing Management. https://doi.org/10.1080/0267257X.2016.1189955

Jaeyoung, L., Farrukh, B., Mir, T. AH., & Sajan, S. (2021, May 15). *Public Intentions to Purchase Electric Vehicles in Pakistan*. Mdpi. https://www.mdpi.com/2071-1050/13/10/5523

Kapoor, A., & Nuangjamnong, C. (2021). Factors Affecting

Purchase Intention of Air Purifier as Green Product among Consumers during the Air Pollution Crisis. *AU- GSB e- Journal*, *14*(2) , 3– 14. https://doi.org/10.14456/augsbejr.2021.10

Krejcie, R. V., & Morgan, D. W. (1970). *Determining Sample Size for Research Activities*. Educational and Psychological Measurement. https://doi.org/10.1177/001316447003000308

Kropfeld, M.I., Nepomuceno, M.V., & Dantas, D.C. (2018, December 12) . *The ecologicalimpact of anti consumption lifestyle and environmental concern*. Journal of Public Policy and Marketing. https://doi.org/10.1177/0743915618810448

Mahajan, V. & Muller, E. (1998). *When is it worthwhile targeting the majority instead of the innovators in a new product launch?* Journal of Marketing Research. https://doi.org/10.1177/002224379803500407

McCowan, D. (2013). *The rise and fall of better place*. Drive. www.drive.com.au/motor-news/the-rise-and-fall-of-better-place-20130218-2emmn

Manutworakit, P., & Choocharukul, K. (2022, July 11). *Factors Influencing Battery Electric Vehicle Adoption in Thailand– Expanding the Unified Theory of Acceptance and Use of Technology's Variables*. Mdpi. https://www.mdpi.com/2071-1050/14/14/8482

Mohammed, A. B., Welf, W. H., & Abdelmonim, S. (2023, October 25). *Drivers of electric vehicle adoption: the moderating role of technological innovativeness*. Emerald. https://www.emerald.com/insight/content/doi/10.1108/MSAR-08-2023-0041/full/pdf?title=drivers-of-electric-vehicle-adoption-the-moderating-role-of-technological-innovativeness

Nadine, B., & Sebastian, W. (2013, August 12). *Why do Consumers resist buying Electric Vehicles?* Copenhagen Business School. https://research-api.cbs.dk/ws/portalfiles/portal/58427925/nadine_bessenbach_og_sebastian_wallrapp.pdf

Nuangjamnong, C. (2021) . Investigation of Factors Influencing Students' Intention to Use Banking Services through Smartphone Devices during COVID- 19 Pandemic. *International Journal of Economics and Business Administration*, *IX*(Issue 1), 331–346. https://doi.org/10.35808/ijeba/676

Ringle, C. M., Wende, S., & Becker, J. M. (2015). *Tourism Marketing: Measuring Tourist Satisfaction*. Journal of Service Science and Management. https://www.scirp.org/(S(vtj3fa45qm1ean45vvffcz55))/reference/ReferencesPapers.aspx?ReferenceID=2060940

Roger, B., Rita, K., & Stephen, S. (2015, December 12). *Factors potentially affecting the successful promotion of electric vehicles*. Emerald. https://www.emerald.com/insight/content/doi/10.1108/JSOCM-08-2015-0059/full/pdf?title=factors-potentially-affecting-the-successful-promotion-of-electric-vehicles

Roger, B., & Rohini, V. (2017, November 8). *Consumer attitudes towards electric vehicles: Effects of product user stereotypes and self- image congruence*. Emerald. https://www.emerald.com/insight/content/doi/10.1108/EJM-09-2016-0538/full/pdf?title=consumer-attitudes-towards-electric-vehicles-effects-of-product-user-stereotypes-and-self-image-congruence

Schweizer, K. (2011). *On the Changing Role of Cronbach's in the Evaluation of the Quality of a Measure*. European Journal of Psychological Assessment. https://doi.org/10.1027/1015-5759/a000069

Sierzchula, W., Bakker, S., Maat, K., & Van Wee, B. (2014). *The influence of financial incentives and other socio-economic factors on electric vehicle adoption*. Energy Policy. https://doi.org/10.1016/j.enpol.2014.01.043

Sa'ait, N., Kanyan, A., & Nazrin, M. (2016). The Effect of E-WOM on Customer Purchase Intention Article Information Abstract. *International Academic Research Journal of Social Science*, 2(1) , 2016. http://www.iarjournal.com/wp-content/uploads/IARJ-SS-20161-73-80.pdf

Simona, B. & Silvia, M. (2018, November 1). *Attitudes Toward Electric Vehicles: The Case of Perugia Using a Fuzzy Set Analysis*. Mdpi. https://www.mdpi.com/2071-1050/10/11/3999

Subhash, A. C., Megha, S., & Vinod, S. K. (2022, October 5). *Using diffusion of innovation framework with*

attitudinal factor to predict the future of mobility in the Indian market. Springerlink. https://link.springer.com/article/10.1007/s11356-022-23149-8

Sample size calculator: find out the sample size. (2024). Calculator.net. https://www.calculator.net/sample-size-calculator.html?type=1&cl=95&ci=5&pp=50&ps=66090475&x=Calculate

Statista. (2024). *Electric vehicles - worldwide* [Infographic]. Statista. https://www.statista.com/outlook/mmo/electric-vehicles/worldwide

White, K. & Peloza, J. (2009). "Self-benefit versus other-benefit marketing appeals: their effectiveness in generating charitable support". *Journal of Marketing*, 73(4), 109-124.

White, K., Habib, R., & Hardisty, D. J. (2019). "How to shift consumer behaviors to be more sustainable: a literature review and guiding framework". *Journal of Marketing*, 83(3), 22-49.

Workpoint Today. (2023, January 5). *Announcement for Thai citizens throughout the country in the year 2022*. workpointTODAY. https://workpointtoday.com/thai-people/

Yadav, R., & Pathak, G. S. (2016). Young consumers' intention towards buying green products in a developing nation: Extending the theory of planned behavior. *Journal of Cleaner Production*. https://doi.org/10.1016/j.jclepro.2016.06.120

Xu, M., & Nuangjamnong, C. (2022). Determinant Factors Influence the Purchase Decision through Handbags in the Luxury Product in China. *International Research E-Journal on Business and Economics*, *7*(1), 30-43. http://www.assumptionjournal.au.edu/index.php/aumitjournal/article/view/628