The Moderating Roles of Environmental Awareness and Product Knowledge on the Impact of Marketing Mix Elements on Purchase Intention

Suchart Tripopsakul*

School of Entrepreneurship and Management, Bangkok University, Thailand. *Email: SUCHART.T@BU.AC.TH

ABSTRACT

The purpose of this study is to examine the moderating effects of environmental awareness (EA) and product knowledge (PK) on the relationship between marketing mix elements and the purchase intention of electric vehicles (EVs) in Thailand. Based on a quantitative research design, 253 samples of Thai respondents aged 20 and above were collected via an online questionnaire as a research tool. Structural Equation Modeling (SEM) analysis was used to analyze the proposed hypotheses. The results indicate that all four marketing mix elements, which are product attributes, pricing strategy, distribution channels (place), and promotional activities, significantly influence the purchase intention of electric vehicles. Product attributes (b = 0.523) have the strongest impact on purchase intention, followed by pricing strategy (b = 0.501), distribution channels (place) (b = 0.477), and promotional activities (b = 0.334) respectively. The results of moderation analysis reveal that environmental awareness significantly moderates the effect of product attributes (b = 0.412) and pricing strategy (b = 0.305) on purchase intention but is not found in the relationships of distribution channels (place) and promotional activities toward purchase intention. Additionally, consumer product knowledge of EVs was found to significantly and negatively moderate only the influence of promotional activities (b = −0.343) on purchase intention. In other words, potential consumers who possess higher EV knowledge seem to be less influenced by promotional activities in their decision to buy EVs. These findings highlight the importance of integrating environmental concerns and EV product knowledge into the firm's marketing strategies to boost EV adoption in emerging countries. The implications and recommendations will be discussed in the paper.

Keywords: Environmental Awareness, Product Knowledge, Marketing Mix, Purchase Intention, Electric Vehicles, Thailand
JEL Classifications: L26, M13, J24

1. INTRODUCTION

Recently, the electric vehicle market has grown substantially worldwide because of advances in EV technology and environmental concerns. The change from internal combustion engine technology to EV technology can be realized as a sustainable transportation technology not only because of the imperative demand for carbon emission reduction but also because of changes in consumer preferences (Rezvani et al., 2015). The data from Global EV Outlook 2024 showed that global electric vehicle sales will be more than 10 million US dollars in 2022, and the sales are expected to reach around 17 million in 2024, which can account for more than one in every five vehicles sold globally (IEA, 2024). The electronic vehicle market has started to become a mass market for vehicles in many countries. In China, the EV market will account for 45% of car sales in 2024, followed by 25% in Europe and around 11% in the USA. Intense competition among manufacturers, falling battery and automobile prices, and ongoing regulatory support bolster this growth.

Thailand is one of the emerging countries in Southeast Asia that shows potential growth in the EV market. In 2023, EV sales will have reached around 76,000 units, which is nearly eight times

higher than the previous year (The Nation, 2024). The Thai government has targeted increasing the number of EVs on the road by setting a target of 30% of total vehicle production by 2030 (The Nation, 2022). The growth of the EV market is driven by supported policies such as subsidies of purchase, incentives for EV battery manufactories, and so on. This situation, as mentioned, emphasizes the importance of understanding the factors influencing consumer adoption of EVs in Thailand.

The marketing mix conventionally conceptualized as the 4Ps, which are product, price, place, and promotion, has been realized as the crucial antecedents affecting consumer purchase intentions (Kotler and Keller, 2016; Borden, 1964; McCarthy, 1960). Those 4Ps shape perceptions and behaviors, thereby influencing consumer purchasing decisions (Yoo et al., 2000; Goi, 2009). Every element plays a unique role in influencing consumer decision-making. The first P is product attributes, which involve the features, functions, quality, and benefits of EVS and play a crucial role in attracting consumer interest. The study by Wang et al. (2019) asserted that product attributes of EVs such as battery life, charging time, and technological features affect the consumer adoption willingness of EVs. The second P is a pricing strategy that relates to the price of EVs, financing options, cost of maintenance, and long-term cost savings. The high upfront cost of EVs has been recognized as one of the major barriers to adopting EVs. However, the major barrier can be reduced by other pricing strategies, such as financial incentives and competitive pricing (Hardman et al., 2017). The third P is the place or channel of distribution, which can refer to the availability and accessibility of EVs. The presence of charging infrastructure and dealerships is also essential for reducing consumers' anxiety after they purchase and own EVs (Gnann et al., 2018). The fourth P is promotional activities, which can refer to any marketing communication efforts such as advertising campaigns, public relations, sales promotions, and direct marketing, which aim to inform, persuade, and remind potential consumers about the products or services. Effective promotional activities increase consumer awareness and interest in EVs, subsequently leading to consumer adoption willingness (Rezvani et al., 2015).

Previous research has shown that concerns about environmental issues can drive consumers to make decisions to buy eco-friendly products (Laroche et al., 2001). EVs can be realized as eco-friendly vehicles since EVs produce zero tailpipe emissions and help reduce total greenhouse gas emissions when fueled by renewable energy sources. The marketing mix element may have a greater impact on consumers with high environmental awareness, potentially increasing their willingness to adopt EVs. On the one hand, product knowledge is defined as the amount of information and understanding that consumers have about EVs. According to Flynn and Goldsmith (1999), consumers who possess extensive product knowledge are more capable of assessing the various components of the marketing mix and making well-informed choices when purchasing.

Despite the rapid rise of the EV market, there is a dearth of empirical research on the factors that drive consumer adoption of EVs, especially in emerging economies such as Thailand, especially the roles of environmental awareness and product knowledge in moderating the impacts of marketing mix elements on EV purchase intentions. To fill this gap, this study aims to investigate how those marketing mix elements affect the purchase intention of EVs and how environmental awareness and product knowledge moderate the relationships between them. Understanding these situations allows firms to develop more effective marketing strategies that can serve the specific needs and preferences of consumers in an emerging country like Thailand. The rest of this paper is organized as follows: Section 2 is a review of the literature about marketing mix factors, purchase intention, environmental awareness, and product knowledge. Section 3 describes the hypothesis's development. Section 4 is about research methods.

2. LITERATURE REVIEW

2.1. Marketing Mix Elements and Purchase Intention

McCarthy (1960) and Borden (1964) initially proposed the concept of the marketing mix. The marketing mix traditionally contains four elements, which are product, price, place, and promotion, known as the 4Ps. The 4Ps, or market mix, have served as the foundational framework for marketers to develop marketing strategies to serve customers' needs and eventually drive purchasing decisions. Previous research has studied the antecedents affecting EV decision-making. Wang et al. (2019) found that product attributes such as battery life, charging time, and distance driving per charge strongly influence consumer purchase intentions toward electric vehicles. Effective pricing strategies can also increase consumer perceptions of value and affordability, hence strengthening purchase intentions for EVs. Hardman et al. (2017) reviewed the effectiveness of financial purchase incentives for battery electric vehicles and found that these incentives raise market growth. Pamidimukkala et al. (2024) also supported these findings by assessing the barriers to EV adoption and highlighting the important role of financial incentives in overcoming the high purchase price barrier. Consumers tend to purchase EVs when they realize that the price of EVs is reasonable and when there are clear long-term cost savings compared to traditional internal combustion engine vehicles (ICEVs) (Hawkins et al., 2013). Distribution channels or places in the EV context can refer to dealership availability, service centers, and charging infrastructure, which are pivotal for the adoption of EVs. Funke et al. (2019) found that the availability of charging infrastructure is one of the important factors for EV purchase decisions. The presence of charging infrastructure not only reduces EV consumers' anxiety, but also enhances the possibility of owning EVs. Similarly, Hardman et al. (2017) noted that public charging infrastructure plays a supportive role, with the majority of EV charging taking place at home (50-80%) and at work (15-25%). Additionally, we must strategically position EV dealerships and service facilities. Dealers who are approachable and informed can greatly impact customers' opinions and willingness to purchase EVs. EV adoption is greatly aided by a strong distribution network, which includes dealerships that have the know-how and resources needed to sell and maintain EVs (Gnann et al., 2018). Prior studies revealed that promotional activities affect EV buying intentions (Bennett et al., 2016; Shanmugavel and Michael, 2022). Promotional activities such as advertising campaigns, public events, sale promotions,

and so on can raise EV consumer awareness. Those activities not only increase product knowledge but also encourage the value perception of EVs, subsequently leading to the possibility of purchasing EVs. Specific promotions, such as those supporting green living programs, significantly influence consumers' purchasing decisions. Customers who care about the environment and are inclined to think about buying an EV as part of their commitment to sustainable living are drawn to these promotions.

2.2. Environmental Awareness and Product Knowledge

Environmental awareness can be defined as an individual's level of concern and understanding about environmental issues, as well as his or her willingness to be involved or behave in promoting environmental sustainability (Okada et al., 2019). Prior studies confirm that environmental awareness acts as an important factor affecting pro-environmental behavior, including the adoption of electric vehicles (EVs), which can be realized as eco-friendly products. An increase in environmental awareness can shift consumer preferences. Axsen and Kurani (2013) found that environmental concerns are a major factor in the adoption of electric and hybrid cars. Rezvani et al. (2015) also confirmed that environmental awareness influences consumer attitudes towards EVs. The study indicates that as consumers gain awareness of how their decisions affect the environment, they are more likely to choose environmentally friendly items like electric vehicles (EVs).

Product knowledge can be defined as the degree to which customers are aware of and comprehend a product's attributes, advantages, and overall value proposition (Flynn and Goldsmith, 1999). In the context of EVs, product knowledge embraces knowledge of technical attributes such as battery life, charging infrastructure, driving range, and economic benefits associated with EV ownership. Product knowledge can reduce consumers' anxiety, especially when they deal with new technologies like EVs. Unlike traditional internal combustion engine vehicles, consumers may have limited information and knowledge about EV performance, maintenance costs, and long-term expenditure savings once they decide to own EVs. According to Smith and Swinyard's (1983) research, customers who possess a high level of product knowledge tend to be less affected by promotional efforts and instead prioritize substantive product features when making selections about what to buy. Increasing consumer product knowledge is especially crucial in emerging nations, where EV adoption is still in the early stages. Consumers are increasingly likely to view EVs as a competitive option compared to traditional cars as they gain greater awareness of the advantages and usefulness of EVs.

3. HYPOTHESIS DEVELOPMENT

This section describes the hypothesis development based on the literature review related to marketing mix elements, purchase intention, environmental awareness, and product knowledge. As mentioned earlier, prior studies confirm the positive impact of product attributes such as battery life, charging speed, safety features, and design on consumers' willingness to buy and own EVs (Wang et al., 2019; Hawkins et al., 2013). Those product attributes are relevant to an EV's usability and reliability, which

can be realized as vital determinants of purchase intention. Pricing is one of the most crucial factors influencing consumer behavior and purchase decisions (Monroe, 2003; Zeithaml, 1988). In the context of the EV market, the attractive price of EVs can help consumers easily decide to purchase EVs. Consumers perceive the costly price of battery electric vehicles as a barrier to their adoption (Hardman et al., 2017). Thus, effective pricing strategies can be realized as a financial incentive to reduce those EV adoption barriers and make EVs more attractive to prospective users. The study by Coffman et al. (2017) showed that when buyers perceive the fairness of the EV purchasing price and consider the long-term economic benefits earned from EVs, they are more likely to purchase EVs compared with traditional internal combustion engine vehicles. Distribution channels in the EV context, such as dealership availability, service centers, and charging infrastructure, are also influential for EV adoption. Funke et al. (2019) discovered that charging infrastructure considerably impacts EV purchase decisions by lowering consumer worry and improving ownership possibilities. Furthermore, well-positioned dealerships and service centers with knowledgeable staff can impact consumer willingness to purchase EVs (Gnann et al., 2018). Promotional activities affect consumer awareness and interest in EVs (Bennett et al., 2016; Shanmugavel and Michael, 2022). Effective promotional activities emphasizing the environmental benefits and cost savings can increase consumer perceptions and lead to a higher possibility of adopting EVs. Drawing from this premise, we propose the following hypotheses:

H1a: Product attributes of electric vehicles have a positive influence on consumers' purchase intention.
H1b: Price strategies have a positive influence on consumers' purchase intention of electric vehicles.
H1c: Distribution channels (place) have a positive influence on consumers' purchase intention of electric vehicles.
H1d: Promotional activities have a positive influence on consumers' purchase intention of electric vehicles.

According to Okada et al. (2019), the level of understanding and concern about environmental issues can be defined as environmental awareness, which affects an individual's willingness to be involved in promoting environmental sustainability behaviors. Rezvani et al. (2015) stated that consumers with high environmental awareness may prioritize eco-friendly attributes when making purchase decisions, and EVs implicitly reduce carbon emissions. Likewise, Axsen and Kurani (2013) found that, recognizing the long-term environmental benefits of EVs, consumers may be more willing to pay a premium for EVs even though the initial purchase price is higher than that of conventional vehicles. The availability of EVs in areas linked to green infrastructure projects may attract more environmentally conscious customers. In addition, promoting environmental awareness can increase the efficacy of marketing initiatives (Funke et al., 2019). Based on this premise, the following hypothesis is proposed:

H2a: Environmental awareness moderates the relationship between product attributes and consumers' purchase intention of electric vehicles.

H2b: Environmental awareness moderates the relationship between pricing strategies and consumers' purchase intention of electric vehicles.

H2c: Environmental awareness moderates the relationship between distribution channels and consumers' purchase intention of electric vehicles.

H2d: Environmental awareness moderates the relationship between promotional activities and consumers' purchase intention of electric vehicles.

Flynn and Goldsmith (1999) assert that consumers' level of information and understanding about a product, including its features and benefits, can shape their purchase decisions. Brucks (1985) found that consumers with greater product knowledge tend to engage in less external information searching and are more likely to rely on their existing knowledge and evaluations when making purchase decisions. In other words, consumers with a high level of product knowledge may be less influenced by the 4Ps. Based on this premise, the following hypothesis is proposed:

H3a: Product knowledge moderates the relationship between product attributes and consumers' purchase intention of electric vehicles.

H3b: Product knowledge moderates the relationship between pricing strategies and consumers' purchase intention of electric vehicles.

H3c: Product knowledge moderates the relationship between distribution channels and consumers' purchase intention of electric vehicles.

H3d: Product knowledge moderates the relationship between promotional activities and consumers' purchase intention of electric vehicles.

The research framework is presented in Figure 1.

4. RESEARCH METHODS

This study employed a quantitative research approach. We used an online questionnaire to investigate the influences of marketing mix elements on EV purchase intentions and to examine the moderating roles of environmental awareness and product knowledge on the relationship between the marketing mix elements and purchase intention. The target population in this study is Thai potential buyers of EVs aged above 20 years. Purposive sampling was used

Figure 1: Conceptual framework of this study

to collect the data. The online questionnaire was initially developed via the Google Forms and Survey Monkey platforms, and the links to the questionnaire were distributed through social media and email lists. Hair et al. (2010) suggest that a sample size of 200 is often considered sufficient for structural equation modeling (SEM), especially when the models are not very complicated and the data quality is appropriate. This study contained 253 samples, which is above the 200-sample threshold recommended by Hair et al. (2010).

The questionnaire contains three main sections. The first section consists of questions gathering demographic information about the respondents. The second section contains car ownership and usage questions such as car ownership status and type of vehicle owned. The third section includes questions about marketing mix elements, environmental awareness, product knowledge, and purchase intentions. The five-point Likert scale from 1 (strongly disagree) to 5 (strongly agree) was used to capture respondents' attitudes and perceptions across seven constructs, namely product attributes, pricing strategies, distribution channels (place), promotional activities, environmental awareness, product knowledge, and purchase intention. For the marketing mix elements, 18 question items were adopted and modified from previous studies by Wang et al. (2019); Funke et al. (2019). Environmental awareness was measured by four items adopted and modified from Mostafa (2007). Product knowledge was measured by four items originated by Flynn and Goldsmith (1999), which stress consumers' perceived knowledge about a product category. Purchase intention was measured through four items adapted from previous studies (Pavlou and Fygenson, 2006; Degirmenci and Breitner, 2017). The details of constructs and measurement items are described in Table 1.

To evaluate the content validity of the questionnaire tool, the authors asked three experts in the fields of marketing and automobile industries to assess the relevance and clarify the measurement items in the questionnaire. Two senior marketing lecturers from Chulalongkorn and Bangkok University and one expert from the EV automobile sector were asked to rate the item-objective congruence (IOC) for items in the questionnaire. Rovinelli and Hambleton (1977) suggest that an IOC score of 0.50 or higher is considered acceptable for content validity. All IOC scores of measurement items range from 0.67 to 1.00, which indicates that content validity was achieved. The authors further conducted the pre-test with 30 samples of Bangkok University students. The Cronbach's alpha values for all constructs in the pre-test range from 0.75 to 0.85, exceeding the recommended threshold value of 0.70 (Nunnally and Bernstein, 1994). The internal reliability was archived.

5. RESULTS

5.1. Sample Profile
According to the data collection process, 267 respondents participated. After checking for completion and corrections of the questionnaire responses, 14 questionnaires were removed, and there are 253 valid samples for further analysis.

The sample contained 253 Thai participants. The majority of our sample was male (52.17%), aged between 31 and 40 years
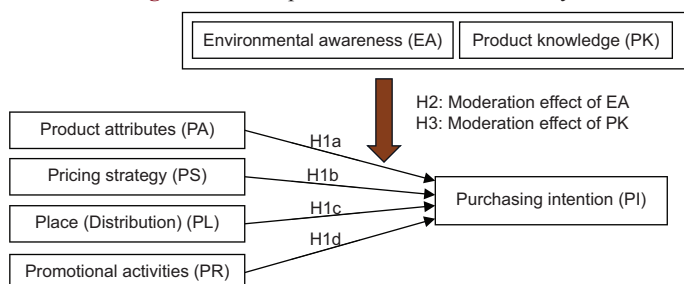
Table 1: The constructs and measurement items in this study

Construct	Measurement items
Product Attributes (PA)	The battery life of EVs generally meets my expectations. The charging speed of EVs is generally satisfactory. The safety features of EVs are generally reliable. The design of EVs is generally appealing. The overall performance of EVs is generally superior to traditional vehicles.
Pricing Strategies (PS)	The price of EVs is generally reasonable considering their features. I believe that the long-term savings from EVs generally justify their price. The available financing options generally make it easier to purchase EVs. The price of EVs is generally competitive compared to other vehicles in the market.
Distribution Channels (Place) (PL)	The availability of charging stations near my area makes EVs more convenient to own. There are generally enough service centers for EVs in my region. Dealership staff are generally knowledgeable and helpful about EVs. It is generally easy to find EVs at local dealerships.
Promotional Activities (PR)	The promotional offers for EVs are generally attractive. The advertising for EVs effectively highlights their environmental benefits. I am aware of EVs due to their promotional campaigns. The public relations efforts make me trust EV brands in general.
Environmental Awareness (EA)	I am aware of the environmental benefits of using electric vehicles. I believe that using electric vehicles can significantly reduce air pollution. I consider the environmental impact of vehicles when making a purchase decision. I support policies and incentives that promote the use of environmentally friendly vehicles
Product Knowledge (PK)	I am knowledgeable about the features of electric vehicles. I understand the benefits of owning an electric vehicle compared to a conventional vehicle. I am aware of the different models of electric vehicles available in the market. I feel confident in my ability to evaluate the performance of electric vehicles.
Purchase Intention (PI)	I am likely to purchase an electric vehicle in the near future. I intend to buy an electric vehicle when I next replace my car. I will consider an electric vehicle as my primary mode of transportation. I am willing to recommend electric vehicles to others.

Table 2: Sample profile

Characteristic	Category	Frequency	Percentage
Gender	Male	132	52.17
	Female	121	47.83
Age	21-30 years old	68	26.88
	31-40 years old	75	29.64
	41-50 years old	60	23.72
	51-60 years old	35	13.83
	Over 60 years old	15	5.93
Education Level	Below Bachelor's degree	39	15.42
	Bachelor's degree	161	63.64
	Master's degree or higher	53	20.95
Occupation	Student	32	12.65
	Company or State enterprise employee	110	43.48
	Business owner	48	18.97
	Freelance/Self-employed	45	17.79
	Other	18	7.11
Average Monthly Income	<714 USD	42	16.60
	714-1429 USD	90	35.57
	1429-2143 USD	65	25.69
	2143-2857 USD	32	12.65
	2857-4286 USD	18	7.11
	More than 4286 USD	6	2.37
Car Ownership Status	Own a car (Either yourself or a family member)	202	79.84
	Do not own a car	51	20.16
Frequency of Driving	7 days per week	95	37.55
	4-6 days per week	60	23.72
	Less 3 days per week	55	21.74
Type of Vehicle Owned	Petrol/Diesel car	136	64.76
	Hybrid car	49	23.33
	Electric car	25	11.90

1 USD=35 THB

5.2. Hypothesis Testing

To examine the proposed hypotheses through structural equation modeling (SEM) analysis, the two-step approach by Fornell and Larcker (1981) was applied. The first step is to validate the measurement model by using confirmatory factor analysis (CFA) to ensure that the constructs possess reliability and validity. After that, the structural model was tested to examine the relationships among the factors.

For the measurement model testing through CFA, discriminant validity and convergent validity were examined. Discriminant validity refers to the distinction between constructs in the model, and convergent validity is defined as the agreement between two attempts to measure the same trait through maximally different methods (Cheung et al., 2024). As recommended by Awang (2015), convergent validity occurs when item factor loadings are >0.7 and item squared multiple correlations are >0.5, and discriminant validity exists by examining the AVE value of each construct against their corresponding inter-construct correlation. To attain the criteria of acceptable discriminant validity, the square root of a construct's AVE must be greater than the correlations between the construct and other constructs in the model. The author revised the measurement model based on the suggested modification indices by drawing covariance between error terms associated with items that were theoretically related. Overall, the final measurement model offered an acceptable fit to the data (chi-square = 318.933, df = 170, CMIN/df = 1.876, GFI = 0.888,

(29.64%), with a bachelor's degree (63.64%), working as company or state enterprise employees (43.48%), and earning between 714 and 1429 USD per month (35.57%). In terms of vehicle ownership, most respondents either owned a car themselves or had a family member who owned a car (79.84%). Among car owners, 37.55% reported driving their car 7 days per week, and in terms of the type of vehicle owned, the majority had a petrol or diesel car (64.76%). The summary of the sample profile is shown in Table 2.

RMSEA = 0.061; CFI = 0.945; NFI = 0.891). Table 3 shows the result of the confirmatory factor analysis, which further supports both convergent and discriminant validity. The final measurement model provided an acceptable fit to the data (chi-square = 297.524, df = 164, CMIN/df = 1.814, GFI = 0.903, RMSEA = 0.058; CFI = 0.952; NFI = 0.899).

As shown in Table 4, all factor loadings range from 0.741 to 0.851, exceeding 0.7, and the composite reliability (CR) values of seven constructs exceed the 0.7 threshold. Additionally, the average variance extracted (AVE) values of all constructs are above the recommended value of 0.5. Thus, convergent validity is considered acceptable for the measurement model. The discriminant validity of the measurement model is also confirmed. The square root of the AVE for each construct is greater than the correlations between that construct and other constructs in the model. Overall, the confirmatory factor analysis results suggest that the measurement model is satisfactory and suitable for testing the proposed hypotheses.

After validating the measurement model, the structural model was examined to determine and test the proposed hypotheses. The path model and relationships of all constructs are summarized in Table 5. The results of the path analysis demonstrated the acceptable fit of the model to the data (Chi-square = 305.789, df = 172, CMIN/df = 1.778, GFI = 0.899, RMSEA = 0.056, CFI = 0.948, NFI = 0.894).

The path analysis revealed that all four marketing mix elements significantly influence the purchase intention (PI) of EVs. Considering factor loadings, product attributes ($\beta = 0.523$, $P < 0.001$) had the strongest effect on purchase intention, followed by pricing strategies ($\beta = 0.501$, $P < 0.001$), distribution channels ($\beta = 0.477$, $P < 0.001$), and promotional activities ($\beta = 0.334$, $P < 0.01$). Thus, H1a, H1b, H1c, and H1d are supported.

To test the moderating effects of environmental awareness (EA) and product knowledge (PK) on the relationship among marketing mix elements (product attributes (PA), pricing strategies (PS), distribution channels (place) (PL), promotional activities (PR), and purchase intention (PI), a mediation analysis was performed. The authors initially conducted the data imputation of seven constructs by extracting the factor scores from each construct's latent variables. We then used these factor scores to create interaction terms between EA, PK, and each of the marketing mix elements (PA, PS, PL, and PR) to evaluate their moderating effects

Table 3: Measurement model results

Constructs and items	Loading	t-value	SE	Alpha	Composite Reliability	AVE
Product attributes (PA)				0.845	0.896	0.627
PA1	0.764	10.562	0.094			
PA2	0.810	11.236	0.091			
PA3	0.789	10.973	0.093			
PA4	0.781	10.875	0.090			
PA5	0.783	10.910	0.092			
Pricing strategies (PS)				0.801	0.875	0.620
PS1	0.741	9.942	0.098			
PS2	0.784	10.183	0.102			
PS3	0.778	10.075	0.100			
PS4	0.812	10.956	0.108			
Distribution Channels (Place) (PL)				0.798	0.867	0.620
PL1	0.782	10.322	0.095			
PL2	0.801	10.491	0.105			
PL3	0.783	10.101	0.102			
PL4	0.759	9.652	0.098			
Promotional Activities (PR)				0.815	0.887	0.623
PR1	0.775	10.673	0.093			
PR2	0.800	10.845	0.098			
PR3	0.802	10.619	0.105			
PR4	0.777	10.271	0.103			
Environmental Awareness (EA)				0.809	0.885	0.623
EA1	0.812	10.927	0.092			
EA2	0.817	11.021	0.095			
EA3	0.805	10.876	0.093			
EA4	0.788	10.654	0.090			
Product Knowledge (PK)				0.803	0.880	0.620
PK1	0.795	10.763	0.091			
PK2	0.814	11.124	0.094			
PK3	0.796	10.835	0.093			
PK4	0.779	10.567	0.090			
Purchase Intention (PI)				0.817	0.895	0.634
PI1	0.829	11.368	0.094			
PI2	0.851	11.768	0.096			
PI3	0.815	11.022	0.092			
PI4	0.793	10.718	0.091			

Table 4: Discriminant validity

Construct	PA	PS	PL	PR	EA	PK	PI
Product Attributes (PA)	**0.791**						
Pricing Strategies (PS)	0.472	**0.787**					
Distribution Channels (Place) (PL)	0.398	0.491	**0.779**				
Promotional Activities (PR)	0.360	0.412	0.373	**0.789**			
Environmental Awareness (EA)	0.342	0.386	0.359	0.426	**0.789**		
Product Knowledge (PK)	0.318	0.358	0.327	0.403	0.444	**0.818**	
Purchase Intention (PI)	0.402	0.452	0.423	0.388	0.405	0.478	**0.797**

The square root of AVE of each construct shown in bold on the diagonal

Table 5: Results of the structural model

Hypotheses	Relationship	Estimate (b)	Result
H1a	PA→PI	0.523***	Supported
H1b	PS→PI	0.501***	Supported
H1c	PL→PI	0.477***	Supported
H1d	PR→PI	0.334**	Supported

**P<0.01; ***P<0.001; PA: Product attributes; PS: Pricing strategies; PL: Distribution channels (place); PR: Promotional activities; PI: Purchase intention

on PI. We then included the interaction terms in the analysis to examine how EA and PK moderate the relationships between each marketing mix element and PI. Table 6 summarizes the results of the moderation effects of EA and PK on the relationship between marketing mix elements and PI.

The moderation analysis results reveal that environmental awareness (EA) significantly moderates the relationship between product attributes (PA) and purchase intention (b = 0.412, P < 0.001) and between pricing strategies (PS) and purchase intention (b = 0.305, P < 0.01). Thus, H2a and H2b are supported. Higher levels of environmental awareness strengthen the positive effects of product attributes and pricing strategies on consumers' purchase intentions. Nevertheless, environmental awareness does not significantly moderate the relationship between distribution channels (PL) and purchase intention (β = 0.102, C.R. = 1.245) and between promotional activities (PR) and purchase intention (β = 0.119, C.R. = 1.573). Thus, H2c and H2d are not supported.

For product knowledge (PK) as the moderator, the author found product knowledge (PK) has a significant negative moderation effect on the relationship between promotional activities (PR) and purchase intention (b = −0.343, C.R. = −3.123) but not on the relationship between product attributes (PA) (b = 0.168, C.R. = 1.432), pricing strategies (PS) (b = 0.156, C.R. = 1.634), and distribution channels (PL) (b = 0.131, C.R. = 1.512) with purchase intention. Thus, H3d is supported, whereas H3a, H3b, and H3c are not. This implies that higher product knowledge might reduce the impact of promotional activities on their purchase intentions.

6. DISCUSSION

This study aims to examine the effect of marketing mix elements on purchase intentions in the EV context. Additionally, the moderating effects of environmental awareness and product knowledge on the relationships between each marketing mix element and purchase intentions were also investigated. The outcomes offer various vital insights for both marketing academia and practitioners in the EV industry. The results confirmed previous works (Kotler and

Table 6: The results of moderation effects of EA and PK on the relationship between marketing mix elements and PI

Hypothesis	Path	Interaction Effect (b)	C.R	Result
H2a	PA × EA→PI	0.412***	4.789	Supported
H2b	PS × EA→PI	0.305**	2.912	Supported
H2c	PL × EA→PI	0.102 (n.s)	1.245	Not Supported
H2d	PR × EA→PI	0.119 (n.s)	1.573	Not Supported
H3a	PA × PK→PI	0.168 (n.s)	1.432	Not Supported
H3b	PS × PK→PI	0.156 (n.s)	1.634	Not Supported
H3c	PL × PK→PI	0.131 (n.s)	1.512	Not Supported
H3d	PR × PK→PI	−0.343**	−3.123	Supported

*P<0.05; **P<0.01; ***P<0.001; n.s: Not significant, C.R: Critical ratio, PA: Product attributes, PS: Pricing strategies, PL: Distribution channels (Place), PR: Promotional Activities, EA: Environmental awareness, PK: Product knowledge, PI: Purchase intention

Keller, 2016; Yoo et al., 2000) that the 4Ps (product attributes, pricing strategies, distribution channels (place), and promotional activities) as the fundamental concept of a marketing strategy influence purchase intent in the EV context. Product attributes provide the strongest influence on purchase intention (b = 5.523), followed by pricing strategies (β = 0.501), distribution channels (place) (β = 0.477), and promotional activities (β = 0.334). These findings are in line with previous research by Wang et al. (2019) that product attributes such as battery life, charging time, and technological features significantly affect consumer adoption willingness of EVs, whereas Hardman et al. (2017) found that the effectiveness of financial incentives in promoting EV adoption. The availability of charging infrastructure and service centers is also vital for boosting consumer willingness to purchase EVs (Funke et al., 2019). This aligns with Bennett et al. (2016) findings on the role of marketing communications in EV adoption.

Environmental awareness showed significant moderating roles in the relationships between product attributes (β = 0.412), pricing strategies (β = 0.305), and purchase intention. These findings are consistent with the studies (Rezvani et al., 2015; Axsen and Kurani, 2013; Laroche et al., 2001) showing that environmental concerns influence consumer attitudes towards EVs. Potential customers who have a higher level of environmental awareness seem to be more likely to appreciate and value the eco-friendly features of EVs. This implies that to enhance the adoption of EVs, firms should focus on communicating environmental benefits to potential buyers. Enhancing the level of environmental awareness in society is also one of the agendas for the government and policymakers to increase EV adoptions in the nation. Interestingly, environmental awareness was found not to significantly moderate

the relationships between distribution channels, promotional activities, and purchase intention. This implies that the impact of distribution channels (place) and promotional activities is consistent across levels of environmental awareness in the Thai market.

Product knowledge (PK) showed a significant negative moderating effect only on the relationship between promotional activities and purchase intention ($\beta = -0.343$) but not found in the other marketing mix elements. This implies that consumers with high product knowledge are less influenced by promotional efforts, which is aligned with the study of Smith and Swinyard (1983). This suggests that marketing initiatives should concentrate more on offering specific, technical information than on broad promotional messaging for consumers with high EV knowledge.

This study provides both theoretical contributions and practical implications. For theoretical contributions, this study extends the application of the marketing mix framework to EV purchase intentions, providing empirical evidence of how the 4Ps influence consumer decisions in this evolving market. Thailand is one of the emerging markets for EVs, and the results of this study extend the body of knowledge in understanding the antecedents affecting EV adoptions. By examining the moderating roles of environmental awareness and product knowledge on the relationship between marketing mix elements and purchase intention, the study provides a new perspective on how those moderating factors strengthen or diminish the impact of marketing strategies towards adoption in the EV market. There are certain practical implications. First, the results highlight how crucial it is to create and promote distinctive EV characteristics, show the long-term financial advantages, and increase the infrastructure for charging EVs to increase consumers' willingness to adopt. Marketing strategies should be customized based on consumers' environmental awareness and product knowledge. Highlighting eco-friendly features could work well for consumers who care about the environment, but giving knowledgeable customers precise technical information might have a greater influence. Second, policymakers can apply these findings to plan effective incentives and regulations to foster environmental awareness and product knowledge. These implications offer a road map for accelerating the adoption of EVs in emerging markets, supporting the objectives of environmentally friendly transportation and preservation.

7. CONCLUSION

This study provides valuable insights into factors influencing EV purchase intentions in Thailand, an emerging market with growing potential for EV adoption. Our findings reveal that all marketing mix elements significantly impact EV purchase intentions, with product attributes and pricing strategies emerging as the strongest predictors. The study also sheds light on the moderating effects of environmental awareness and product knowledge. Environmental awareness strengthens the relationship between product attributes, pricing strategies, and purchase intention, suggesting that eco-conscious consumers are more receptive to the environmental benefits of EVs. Interestingly, product knowledge negatively moderates the impact of promotional activities on purchase

intention, indicating that highly informed consumers are less influenced by general marketing efforts.

Although the study provides useful results and offers valuable implications for EV manufacturers, marketers, and policymakers, there are some limitations to consider. First, the samples for this study were obtained from Thailand. It is important to carefully generalize the outcomes to other emerging markets, as they may differ in terms of culture, economic conditions, and regulatory environments. Secondly, this study employed self-reported data collected through questionnaires. Future research could use other methods, such as in-depth interviews, to gain a better understanding of EV purchase intentions. Third, this study applied a cross-sectional design, which does not account for potential changes in consumer attitudes, intentions, and behavior over time, specifically related to the rapidly evolving EV market. Future studies can conduct cross-cultural research in other emerging markets to improve generalizability. A mixed-methods approach is recommended for deeper insights into consumer motivations.

REFERENCES

Awang, P. (2015), SEM Made Simple: A Gentle Approach to Learning Structural Equation Modeling. Bangi: MPWS Rich Publication.

Axsen, J., Kurani, K.S. (2013), Hybrid, plug-in hybrid, or electric-what do car buyers want? Energy Policy, 61, 532-543.

Bennett, R., Kottasz, R., Shaw, S. (2016), Factors potentially affecting the successful promotion of electric vehicles. Journal of Social Marketing, 6(1), 62-82.

Borden, N.H. (1964), The concept of the marketing mix. Journal of Advertising Research, 4(2), 2-7.

Brucks, M. (1985), The effects of product class knowledge on information search behavior. Journal of Consumer Research, 12(1), 1-16.

Cheung, G.W., Cooper-Thomas, H.D., Lau, R.S., Wang, L.C. (2024), Reporting reliability, convergent and discriminant validity with structural equation modeling: A review and best-practice recommendations. Asia Pacific Journal of Management, 41(2), 745-783.

Coffman, M., Bernstein, P., Wee, S. (2017), Electric vehicles revisited: A review of factors that influence adoption. Transport Reviews, 37(1), 79-93.

Degirmenci, K., Breitner, M.H. (2017), Consumer purchase intentions for electric vehicles: Is green more important than price and range? Transportation Research Part D: Transport and Environment, 51, 250-260.

Flynn, L.R., Goldsmith, R.E. (1999), A short, reliable measure of subjective knowledge. Journal of Business Research, 46(1), 57-66.

Fornell, C., & Larcker, D. F. (1981), Evaluating structural equation models with unobservable variables and measurement error. Journal of marketing research, 18(1), 39-50.

Funke, S.Á., Sprei, F., Gnann, T., Plötz, P. (2019), How much charging infrastructure do electric vehicles need? A review of the evidence and international comparison. Transportation Research Part D: Transport and Environment, 77, 224-242.

Goi, C. L. (2009), A review of marketing mix: 4Ps or more. International journal of marketing studies, 1(1), 2-15.

Gnann, T., Funke, S., Jakobsson, N., Plotz, P., Sprei, F., Karlsson, S. (2018), Fast charging infrastructure for electric vehicles: Today's situation and future needs. Transportation Research Part D: Transport and Environment, 62, 314-329.

Hair, J.F., Black, W.C., Babin, B.J., Anderson, R.E. (2010), Multivariate

Data Analysis. 7th ed. London, United Kingdom: Pearson Education.

Hardman, S., Chandan, A., Tal, G., Turrentine, T. (2017), The effectiveness of financial purchase incentives for battery electric vehicles-A review of the evidence. Renewable and Sustainable Energy Reviews, 80, 1100-1111.

Hawkins, T.R., Singh, B., Majeau-Bettez, G., Strømman, A.H. (2013), Comparative environmental life cycle assessment of conventional and electric vehicles. Journal of Industrial Ecology, 17(1), 53-64.

International Energy Agency (IEA). (2024), Global EV Outlook 2024. Available from: https://www.iea.org/reports/global-ev-outlook-2024

Kotler, P., Keller, K.L. (2016), Marketing Management. 15th ed. London, United Kingdom: Pearson Education Limited.

Laroche, M., Bergeron, J., Barbaro-Forleo, G. (2001), Targeting consumers who are willing to pay more for environmentally friendly products. Journal of Consumer Marketing, 18(6), 503-520.

McCarthy, E.J. (1960), Basic Marketing: A Managerial Approach. Homewood, Illinois: Richard D. Irwin.

Monroe, K.B. (2003), Pricing: Making Profitable Decisions. 3rd ed. United States: McGraw-Hill Education.

Mostafa, M.M. (2007), Gender differences in Egyptian consumers' green purchase behaviour: The effects of environmental knowledge, concern and attitude. International Journal of Consumer Studies, 31(3), 220-229.

Nunnally, J.C., Bernstein, I.H. (1994), Psychometric Theory. 3rd ed. United States: McGraw-Hill.

Okada, T., Tamaki, T., Managi, S. (2019), Effect of environmental awareness on purchase intention and satisfaction pertaining to electric vehicles in Japan. Transportation Research Part D: Transport and Environment, 67, 503-513.

Pamidimukkala, A., Kermanshachi, S., Rosenberger, J.M., Hladik, G. (2024), Barriers and motivators to the adoption of electric vehicles: A global review. Green Energy and Intelligent Transportation, 3, 100153.

Pavlou, P.A., Fygenson, M. (2006), Understanding and predicting electronic commerce adoption: An extension of the theory of planned behavior. MIS Quarterly, 30, 115-143.

Rezvani, Z., Jansson, J., Bodin, J. (2015), Advances in consumer electric vehicle adoption research: A review and research agenda. Transportation Research Part D: Transport and Environment, 34, 122-136.

Rovinelli, R.J., Hambleton, R.K. (1977), On the use of content specialists in the assessment of criterion-referenced test item validity. Dutch Journal of Educational Research, 2(1), 49-60.

Shanmugavel, N., Micheal, M. (2022), Exploring the marketing related stimuli and personal innovativeness on the purchase intention of electric vehicles through Technology Acceptance Model. Cleaner Logistics and Supply Chain, 3, 100029.

Smith, R.E., Swinyard, W.R. (1983), Attitude-behavior consistency: The impact of product trial versus advertising. Journal of Marketing Research, 20(3), 257-267.

The Nation. (2022), Plugging into the Future with EV Mobility. Available from: https://www.nationthailand.com/special-edition/40015527

The Nation. (2024), Thailand's Electrical Vehicle Registrations Surge 380% in 2023. Available from: https://www.nationthailand.com/business/automobile/40034866

Wang, N., Tang, L., Pan, H. (2019), A global comparison and assessment of incentive policy on electric vehicle promotion. Sustainable Cities and Society, 44, 597-603.

Yoo, B., Donthu, N., Lee, S. (2000), An examination of selected marketing mix elements and brand equity. Journal of the Academy of Marketing Science, 28(2), 195-211.

Zeithaml, V.A. (1988), Consumer perceptions of price, quality, and value: A means-end model and synthesis of evidence. Journal of Marketing, 52(3), 2-22.