

An Empirical Study on the Development of New Energy Vehicle Technology and Consumer Car Purchase Behavior

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Abstract

Purpose – The empirical study of the development of new energy vehicle technology on consumers' car purchasing behavior is an important and prospective topic. With the increasing awareness of environmental protection and the increasing importance of sustainable energy development, consumers' willingness to purchase new energy vehicles is gradually increasing. This study aims to explore the impact of the development of new energy vehicle technology on consumer behavior in choosing new energy vehicles, while considering the mediating effect of consumer product attitudes on car buying behavior. Under the concept of green and sustainable development, new energy vehicle technology, as an independent factor, has a direct impact on consumer behavior in choosing new energy vehicles.

Design/Methodology/Approach – Firstly, a comprehensive literature review is conducted on the development of new energy vehicle technology, product attitudes, and consumer purchasing behavior. Based on the evidence and logical chain of previous research, it provides a theoretical basis for proposing research hypotheses and models, and ensures that the research design is built on a solid foundation. Finally, a questionnaire survey was used to conduct empirical analysis on the collected and organized 232 valid data, and linear regression analysis was conducted using SPSS 27.0 to draw conclusions.

Findings – According to empirical research results, it is indicated that: The development of new energy vehicle technology has a positive impact on consumer car buying behavior; The development of new energy vehicle technology has a positive impact on consumer attitudes; Consumer attitudes play a mediating role between the development of new energy vehicle technology and consumer car buying behavior.

Research Implications – With the advancement of new energy vehicle technology, consumers need to make more detailed comparisons and evaluations between traditional fuel vehicles and new energy vehicles when purchasing cars. This is of great significance for understanding consumer decision-making processes and preferences, and also provides reference opinions for the development of new energy enterprises. In addition, the promotion and popularization of new energy vehicles will also be influenced by consumer purchasing behavior. Therefore, studying consumer acceptance and willingness to purchase new energy vehicles can provide important references for the development of the green industry.

Keywords: New Energy Vehicle Technology, New Energy Technology, Product Attitudes, Consumer Purchasing Behavior, Empirical Study

JEL Classifications: Q41, L60, Q54, R41, D12

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I . Introduction

As an important pillar industry of the national economy, the vehicle industry plays a crucial role in the development of the national economy. The rapid development of new energy vehicle technology has had a profound impact on the market share of the vehicle industry. With the global emphasis on sustainable development and the increasing awareness of environmental protection among consumers, new energy vehicles as substitutes for traditional fuel vehicles are gradually being favored by consumers. This article aims to explore the impact of the promotion of new energy vehicle technology on the market share of the vehicle industry through empirical research, in order to provide a basis and reference for relevant decision-making.

II . Literature review

With the advancement of the "dual carbon" goal, new energy technologies have attracted much attention, such as the application of solar energy, wind energy, biomass energy, tidal energy, and geothermal energy technologies, which make important contributions to energy conservation and emission reduction. At the same time, it has also pointed out that new energy technologies still face some challenges, such as economic feasibility, investment return rate, energy storage technology, and energy conversion efficiency. (Li Qiong, Lv Ling, Qian Weiping, 2023).

New energy vehicle technology is a method of producing energy using renewable or clean resources. Especially within the framework of the concept of green and sustainable development, in order to achieve resource conservation and reduce environmental pollution in the process of industrial production development, promoting industrial integration and development has become a new trend in the industry's development (Yu Xiaoning, Yang Yanwei, 2023).

Wang Zhe (2024) believes that the Chinese government's support and investment in the new energy vehicle industry have promoted the rapid improvement of the technological level of domestic cars in the field of new energy vehicles. Through policy support and financial investment, Chinese new energy vehicle companies have made significant breakthroughs in the core areas of "three electric", such as battery technology, motor technology, and electronic control technology, which is improving the performance and competitiveness of the entire vehicle. These measures have laid a solid foundation for the development of China's new energy vehicle industry and injected more vitality into the global new energy vehicle market.

From the perspective of psychological perception, some scholars believe that attitude is an emotion obtained before making a decision, which is the evaluation feeling that an individual can maintain towards a specific object over a period of time (Schiffman L G, Kanuk L L, 2003).

And some scholars also have conducted research from an external perspective and believe that the media, social platforms, and reputation of enterprise products in the dissemination process have an impact on consumer attitudes (Du Weiqiang, Yu Chunling, Zhao Ping, 2011).

Liu Chunling, Sun Biao, and others (2023) believe that in the increasingly fierce market competition and diversified market demand, new energy vehicles not only face competition from traditional fuel vehicles, but also competition among new energy vehicle enterprises. Therefore, marketing strategies driven by consumer psychological behavior have become particularly important for new energy vehicles.

Product attitude refers to the evaluation and emotional inclination of consumers towards a specific product or service, which may be influenced by various factors such as product quality, function, price, brand image, etc. Consumer product attitude can affect their purchase intention and behavior. Therefore, research on product attitude is of great significance for marketing and consumer behavior in the new energy vehicle market. The meaning of product attitude in this article is the emotional inclination of consumers towards the choice of new energy vehicles.

Liu Chunling and Sun Biao et al. (2023) found in the optimal control decision of the new energy vehicle supply chain based on consumer purchasing behavior that the reference price effect has a positive impact on the technological innovation level, advertising promotion level, and consumer satisfaction of new energy vehicle manufacturers, and can improve the profits of the entire supply chain.

Tang Wendi and Yu Sitong et al. (2024) conducted a multiple linear regression analysis on the influencing factors of residents' willingness to purchase new energy vehicles in 16 prefecture level cities in Shandong Province, and found that the various influencing factors included in the two variables of attitude and behavioral intention have a direct positive impact on the willingness to purchase new energy vehicles.

Car buying behavior includes a series of behaviors such as evaluating, comparing, selecting, and making purchasing decisions for different car brands and types. Car buying behavior is influenced by various factors such as individual consumer needs, preferences, economic conditions, and social influences. Therefore, research on car buying behavior is of great significance for the vehicle industry and marketing. The definition of car buying behavior in this study is the behavior and decision-making process of consumers choosing new energy vehicles when purchasing a car.

III .Theoretical models and research hypotheses

1.Theoretical models

This study aims to explore the impact of the development of new energy vehicle technology on consumer behavior in choosing new energy vehicles(For the convenience of research, the behavior of consumers choosing new energy vehicles is referred to as car buying behavior.), while considering the mediating effect of consumer attitudes on car purchasing behavior. Under the concept of green and sustainable development, new energy vehicle technology can have a direct impact on consumer behavior in choosing new energy vehicles as an independent factor.

The theoretical model is as follows:

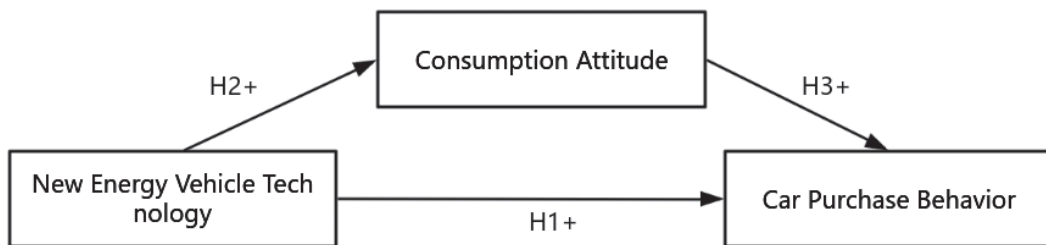


Figure 1. Theoretical Model

2.Research hypotheses

According to the theoretical modeling framework, the following hypotheses are derived:

H1: The development of new energy vehicle technology has a positive influence on consumer car buying behavior.

H2: The development of new energy vehicle technology has a positive influence on consumer attitudes.

H3: Consumer attitudes play a mediating role between the development of new energy vehicle technology and consumer car buying behavior.

IV . Empirical research

This article studies the relationship between the development of new energy vehicle technology, consumer attitudes, and consumer behavior intentions, therefore it is a correlation study. In a natural, non-artificial environment, the field research is conducted in the form of a questionnaire, and the analysis unit is the individual.

1.Definition and measurement of variables

The development of new energy vehicle technology (dependent variable): With the rapid development of global new energy vehicle technology, several new energy vehicle technologies, including energy-saving vehicle technology, pure electric and plug-in hybrid vehicle technology, fuel cell vehicle technology, intelligent connected vehicle technology, power battery technology, lightweight technology, and vehicle manufacturing technology, were set up to seven question items. By setting each question in three aspects of the speed, scale, and innovation of the development of new energy vehicle technology, the detailed situation of each technology is reflected. This study tests the dependent variable of this dimension through seven question items.

Consumer attitude (mediating variable): By understanding new energy knowledge, four dimensions were selected, namely Cognitive Dimension, Affective Dimension, Behavioral Intention Dimension, and Behavioral Dimension, to explain green consumption attitude. There are a total of 10 mediating variables. Among them, there are 2 items in the cognitive dimension, 2 items in the emotional dimension, 3 items in the behavioral intention dimension, and 3 items in the behavioral dimension. Consumer perception of products or services, including product features, brand image, functionality, and performance.

Consumer car buying behavior is taken as the dependent variable. When conducting item analysis, three variables are selected from the aspects of consumer decision-making process, preference influencing factors, and actual actions taken: purchase intention intensity, brand preference, and actual purchase behavior.

2.Questionnaire design

The survey questionnaire includes two aspects: first, the main part of the questionnaire, which includes understanding of the development of new energy vehicle technology, willingness to consume in the automotive industry, and attitudes towards consumption of new energy vehicles; the second is the basic sample demographic information. The questionnaire uses a Likert five component scale, with scores ranging from 1 to 5 for "strongly disagree", "strongly disagree", "uncertain", "somewhat agree", and "strongly agree". The lower the score, the lower the level of agreement for that item. On the contrary, the degree of agreement is higher.

Sampling method and sample description: the research environment is field research, and questionnaires are distributed through low intervention. The survey targets some employees of enterprises and community residents in Shandong, China, and the survey targets are representative.

A total of 250 questionnaires were distributed in this survey, and 232 valid questionnaires were received with an effective response rate of 92.8%. The basic demographic indicators are shown in Table 4.1.

From Table 4.1, it can be seen that the gender ratio distribution of the sample is uniform, and the age range is also between 19 and 40 years old, mostly younger. The educational background is also high school, college diploma, undergraduate or above, with a certain educational background and a high level of acceptance of new technologies. More than 90% of the total sample population have an income of over 3000 yuan. Therefore, the sample size of the questionnaire survey is reasonable and has certain representative significance for the research in this article.

At the same time, all valid questionnaires collected were numbered, and data analysis was conducted using SPSS 27.0 software.

Table 1. Basic sample demographic indicators (N=232)

Sample characteristics	Feature Description	frequency	Mode	percentage %
Gender	A. male	122	A	52.6
	B. female	110		47.4
Age	A. Under 18 years old	20	C	8.62
	B.19-25 years old	30		12.9
	C.26-30 years old	63		27.2
	D.31-40 years old	77		33.2
	E.41 years old and above	52		22.4
qualification	A.Junior high school and below	14	C	6
	B. High school, technical secondary school, vocational high school	86		37.1
	C. Undergraduate, associate, and vocational education	114		49.1
	D. Master's degree or above	18		7.8
monthly income	A. 1000 yuan and below	8	B	3.4
	B.1001—3000 yuan	32		13.7
	C.3001 —5000 yuan	56		24.1
	D.5001 -8000 yuan	44		19.0
	E.8001-10000 yuan	64		27.6
	F.10001 yuan and above	52		22.4
	total	232		100.0

V . Data analysis

1.Validity testing

Using SPSS 27.0 software, factor analysis was conducted on the development of new energy vehicle technology and consumer attitudes towards products, as well as the willingness to purchase green energy vehicles. The KMO of green product information was $0.836 > 0.8$, and the Bartlett sphericity test value was significant ($p < 0.05$), meeting the prerequisite conditions for factor analysis. A total of 2 common factors were extracted, with the first factor explaining 42.396% of the total variance of the original item, the second factor explaining 27.926% of the total variance of the original item, and the cumulative ratio of the two factors explaining 71.322% of the total variance of the original item. According to data analysis, the load of all items on the common factor of consumer attitude and willingness to purchase new energy vehicles exceeds 0.5, indicating that convergent validity has passed the test and that the measurement tool can effectively measure the concept to be measured; All measurement dimensions have loadings on different factors, indicating that the discriminant validity has also passed the test, indicating that the measurement dimensions can be well distinguished from each other.

2.Reliability Analysis

Using SPSS software to conduct reliability tests on the development of new energy vehicle technology, consumer attitudes, and willingness to purchase green energy vehicles. The data is shown in the table below:

Table 2. Reliability Analysis of Green Marketing

Variable Name	Number of question items	Cronbach α Alpha
Development of New Energy Technologies	7	0.860
Consumption Attitude	10	0.725
purchasing behavior	3	0.835

From the above table, it can be seen that the number of question items set for each variable dimension is calculated, and the results are as follows:

The coefficient of Cronbach's α on the Development Dimension of New Energy Vehicle Technology is 0.860; the coefficient of Cronbach's α on Consumer Attitude Dimensions is 0.725; the coefficient of Cronbach's α on the dimensions of consumer car buying behavior is 0.835.

The coefficients of Cronbach's α are all above 0.7, indicating good reliability of the variables. All measurement items of the scale meet the requirements, with good internal consistency and high reliability.

3. Regression analysis

Assumption 1:

H1: The development of new energy vehicle technology has a positive impact on consumer car buying behavior.

Firstly, the mean value of the development of new energy vehicle technology on consumer purchasing behavior was tested for normal distribution by using Nonparametric Test1-SampleK-S. The development of new energy vehicle technology $P > 0.05$ followed a normal distribution, while consumer purchasing behavior $P > 0.05$ followed a normal distribution. Therefore, Pearson correlation coefficient was used.

Conduct correlation analysis, and the results of correlation analysis are shown in Table 3. The correlation coefficient between the average development of new energy vehicle technology and consumer purchasing behavior Pearson is 0.464, and the P-values are all less than 0.001. In the analysis of variance table, $F = 38.048$, and a significance probability is reach to 0.000, which indicates a significant overall regression effect. The regression equation is: Consumer behavior = $0.464 * \text{Development of new energy vehicle technology}$, therefore hypothesis 1 is validated.

Figure 3. The linear regression analysis results of the development of new energy vehicle technology on consumer car purchasing behavior

	Unstandardized Coefficients		Standardized Coefficients	t	Sig	Collinearity Statistics	
	B	Std. Error	Beta			VIF	D—W
Constant	2.842	0.165	-	16.793	0.000	-	-
The average development of new energy vehicle technology	0.832	0.036	0.639	6.167	0.000	1.000	1.000
ANOVA							
Model	Sum of Squares		df	Mean Square	F	Sig	
Regression	5.296		1	5.306	38.048	0.000	
Residual	19.345		140	0.141	-	-	
Total	24.645		139	-	-	-	

Assumption 2:

H2: The development of new energy vehicle technology has a positive impact on consumer attitudes.

The regression analysis results of the development of new energy vehicle technology on consumer attitudes are shown in the table below: in the analysis of variance table, $F = 37.135$, and a significance probability of 0.000, which indicates a significant overall regression effect. The regression equation is: car purchasing behavior = $0.47 * \text{development of new energy vehicle technology}$, so hypothesis 2 is verified.

Figure 3. Linear regression analysis results of the development of new energy vehicle technology on consumer attitudes

		Unstandardized Coefficients		Standardized Coefficients	t	Sig	Collinearity Statistics	
		B	Std. Error	Beta			VIF	D—W
Constant		2.842	0.165	-	16.793	0.000	-	-
Product attitude		0.832	0.036	0.639	6.167	0.000	1.000	1.000
ANOVA								
Model		Sum of Squares		df	Mean Square	F	Sig	
1	Regression	4.179		1	6.306	37.135	0.000	
	Residual	15.298		132	0.141	-	-	
	Total	14.735		137	-	-	-	

Assumption 3:

H3: Consumer attitudes play a mediating role between the development of new energy vehicle technology and consumer car buying behavior. Regression analysis was conducted on the development of new energy vehicle technology and consumer product attitudes, and the results are shown in Table 4. From Table 4, it can be seen that

DW=1.806, close to 2, indicating that there are basically no related issues with the residual sequence in the model. In the analysis of variance table, $F=33.708$, and a significance probability is 0.000, which indicates a significant overall regression effect. From the table below, it can be seen that the overall regression effect is significant.

The regression equation is: behavioral intention=0.060 * development of new energy vehicle technology+0.914 * consumption attitude. Consumer attitudes towards products play a mediating role between the development of new energy vehicle technology and consumer purchasing behavior. Verified hypothesis 3 of this article

Figure 4. Linear regression analysis results on the mediating role of consumer attitudes between the development of new energy vehicle technology and consumer car buying behavior

		Unstandardized Coefficients		Standardized Coefficients	t	Sig	Collinearity Statistics	
		B	Std. Error	Beta			VIF	D—W
Constant		7.946	0.165	-	16.793	0.000	-	-
		0.832	0.036	0.639	6.167	0.000	1.000	1.806
ANOVA								
Model		Sum of Squares		df	Mean Square	F	Sig	
1	Regression	5.296		1	5.306	38.048	0.000	

VI . Research conclusions and countermeasure suggestions

1.research conclusion

Based on the above empirical research, the research conclusions of this article are as follows:

1.The development of new energy vehicle technology has a positive impact on consumer car buying behavior. This indicates that the development of new energy vehicle technology plays an important role in the formation of consumer purchase intention behavior.

2. The development of new energy vehicle technology has a positive impact on consumer attitudes. This indicates that consumers have a positive attitude towards the development of new energy vehicle technology, and they may be more willing to purchase new energy vehicles or use other new energy products. This positive impact may promote the market promotion and development of new energy vehicle technology, and help reduce dependence on traditional energy, thereby promoting environmental protection and sustainable development.

3. Consumer attitudes play a mediating role between the development of new energy vehicle technology and consumer car buying behavior. Consumers holding a positive attitude towards new energy vehicle technology may promote the market promotion and development of new energy products, and their purchasing behavior directly affects the sales and popularization of new energy vehicles. Therefore, consumer attitudes play a connecting and mediating role between the development of new energy vehicle technology and car purchasing behavior.

2.Suggestions for countermeasures

Based on the conclusions of the empirical research mentioned above, the following are some suggestions and opinions:

1. Combining technological innovation with market education

Continuously increasing investment in new energy vehicle technology research and development, ensuring that the performance, range, convenience and safety of charging facilities of new energy vehicles can meet or even exceed consumer expectations, further enhancing consumer confidence. In response to the positive attitude of consumers towards new energy vehicle technology, extensive market education activities should be carried out to promote the advantages of new energy vehicles, including but not limited to energy conservation and emission reduction, cost-effectiveness, and national and local policy support, to strengthen consumer awareness and identification with new energy vehicles.

2. Policy guidance and incentive measures

The government should introduce more targeted support policies, such as extending or adding subsidies for purchasing new energy vehicles, reducing relevant taxes and fees, prioritizing the provision of license plate indicators, and investing in the construction of more public charging facilities, all of which can effectively stimulate consumers' willingness to purchase cars. The government can also formulate long-term development plans for the new energy industry, encourage the coordinated development of the upstream and downstream of the industrial chain, reduce the production cost and terminal selling price of new energy vehicles, and make them more competitive in the market.

3. Brand shaping and word -of -mouth dissemination

By utilizing the positive attitude of consumers towards new energy vehicle technology, car companies should strengthen their professional image in the field of new energy, create high-quality, high-performance, and high-tech new energy vehicle products, and accelerate word-of-mouth dissemination through successful cases and positive user evaluations to enhance consumer purchasing intentions.

4. Personalized and differentiated services

In response to the needs of different consumer groups, more differentiated and personalized new energy vehicle products and services should be provided, such as Vehicles with long driving range for household users and intelligent connectivity functions for young consumers, in order to meet diversified car purchasing needs and further stimulate market potential.

5. Building a Good Consumption Environment

Strengthen the construction and improvement of the after-sales service system for new energy vehicles, provide convenient and efficient maintenance and battery recycling services, and dispel consumer concerns about the after-sales process of new energy vehicles. Promote the construction of a new energy ecosystem as a whole in society, including optimizing the layout of charging station networks, mechanisms for phasing out and updating old vehicles, etc., to make the entire lifecycle of new energy vehicles more green and environmentally friendly, reflecting their value in sustainable development.

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