

Article

The Impact of New Energy Vehicle Product Attributes on Consumer Purchase Intention in the Backdrop of Sustainable Development Goals

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Abstract: In the backdrop of the ‘dual carbon goal’, which aims to promote sustainable development of China, adoption of new energy vehicles (NEVs) is an important measure to help improve the environment, so it is of great significance to investigate the purchase intention of NEVs. Previous studies have established that subsidies and various product attributes could affect consumers’ purchase intention toward NEVs. As government subsidies have been on the decline in recent years, product attributes of NEVs need to be given more attention. However, there have been limited studies that quantitatively analyze the impact of product attributes of NEVs on purchase intention. Therefore, to fill this gap and help further expand the NEV market, this study investigated consumers’ adoption of NEVs empirically from the perception of product attributes. A questionnaire survey and structural equation model (SEM) were used for data collection and analysis. The results indicate that (1) both the functional and symbolic attributes of NEVs had a significant positive impact on consumers’ purchase intention; (2) both the functional and symbolic attributes of NEVs had a significant positive impact on consumers’ purchase intention through consumers’ perceived value; and (3) citizens’ environmental awareness positively moderated the relationship between products attributes and purchase intention. According to the results, to meet consumers’ needs of daily driving and self-image expression, new energy vehicle enterprises need to focus on improving the products in both functional and symbolic aspects by using various marketing strategies.

Keywords: new energy vehicles; product attributes; purchase intention; environmental awareness; structural equation model; sustainable development goals



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1. Introduction

The prosperity of China’s transportation sector brought about by the country’s rapid economic development has exerted pressure on the environment in recent years. As an important means of transport, private cars have become pervasively common. However, a large number of private vehicles with combustion engines consume fossil fuels, such as petroleum, which is suggested to be exhausted in the near future, and the emissions from fossil fuels can be harmful to human health [1].

Under this condition, China has proposed a dual carbon plan, which requires society to achieve a carbon peak by 2030 and carbon neutrality by 2060. Different sectors of society are also searching for alternatives to fossil fuels and taking necessary measures to develop instruments that can help change and improve the effects that human activities have had on the environment [1,2]. In addition, green investment in new energy has become the focus of development [3]. Adoption of new energy vehicles (NEVs) is one of the important measures to improve environmental issues and help reach the dual carbon goal.

It is a good trend that an increasing number of people have started to use NEVs. According to the report of the MIIT of China, by the end of 2020, the number of new energy vehicles in China reached 4.92 million, basically fulfilling the target quantity of 5 million set

in the Energy Conservation and New Energy Vehicle Development Planning (2012–2020). The popularity of NEV adoption is mainly because of subsidy support [4,5] and unique attributes of the products themselves [6].

However, subsidy supports have been on the decline recently; therefore, the products' attributes may become the main factor affecting consumers' purchasing. It is of great importance to study the impact of product attributes of new energy vehicles on consumers' purchase intention as the profound understanding of this research question can improve consumers' adoption and thus further expand the market.

Previous research has established that consumers will purchase NEVs based on many factors, such as the support of subsidy incentives, perception of innovation and environmental awareness [7–9]. However, the analyses of how product attributes influence consumers' purchase intention of NEVs are mainly descriptive, and the relevant quantitative analysis is still limited.

To fill this gap, this paper analyzes the consumers' adoption of NEVs from the perception of product attributes, using a structural equation model (SEM) and data collected from a questionnaire survey. The importance and originality of this study are that it provides insights into NEV uptake through an empirical analysis. This study also contributes to a better understanding of consumers' attitude toward NEVs' attributes and can help NEV enterprises improve their manufacturing and marketing strategies.

The remaining parts of the paper proceed as follows. Section 2 explains the definition of variables, hypothesizes the potential relationships among them, and proposes the conceptual framework. Section 3 describes the research design and methodology. The fourth section describes the empirical analysis and results, followed by interpretation of results, implications and limitations in Section 5; Section 6 concludes the report.

2. Theoretical Basis and Research Hypothesis

2.1. Product Attributes and Purchase Intention

(1) Product attributes

In terms of the definition of product attributes, different definitions are given in various fields. For example, some stated that product attributes were characteristics that could meet consumers' needs, or more specifically, those internal and external characteristics of products. Philip Kotler proposed that product attributes were the characteristics necessary to meet the product or service functions that consumers seek [10]. Considering the definitions in previous studies, we define product attributes in this context as the combination of internal and external characteristics of new energy vehicles, which is a necessary feature to meet consumer demand. In terms of the classification of this concept, most studies divided it into functional attributes and hedonic attributes. For example, Dhar and Wertenbroch [11] pointed out that consumers may care about both practical features such as fuel consumption and hedonic features such as design when choosing new cars. Miyazaki et al. [12] suggested that product attributes can be divided into internal and external attributes. Internal attributes are physical components that cannot be separated from products, while external attributes mainly refer to price, country of origin, etc. In this study, product attribute of NEVs are divided into functional attributes and symbolic attributes by referring to the study of Yang Yan et al. [13] on durable goods.

(2) Purchase intention

Intention originated in the field of psychology. It refers to the probability of taking a specific action [14]. Purchase intention can be understood as the probability of consumers following a purchasing behavior. Similar definitions have been given in previous studies [15,16].

The relationship between product attributes and purchase intention has been previously examined in studies about traditional fuel vehicles. Fan Lei [17] proved that product attributes of family cars can increase consumers' willingness to purchase; WWu Shuilou et al. [18] also found that the functional attributes of cars can promote purchase intention through brand

equity. NEVs are also a kind of vehicle. Consumers may refer to traditional vehicles in making purchasing decisions, so we assume that:

H1a: *The functional attributes of NEVs have a significant positive impact on consumers' purchase intention.*

In addition to the functional attributes, symbolic stimulus may also affect the purchase intention of NEVs. Consumers owning a hybrid vehicle might be thought of as “mature, intelligent and promising” in California as people would associate NEVs with the concept of environmental protection [19]. Skippon and Schuitema [20] found that people would give certain symbolic meaning to NEVs as they would consider those who drive NEVs as having the sense of responsibility. In addition, when products' traits could match consumers' subjective perceptions of themselves and others' perceptions of them to a high degree, the purchase intention could be enhanced [21]. Therefore, we propose hypothesis H1b:

H1b: *The symbolic attributes of NEVs have a significant positive impact on consumers' purchase intention.*

2.2. Product Attributes and Perceived Value

Peter F. Drucker initially proposed that perceived value refers to the worth of the product perceived by customers through feeling and analysis. After that, Porter, Monroe and alternative students projected understanding perceived worth from the attitude of tradeoff between gains and losses [22,23]. Woodruff emphasizes that perceived value also includes the experience and process of purchasing products [24]. From this, we can see that perceived value is the subjective feeling of customers, involving the balance of interests and emotional experience of customers. Sheth and Newman earlier divided the dimensionality of perceived value into five dimensions (functional value, conditional value, social value, emotional value and cognitive value) [25]. Sweeney and Soutar improved it and developed the classic four-dimensional scale (quality value, emotional value, price value, social value) [26]. This paper also mainly refers to this classification method.

According to the above content, consumers buy products not only to obtain the product itself but also to obtain the value brought by the product. The product is the carrier of value. At the same time, the purchase of customers can reflect the attributes and interests they care about. Product attributes are important factors that determine the perceived value of consumers [27]. For example, Cho et al. pointed out that product quality, price, convenience and other factors will affect customer perceived value. Min Meimei found that product brand, packaging and so on can better reflect the social status of consumers [28]. As a result, consumers' positive perception of various product attributes will have an impact on their perceived value. Based on the above analysis and the dimensional division of product attributes and perceived value in this paper, this paper proposes the following hypothesis:

Peter F. Drucker first proposed that perceived value refers to the value of products that consumers perceive through evaluation. Later, Porter and Monroe [29] and other scholars proposed to understand perceived value from the perspective of balancing gains and losses, while Woodruff [24] emphasized that perceived value also included the experiencing and process of purchasing products. It could be summarized that perceived value is the subjective feeling of customers, involving the balance of interests and emotional experience.

As for the dimensions of perceived value, Sheth and Newman [25] divided it into five dimensions (functional value, conditional value, social value, emotional value and cognitive value). Sweeney and Soutar [26] improved it and developed the classic four-dimensional scale (quality value, emotional value, price value and social value). We employed this classic classification method for research.

It can be seen from the above that consumers purchase products not only to obtain the product itself, but also hope to obtain the value brought by the product. The product is the carrier of its value. At the same time, the customers' purchase can reflect the attributes and interests they care about. Product attributes are important factors that determine consumer perceived value. Therefore, consumers' positive cognition of product attributes may have an impact on their perceived value, so we assume that:

H2a: *The functional attributes of NEVs have a significant positive impact on quality value.*

H2b: *The functional attributes of NEVs have a significant positive impact on emotional value.*

H2c: *The functional attributes of NEVs have a significant positive impact on price value.*

H2d: *The functional attributes of NEVs have a significant positive impact on social value.*

H2e: *The symbolic attributes of NEVs have a significant positive impact on quality value.*

H2f: *The symbolic attributes of NEVs have a significant positive impact on emotional value.*

H2g: *The symbolic attributes of NEVs have a significant positive impact on price value.*

H2h: *The symbolic attributes of NEVs have a significant positive impact on social value.*

2.3. Perceived Value and Purchase Intention

Existing research suggests that perceived value is a crucial antecedent variable of purchase intention [26,30]. Perceived quality value is the utility obtained by comparing the quality consumers perceived with the quality consumers expected, and it is consumers' overall judgment of the superiority of the products. Previous studies have found in various context that higher perceived quality could improve customers' purchase intention [31,32].

The quality of automobile products is very important. As a new type of vehicle, consumers would also give much attention to its quality before purchasing. Therefore, we propose hypothesis H3a:

H3a: *Consumers perceived quality value has a significant positive impact on purchase intention.*

Price value is the utility brought to consumers through the reduction in short-term or long-term cost. Perceived price value is also considered to positively affect purchase intention [33]. The special structure of new energy vehicles can enable consumers to reduce some cost during their use. By reducing the cost of holding and using, consumers can feel the long-term benefits of purchasing NEVs, which will help enhance their willingness to buy. Thus, we propose hypothesis H3b:

H3b: *Consumers perceived price value has a vital positive impact on purchase intention.*

Emotional value is the utility produced by the emotion brought by the product. Consumers buy and use products not only to obtain the utility of functional price but also to obtain emotional satisfaction. Kato found that emotional value has a significant impact on brand preference in Japan [34]. New energy vehicles often have the advantages of fast acceleration and low driving noise; while saving some fuel costs, consumers may have a pleasant feeling when driving. Therefore, hypothesis H3c is proposed in this paper.

Emotional value is the utility produced by the emotion brought by the product. Consumers not only purchase and use products to obtain the function and price utility; they also hope to acquire emotional satisfaction. New energy vehicles often have the advantages of fast acceleration, little driving noise, and fuel-savings, so consumers might feel pleasant when they drive NEVs. Thus, we propose hypothesis H3c:

H3c: *Consumers perceived emotional value has a significant positive impact on purchase intention.*

When the product can help consumers show their personal image or status and gain social recognition, consumers can experience a sense of achievement and thus perceive social value. New energy vehicles are characterized by features of environmental protection

and high-tech. Consumers may believe that buying NEVs can reflect their responsible attitude toward the environment and their pursuit of fashion. Based on this, hypothesis H3d is proposed:

H3d: *Consumers perceived social value has a significant positive impact on purchase intention.*

2.4. Mediating Effect of Perceived Value

Previous studies have shown that perceived value could have a significant impact on purchase intention and purchase intention is due to the value of products or services. In addition, perceived value was widely believed to an internal perception, and consumers would form judgments and take actions based on their knowledge and perception of the products. Thus we assume that:

H4a: *Consumers perceived quality value plays a mediating role between functional attributes and purchase intention of NEVs.*

H4b: *Consumers perceived emotional value plays a mediating role between functional attributes and purchase intention of NEVs.*

H4c: *Consumers perceived price value plays a mediating role between functional attributes and purchase intention of NEVs.*

H4d: *Consumers perceived social value plays a mediating role between functional attributes and purchase intention of NEVs.*

H4e: *Consumers perceived quality value plays a mediating role between symbolic attributes and purchase intention of NEVs.*

H4f: *Consumers perceived emotional value plays a mediating role between symbolic attributes and purchase intention of NEVs.*

H4g: *Consumers perceived price value plays a mediating role between symbolic attributes and purchase intention of NEVs.*

H4h: *Consumers perceived social value plays a mediating role between symbolic attributes and purchase intention of NEVs.*

2.5. Moderating Effect of Citizens' Environmental Awareness

Gadenne et al. [35] studied the factors affecting environmental protection behavior and found that the stronger the environmental awareness of consumers, the more willingness they have to purchase green products such as green energy. By introducing environmental awareness to the theory of planned behavior, Skallerud et al. [36] found that consumers with environmental awareness were more supportive of sustainable consumption. NEVs are products promoted by the country in the context of sustainable development goals, and their purchase intention may also be affected by environmental awareness. Thus we assume that:

H5a: *Citizens' environmental awareness plays a positive moderating role between functional attributes and purchase intention.*

H5b: *Citizens' environmental awareness plays a positive moderating role in symbolic attributes and purchase intention.*

According to the hypotheses listed above, this study puts forward in Figure 1 the theoretical model.

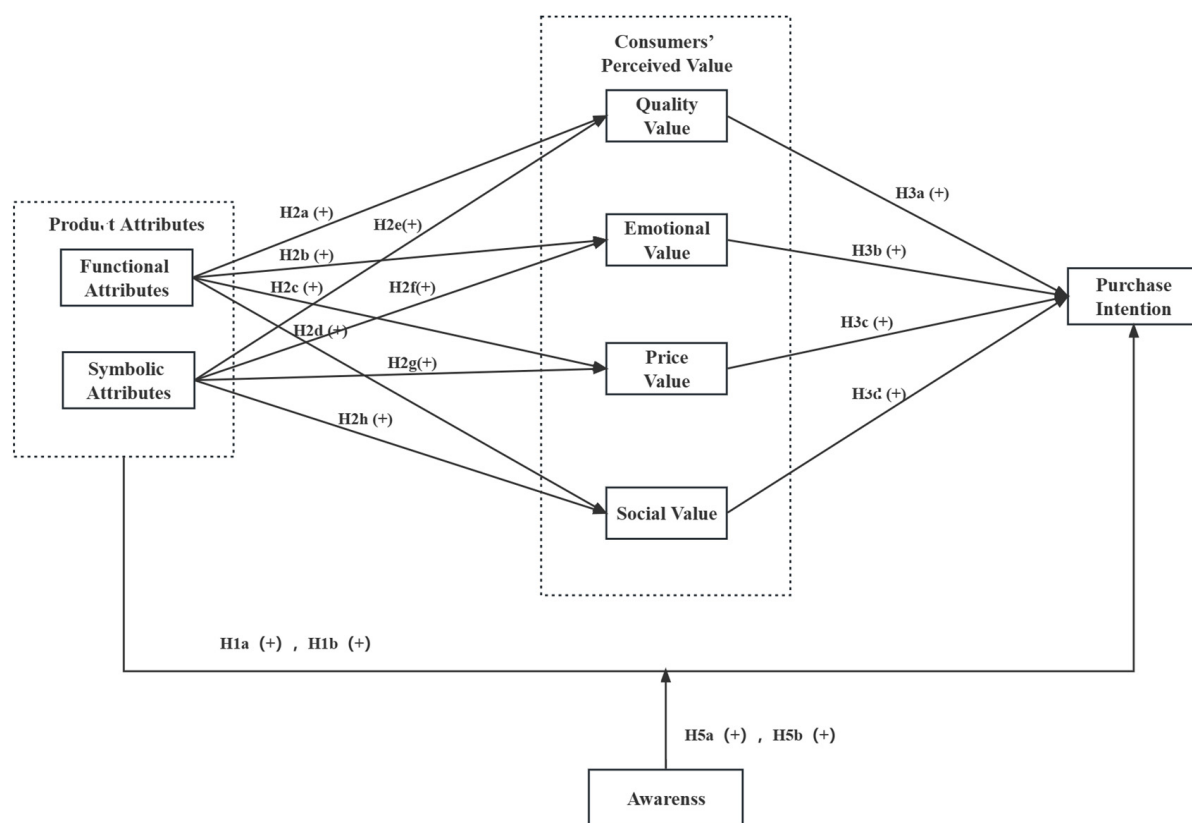


Figure 1. Theoretical model.

3. Study design

3.1. Variable Measurement

In this paper, the product attributes of new energy vehicles are taken as the independent variable, consumers' perceived value as mediating variable, purchase intention as dependent variable, and citizen awareness of environmental protection is introduced as moderating variable. All variables were measured by referring to the authoritative scales proposed or used by previous research, and they were modified according to the specific context of this paper.

(1) Product Attribute (PA)

Based on the classification of product attributes proposed by Yang Yan et al. [13], this paper considered two kinds of attributes of NEVs, functional attributes (FA) and symbolic attributes (SA). The measurement of functional attributes is based on the scales of Dhar and Wertenbroch [11,35], with a total of five items. The measurement of symbolic attributes is based on the scales of Du Yanqing [37] and Liu et al. [38], with a total of four items.

(2) Perceived Value (PV)

In this study, perceived value is defined as the value brought by products that consumers feel through feeling and evaluation. It is divided into the four dimensions (quality value, emotional value, price value, social value) according to the 2001 study by Sweeney and Soutar. A total of five items were derived from the study of Sweeney and Soutar [26] and for the measurement of quality value. Sweeney and Soutar's study was also referred to in constructing the measurement of the four items for emotional value. The three measurement items of price value study were derived from Chen Jie's study (2010) [39]. The scale of Sweeney and Soutar [26] and Liu [38] (2020) is used to measure social value, with a total of five items.

(3) Purchase Intention (PI)

In this paper, purchase intention is measured by the scale developed by Dodds et al. [30], which consists of three items.

(4) Environmental awareness (EA)

Environmental awareness is considered as a person's overall understanding of environmental issues, including views and sensitivity to environmental issues. Environmental awareness is studied by referring to the scales of Carlsson-Kanyama (2005) [40], with a total of four items.

3.2. Questionnaire Structure

A Likert five-level scale was used to measure consumers' attitudes toward questions in the questionnaire. For the options of each question, 1 to 5 points were given as the answer ranged from "strongly disagree" to "strongly agree".

3.3. Data Collection

After designing the scale, the questionnaire was distributed on the online questionnaire platform 'wenjuanxing' for data collection.

As the questionnaire involves content about the use or understanding of new energy vehicles, the online questionnaire was distributed to those who had bought NEVs or have a tendency to buy NEVs since they usually have more knowledge of the products and may find it much easier and be willing to answer the questions. The data collection process lasted from 8 February 2022 to 22 February 2022. A total of 496 responses were received. After deleting the responses with the answer "No" in the filter question (Are you considering purchasing a new energy vehicle or have you purchased a new energy vehicle?), 423 questionnaires were finally used for analysis and research, contributing to the effective rate of 85.28%.

4. Empirical Analysis and Hypothesis Testing

4.1. Descriptive Statistics

Descriptive statistics of the sample are shown in Table 1. The proportions of men and women are 53.43% and 46.57%, respectively, indicating a balanced gender distribution in our sample. In terms of age characteristics, there are respondents in all age groups, and most of them are in the age range of 25 to 45 years old. A majority of respondents live in first- (41.37%) and second-tier cities (33.57%) while only 16.31% of respondent residences are in third- and fourth-tier cities. As for education level, 29.31% and 26.95% of the respondents had a bachelor's degree or above, suggesting that the respondents included in the sample had comparatively high education levels. Most respondents had an annual household income of 250,000 to 300,000 yuan, accounting for 32.15% of the whole sample. Concerning occupation, the respondents working as company employees took up a percentage of 50.83%; there were also 18.44% staff of government agencies and 13.00% of private owners included. The occupational distribution of the sample was relatively comprehensive. In addition, the respondents of this questionnaire were also consumers of various types of NEVs and should have the basic knowledge to answer relevant questions.

Descriptive statistics of the variables are shown in Table 2. It can be observed that the functional attributes (FA) were positively correlated with four dimensions of perceived value: quality value (QV) ($R = 0.185, p < 0.01$), emotional value (EV) ($R = 0.225, p < 0.01$), price value (PV) ($R = 0.215, p < 0.05$) and social value (SV) ($R = 0.110, p < 0.05$). The symbolic attribute (SA) was also significantly positively correlated with the above four dimensions of perceived value ($R = 0.106, p < 0.1$; $R = 0.121, p < 0.05$; $R = 0.091, p < 0.1$; $R = 0.153, p < 0.05$). There was also a significant positive correlation between functional attributes (FA), symbolic attributes (SA) and purchase intention (PI) ($R = 0.294, p < 0.01$; $R = 0.217, p < 0.01$). The four dimensions of perceived value were also significantly positively correlated with purchase intention (PI) ($R = 0.261, p < 0.05$; $r = 0.232, p < 0.01$; $r = 0.258, p < 0.01$; $r = 0.272, p < 0.01$). These results provide preliminary support and the basis for testing the hypotheses proposed above.

Table 1. Descriptive statistics of the sample.

Sample Characteristics	Eigenvalue	Number of Samples	Percentage				
Gender	Male	226	53.43%	Annual household income level (RMB)	<250,000	97	22.93%
	Female	197	46.57%		250,000–300,000	107	25.30%
Age	<25	71	16.78%		300,000–400,000	136	32.15%
	25–35	141	33.33%		>400,000	83	19.62%
	36–45	127	30.03%	Occupation	Company staff	215	50.83%
	46–50	53	12.53%		Private owners	55	13.00%
	Over 50	31	7.33%		Staff of government agencies/institutions	78	18.44%
Usual place of residence	First-tier cities	175	41.37%		Freelance	44	10.40%
	Second-tier cities	142	33.57%		Others	31	7.33%
	Third- and fourth-tier cities	69	16.31%	Types of new energy vehicles considered or purchased	Pure electric vehicle	185	43.74%
	Others	37	8.75%		Hybrid electric vehicle	164	38.77%
	High school or below	84	19.86%		Plug-in hybrid electric vehicles	54	12.76%
Education level	Junior college	101	23.88%		Others	20	4.73%
	Undergraduate	124	29.31%				
	Master and above	114	26.95%				

Source: compiled by the authors.

Table 2. Descriptive statistics of variables.

	Mean	Sd	FA	SA	QV	EV	PV	SV	PI	EA
FA	3.544	0.510	1.000							
SA	3.557	0.530	−0.025	1.000						
QV	3.545	0.494	0.185 ***	0.106 *	1.000					
EV	3.532	0.388	0.225 ***	0.121 **	0.061	1.000				
PV	3.510	0.522	0.215 ***	0.091 *	0.057	0.068	1.000			
SV	3.467	0.546	0.110 **	0.153 **	0.175 ***	0.013	0.043	1.000		
PI	3.695	0.686	0.294 ***	0.217 ***	0.261 ***	0.232 ***	0.258 ***	0.272 ***	1.000	
EA	3.566	0.584	0.090 ***	−0.046	−0.030	0.003	0.117	0.023	0.160 ***	1.000

Note: * indicates $p < 0.1$, ** indicates $p < 0.05$, *** indicates $p < 0.01$; data analysis calculated by RStudio's validity test.

In this paper, RStudio was employed to test the construct validity, convergent validity and discriminant validity. The construct validity results showed that $\chi^2/DF = 1.044$, which is greater than 1 and less than 3; CFI = 0.998 > 0.9; TLI = 0.998 > 0.9; SRMR = 0.033 < 0.05; RMSEA = 0.004 < 0.05, indicating the scale has ideal construct validity. Convergent validity is mostly tested through CR (composite reliability) and AVE (average variance extraction). Generally, the internal consistency of each dimension is considered high when CR is over 0.7; values between 0.36 and 0.5 is the acceptable range for AVE according to Zhiqiang Zhang and Zheng Lei [41] and Nan Yin [42]. From the results given in Table 3, it can be seen that the convergent validity of the scale is acceptable. Discriminative validity is used to explain the ability to distinguish between different constructs. The usual way to judge whether the discriminant validity meets the standards is to check whether the square root of AVE for every dimension is larger than the correlation between this dimension and other dimensions. After calculation, the correlation between dimensions was a smaller amount than the root of the AVE for every dimension, indicating that the scale has sensible discriminant validity.

Table 3. Reliability and convergent validity analysis.

Variable Name	Dimension	Title Number	Evaluation Content	Cronbach's α	CR	AVE
Product attributes	Functional attributes	FA1	New energy vehicles require lower fuel consumption.	0.81	0.809	0.460
		FA2	The battery of new energy vehicles has stronger endurance.			
		FA3	New energy vehicles have sufficient power.			
		FA4	New energy vehicles are safer.			
	Symbolic attribute	FA5	New energy vehicles generate less noise when driving.	0.79	0.795	0.473
		SA1	Driving a new energy vehicle can show others that I care about the environment.			
		SA2	Driving a new energy vehicle can show others that I am contributing to reducing carbon emissions.			
		SA3	Driving a new energy vehicle can show others that I enjoy the benefits of technological innovation.			
Perceived value	Quality value	SA4	Driving a new energy vehicle can show others that I am at the forefront of innovation.	0.84	0.836	0.508
		QV1	New energy vehicles bear stable quality.			
		QV2	The quality level of new energy vehicles is acceptable.			
		QV3	New energy vehicles are well made.			
	Emotional value	QV4	New energy vehicles generate fewer failures.	0.81	0.861	0.512
		QV5	New energy vehicles have longer operating life.			
		EV1	Driving a new energy vehicle makes me feel happy.			
		EV2	Driving a new energy vehicle makes me feel at ease.			
	Price value	EV3	Driving a new energy vehicle makes me feel comfortable.	0.75	0.750	0.502
		EV4	I feel good when I drive a new energy vehicle.			
		PV1	New energy vehicles reduce fuel consumption and maintenance costs, which is economically reasonable in the long run.			
		PV2	The country provides certain financial subsidies, which makes me feel that the price is within the acceptable range.			
Perceived value	Social value	PV3	New energy vehicles provide value that matches their price.	0.83	0.825	0.486
		SV1	Driving a new energy vehicle can show personality.			
		SV2	Driving a new energy vehicle can leave a good impression on others.			
		SV3	Driving a new energy vehicle can improve other people's perception of me.			
		SV4	Driving a new energy vehicle gives me social recognition.			
Purchase intention	Purchase intention	SV5	Driving a new energy vehicle can make others feel that I am socially responsible.	0.80	0.804	0.578
		PI1	I will consider buying a new energy vehicle.			
		PI2	I am willing to buy a new energy vehicle.			
Citizens' environmental awareness	Citizens' environmental awareness	PI3	I am happy to recommend others to buy new energy vehicles.	0.84	0.838	0.564
		EA1	I think saving energy is very important for environmental protection.			
		EA2	I think it is important to buy environmentally friendly products for environmental protection.			
		EA3	I will avoid buying products that pollute the environment.			
		EA4	When I have to make a choice between two equivalent products, I will choose the one that is less harmful to the environment.			

Source: authors calculations.

4.2. Structural Equation Modeling and Model Fit Test

Structural equation modeling is a statistical analysis method in social sciences. In management, psychology and other disciplines, some variables cannot be directly measured, such as degree of satisfaction, purchase intention, etc., but can only be indirectly measured with some explicit indicators. A structural equation model (SEM) can simultaneously manage these potential variables and their observable indicators. In this study, because the key variables—product attributes, perceived value and purchase intention—can hardly be measured directly or by a single indicator, SEM is used to test the relationship among them.

The lavaan program package in RStudio was employed to construct the structural equation model shown in Figure 2 and to test the fitting indexes of the model. The fitting results showed that $\chi^2/DF = 1.035$, which is greater than 1 and less than 3; CFI = 0.997 > 0.9; TLI = 0.996 > 0.9; SRMR = 0.037 < 0.05; RMSEA = 0.009 < 0.08. All of the indexes met the recommended standards, and model is therefore well-fit.

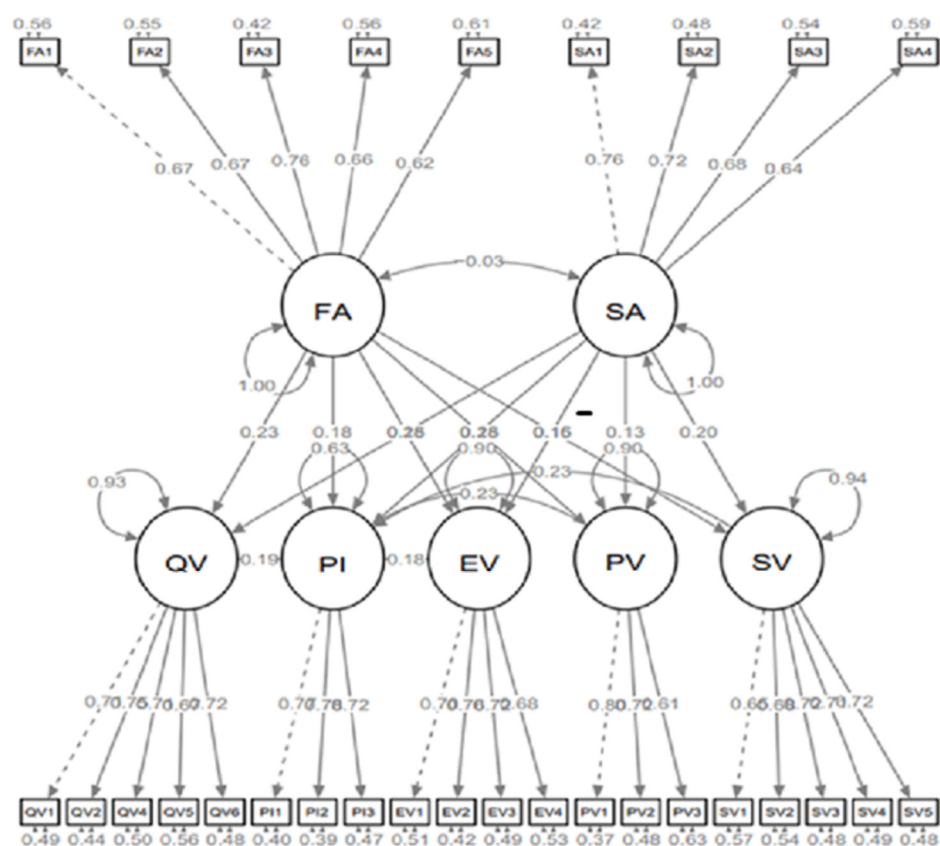


Figure 2. Structural equation model.

4.3. Standardized Path Coefficient Test

The standardized path coefficients between variables were calculated in RStudio and thus verifying some of the assumptions. According to Table 4, the standardized path coefficient from functional attributes to purchase intention was 0.205, $p < 0.01$, suggesting that the functional attributes of NEVs had a significant positive impact on purchase intention. This proved the first hypothesis, H1a. The standardized path coefficient from symbolic attributes to purchase intention was 0.159, $p < 0.01$, indicating that the symbolic attributes of NEVs had a significant positive effect on purchase intention H1b and could be proved. The standardized path coefficients from functional attributes to quality value, emotional value and price value were 0.225, 0.295 and 0.305, respectively, with p values all less than 0.001. This showed that the functional attributes of NEVs had a significant positive impact on these three perceived values and that H2a, H2b and H2c were supported. The standardized path coefficient from functional attributes to social value was 0.145, $p < 0.05$, indicating

that functional attributes also have a significant positive impact on social value, suggesting that H2d would hold. The standardized paths coefficients from symbolic attributes to emotional value and social value were 0.158 and 0.182, respectively, and the corresponding p value was smaller than 0.01; that is, the symbolic attributes of NEVs had a significant positive impact on emotional value and social value, indicating that H2f and H2h could be supported. At the same time, the standardized path coefficients of symbolic attributes to quality value and price value were 0.135 and 0.130, respectively, with p value smaller than 0.05, indicating that H2e and H2g could be supported.

Table 4. Standardized path coefficients and hypothesis testing.

Path	Standardized Path Coefficients	S.E.	P	Whether Hypothesis Is Supported
Functional Attributes → Purchase Intention	0.205	0.070	**	Yes
Symbolic Attributes → Purchase Intention	0.159	0.061	**	Yes
Functional Attributes → Quality Value	0.225	0.059	***	Yes
Functional Attributes → Emotional Value	0.295	0.067	***	Yes
Function Attributes → Price Value	0.305	0.067	***	Yes
Functional Attributes → Social Value	0.145	0.057	*	Yes
Symbolic Attributes → Quality Value	0.135	0.057	*	Yes
Symbolic Attributes → Emotional Value	0.158	0.061	**	Yes
Symbolic Attributes → Price Value	0.130	0.062	*	Yes
Symbolic Attributes → Social Value	0.182	0.056	**	Yes
Quality Value → Purchase Intention	0.221	0.069	***	Yes
Emotional Value → Purchase Intention	0.189	0.063	**	Yes
Price Value → Purchase Intention	0.245	0.067	***	Yes
Social Value → Purchase Intention	0.273	0.069	***	Yes

Note: * indicates $p < 0.05$, ** indicates $p < 0.01$, and *** indicates $p < 0.001$.

The standardized path coefficients from quality value, price value and social value to purchase intention were 0.221, 0.245 and 0.273, respectively, p smaller than 0.001, while the standardized path coefficient from emotional value to purchase intention was 0.189, p less than 0.01, indicating that hypotheses H3a, H3b, H3c and H3d could be supported.

4.4. Testing of Mediating Effect

The mediation effect is tested with bootstrap samples with 5000 sampling times in RStudio; the results are shown in Table 5.

Table 5. Testing of mediating effect.

Indirect Effect	Boot.Est	Boot.S.E.	Boot.LLCI	Boot.ULCI
Functional Attribute → Quality Value → Purchase Intention	0.050	0.021	0.018	0.101
Functional Attribute → Emotional Value → Purchase Intention	0.056	0.023	0.020	0.110
Functional Attributes → Price Value → Purchase Intention	0.075	0.026	0.033	0.139
Functional Attribute → Social Value → Purchase Intention	0.040	0.018	0.012	0.086
Symbolic Attribute → Quality Value → Purchase Intention	0.030	0.015	0.008	0.070
Symbolic Attribute → Emotional Value → Purchase Intention	0.030	0.015	0.007	0.069
Symbolic Attribute → Price Value → Purchase Intention	0.032	0.017	0.006	0.075
Symbolic Attribute → Social Value → Purchase Intention	0.050	0.019	0.021	0.098

The 95% confidence interval corresponding to the indirect effect of the functional attributes (FA) on the purchase intention through the four dimensions of perceived value (QV, EV, PV, SV) did not contain 0, which meant that there was a mediating effect. H4a to H4d were supported. Similarly, 95% confidence interval corresponding to the indirect effect of symbolic attributes (SA) on purchase intention through the four dimensions of perceived value (QV, EV, PV, SV) also did not contain 0, so the mediating effect existed, supporting H4e to H4h.

The 95% confidence intervals corresponding to the indirect effect of symbolic attribute (SA) on purchase intention through the four dimensions of perceived value (QV, EV, PV, SV) did not contain 0, providing evidence for the existence of mediating effect and thus supporting H4e to H4h. Additionally, as the direct effect of functional attributes on purchase intention (FA-PI) and the direct effect of symbolic attributes on purchase intention (SA-PI) were significant, it can be inferred that the mediating effect of functional attributes and symbolic attributes on purchase intention through four perceived values were partial mediation.

4.5. Testing of Moderating Effect

By performing regression in RStudio, hypotheses were tested showing that citizens' environmental awareness positively moderates the relationship between functional attributes and purchase intention, and positively moderates the relationship between symbolic attributes and purchase intention. The results are shown in Table 6. To avoid multicollinearity, the variables involved were centralized before generating the interaction terms.

Table 6. The moderating effect of citizens' environmental awareness.

	Model 1	Model 2		Model 3	Model 4
(Intercept)	2.15 ***	2.13 ***	(Intercept)	2.30 ***	2.29 ***
Functional Attributes (FA)	0.32 ***	0.32 ***	Symbolic Attribute (SA)	0.25 ***	0.25 ***
Environmental Awareness (EA)	0.11 **	0.11 **	Environmental Awareness (EA)	0.14 ***	0.14 ***
FA × EA		0.16 *	SA × EA		0.25 ***
F	24.38 ***	17.77 ***	F	17.16 ***	15.50 ***
R ²	0.10	0.11	R ²	0.08	0.09
ΔR ²		0.01 *	ΔR ²		0.01 ***

Note: * indicates $p < 0.05$, ** indicates $p < 0.01$, and *** indicates $p < 0.001$.

When examining the potential moderating effect of citizens' environmental awareness on the relationship between functional attributes (FA) and purchase intention (PI), purchase intention was taken as the dependent variable, and citizens' environmental awareness was added to establish model 1. On this basis, the interaction term FA × EA was then added to establish model 2. It can be seen from the results that there was a significant change in R² from model 1 to model 2, indicating that the explanatory power of the model was enhanced after adding the interaction term. At the same time, it can be seen that the interaction term FA × EA had a significant positive impact on purchase intention (coefficient = 0.16, $p < 0.05$), and environmental awareness had a positive moderating effect on the relationship between functional attributes on purchase intention. This supported H5a.

When testing the possible moderating effect of citizens' environmental awareness on the relationship between symbolic attributes (SA) and purchase intention (PI), we built model 3 with purchase intention and environmental awareness. Model 4 was constructed by adding the interaction term SA × EA. It can be seen that from model 3 to model 4, R² changes significantly, and the interaction term had a significant positive impact on purchase intention (coefficient = 0.25, $p < 0.001$). Considering these results, it could be inferred that environmental awareness had a positive moderating effect on the relationship between symbolic attributes and purchase intention, assuming that H5b could be supported.

5. Discussion and Implications

5.1. Discussion of the Results

The adoption of new energy vehicles is an important measure to help improve current environmental problems and assist China in achieving the dual carbon goal, so it is important to place emphasis on the purchase intention of NEVs. In the past, consumers' adoption of NEVs was mainly because of the government subsidy or various attributes of the products themselves. However, since the subsidy supports have declined in recent

years, more attention needs to be focused on the product attributes of NEVs because consumers may give more consideration to this factor when making purchase decisions. There was limited empirical study, however, that focused on how different product attributes would contribute to consumers' purchase intention. Therefore, to fill this gap and help further expand the NEV market, this study explored the consumers' adoption of NEVs from the perception of product attributes, using a structural equation model and data collected through a questionnaire survey. The key findings of this paper are discussed below.

First, functional attributes of new energy vehicles positively affect purchase intention. A new energy vehicle is a kind of automobile and is also a durable good involving much consideration and financial preparation before purchasing. The decision-making process of consumers is usually complex, and they may have certain requirements for all aspects of the product. As the most basic attribute is daily use of the NEV, perhaps this function should be given the greatest attention. In this paper, some functional attributes of new energy vehicles for satisfying the driving experience included good battery endurance, sufficient power, low noise, complete safety configuration, etc. The result showed that functional attributes had a significant direct impact on consumers' purchase intention, which is consistent with the result of Wu Shuilong's research on traditional fuel vehicles [18]. The result indicates that good functions are the basic factor for consumers to consider buying new energy vehicles, providing evidence that function is the core content at the innermost level of product concept.

Second, symbolic attributes of new energy vehicles positively affect purchase intention. The results show that the symbolic characteristics brought about by NEVs (such as environmental protection and innovation) had a significant positive impact on purchase intention, but the impact (0.159) is less than the impact of functional attributes (0.205). This finding might relate to previous literature concerning the relationship between product attributes and purchase intention. According to Yang Yan et al.'s study [13], although the stimulation brought about by some symbolic features (such as the fashionable design) might easily attract consumers' attention and leave them with a good impression at first, consumers may quickly adapt to these characteristics, thus making the impression soon fade.

Third, quality value, price value, emotional value and social value all played a mediating role between product attributes and purchase intention. This finding is in line with the result of Jiang et al. [43]. As for quality value, NEVs have some characteristics that are different from traditional fuel vehicles, so if NEVs are well configured, consumers could feel the quality value of the product. In terms of price value, since the special attributes of NEVs may help save fuel and maintenance costs, consumers may feel their long-term benefits, thus increasing purchase intention. Concerning emotional value, a comfortable driving environment can provide consumers with pleasure; at the same time, the self-image brought by NEVs to consumers would also bring satisfaction, resulting in willingness to buy. About social value, Du Yanqing [37] pointed out that the car one drove represented his lifestyle and social class. It appears therefore that consumers may purchase NEVs because they love to follow the trend or because of their environmental concerns.

Finally, consumers' awareness of environment can better promote the intention to purchase NEVs. The results showed that consumers with environmental awareness would be more willing to purchase NEVs, which supports the results of previous studies [35]. Environmental awareness is the concern for environmental issues, the view and willingness to maintain the relationship between people and the environment [44]. Compared with traditional fuel vehicles, NEVs have the characteristics of energy conservation and environmental protection, and also symbolize environmentalism to a certain extent. When consumers have an awareness of environmental protection, this important feature may become the driving factor for them to take environmental protection actions and purchase new energy vehicles.

5.2. Implications

Our study puts forward several implications. On the one hand, it is advisable for NEV companies to improve the functional attributes of products. For example, technological improvements can be made and deficiencies in products can be mitigated. Reliable functional attributes can make consumers perceive better quality value, be more willing to pay the corresponding price, and obtain higher emotional and social value, all of which enhance their willingness to buy.

On the other hand, the significance of symbolic attributes bought by NEV to consumers need to be enhanced. Enterprises should exert more effort to display the image of products and brands in terms of environmental protection, high-tech and innovation. This can be carried out through physical evidence in the service scape. For example, an environmentally friendly design can be applied to external design and internal facilities. By establishing the right atmosphere, the environmental concern held by enterprises and their products could be conveyed to consumers. In addition, the sense of technology and innovation brought about by the products can also be transferred to customers by designing the service scenario, which would help make consumers perceive the product image.

5.3. Limitations and Future Research

There are still some limitations in this study that need to be noted. On the one hand, this paper only considered the moderating effect of environmental awareness, but other factors might also moderate the relationship between product attributes and purchase intention. Thus, future studies may use additional moderating variables to gain a more comprehensive understanding of the research question. On the other hand, this study examined the effect of product attributes on all kinds of NEVs, so the practical implications might be somewhat general. Thus, future research could further focus on a certain brand for exploring this question and provide more specific suggestions.

6. Conclusions

We investigated the impact of NEVs' product attributes on consumers' purchase intention in the context of the sustainable 'dual carbon goal' and the decline of government subsidy in order to provide suggestions for enterprises to improve their products and thus help them further expand the market and contribute to the goal of sustainable development. In this study, we conducted an online survey and collected data on consumers' attitudes toward different product attributes, their perceptions of perceived value and their willingness to purchase NEVs. The construction of conceptual framework and testing of hypothesis was performed by using a structural equation model. We found that both functional and symbolic attributes of NEVs could improve consumers' purchase intention while functional attributes may have a larger impact. This suggests that outstanding function is the consumers' core concern. The four dimensions of perceived value are found to play a mediating role between product attributes and purchase intention, providing evidence for the contributing mechanism between the independent and dependent variable. In addition, consumers' environmental awareness could positively moderate this relationship, indicating that those who care more about environmental protection might be more willing to buy a NEV. Through an empirical analysis, this study provides insights into the purchase intention of NEVs from the perspective of product attributes and also contributes to a better understating of consumers' attitude toward NEVs, thus helping to provide suggestions for relative companies.

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