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ORIGINAL CONTRIBUTION

Consumer-Perceived Value Systems and Sustainable NEV Brand Competitiveness: The Mediating Role of Perceived Sustainable Value

ShengJie Wang[1], Chonlavit Sutunyarak[2]*

[1,2]Chakrabongse Bhuvanarth International College of Interdisciplinary Studies, Rajamangala University of Technology Tawan-ok, Bangkok, Thailand

Abstract— This paper examines how the four dimensions of consumer-perceived value, namely value proposition, value creation, value acquisition, and value maintenance, promote the long-term competitiveness of New Energy Vehicle (NEV) brands in China through perceived sustainable value. Conducted a survey of 1,200 Chinese consumers who have purchased and driven new-energy vehicles to collect data. First, reliability, convergent validity, discriminant validity, and common method bias were tested, and then structural equation modeling and a 5,000-sample bootstrap mediation analysis were performed. Both value proposition and value maintenance have direct and indirect effects on customer-based sustainable NEV brand competitiveness, with partial mediation. Value creation and value acquisition had a small direct impact; instead, they reduced brand competitiveness by lowering the perceived sustainable value and were fully mediated. Not all enterprise value activities are continuous drivers of brand competitiveness. The competitive effect of the above depends on how much consumers believe that these provide functional, social, emotional, and sustainability-related values. Clarify the link between the value system of a business model and customer-oriented brand competition in the New Energy Vehicle (NEV) industry. Therefore, the NEV company needs to make a distinction between visible indicators of value, such as reasonable prices and excellent after-sales service, and invisible forms of value, such as ecosystem construction, community building, and price mechanisms. The latter need to have better transparency and user-friendliness before they can boost brand competitiveness.

Index Terms— New energy vehicles, Customer-based sustainable NEV brand competitiveness, Perceived sustainable value, Value proposition, Value creation, Value acquisition, Value maintenance, Structural equation modeling

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Introduction

With the world's move towards low-carbon transportation, New-Energy Vehicles (NEVs) have gradually gained widespread attention for their contribution to green development and ecological civilization. The transport sector remains a major source of carbon emissions; therefore, many countries are encouraging the transition from traditional-fuel vehicles to new-energy vehicles to build a clean-mobility system (Shahzad & Iqbal Cheema, 2024). Among the world's New Energy Vehicle (NEV) markets, China has been developing at an advanced pace due to extensive deployment and support from various governments (Gong & Hansen, 2023). Although the sales of new energy vehicles continue to rise,

*Corresponding Author: chonlavit_su@rmutto.ac.th

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the competition in the market is gradually moving away from vehicle adoption and technological differentiation towards long-term brand competitiveness and customer loyalty ("Breakthrough Agenda Report 2025, IEA, Paris", 2025).

Early on, many new energy vehicle models were differentiated by factors such as longer-range driving, high-performance batteries, and intelligent features. However, as the core technologies and supply-chain systems have become more standardized, the space for product-based differentiation has been reduced (Wu, 2025). At the same time, heightened price competition has reduced profit margins and weakened the long-term viability of hardware-based competitive advantages (Hong, 2024). Therefore, the new energy vehicle enterprises have started to focus more on the quality of service and have built strong customer relationships and provided long-term value as their sources of competition.

Customer-based sustainable NEV brand competitiveness refers to consumers' overall evaluation of a brand's recognition, reputation, recommendation ability, and relative competitive position among sustainable NEV brands (Zang et al., 2024). This idea is not an index of firm-level competitiveness but rather the consumer's self-assessment based on actual ownership and use. As the new energy vehicle market has developed in recent years, people's demand for brands now extends to include factors such as service quality, transparency, environmental responsibility, and long-term ownership support (Zheng et al., 2025). Therefore, customer-based sustainable NEV brand competitiveness can be considered a post-purchase brand outcome that reflects consumers' overall evaluations of a brand after prolonged use.

Previous research on New Energy Vehicles (NEVs) has generally focused on the adoption intention, purchase intention, technology acceptance, environmental awareness, perceived risk, policy support, etc. L. Zhang et al. (2023) examined the reasons for NEV purchase intention by combining the two factors of technology acceptance and attitude-ambivalence, and Zhao et al. (2024) studied why women are interested in purchasing new energy vehicles by combining perceived value and trust. Hu et al. (2023) also found that the sense of value for consumers will drive their purchase decisions for new-energy vehicles in China. Although these studies have advanced the understanding of pre-purchase decision-making, relatively less attention has been paid to how consumers assess brand competitiveness after purchasing and using a car. Furthermore, most existing post-purchase research has focused on customer satisfaction, loyalty, or recommendations, whereas there remains a lack of studies investigating the general perception of sustainable brand competitiveness in the NEV sector. Therefore, the study of customer-based sustainable NEV brand competitiveness may offer new ideas for post-adoption consumer evaluation.

The second research gap is the connection between firm-designed values and consumer perceptions of these values. According to business model theory, enterprises build, deliver, and obtain value through interconnected systems of activities rather than just superior product features (Teece, 2010). Yang et al. (2024) proposed the four general categories of value systems for new-energy vehicles (NEVs): Value proposition, value creation, value acquisition, and value maintenance. Together, the above indicators show how the firm creates value, promotes joint creation of value, sets up a mechanism for value collection, and ensures continuous delivery of value throughout the entire customer life cycle. However, most of the previous studies have not investigated how the above values are reflected in the consumers' assessment of the sustainable competitiveness of the brand.

According to the consumer value theory, value is ultimately determined by customers' judgment of the benefits-to-costs ratio they perceive (Zeithaml, 1988). The different levels of the perceived value are functions, emotions, social standing, and money. Based on the above, perceived sustainable value refers to the combined perception of consumers' consumption benefits and sustainability-related benefits in owning a New Energy Vehicle (NEV). Therefore, the effect of firm-designed value-system activities may be affected by both internal implementation within the organization and the way consumers perceive and interpret these activities. Perceived sustainable value may thus function as an important bridge linking value systems to customer-based sustainable NEV brand competitiveness.

RQ1: Whether value proposition, value creation, value acquisition, and value maintenance are positively correlated with the perception of sustainable value in the New Energy Vehicle (NEV) market in China?

RQ2: Is the perceived sustainable value positively associated with customer-based sustainable NEV brand competitiveness?

RQ3: Does the perceived sustainable value mediate the effect of consumer-perceived value-system dimensions on customer-based sustainable NEV brand competitiveness?

Thus, this paper has three objectives. First, it studies the connection among the above: Value proposition, value creation, value acquisition, value maintenance, and perceived sustainable value. Second, it studies the relationship between perceived sustainable value and customer-based sustainable NEV brand competitiveness. Third, it investigates the mediating role of perceived sustainable value in the connection between value-system dimensions and customer-based sustainable NEV brand competitiveness.

This paper offers three contributions to the research on new energy vehicles. First, it expands the scope of existing studies on adoption-related outcomes by investigating consumer perceptions of the competitiveness of sustainable brands after purchase and use. Second, based on the theory of business models and customer value theory, this paper explores how firm-designed value-system activities are perceived by consumers in terms of sustainable value. Third, it proposes and tests a mechanism for how value-system dimensions are linked to customer-based sustainable NEV brand competitiveness via perceived sustainable value, providing practical support for firms that wish to enhance their long-term brand competitiveness through non-price-based strategies.

Literature Review

Theoretical approaches

According to Teece (2010), business model theory defines a set of activities in an enterprise that create, deliver, and obtain value for that enterprise; such activities will offer a competitive edge. The theory provides the basis for understanding the design of value systems in the NEV industry in this study. As technology has become increasingly sophisticated, the demand for integrated, value-oriented services across all stages of a customer's life and a longer-term way for enterprises to enhance their own competitiveness is now rising. Recently, scholars have investigated how to improve the performance and competitiveness of Chinese New-Energy Vehicle (NEV) companies through the construction of a sustainable business model (Y.-y. Zhang et al., 2026).

Yang et al. (2024) proposed four dimensions for the system of consumer perception of value in this study: Value proposition, value creation, value acquisition, and value maintenance. Together, the above indicators reflect how enterprises convey value, promote value co-creation, construct value-capture mechanisms, and maintain value delivery over an extended period. They are not isolated marketing measures, but rather an integrated system for forming a sense of belonging and brand consciousness among the public.

According to the theory of consumer value, consumers are also motivated to seek high-benefit-and-low-cost products or services (Zeithaml, 1988). The three kinds of perceived values are functions, feelings, and social standing (Sweeney & Soutar, 2001). Based on the above view, perceived sustainable value is generally understood as consumers' collective assessment of all consumption-related and sustainability-related advantages in owning New Energy Vehicles (NEVs).

The results of the value-system activities organized by the company will differ according to consumers' perceptions of them. Therefore, perceived sustainable value may be an important way through which value-system dimensions relate to customer-based sustainable NEV brand competitiveness. When consumers believe that the practical value, trustworthiness, and long-term benefits provided by value-system activities are authentic, they are more likely to form a positive attitude towards the brand's competitiveness, reputation, and willingness to recommend it.

Research hypotheses and development of the conceptual model

Together, the four components of the company's value system are value proposition, value creation, value acquisition and value maintenance (Yang et al., 2024). Although these dimensions are different parts of value-system design, together they help consumers evaluate brand benefits and long-term value realization (Tuan & Doan, 2025). Value proposition refers to the expected advantages and assurances that a brand offers Piepponen et al. (2022); value creation extends these experiences for customers through digital services, charging ecosystems, user communities, and participatory service platforms (Yang et al., 2024). Value acquisition refers to the consumer's evaluation of pricing and service systems, and value maintenance addresses the continuous provision of value through after-sales support and long-term ownership services.

According to the theory of business models, value-creation and delivery are performed by these activities for consumers. However, based on consumer value theory, the effectiveness of the above activities will be determined by whether consumers feel that the benefits they obtain outweigh the costs they bear (Janchai, 2026; Zeithaml, 1988). Therefore, the value-system dimensions are expected to be positively associated with consumers' sense of sustainability.

Earlier studies have indicated that perceived value, positive emotions, and green brand authenticity are all positively associated with consumer behavior in the NEV sector (W. Li et al., 2025; Nawaz, 2025). As consumers are beginning to consider all-round performance, services, digital platforms and extended support for new-energy vehicles, many will feel that these values are more in line with a sustainable consumption model (Vafaei-Zadeh et al., 2022).

Therefore, the following hypotheses are proposed:

H1: Value proposition positively affects perceived sustainable value.

H2: Value creation increases perceived sustainable value.

H3: The acquisition of value promotes the sense of sustainable value.

H4: Value maintenance positively impacts perceived sustainable value.

Perceived sustainable value reflects consumers' evaluations of the sustainability-related and consumption-related advantages of a brand. Functional, social, and emotional benefits in the context of NEVs are shown by the above evaluations (Wang et al., 2024). Based on previous studies, perceived value has been linked to an increase in purchase intention and other consumer behaviors for New Energy Vehicles (NEVs) (Luo et al., 2022).

According to the theory of consumer value, consumers who perceive a brand as having higher value will be more likely to have a good attitude towards that brand in their minds and recommend it. When consumers find that a certain brand is convenient and reliable, they may feel that it can provide a sense of security for a long time, and as such, choose this brand over others. Therefore, it is expected that perceived sustainable value will be positively correlated with customer-based sustainable NEV brand competitiveness.

Therefore, the following hypothesis is proposed.

H5: Perceived sustainable value positively affects customer-based sustainable NEV brand competitiveness.

The impact of value-system activities on the competitiveness of a customer-based sustainable NEV brand will vary by dimension. Some value-system activities are more obviously displayed as the results of a brand's concern for its consumers over time, and others may affect competitiveness indirectly by changing consumer values.

Among the four categories, Value Proposition and Value Maintenance are closer to the expected reliability and extended usability of a brand by consumers. At the same time, both the creation and collection of value often involve service ecosystems, platform cooperation, and value-capture mechanisms, and their benefits may need to be understood by consumers before affecting brand perception (X. Li et al., 2025). Therefore, it is expected that the dimensions of value will be positively correlated with customer-oriented sustainable NEV brand competitiveness.

Therefore, the following hypotheses are proposed:

H6a: Value proposition positively affects customer-based sustainable NEV brand competitiveness.

H6b: Value creation positively impacts customer-based sustainable NEV brand competitiveness.

H6c: Value acquisition positively affects customer-based sustainable NEV brand competitiveness.

H6d: The amount of retained value is positively correlated with the long-term sustainability of NEV brand competitiveness for consumers.

According to consumer value theory, if the value-creation activities undertaken by an enterprise enable consumers to perceive them as useful and meaningful, then a positive effect will be achieved (Tissayakorn, 2025). Perception of ecosystem services, integration of supporting services, flexible monetization schemes, long-term ownership assistance in the New Energy Vehicle (NEV) market, and brand competitiveness are potentially related to consumer perceptions (Ackaah et al., 2021).

Therefore, perceived sustainable value may serve as an important link to connect value systems with customer-oriented sustainable competitiveness of NEV brands. Although prior studies have explored the role of perceived value in NEV purchase intention and green brand responses, few have investigated whether perceived sustainable value serves as a mediator between the value-system dimensions and customer-based sustainable NEV brand competitiveness (W. Li et al., 2025).

Therefore, the following mediation hypotheses are proposed:

H7a: Perceived sustainable value mediates the effect of value proposition on customer-based sustainable NEV brand competitiveness.

H7b: Perceived sustainable value mediates the relationship between value creation and customer-based sustainable NEV brand competitiveness.

H7c: Perceived sustainable value mediates the effect of value acquisition on customer-based sustainable NEV brand competitiveness.

H7d: Perceived sustainable value mediates the effect of value maintenance on customer-based sustainable NEV brand competitiveness.

Figure 1 is the conceptual framework of this study. The four factors are all related to changes in a sustainable New Energy Vehicle (NEV) brand's perception of sustainable value, directly or indirectly, and thus impact its competitiveness, as shown by the model. Perceived sustainable value mediates the relationship between value-system behavior consumption and extended use, thus creating an extended advantage for the brand.

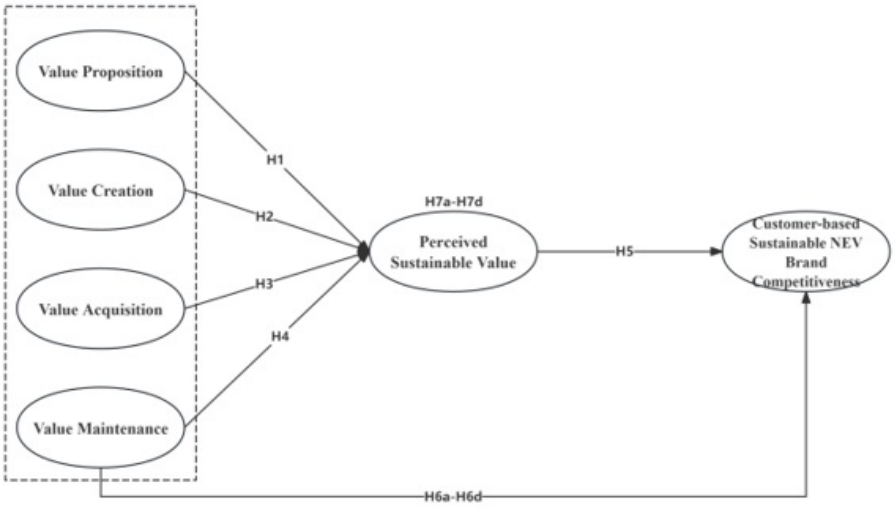


Fig. 1 *Conceptual model for customer-based sustainable NEV brand competitiveness*

Methodology

Data collection

The subjects of this study were consumers in mainland China who had purchased and used New-Energy Vehicles (NEVs). The selected population was deemed suitable because the main constructs in this study consumer-perceived value systems Sánchez-Fernández and Iniesta-Bonillo (2007), perceived sustainable value, and customer-based sustainable NEV brand competitiveness are based on evaluations formed through actual ownership and use experience (Featherman et al., 2021). Therefore, existing NEV users were regarded as more suitable subjects for the study than potential buyers or members of the public.

To improve the practical value of the sample, several leading New Energy Vehicle (NEV) brands in China have been selected as representatives, including BYD, Tesla, NIO, XPeng, Li Auto, AITO, and Zeekr. The listed brands are leading companies in China's New Energy Vehicle (NEV) industry, and among them are domestic and foreign enterprises (Chen, 2025).

As there is no complete sampling frame of Chinese NEV owners, convenience sampling was used for data collection. Online channels included social media platforms, NEV user communities and consumer networks, and offline locations such as commercial districts and automobile exhibition venues with a high concentration of NEV users were used to distribute questionnaires. Data were collected between March and June 2025. Only those who confirmed they owned and used an NEV were included in the analysis.

A total of 1,286 questionnaires were distributed. After excluding the responses with missing values or irregular patterns in the data, questionnaires with overly short completion times or inconsistent screening answers were also removed, resulting in a total of 1,200 valid questionnaires and a valid response rate of about 93.3%. The final sample size met or exceeded the lower bound required for structural equation modeling of multiple latent constructs and mediation paths Wolf et al. (2013), and thus sufficient statistical power and stable parameter estimation were achieved.

Measurement instruments and scale construction

All the measurement items were adopted from previous validated studies in the NEV and consumer behavior literature. All five levels of the Likert scale (strongly disagree to strongly agree) were used.

Yang et al. (2024) proposed value proposition, value creation, value acquisition, and value maintenance. Perceived sustainable value was taken from Hu et al. (2023), and customer-based sustainable NEV brand competitiveness was borrowed from (Wangmo et al., 2024).

To guarantee the equivalence of language and context, translation and back-translation were performed. First, a bilingual scholar with a strong understanding of consumer behavior and NEV terms translated the original English questionnaire into Chinese. Second, an independent bilingual researcher re-translated the Chinese version into English. Any discrepancies between the original and the back-translated versions were corrected. Finally, the two marketing researchers and the consumer behavior specialist reviewed the content and appropriateness of the context for the questionnaire.

Before distributing the questionnaire, some modifications were implemented by scholars based on initial trials involving a small group of New Energy Vehicle (NEV) drivers. A few small modifications have been made to improve the readability and brevity of the expression, and some supporting content has been added.

Data analysis

SPSS 26.0 and AMOS 24.0 were used for the data analysis. After data screening, descriptive statistics were used to show some characteristics of the respondents and their NEV consumption.

All variables were collected through self-report questionnaires, so the Common Method Bias (CMB) was addressed before the main analysis. Harman's single-factor test is a simple method for checking multicollinearity that can be used. The results indicated that the common-method bias is unlikely to affect the reliability of the results.

Then, the reliability, convergent validity, and discriminant validity of the measurement model were examined by Cronbach's α, Composite Reliability (CR), standardized factor loadings, Average Variance Extracted (AVE), and the Fornell-Larcker criterion.

After confirming satisfactory measurement properties, Structural Equation Modeling (SEM) was used to examine the expected relationships among value proposition, value creation, value acquisition, value maintenance, perceived sustainable value, and customer-based sustainable NEV brand competitiveness. Multiple indices for model fit were used, such as χ^2/df, RMSEA, SRMR, GFI, AGFI, CFI, TLI, NFI, IFI, PNFI, and PCFI.

Based on the mediation analysis results, 5,000 resamples were obtained by bootstrapping, and their 95% confidence intervals for the indirect effect were calculated.

Pre-test

Before the actual distribution of the questionnaire, a pilot study was carried out to check for any problems in the question design or reliability issues. Sixty NEV users who have personally used them were invited to participate, and after filtering the data, 52 valid responses were collected.

The pilot study results indicated that all items showed good internal consistency; Cronbach's α values ranged from 0.782 to 0.891, and the corrected item-total correlations were all greater than 0.50 (Hair et al., 2019). The questionnaire was suitable and feasible for the respondents' own experience with new energy vehicles. Based on the recommendations of experts and the results of the pilot study, some modifications have been made to improve the semantic clarity of the language and reduce the risk of item overlap.

Overall, the pilot study provided support for the reliability and applicability of the measurement instrument.

Ethical considerations

Before data collection, all participants were informed about the purpose of the study, their voluntary participation status, and the right to withdraw at any time without penalty. All the subjects consented to take part in the study.

No personal information such as names, ID numbers, addresses, or contact details was collected. All answers were anonymous and were used solely for research purposes. The collected data were kept safely and were available only to the research team. In line with the rules of good research ethics, no one will disclose that any person participated in this research.

Results

Descriptive statistical analysis

First, the demographic characteristics and consumption habits of the respondents were described using descriptive statistics. As shown in Table I, the final sample included 1,200 NEV users in mainland China.

The proportions of male and female respondents in the sample are approximately 57% and 43%. Most were in their mid-20s and mid-40s (68.4%). Most of the respondents had obtained a university degree or higher in terms of education (73.7%).

Respondents were spread out in many areas of China, such as Beijing, Shanghai, Guangzhou, Shenzhen, Hangzhou, Chengdu, Nanjing, Wuhan and Suzhou. Most of the participants lived in prosperous, urban areas and thus had relatively higher rates of new energy vehicle ownership.

Respondents' brands of ownership include BYD, Tesla, NIO, XPeng, Li Auto, AITO and Zeekr. BYD (23.8%) and Tesla (17.8%) were the first and second, respectively.

The sample has met the requirements for demographic and market features of Chinese NEV users and was therefore suitable for the following analysis.

Table I
Descriptive statistics of respondents (*N* = 1,200)

Variable	Category	Frequency	Percentage (%)
Gender	Male	682	56.8
	Female	518	43.2
Age	18–25 years	146	12.2
	26–35 years	428	35.7
	36–45 years	392	32.7
	46–55 years	176	14.7
	56 years and above	58	4.8
Educational level	High school or below	102	8.5
	Junior college	214	17.8
	Bachelor's degree	612	51.0
	Master's degree	224	18.7
	Doctoral degree	48	4.0
City	Beijing	138	11.5
	Shanghai	146	12.2
	Guangzhou	128	10.7
	Shenzhen	156	13.0
	Hangzhou	132	11.0
	Chengdu	126	10.5
	Nanjing	118	9.8
	Wuhan	130	10.8
	Suzhou	126	10.5

Cont...

Variable	Category	Frequency	Percentage (%)
NEV brand used/purchased	BYD	286	23.8
	Tesla	214	17.8
	NIO	162	13.5
	XPeng	148	12.3
	Li Auto	176	14.7
	AITO	108	9.0
	Zeekr	106	8.8

Common method bias test

All the variables were collected via self-report questionnaires, and thus, Common Method Bias (CMB) was examined prior to hypothesis testing.

Harman's single-factor test showed that the first unrotated factor accounted for only 31.982% of the total variance and thus did not meet the threshold of 50%. In addition, all the VIF values of full collinearity were less than 3.3, ranging from 1.684 to 2.946.

Therefore, it can be concluded that the bias of the common method was unlikely to affect the reliability of the research results.

Measurement model testing: Reliability and convergent validity

Cronbach's alpha, Composite Reliability (CR), standardized factor loadings, and Average Variance Extracted (AVE) were used to assess reliability and convergent validity.

As shown in Table II, Cronbach's alpha and CR values for all constructs exceeded the recommended threshold of 0.70, indicating good internal consistency. The AVE values ranged from 0.622 to 0.656, exceeded the 0.50 recommended threshold, and thus supported convergent validity.

The standardized factor loadings were between 0.762 and 0.832, and all of them were significant at the 0.001 level. The above results are consistent with the requirements for good reliability and convergent validity of the measurement model.

Table II
Reliability and convergent validity test results of the measurement model

Latent Variable	Observed Variable	Factor Loading	CR	AVE
Value Proposition (VP)	Potential Value	0.787	0.896	0.634
	Value of Goods	0.811		
	Popularity	0.812		
	Brand Support Promise	0.792		
	Travel-Related Utility	0.779		
Value Acquisition (VCA)	Information Push	0.832	0.879	0.645
	User Application	0.805		
	Dedicated Group	0.762		
	Cooperative Partner	0.778	0.893	0.625
	New Services	0.809		
	New Products	0.794		
	Product Cost	0.797		
	Cost-Value Fairness	0.773		
Value Maintenance (VMA)	Continuous After-sales Support	0.815	0.904	0.653
	Information Resources	0.789		
	Continuous Communication	0.815		
	Service Responsiveness	0.797		
	Service Improvement	0.825		
Value Creation (VCR)	Functional Value	0.829	0.851	0.656
	Value Creation Methods	0.811		
Perceived Sustainable Value (CPV)	Social Value	0.797		
	Emotional Value	0.804		

Reliability and convergent validity test results of the measurement model

Latent Variable	Observed Variable	Factor Loading	CR	AVE
Customer-based Sustainable NEV Brand Competitiveness (BC)	Brand Awareness	0.786	0.868	0.622
	Market Competitiveness	0.779		
	Brand Recommendation	0.797		
	Brand Reputation	0.792		

Measurement model testing: Discriminant validity

Discriminant Validity is assessed through the Fornell-Larcker criterion and Heterotrait-Monotrait (HTMT).

As shown in Table III, the square root of AVE for each construct was greater than its correlations with all other constructs; thus, according to the Fornell-Larcker criterion, discriminant validity was met.

The correlation coefficients of the constructs were between 0.340 and 0.735, and thus these constructs were not strongly correlated.

Table III
Discriminant validity test (Fornell-Larcker Criterion)

Variable	VP	VCR	VCA	VMA	CPV	BC
VP	0.796					
VCR	0.360	0.803				
VCA	0.340	0.352	0.791			
VMA	0.380	0.341	0.381	0.808		
CPV	0.596	0.567	0.548	0.602	0.810	
BC	0.621	0.452	0.474	0.621	0.735	0.789

Note: Diagonals represent the square root of AVE; off-diagonals represent correlations

HTMT values were also in the range of 0.397-0.812, and all were below the upper limit of 0.85. Therefore, the above results further support the discriminant validity of the measurement model.

The HTMT values of the four value-system dimensions were relatively low (0.397-0.448), indicating adequate discriminant validity among these constructs. The HTMT values between perceived sustainable value and the four value-system dimensions were between 0.628 and 0.694, and those for Customer-based Sustainable NEV Brand Competitiveness and the other constructs ranged from 0.526 to 0.812. Although the highest HTMT value occurred between Perceived Sustainable Value and Customer-based Sustainable NEV Brand Competitiveness, it did not reach the 0.85 threshold, and all constructs were thus discriminant-valid.

Structural model fit testing

Three types of goodness-of-fit indices were used to evaluate the structural model: Absolute, incremental, and parsimonious. The absolute fit indices showed that the model was in good agreement with the data (χ^2/df = 2.214; RMSEA = 0.049; SRMR = 0.043; GFI = 0.917; AGFI = 0.892). Although AGFI was slightly less than 0.90, it was still close to the standard of 0.90. The incremental fit indices were CFI = 0.873, TLI = 0.864, NFI = 0.863, and IFI = 0.879. Although the above values did not reach the generally recommended 0.90 standard, they exceeded the lower limit of 0.80 and were therefore considered to have a relatively good model fit. The parsimonious fit indices were PNFI = 0.833 and PCFI = 0.869; both exceeded the recommended limit of 0.50. Overall, the above results indicate that the model has achieved a good fit and is suitable for hypothesis testing. The model accounted for 79.8% of the variance in perceived sustainable value and 78.6% of the variance in customer-based sustainable NEV brand competitiveness.

Path coefficients and hypothesis testing

Maximum Likelihood (ML) estimation was used to obtain the structural path coefficients, and the results of the hypothesis testing are presented in Table IV. All four indicators of the value system were positively and significantly correlated with CPV. Value Proposition had a positive correlation with CPV at the 0.371 level ($p < 0.001$) and thus supported H1. Value creation also increased CPV ($\beta = 0.331$, $p < 0.001$) and supported H2. Value acquisition positively affected CPV ($\beta = 0.283$, $p < 0.001$) and supported H3. Value maintenance was positively correlated with CPV (β =0.334, $p < 0.001$) and thus supported H4.

CPV was also positively associated with BC ($\beta = 0.493$, $p < 0.001$) and thus supported H5. The direct effects of the four value dimensions on BC are as follows: Value Proposition positively affects BC significantly ($\beta = 0.260$, $p < 0.001$), and this supports H6a. Value creation had no significant direct effect on BC ($\beta = -0.029$, $p = 0.605$), and H6b was not supported. Value acquisition did not have a significant direct effect on BC ($\beta = 0.027$, $p = 0.609$), and H6c was not supported. Value maintenance positively correlated with BC ($\beta = 0.226$, $p < 0.001$) and supported H6d.

Based on these findings, the direct effects of the four dimensions of value systems are not equal. Value proposition and value maintenance directly increased the competitiveness of the customer-based sustainable NEV brand, and value creation and value acquisition changed people's perceptions of sustainable value, thus boosting this improvement in competitiveness.

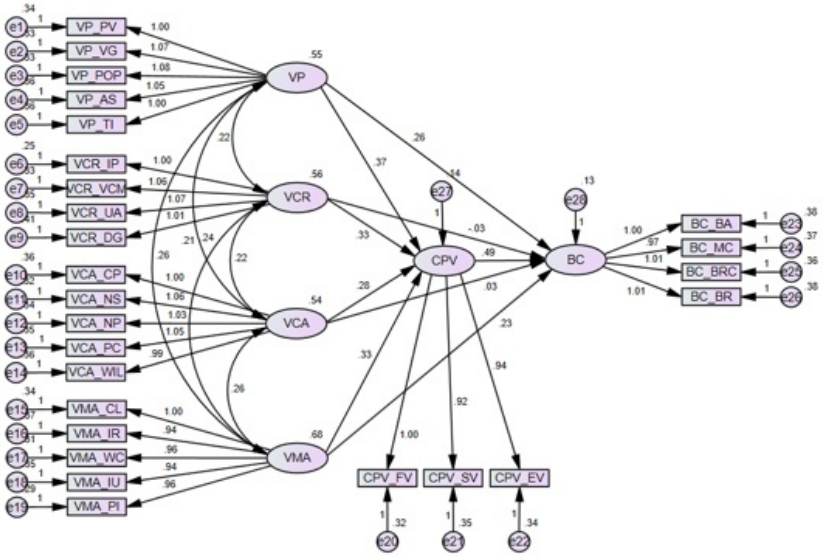


Fig. 2 *Path diagram of the structural equation model and standardized parameter estimates*

Table IV
Path coefficients and hypothesis test results

Hyp.	Path Relationship	Std. Coeff. (*β*)	S.E.	*T*-value	*p*-value	Result
H1	VP → CPV	0.371	0.050	7.436	<0.001	Supported
H2	VCR → CPV	0.331	0.048	6.854	<0.001	Supported
H3	VCA → CPV	0.283	0.049	5.804	<0.001	Supported
H4	VMA → CPV	0.334	0.045	7.452	<0.001	Supported
H5	CPV → BC	0.493	0.105	4.706	<0.001	Supported
H6a	VP → BC	0.260	0.060	4.318	<0.001	Supported
H6b	VCR → BC	-0.029	0.056	0.517	0.605	Not Supported
H6c	VCA → BC	0.027	0.053	0.511	0.609	Not Supported
H6d	VMA → BC	0.226	0.054	4.178	<0.001	Supported

VP = Value Proposition; VCR = Value Creation; VCA = Value Acquisition; VMA = Value Maintenance; CPV = perceived sustainable value; BC = customer-based sustainable NEV brand competitiveness.

Mediation effect analysis: Bootstrap procedures and pathway identification

Bootstrap analysis using 5,000 resamples was used to determine whether perceived sustainable value mediates the relationship between the four value-system dimensions and customer-based sustainable NEV brand competitiveness. Preacher and Hayes (2008) proposed that a mediation effect can be considered statistically significant if the 95% confidence interval for the indirect effect does not contain zero.

Table V
Bootstrap Test Results of Mediation Effects

Path	Indirect Effect	S.E.	95% CI	Mediation Type
VP → CPV → BC	0.183	0.046	[0.104, 0.287]	Partial Mediation
VCR → CPV → BC	0.163	0.041	[0.092, 0.253]	Full Mediation
VCA → CPV → BC	0.140	0.040	[0.072, 0.230]	Full Mediation
VMA → CPV → BC	0.165	0.041	[0.093, 0.256]	Partial Mediation

As shown in Table V, the indirect effect of value proposition on customer-based sustainable NEV brand competitiveness through perceived sustainable value is 0.183 (95% CI: [0.104, 0.287]). Since the confidence interval did not include zero and the direct effect was still significant,

perceived sustainable value partially mediated the effect of value proposition on customer-based sustainable NEV brand competitiveness.

The indirect effect of value creation on customer-based sustainable NEV brand competitiveness through perceived sustainable value is 0.163, and the 95% confidence interval is [0.092, 0.253]. As the indirect effect was significant and the direct effect was not, perceived sustainable value fully mediated this relationship. Therefore, it can be concluded that the impact of value creation on the competitiveness of customer-based sustainable New Energy Vehicle (NEV) brands is mainly exerted through the perceived sustainable value.

The indirect effect of value acquisition on customer-based sustainable NEV brand competitiveness through perceived sustainable value is 0.140 (95% CI: [0.072, 0.230]). Since the indirect effect was positive and the direct effect was not significant, perceived sustainable value fully mediated this path. The above shows that value acquisition will help enhance the long-term competitiveness of a consumer-oriented New Energy Vehicle (NEV) brand by modifying consumer values.

The indirect effect of value maintenance on customer-based sustainable NEV brand competitiveness through perceived sustainable value is 0.165, and the 95% confidence interval is [0.093, 0.256]. Since both the indirect and direct effects were significant, perceived sustainable value partially mediated this path. Based on the analysis above, Value Maintenance is positively correlated with customer-based sustainable NEV brand competitiveness through two pathways.

The four values of the system had varying degrees of mediation. Value proposition and value maintenance showed partial mediation; thus, both directly and indirectly affected brand competitiveness through perceived sustainable value. Value creation and value acquisition demonstrated full mediation. Therefore, it can be concluded that the central intermediary variable for value-system activity and customer-based sustainable NEV brand competitiveness is perceived sustainable value.

Discussion

Key findings

Therefore, the four components of the value system do not have the same impact on customers' reasons for supporting New Energy Vehicle (NEV) brands and thus cannot be considered equally influential. Value proposition and value maintenance were directly and indirectly related to customer-based sustainable NEV brand competitiveness through perceived sustainable value, whereas the effects of value creation and value acquisition were primarily transmitted through perceived sustainable value. These findings indicate that the actual impact of the value-system activities is also linked to how consumers perceive the values provided by such activities. From the perspective of business model theory, a good value proposition and high visibility of the consumer experience are required. Brand promises, service stability, long-term support, and information disclosure are all directly known to the public, and thus can directly affect brand competitiveness. The findings are consistent with those of Y.-y. Zhang et al. (2026), who emphasized that building value systems and introducing a new, sustainable business model for the Chinese NEV industry are in line with this interpretation.

At the same time, both value creation and value acquisition did not directly correspond with customer-based sustainable NEV brand competitiveness. Consumers will only select platforms that meet their needs for convenience and value in digital services, good platform functions, price adjustments, service sets, etc. Similarly, previous research has shown that the positive effects of sustainability initiatives on brand image are more likely to be realized when consumers recognize and value them (W. Li et al., 2025). This paper will examine post-purchase brand evaluation of New Energy Vehicles (NEVs) rather than adoption. Although previous studies have focused on the intention to purchase, technology acceptance, and environmental attitudes Lv et al. (2024), this paper will investigate the role of ownership experience in forming long-term brand competitiveness. In short, perceived sustainable value generally serves as a mediating factor for value-system activities in generating customer-based sustainable competitiveness of New Energy Vehicles (NEVs), and the effect of this path varies among different value-system dimensions.

Theoretical contribution

First, this paper extends previous research on new energy vehicles by studying customer-based sustainable new energy vehicle brand competitiveness as a post-purchase evaluation indicator. Most of the prior research has focused on purchase intention, technology acceptance, environmental concern, and perceived value; however, relatively few studies have examined consumers' evaluation of brand competitiveness after purchasing and using (Acar & Taşkın, 2025)

Second, the research contributes to the literature on perceived sustainable value by showing that it serves as an intermediary for value-system activities to affect customer-based sustainable NEV brand competitiveness. The findings suggest that the perceived sustainability-related and consumption-related benefits by consumers may account for the good brand outcomes achieved through the firm's value-added activities.

Third, this paper combines business model and customer value in a unified system. It connects value proposition, value creation, value acquisition, and value maintenance with perceived sustainable value and brand competitiveness to provide a more comprehensive explanation of how value-system activities are converted into consumer evaluations.

Finally, the findings indicate that all dimensions of the value system contribute to brand competitiveness in many ways. Both partial mediation and full mediation effects may be involved in the way value-system activities influence customers' perception of sustainable New Energy Vehicle (NEV) brand competitiveness, and different paths need to be examined.

Practical application

Based on the above analysis, the following practical recommendations can be drawn for NEV enterprises. First, as value propositions and value maintenance are linked to the sustainability of brand competitiveness in the customer's mind, these enterprises should focus on effectively communicating the advantages of the brand and building a strong post-purchase service system. The reasons for the brand's sustainability claims need to be reasonable, such as convenience of charging, long-term battery life, quality of software support, safety performance, and extended service life.

Second, after-sales service should be regarded as a value-supporting strategic initiative rather than merely a basic operating function. Address the demands of customers promptly, provide charging support and software updates, communicate openly with them, build good relationships with consumers over a long period, and enhance their feeling of brand quality.

Third, given that there is no significant direct effect on value creation and value capture, the digital ecosystem, platform services, pricing system, and service package, etc., are not inherently competitive advantages. The effectiveness of these initiatives depends on how convenient, transparent, and valuable they are perceived to be by consumers.

Fourth, increase the perceived value of ownership by improving the informativeness of prices and fairness in services. Clearly communicate the costs of battery, software subscriptions, charging fees, and service packages to reduce the uncertainty people have about how much value they will receive for their money.

At the level of policy, support for the NEV industry should not only boost short-term demand. It should also strengthen the construction of charging facilities and services, improve information disclosure and consumer protection, and increase the sense of sustainable value for consumers.

In brief, according to the above analysis, the future power of NEV brands will depend on how effectively enterprises can create, spread, and retain value for their owners in the long run.

Limitations and future research

Although this study obtained a relatively large sample of 1,200 valid responses, convenience sampling was used because there is no comprehensive sampling frame of Chinese NEV owners. Therefore, the sample may not fully represent all users of new energy vehicles in China, particularly those in underdeveloped areas or regions with a lower density of new energy vehicles. Future research should employ probability sampling or stratified sampling to increase the representatives of the sample.

Second, as the subjects of this study are consumers in China's New Energy Vehicle market, the results may not be applicable to other regions. Different places have different policy environments, charging facilities, market levels, and other factors, so this study's applications will vary. Future research can be conducted in other regions to determine the general applicability of the above system.

Thirdly, this study collected cross-sectional self-reported data. Although the ordinary way to diagnose bias and check validity has been used, it does not establish a causal relationship in cross-sectional designs. Therefore, the observed relationships should be regarded as statistical correlations rather than definite causes. A long-term or experimental multiple-source research design can be used in the future to enhance the reliability of causal inference.

Finally, only perceived sustainable value served as the mediator. There may be other reasons for the psychological and relational support of long-term brand competitiveness through value-based activities. Future research will explore additional constructs, such as brand trust, ESG performance, green brand credibility, and customer participation, among others. Moderators such as environmental concern, green skepticism, policy awareness, brand familiarity, and charging-infrastructure satisfaction can also be used to delineate the conditions under which value-system activities affect customer-based sustainable NEV brand competitiveness.

This paper offers some empirical studies on the relationship between value-system activities, perceived sustainable value, and customer-based sustainable NEV brand competitiveness, as well as the limitations of the research design. Future research will employ a combination of long-term studies, experiments, and various data sources to investigate these relationships in greater detail.

Conclusion

This paper explores the impact of the four-dimensional consumer-perceived value system on customer-based sustainable NEV brand competitiveness through perceived sustainable value in China's NEV market. By linking value proposition, value creation, value acquisition, and value maintenance with perceived sustainable value, this study focuses on enhancing post-purchase brand competitiveness rather than on purchase

intention. Based on the research, both paths for supporting the sustainability of value propositions and value preservation have been shown to affect customer-based sustainable NEV brand competitiveness. Value creation and value acquisition only affect brand competitiveness through perceived sustainable value and are thus fully mediated. Therefore, tangible and trust-based activities, such as a clear brand promise and after-sales service, can directly strengthen the company's competitive strength; at the same time, mechanism-based activities, including digital ecosystems, user communities, price systems, and service packages, need to be perceived as stable values by consumers first. In short, this study has found that the consumer's perception of value-system activities can be converted into customer-based sustainable NEV brand competitiveness by enhancing the perceived sustainable value. This research provides support for understanding the effect of a value system on the link between Environmental and Social Responsibility (ESR) and performance. However, because the study used cross-sectional self-reported data and convenience sampling, the results should be interpreted as structural associations rather than causes. Future research should employ a longitudinal design, multiple data sources, or cross-market research designs to further verify these relationships.

Declaration

Conflict of interest:

The authors have reported that they are not in a position of conflict of interest.

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Author contributions:

Shengjie Wang provided the initial concept and collected data; conducted analysis and wrote this paper. Chonlavit Sutunyarak provided guidance and approved/corrected it.

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Ethical approval was obtained from ASD20260103.

Informed consent:

All subjects voluntarily participated in the study after being fully informed.

Data availability:

Upon a reasonable request, the data will be provided by the corresponding author.

Generative AI disclosure:

Only generative AI tools were used for language polishing. The authors have reviewed and accept the final version of this paper.

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Appendix

Measurement scale

Table VI
Measurement scale

Variable	Measurement Items
Value Proposition (VP)	VP1. Potential Value: This NEV brand offers long-term sustainable value that goes beyond my immediate purchase needs.
Value Proposition (VP)	VP2. Value of Goods: The products of this NEV brand provide good value for money while supporting low-carbon mobility.
Value Proposition (VP)	VP3. Popularity: This NEV brand has strong market visibility and recognition as a sustainable mobility brand.
Value Proposition (VP)	VP4. Brand Support Promise: This NEV brand clearly communicates reliable ownership support for long-term sustainable vehicle use.
Value Proposition (VP)	VP5. Travel-Related Utility: This NEV brand effectively meets my daily travel needs in a cleaner and more sustainable way.
Value Creation (VCR)	VCR1. Information Push: This NEV brand provides timely and useful information about vehicle use, services, and sustainable mobility.
Value Creation (VCR)	VCR2. Value Creation Methods: This NEV brand creates sustainable value for users through diverse services and interaction methods.
Value Creation (VCR)	VCR3. User Application: The digital applications or platform functions of this NEV brand enhance my sustainable mobility experience.
Value Creation (VCR)	VCR4. Dedicated Group: This NEV brand has built user communities or groups that encourage participation in sustainable mobility practices.
Value Acquisition (VCA)	VCA1. Cooperative Partner: This NEV brand collaborates with external partners to improve customer value and sustainable mobility services.
Value Acquisition (VCA)	VCA2. New Services: This NEV brand continuously introduces new services that support more sustainable vehicle ownership and use.
Value Acquisition (VCA)	VCA3. New Products: This NEV brand continues to offer new products or upgrades that promote cleaner and smarter mobility.
Value Acquisition (VCA)	VCA4. Product Cost: The cost of this NEV brand's products is reasonable compared with the sustainable benefits provided.
Value Acquisition (VCA)	VCA5. Cost-Value Fairness: The prices, service packages, or additional service fees of this NEV brand are fair considering the sustainable value provided.
Value Maintenance (VMA)	VMA1. Continuous After-sales Support: This NEV brand provides continuous after-sales support after purchase.
Value Maintenance (VMA)	VMA2. Information Resources: This NEV brand provides sufficient information resources to support long-term sustainable vehicle use and ownership.
Value Maintenance (VMA)	VMA3. Service Responsiveness: This NEV brand responds effectively to customers' service needs and feedback.
Value Maintenance (VMA)	VMA4. Continuous Communication: This NEV brand maintains stable communication with users after purchase.
Value Maintenance (VMA)	VMA5. Service Improvement: This NEV brand continuously improves its service quality to support long-term sustainable vehicle ownership.
Perceived sustainable value (CPV)	CPV1. Functional Value: This NEV brand provides practical and useful benefits for my daily low-carbon travel.
Perceived sustainable value (CPV)	CPV2. Social Value: Using this NEV brand enhances my social image as a consumer who supports sustainable mobility.
Perceived sustainable value (CPV)	CPV3. Emotional Value: This NEV brand gives me positive feelings because it is associated with cleaner and more responsible mobility.
Customer-based Sustainable NEV Brand Competitiveness (BC)	BC1. Brand Awareness: I think this NEV brand is widely recognized as a sustainable mobility brand.
Customer-based Sustainable NEV Brand Competitiveness (BC)	BC2. Market Competitiveness: I perceive this NEV brand as more competitive than other NEV brands in the sustainable mobility market.
Customer-based Sustainable NEV Brand Competitiveness (BC)	BC3. Brand Recommendation: I would recommend this NEV brand to others because of its sustainable value and reliable performance.
Customer-based Sustainable NEV Brand Competitiveness (BC)	BC4. Brand Reputation: I think this NEV brand has a strong and favorable reputation for sustainable mobility.