



Article Materialism, Ecological Consciousness and Purchasing Intention of Electric Vehicles: An Empirical Analysis among Chinese Consumers

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Abstract: Electric vehicles (EVs) have great potential for solving problems that threaten sustainability. However, the market penetration of EVs is difficult and slow. From the perspective of consumer resistance, this study proposes a theoretical model to investigate the impacts of two growing personal values in the Chinese context (materialism and ecological consciousness) on consumers' purchase intention of EVs. The research model was empirically examined with online survey data from 511 general Chinese consumers. The results indicate that consumer resistance is a crucial element hindering EV consumption and that materialism will promote consumer resistance by exerting a positive impact on perceived costs and a negative impact on perceived benefits of purchasing EVs, while ecological consciousness can effectively prevent consumers from developing a resistant attitude by increasing perceived benefits and decreasing perceived costs of purchasing EVs. Furthermore, the mediation tests suggest that value perceptions (perceived costs and perceived benefits) fully mediate the effects of materialism and ecological consciousness on consumer resistance and that resistant attitude fully mediates the relationships between value perceptions and purchase intention of EVs. Theoretically, this study contributes to the literature by investigating the influence of materialism and ecological consciousness on EV consumption and verifying the underlying mechanism linking them. Practically, the findings of this study can provide valuable insights for promoting the market penetration of EVs.

Keywords: electric vehicle; purchase intention; materialism; ecological consciousness; resistance

1. Introduction

As the world's largest automobile market, the rapid development of China's automobile industry has contributed greatly to its economic growth. From 2013 to 2019, the annual sales of automobiles in China have exceeded 20 million for seven consecutive years. Behind this staggering figure lies the massive consumption of fossil fuels (e.g., coal, oil, and natural gas) and the excessive emission of air pollutants (e.g., SO₂, NO_X, and PM 2.5). Consequently, energy crisis, environmental pollution, and many other concerns threatening sustainable development are becoming increasingly prominent [1,2].

Electric vehicles (EVs) have the characteristics of clean, low energy consumption, and zero-emission, which are considered the best substitute for traditional fuel vehicles and the main trend in the future [3]. Hence, far, the Chinese government has promulgated more than 120 state-level policies to encourage EV production and consumption [4]. In particular, after China released a new subsidies policy for EVs in 2013, the annual sales of EVs rose from a negligible amount in 2012 to nearly 1 million in 2019. However, the role of policy has become limited with the decline of government subsidies in recent years. For example, the growth rate of EVs slowed down in 2018 and even showed negative growth in 2019. As a result, the EV share of the overall vehicle sales market



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Copyright: © 2021 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (https:// creativecommons.org/licenses/by/ 4.0/). is still meager (less than 5%). In the absence of revolutionary breakthroughs in battery technology, considering consumer-driven forces, rather than relying solely on government subsidies, is the fundamental solution to ensure the sustainable growth of the EV industry. However, after reviewing the extant literature on EV adoption, we found that personal psychological factors, especially the highest norms guiding human behavior, personal values, have received limited attention from scholars. To address this research gap, we in this study focus on two growing personal values in the Chinese context, materialism and ecological consciousness [5,6], and investigate how these two personal values influence consumer intentions to purchase EVs.

Further, based on the theories of consumer perceived value and planned/reasoned behavior [7,8], we introduce value perceptions and consumer attitude as the potential mechanism linking personal values with EV purchase intention. Specifically, we propose that personal values (materialism and ecological consciousness) will change individuals' value perceptions of purchasing EVs (perceived benefits and perceived costs), affecting their attitude towards EVs and ultimately influencing their decisions. Specific to consumer attitude, She et al. [9] have pointed out that most consumers hold a "wait-and-see" attitude, which implies that consumers may have both positive (accept) and negative (resistant) attitudes towards EVs, with the former driving their optimism about the future of EVs while the latter discouraging their current purchase intentions. Considering a great deal of literature has indicated that resistant attitude plays an even more important role in determining one's disengagement in specific behaviors [10–13], we in this study propose that consumer resistance should be the primary reason hindering EV market penetration. In this regard, we choose a resistant attitude rather than the traditional accept attitude as the proximal predictor of consumers' purchase intention.

This study contributes to the literature in the following three ways. First, this study extends the existing knowledge on consumers' purchase intention of EVs by investigating the differential effects of materialism and ecological consciousness. Second, this study proposes and empirically examines the potential mechanism linking personal values with attitude and purchase intention, that is, acting on individuals' value perceptions of adopting EVs (perceived benefits and perceived costs). Third, by emphasizing the critical role of resistant attitude in determining purchase intention, the current study provides some new insights into understanding why consumers do not buy EVs, thus providing a reference for future research.

The rest of this paper is organized as follows: Section 2 presents a literature review of previous research on EV adoption and purchase. Section 3 describes the research model and develops the associated hypotheses. Then, Sections 4 and 5 report the methodology and data analysis results, respectively. Section 6 discusses the key findings of this study. Finally, a conclusion is given in Section 7, including both theoretical and practical implications as well as limitations and future research directions.

2. Literature Review

The amount of literature on EV adoption and purchase has grown dramatically in recent years [14–16]. Based on the theory of planned behavior, the theory of reasoned action, diffusion of innovation theory, technology acceptance model, value–belief–norm theory, etc., scholars have examined a series of factors that affect the market penetration of EVs. In this study, we summarize them into the following three aspects.

The first aspect is macro-environment-related factors, which attract the most attention from researchers. In particular, the incentive policies promulgated by the government have been demonstrated to significantly facilitate consumers to purchase EVs [17–20]. More specifically, monetary incentive policy includes government subsidies, reduction of purchase tax and value-added tax, free parking privilege, preferential insurance policy, etc. Non-monetary incentives policy includes separate allocations of license plates, bus lane driving privileges, and so on. Beyond this, the development of charging infrastructure is also an important factor that consumers care about [15,21–23].

The second aspect is EV attribute-related factors, such as cruising range, speed, battery life, charging time, ease of operation, safety, and so on [1,9,24–27]. In addition, price factors and usage costs have also been examined in previous literature [2,28,29]. Of course, due to the economic and cultural differences, studies from different regions yield different findings. For example, Thananusak et al. [30] found that consumers in Thailand seem to pay less attention to financial factors, while the research conducted in China [31] and Spain [32] suggested that high purchase cost is a key inhibitor for EV consumption.

The third aspect is the consumer-related factor, which has been increasingly studied in recent years. Apart from the traditional demographic variables such as gender, age, education, income, family size, marital status, geographical location, etc., scholars have also investigated the impacts of individual attitude and emotions, perceived behavioral control, subjective norms, cognitive status, and moral level on consumers' purchase intention of EVs [2,28,33–36]. Moreover, consumer characteristics such as personal innovativeness, environmental concern, self-image, openness, and lifestyle are also effective in predicting EV adoption [37–41].

Although previous scholars have done much work, several research gaps warrant more effort. First, almost all studies that consider individual attitude towards EVs focused on acceptance attitude, ignoring resistant attitude. People with a positive attitude towards EVs do not necessarily make actual purchases, but those who hold a resistant or negative attitude are highly unlikely to purchase EVs. In this regard, it is of great significance to investigate consumers' purchase intention from the perspective of consumer resistance. Second, a great deal of research has focused on macro-environment and EV attribute-related factors; while it is necessary, the role of policy has become limited with the retreat of government purchasing subsidies in China. In this case, consumer-driven forces are the key elements in ensuring the long-term growth of the EV industry. However, maybe due to its complexity, the extant research on personal psychological factors is still insufficient [14,42]. In particular, how personal values influence consumers' EV purchase intention has received minimal attention from researchers. Finally, as He et al. [37] pointed out, most previous studies failed to examine the positive and negative aspects of perceptions simultaneously, resulting in an incomprehensive cognition.

This study aims to narrow the above research gaps. Specifically, from the perspective of consumer resistance, we hypothesize that personal values will change the value perceptions (perceived benefits and perceived costs) of purchasing EVs, which, in turn, influence consumers' resistant attitude towards EVs, and ultimately their purchase intention. In summary, this study is focused on answering the following research questions: RQ1—How do the two personal values (materialism and ecological consciousness) affect consumers' purchase intention of EVs? RQ2—What is the underlying mechanism by which personal values influence consumers' purchase intention of EVs?

3. Research Model and Hypotheses

Figure 1 depicts the research model of this study, in which we propose that materialism and ecological consciousness exert opposite effects on consumers' purchase intention of EVs. Specifically, materialism is believed to increase the perception of costs and weaken the perception of benefits, thereby leading to a resistant attitude. On the contrary, ecological consciousness will prevent consumers from resisting EVs by increasing the perception of benefits and reducing the perception of costs. Furthermore, we highlight the critical role of resistant attitude in hindering EV consumption. Finally, the mediating roles of value perceptions and resistant attitude in materialism and ecological consciousness on EV purchase intention are also examined. The remainder of this section will develop the hypotheses in detail.



Figure 1. Research model.

3.1. Materialism and Value Perceptions

Materialism is an important life value, which measures one's belief in the importance of material wealth in his/her life [43]. Put it differently; materialism is a value structure through which individuals seek more than the instrumental value from the goods they acquire [44]. According to Richins and Dawson [45], materialists tend to judge themselves and others by the quality and quantity of possessions owned. As such, people who have a higher level of materialism find it harder to be satisfied because they want to get the best quality products [46]. Those perfectionist consumers will perceive more of the product's drawbacks and focus less on its merits [47]. Based on this logic, we can develop the first two hypotheses of this study. On one hand, the perceived costs of purchasing EVs are usually closely related to the quality, such as driving range, battery life, safety hazards, etc. As materialists care more about EV quality [46], consumers with high levels of materialism will perceive more costs of purchasing EVs. On the other hand, the perceived benefits of purchasing EVs mainly lie in policy subsidies and environmental protection. Since materialists are usually more sensitive to the drawbacks than the merits [48], and they are generally self-centered rather than public-interest oriented [49], consumers with high levels of materialism will perceive fewer benefits of adopting EVs than those with low levels of materialism. Based on the above discussion, we posit the following hypotheses:

Hypothesis 1 (H1). *Materialism has a positive effect on consumers' perceived costs of purchasing EVs.*

Hypothesis 2 (H2). *Materialism has a negative effect on consumers' perceived benefits of purchasing EVs.*

3.2. Ecological Consciousness and Value Perceptions

Ecological consciousness is a form of consciousness characterized by a psycho-spiritual connectedness with nature [50]. More generally, ecological consciousness is a personal value that reflects the harmonious development between humans and the natural environment [51]. According to previous research, ecologically conscious individuals show a strong sense of environmental concern [52], which is positively related to consumers' green consumption intention and behavior [53]. Moreover, with a higher spirit of self-dedication for ecological consumers, they are more likely to sacrifice their own interests to protect the environment [54,55]. In the current study, although EVs are defective in some respects, EVs have the characteristics of energy-saving and environmentally friendly. Out of the motivation of keeping positive self-image congruity, consumers with high ecological con-

sciousness will adjust their cognitions to match their ideal self-image [56]. For example, they will magnify the benefits of purchasing EVs, downplay their concerns about the costs of using EVs. Moreover, they will feel proud of their contributions to ecological harmony because the shortcomings of EVs are inevitable sacrifices to protect the environment. Therefore, we propose the following hypotheses:

Hypothesis 3 (H3). *Ecological consciousness has a positive effect on consumers' perceived benefits of purchasing EVs.*

Hypothesis 4 (H4). *Ecological consciousness has a negative effect on consumers' perceived costs of purchasing EVs.*

3.3. Value Perceptions and Resistant Attitude

The relationships between perceived costs and benefits with resistant attitude can be understood through the logic elaborated in the theory of consumer perceived value, which points out that the tradeoff between perceived benefits and perceived costs is the key to determining consumer attitude and behavior [7]. Specific to the current study, a rational consumer will assess EV utility based on his/her perceptions of what is received and what is given [57]. The results of the assessment provide information support for shaping attitude towards EVs. Obviously, perceived costs, such as defects in driving range, battery life, and performance, will contribute to the formation of a negative attitude and lead to consumer resistance. On the contrary, the benefits of purchasing EVs, such as government subsidies, reduction of purchase tax, easy access to licenses, etc., will increase the perceived value of purchasing EVs and reduce the possibility of consumer resistance. Some previous studies have reported the positive relationship between perceived costs and user resistance [58], as well as the negative relationship between perceived benefits with user resistance [59]. Hence, consistent with previous literature, we posit the following hypotheses:

Hypothesis 5 (H5). *Perceived costs have a positive effect on consumers' resistant attitude towards EVs.*

Hypothesis 6 (H6). *Perceived benefits have a negative effect on consumers' resistant attitude towards EVs.*

3.4. Resistant Attitude and Purchase Intention

As Ajzen's theory of planned behavior [8] has been widely adopted in previous literature on EVs, consumer attitude has been considered a key determinant of purchasing behavior [60,61]. However, most previous researchers focus on the acceptance of EVs, few works have explored consumers' resistant attitude. Recently, increasing scholars have realized the hindering effect of consumer resistance in the proliferation of new products [11–13]. For example, Mahmud et al. [62] pointed out that emphasizing the concept of resistance is of great significance when considering the transition from traditional things to innovative things. In this study, resistant attitude reflects the degree of consumers' disapproval of EVs. According to the user resistance theory, consumer resistance is the key element leading to unsuccessful adoption [63]. Specific to the current study, to maintain good consistency in attitude and behavior and reduce the discomfort caused by cognitive dissonance, those who hold a resistant attitude towards EVs thus are less likely to purchase EVs. Therefore, we propose the following hypothesis:

Hypothesis 7 (H7). *Resistant attitude has a negative effect on consumers' purchase intention of EVs.*

3.5. The Mediating Roles of Value Perceptions and Resistant Attitude

The preceding hypotheses suggest that materialism and ecological consciousness have significant impacts on consumers' value perceptions (H1–H4) and that value perceptions have significant impacts on consumers' resistant attitude towards EVs (H5–H6). Further, we propose the indirect effects of materialism and ecological consciousness on resistant attitude through value perceptions. That is, mediating effects. Since personal values represent the highest level of behavioral guidance factors, their influence on individual attitudes and behaviors is usually exerted through affecting personal cognitions and beliefs [64,65]. In this sense, we take the two determinants of perceived value (perceived costs and perceived benefits) as the key mechanism linking materialism and ecological consciousness with consumer resistance. That is the following hypotheses:

Hypothesis 8 (H8). *Perceived costs and perceived benefits will mediate the effect of materialism on resistant attitude.*

Hypothesis 9 (H9). *Perceived costs and perceived benefits will mediate the effect of ecological consciousness on resistant attitude.*

Meanwhile, the proposed hypotheses (H5–H7) motivate us to further propose a mediating role of resistant attitude in the relationships between perceived costs and perceived benefits with purchase intention. There is no doubt that perceived costs are negative, while perceived benefits are positively related to consumers' purchase intention [57]. However, they may not directly affect behavioral intention. Because according to the theory of planned/reasoned behavior [8,66], attitude is the direct determinant of behavioral intention, which conveys the impacts of personal beliefs and evaluation. In this study, perceived costs and perceived benefits are consumers' evaluation of purchasing EVs, while resistant attitude represents the result of the comprehensive tradeoff of perceived costs and perceived benefits; it is thus more representative in determining purchase intention. Moreover, a great deal of research has confirmed the significant mediating role of attitude in the relationships between value perceptions and behavioral intentions [67–69]. Therefore, in line with previous literature, we posit the following hypotheses:

Hypothesis 10 (H10). *A resistant attitude will mediate the effect of perceived costs on purchase intention.*

Hypothesis 11 (H11). A resistant attitude will mediate the effect of perceived benefits on purchase intention.

4. Methodology

4.1. Measures

All measures of our constructs were adopted from previous research, with slight modifications to fit the current study and the realities of China. Specifically, materialism was measured using six items taken from Richins and Dawson's work [45]. A sample item is "I admire people who own expensive homes, cars, and clothes." Cronbach's alpha reliability coefficient of the items is 0.868. Ecological consciousness was measured with four items adapted from Fu and Liang [70] and Bittar [71]. A sample item is "I have convinced my family/friends not to buy products that are harmful to the environment." The internal consistency reliability of the items is 0.784 in this study. Perceived costs were measured with five items adapted from He et al. [37] and Kuo [72]. A sample item is "I worry that electric vehicles won't perform as well as advertised." The Cronbach's alpha in this study is 0.892. To measure perceived benefits, six items were adapted from Huang and Ge [33] and [57]. A sample item is "I think that the government's purchase subsidy for electric vehicles is attractive to me." The internal consistency reliability of the six items is 0.909. The items for resistant attitude were borrowed from Kim and Park [59]. A sample item

is "I am opposed to buying electric vehicles." The Cronbach's alpha reliability coefficient of the four-item scale is 0.877. Finally, four items from Sreen et al. [73] were adopted to measure consumers' purchase intention of EVs. A sample item is "I intend to buy an electric vehicle." The scale showed a high internal consistency, as the Cronbach's alpha value of these items is 0.923.

Considering this study was conducted in mainland China, all the measurements were properly translated using the forward (from English to Chinese) and backward (from Chinese to English) translation procedures. Moreover, then, we invited 20 graduate students working in this field to evaluate the logical consistency, clarity, and understandability of the questionnaire. Based on their feedback, we adjusted the order of the questions and revised the wording appropriately to remove any possible ambiguity. The detailed measurement items are shown in the Appendix A. All the questions were answered on a seven-point Likert scale, ranging from 1 (strongly disagree) to 7 (strongly agree).

4.2. Data Collection and Samples

To cover Chinese consumers in a broader range of regions, we did not use convenience samples around us (e.g., students, colleagues, and friends). Instead, we collected the data using a paid sample service supported by a professional online survey service provider in mainland China (wenjuanxing, sojump.com), which has more than 2.6 million active members with diversified experience and backgrounds. The company is responsible for randomly recommending our questionnaire to its active users. Each successful respondent will receive certain points that can be redeemed for the prizes offered by the company. Before the formal questionnaire, a detailed description of our purpose was arranged to remind the respondents to focus on EVs. Meanwhile, to eliminate privacy concerns, we promised our respondents that all their provided information would be kept confidential and used only for academic research. Moreover, we offered a cash reward of 10 yuan (about \$1.54) to encourage the respondents to answer the questions seriously. The questionnaire cannot be submitted successfully unless all the questions have been completed, and each IP address was allowed to submit the questionnaire only once. In this way, we finally got 511 valid responses from 28 provincial administrative units in China. To ensure the statistical power of our data, we conducted an analysis using G*Power 3.1 [74]. The results suggested that the required minimum sample size for estimating our research model is 146. Therefore, the sample size of 511 demonstrates sufficient statistical power.

Table 1 reports the demographic characteristics of our respondents. The final sample consisted of 256 males (50.1%) and 255 females (49.9%), most of them aged from 18 to 40 years old (93.5%), owned one or more cars (84.3%), lived in cities rather than villages or towns (91.6%), and more than 60% of them were undergraduate (63.9%). Regarding the personal annual income, most respondents, 37.4%, earned CNY 50,000–100,000, 21.8% earned less than CNY 50,000, 27.6% earned CNY 100,000–150,000, and only 4.1% had an annual income above CNY 200,000. With regard to family size, about half of our respondents came from families of three (48.3%), and only 14.5% of the respondents had families larger than five.

Demographic Characteristics	Types	Frequency 256 255 6 130 201 147 19	Percentage (%)	
Gender	Male Female	256 255	50.1 49.9	
	Younger than 18	6	1.2	
	19–25	130	25.4	
A ===	26–30	201	39.3	
Age	31–40	147	28.8	
	41–50	19	3.7	
	Older than 51	8	1.6	

Table 1. Sample characteristics.

Demographic Characteristics	Types	Frequency	Percentage (%)
	High school and below	37	7.2
E have the	Junior college	147	28.8
Education	Undergraduate	291	56.9
	Master and above	36	7.0
	Less than 50,000	111	21.8
	50,000 to less than 100,000	191	37.4
Personal annual income (CNY)	100,000 to less than 150,000	141	27.6
	150,000 to less than 200,000	47	9.2
	More than 200,000	21	4.1
	0	80	15.7
NI I	1	371	72.6
Number of cars owned	2	43	8.4
	More than 2	17	3.3
	First-tier city	98	19.2
Posidontial situ laval	Second-tier city	201	39.3
Residential city level	Third- or fourth-tier city	169	33.1
	Villages and towns	43	8.4
	2 and less	77	15.1
Family size	3	247	48.3
Failiny Size	4	113	22.1
	5 and more	74	14.5

Table 1. Cont.

4.3. Common Method Bias

To avoid the issue of common method bias that may occur in survey-based studies, we adopted the suggestion of Lin and Huang [75] and arranged independent variables in front of the dependent variable in the questionnaire. Second, Harman's one-factor test was conducted; the results reveal that the first primary component accounted for 33.41% of the total variance, far less than the threshold of 50% [76]. In addition, following the procedure proposed by Liang et al. [77], we created a common method factor that included all the items and conducted a structural model analysis. The results are reported in Table 2, which show that all the loadings on the substantive factor are significant, while all the loadings on the common method factor are not significant. Beyond this, compared to the average substantively explained variance (69.2%), the average method-based variance (1.0%) is so small that it can be ignored. Based on the above results, we can conclude that common method bias is not a concern in this study.

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Construct	Indicator	Substantive Factor Loading (R_1)	R_1^2	Method Factor Loading (R ₂)	R_2^2
	MA1	0.757 ***	0.574	0.067	0.005
	MA2	0.789 ***	0.623	0.009	0.000
Materialism	MA3	0.788 ***	0.622	0.043	0.002
(MA)	MA4	0.791 ***	0.625	0.006	0.000
	MA5	0.795 ***	0.632	-0.138	0.019
	MA6	0.740 ***	0.548	0.004	0.000
	EC1	0.770 ***	0.593	-0.022	0.000
Ecological consciousness	EC2	0.819 ***	0.671	0.022	0.000
(EC)	EC3	0.772 ***	0.596	0.017	0.000
	EC4	0.754 ***	0.569	-0.017	0.000
	PC1	0.496 ***	0.246	0.366	0.134
Demonstrand sparts	PC2	0.813 ***	0.661	0.039	0.001
(PC)	PC3	0.974 ***	0.948	-0.182	0.033
$(\mathbf{r}\mathbf{C})$	PC4	0.902 ***	0.814	-0.068	0.005
	PC5	0.995 ***	0.990	-0.157	0.024

Construct	Indicator	Substantive Factor Loading (R_1)	R_1^2	Method Factor Loading (R ₂)	R_2^2
	PB1	0.731 ***	0.534	-0.049	0.002
	PB2	0.894 ***	0.799	0.065	0.004
Perceived benefits	PB3	0.904 ***	0.817	0.064	0.004
(PB)	PB4	0.840 ***	0.706	-0.001	0.000
	PB5	0.836 ***	0.698	0.012	0.000
	PB6	0.766 ***	0.586	-0.094	0.009
	RA1	0.735 ***	0.540	0.149	0.022
Resistant attitude	RA2	0.927 ***	0.859	-0.076	0.006
(RA)	RA3	0.957 ***	0.916	-0.135	0.018
	RA4	0.807 ***	0.652	0.053	0.003
	PI1	0.889 ***	0.790	-0.001	0.000
Purchase intention	PI2	0.907 ***	0.823	0.005	0.000
(PI)	PI3	0.904 ***	0.817	0.006	0.000
	PI4	0.906 ***	0.820	-0.011	0.000
Average		0.826	0.692	-0.001	0.010

Table 2. Cont.

Note: *** *p* < 0.001.

5. Data Analysis and Results

We used variance-based structural equation modeling (VB-SEM) with partial leastsquares-based structural equation modeling (PLS-SEM) techniques. The PLS procedure is a second-generation multivariate technique that can assess the measurement model and the structural model simultaneously in one operation [78]. Compared with covariance-based structural equation modeling (CB-SEM), PLS-SEM performs better in small and non-normal sample analyses [79], and it is more appropriate for exploratory study [80]. Considering the sample size of this study was relatively small, and the data were not normally distributed, we adopted the PLS-SEM approach to analyze the empirical data to validate our research model. In particular, SmartPLS 2 [81], a completely free and widely adopted software of the PLS-SEM software packages, serves to analyze the data. Following the two-stage analysis procedure, we first evaluated the measurement model by conducting a confirmatory factor analysis (CFA). Moreover, then we analyzed the structural model by calculating the overall model fit and the path coefficients for the hypothesized relationships [82].

5.1. Measurement Model

The reliability, convergent validity, and discriminant validity were considered to assess the measurement model. Table 3 shows the CFA results; Cronbach's alpha for our constructs ranges from 0.784 to 0.923, the composite reliability values range from 0.860 to 0.945, both of which exceed the 0.70 thresholds, demonstrating adequate reliability [83]. Furthermore, the individual item loadings range from 0.706 to 0.913, exceeding the benchmark of 0.70. The minimum value of average variance extracted (AVE) is 0.600, higher than the acceptable standard of 0.50. Therefore, the items for our constructs have excellent convergent validity [84]. Finally, the discriminant validity of our measurement model is considered good using the following two criteria. First, as shown in Table 4, all the square root values of the constructs' AVE are greater than the inter-construct correlations [84]. Second, the highest Heterotrait–Monotrait ratio (HTMT) between our constructs is 0.844 (see Table 5), which is lower than the recommended value of 0.85 [85]. The above results indicate that the measurement model of this study exhibits satisfactory reliability, convergent validity, and discriminant validity.

Constructs	Items	Loadings	Cronbach's Alpha	Composite Reliability	Average Variance Extracted	
	MA1 MA2	0.799				
Matorialism	MA3	0.799				
	MAA	0.788	0.868	0.900	0.600	
	MA5	0.706				
	MA6	0.700				
	TO 10	0.737				
	EC1	0.789				
Ecological consciousness	EC2	0.797	0.784	0.860	0.607	
(EC)	EC3	0.757				
	EC4	0.772				
	PC1	0.819				
Domasizzad south	PC2	0.851				
(PC)	PC3	0.810	0.892	0.920	0.698	
	PC4	0.841				
	PC5	0.855				
	PB1	0.773				
	PB2	0.836				
Perceived benefits	PB3	0.849				
(PB)	PB4	0.841	0.909	0.929	0.687	
	PB5	0.828				
	PB6	0.846				
	RA1	0.869				
Resistant attitude	RA2	0.859				
(RA)	RA3	0.833	0.877	0.915	0.730	
	RA4	0.857				
	PI1	0.888				
Purchase intention	PI2	0.905	0.000	0.045	0.010	
(PI)	PI3	0.899	0.923	0.945	0.812	
× /	PI4	0.913				

 Table 3. Results of reliability and convergent validity.

Table 4. Descriptive statistics, correlation matrix, and squared root of the average variance extracted (AVE).

Constructs	Mean	SD	MA	EC	РС	РВ	RA	PI
Materialism (MA) Ecological consciousness (EC)	4.200 4.950	1.270 1.170	0.775 0.151	0 779				
Perceived costs (PC)	3.840	1.450	0.322	-0.211	0.835	0.820		
Resistant attitude (RA)	4.730 3.330 4.620	1.420 1.490 1.610	0.252	-0.259	-0.337 0.744	-0.582	0.855	0 001
Purchase intention (PI)	4.620	1.610	-0.059	0.374	-0.409	0.362	-0.550	0.901

Notes: SD-standard deviation. The values on the diagonal line are the square roots of AVE.

Table 5. Heterotrait-monotrait ratio (1	HTMT)).
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HTMT	MA	EC	PC	РВ	RA	PI
Materialism (MA)						
Ecological consciousness (EC)	0.184					
Perceived costs (PC)	0.366	0.254				
Perceived benefits (PB)	0.153	0.460	0.600			
Resistant attitude (RA)	0.290	0.314	0.844	0.653		
Purchase intention (PI)	0.094	0.440	0.452	0.395	0.611	

5.2. Structural Model

In PLS analysis, the explanatory power of a theoretical model is measured by the R^2 of endogenous variables. Figure 2 depicts the results of PLS analysis, which indicates that our proposed research model explains a substantial proportion of the variance in perceived costs (17.8%), perceived benefits (18.7%), resistant attitude (61.4%), and purchase intention (31.4%). Furthermore, based on the formula suggested by Tenenhaus et al. [86], we calculated the goodness-of-fit (GoF) of this model is 0.47, which exceeds the cutoff value of 0.36 for a large effect size [79]. Taken together, the above results provide support for the well fit of the structural model.



Note: *** *p* < 0.001, + *p* < 0.10, n.s not significant.

Figure 2. Partial least-squares (PLS) results.

As illustrated in Table 6, all the hypotheses regarding direct relationships proposed in this study (H1-H7) are statistically well supported. Specifically, materialism is positively related to perceived costs ($\beta = 0.365$, t = 9.251, p < 0.001), and negatively related to perceived benefits ($\beta = -0.190$, t = 4.686, p < 0.001). On the contrary, ecological consciousness has a significant positive effect on perceived benefits ($\beta = 0.416$, t = 11.131, p < 0.001), and negatively influences the perception of costs ($\beta = -0.269$, t = 7.398, p < 0.001). As expected, the relationships between value perceptions (perceived costs and perceived benefits) with resistant attitude are also significant, with path coefficients at 0.605 (t = 16.785, p < 0.001) and -0.230 (t = 5.253, p < 0.001), respectively. Regarding the hindering effect of resistant attitude in EV consumption, the results of this study provide sufficient support, as resistant attitude is strongly and negatively correlated to purchase intention of EVs ($\beta = -0.537$, t = 8.551, p < 0.001).

Hypothesis	Paths	Path Coefficient	t-Statistics	<i>p</i> -Values	Results
H1	Materialism→perceived costs	0.365	9.251	0.000	Support
H2	Materialism→perceived benefits	-0.190	4.686	0.000	Support
H3	Ecological consciousness → perceived benefits	0.416	11.131	0.000	Support
H4	Ecological consciousness-perceived costs	-0.269	7.398	0.000	Support
H5	Perceived costs→resistant attitude	0.605	16.785	0.000	Support
H6	Perceived benefits→resistant attitude	-0.230	5.253	0.000	Support
H7	Resistant attitude→purchase intention	-0.537	8.551	0.000	Support

To verify the hypotheses of mediating effects, we adopted the classic three-step method proposed by Baron and Kenny [87]. Step 1 evaluates the relationships between independent

variables and dependent variables; Step 2 evaluates the relationships between independent variables and mediators. In Step 3, both independent variables and mediators are added into a model to perform regression on dependent variables. As shown in Table 7, the significant paths from materialism and ecological consciousness to resistant attitude (in Step 1) become non-significant when perceived costs and perceived benefits are added into the model (in Step 3), indicating full mediating effects of perceived costs and perceived benefits. Therefore, H8 and H9 are supported. Similarly, a resistant attitude fully mediates the impacts of perceived costs and perceived benefits on purchase intention, supporting H10 and H11.

TX 7		DV	Step 1 Step 2 Step 3		р 3	Results	
IV	IVI	DV	IV→DV	IV→M IV-	$IV { ightarrow} DV$	$\mathbf{M} { ightarrow} \mathbf{D} \mathbf{V}$	Kebulto
MA	PC PB	RA	0.269 ***	0.328 *** -0.141 **	0.034 n.s.	0.608 *** -0.207 ***	H8: Full mediation
EC	PC PB	RA	-0.265 ***	-0.231 *** 0.393 ***	-0.040 n.s.	0.620 *** -0.230 ***	H9: Full mediation
PC PB	RA RA	PI PI	-0.416 *** 0.363 ***	0.755 *** -0.585 ***	0.004 n.s. 0.060 n.s.	-0.556 *** -0.518 ***	H10: Full mediation H11: Full mediation

Table 7. Results of mediation test.

Notes: IV—independent variable; DV—dependent variable; M—mediator; MA—materialism; EC—ecological consciousness; PC—perceived costs; PB—perceived benefits; RA—resistant attitude; PI—purchase intention. *** p < 0.001; ** p < 0.01; n.s.—not significant.

6. Discussion

This study proposes a theoretical model to investigate the impacts of two growing personal values in the Chinese context (materialism and ecological consciousness) on consumer purchase intention of EVs. The empirical analysis using data from 511 online surveys supports all our hypotheses. Each of the findings of this study is noteworthy for further discussion.

First, consistent with many researchers suggesting that materialism is an unhealthy personal value [88,89], this study finds that materialistic value is not conducive to the proliferation of EVs. According to the supported H1 and H2, we can conclude that materialists tend to perceive more costs and fewer benefits of adopting EVs, thus less likely to purchase EVs. Meanwhile, the finding of the current study, to some extent, can support previous conclusions that materialism is bad for environmental behavior [90–92]. In this regard, to reduce consumer resistance to EVs, it is necessary to guide consumers to abandon such unhealthy personal values within the whole society.

Second, as opposed to materialism, this study finds that ecological consciousness exerts an important role in promoting the market penetration of EVs. Consistent with the proposed H3 and H4, the empirical results indicate that ecological consciousness has a positive impact on consumers' perceived benefits of adopting EVs on one hand, a negative impact on perceived costs on the other hand. As a consequence, people with high levels of ecological consciousness are more likely to purchase EVs. In line with several recent studies [93,94], for instance, the research conducted in India by Shalender and Sharma [93], which found a positive relationship between environmental concern and EV adoption intention, the present study provides additional support for the significant relationship between ecological consciousness and EV adoption among general Chinese consumers.

Third, the supported H5 and H6, along with the high variance of resistant attitude explained by value perceptions (61.4%), suggest the finding that value perceptions, including perceived benefits and perceived costs, are the core determinant of consumer attitude. This finding fully confirms the universality of Zeithaml's theory of consumer perceived value [7], which emphasizes that the tradeoff between perceived benefits and perceived costs is the key to determining consumers' purchasing behavior. Furthermore, the comparison between the coefficients from perceived benefits and perceived costs to

resistant attitude indicates that perceived costs exert a much more critical role in developing resistant attitude (0.605 > 0.230, p < 0.001), which echoes Baumeister et al.'s suggestion that "bad is stronger than good" [95].

Fourth, this study finds that consumer resistance is an important reason for the slow market penetration of EVs. Specifically, the supported H7 regarding the significant and negative relationship between resistant attitude and consumers' purchase intention of EVs is a supplement to the existing literature on EV adoption. Considering a tremendous amount of attention has been paid to traditional accept attitude [33,93], we in this study investigate EV adoption from the perspective of consumer resistance. This finding, to some extent, supports scholars' argument that resistant attitude is the fundamental element in determining one's disengagement in specific behaviors [12,13]. Therefore, more investigations on the factors contributing to consumer resistance are worth being conducted in the future.

Finally, in line with the logics elaborated in theories of consumer perceived value and planned/reasoned behavior [7,8], we find that value perceptions and consumer attitude are the key mechanisms linking personal values with purchase intention. On one hand, the results support H8 and H9. That is, value perceptions (perceived benefits and perceived costs) not only fully mediate the positive impact of materialism on consumer resistance to EVs but also the inhibitory effect of ecological consciousness on consumer resistance. On the other hand, H10 and H11, which suggest complete mediations of resistant attitude in the relationship between value perceptions and purchase intention, are also supported. The above results inform us that personal values affect consumer behavior by changing their value perceptions and further shaping their behavioral attitude.

7. Conclusions

This study investigates how the two growing personal values in the Chinese context (materialism and ecological consciousness) affect the purchase intention of EVs. The empirical results suggest that materialism will hinder EV adoption, while ecological consciousness can promote consumers' purchase intention. Moreover, value perceptions (perceived benefits and perceived costs) and resistant attitude fully mediate the effects of these two personal values. The theoretical and practical implications of these findings and the limitations and future research directions will be described in detail in the remainder of this section.

7.1. Theoretical Implications

This study contributes to the literature in the following three ways. First, this study advances the understanding of EV adoption by investigating the differential effects of two growing personal values (materialism and ecological consciousness). As mentioned before, although much work has been done to help understand consumers' purchase intention of EVs, a great deal of them focused on macro-environment and EV attribute-related factors. In contrast, limited exploration activities of personal psychological factors, especially personal values, have been undertaken to date. With the gradual withdrawal of policy subsidies in the future, consumer-related factors will become the core elements that dominate the consumption of EVs. In this sense, by investigating the impacts of two personal values of materialism and ecological consciousness, this study emphasizes the vital role of personal psychological factors in determining EV adoption.

Second, this study proposes and verifies the underlying mechanism that links personal values and behavioral intention. Specifically, the results of this study suggest that value perceptions such as perceived costs and perceived benefits significantly and fully mediate the relationships between materialism and ecological consciousness with consumer resistance. Put it differently, personal values, as the highest level of behavioral guidelines, affect individuals' behaviors by changing both the perceptions of costs and benefits. Beyond this, as most previous literature on EVs failed to examine the positive and negative aspects simultaneously, the current study is expected to narrow this research gap by taking both

perceived costs and perceived benefits of adopting EVs into consideration. The results indeed highlight the necessity of targeting both of them, thus offering an empirical reference for future studies.

Finally, by investigating the role of resistant attitude in determining consumer purchase intention of EVs, the current study provides some new insights into understanding the market penetration dilemma of EVs. Specifically, as the theory of planned/reasoned behavior has been widely adopted in prior relevant studies, researchers have demonstrated the effectiveness of attitude in predicting purchase behavior. However, most previous studies focus solely on the traditional accept attitude, ignoring resistant attitude, which is also crucial in determining the successful transition from traditional things to new things. Therefore, the findings of this study, for example, resistant attitude cannot only effectively predict purchase intention but also fully mediate the relationships between perceived costs and perceived benefits with purchase intention, suggest that consumer resistance cannot be ignored when discussing EV adoption. In this regard, the perspective adopted in this study is believed to provide possible directions for future research.

7.2. Practical Implications

This study also provides several practical implications. First, as resistant attitude is negatively related to purchase intention, the government and the industry should find ways to reduce consumer resistance. In this respect, the current study further offers two feasible schemes. On one hand, measures to decrease consumers' perception of costs can be taken. For instance, the government should speed up the construction of public charging infrastructure for EVs and increase the geographic coverage of charging piles. EV manufacturers should strive to improve charging speed and shorten charging time through technological innovation. If conditions permit, they can install home-charging devices for consumers to further improve the convenience of using EVs. Meanwhile, to reduce the concerns about EV performance, it is worthwhile to set up more physical experience stores and invite consumers to test drives. Beyond this, the marketers are encouraged to hire authoritative third parties to conduct field tests on their products. This approach can increase consumers' trust, thereby promoting the smooth penetration of EVs. On the other hand, measures to increase the perceived benefits of using EVs are suggested to implement. For example, the government should focus more attention on EV promotion, including increasing financial subsidies and tax reductions, decreasing charging prices and insurance costs, allocating license plates separately, and granting EVs the right to use bus lanes.

Second, since materialism has a positive effect on consumer resistance to EVs, the following suggestions are given to promote the penetration of EVs in the market. Specifically, although materialism may promote the consumption of some commodities (e.g., luxury goods), it is generally considered by scholars to be a bad personal value because materialism can lead to unhealthy consumer behavior and a series of adverse effects [89,96,97]. This study finds that materialism can increase perceived costs and decrease perceived benefits of adopting EVs, thus leading to consumer resistance. In this regard, governments and societies, especially those in developing countries, should encourage people to establish correct and healthy personal values through school education and the media. At the same time, considering that some individuals have already developed a high-level of materialistic value, the manufacturers can make corresponding strategies according to consumers' preferences. For example, as materialists care more about product quality, it is essential for manufacturers to improve EV quality, especially in terms of battery life, driving range, and safety. Alternatively, considering that materialists desire high social value in the products they purchase [46], the government and the industry can promote EVs by encouraging high-influential public figures (e.g., celebrities, politicians, etc.) to establish an excellent image of EVs.

Third, the significantly negative effect of ecological consciousness on resistant attitude towards EVs demonstrates several practical guidance. For instance, the belief that everyone is responsible for protecting the environment should be deeply rooted in everyone's mind. The government must do adequate environmental protection propaganda work through public media to further enhance national ecological consciousness. Meanwhile, the government should spare no effort to create an environment-friendly society and keep a zero-tolerance attitude towards behaviors harmful to the environment. Second, relevant dealers and marketers could emphasize the seriousness of environmental problems and EV environment-friendly features. Moreover, some other measures, such as encouraging EV manufacturers to donate a certain percentage of their sales to participate in environmental protection public welfare activities, awarding environmental protection honors to consumers who purchase EVs, etc., are worthy of being implemented.

7.3. Limitations and Future Research

This research has several limitations that should be noted. First, as the data were crosssectional, all statistically supported relationships can only be seen as tentative. Therefore, future studies are encouraged to collect multiple-wave data to verify the causal relationships among these constructs. Second, the dependent variable of this study is purchase intention rather than actual purchase behavior. In this regard, there are two possible suggestions for future studies. On one hand, future scholars are encouraged to collect data on consumers' actual purchase behavior from EV retailers. On the other hand, the factors determining whether purchase intention can be transformed into actual purchase behavior are worth exploring. Third, this study only focuses on two specific personal values (materialism and ecological consciousness). Some other personal values such as hedonism, conformity, cultural openness, and tradition deserve further study in the future. Last, but not least, we call on scholars in this field to develop research models from the perspective of consumer resistance, which may be more appropriate for understanding why consumers do not purchase EVs.

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Constructs	Items
Materialism (MA)	 MA1: I admire people who own expensive homes, cars, and clothes. MA2: I place much emphasis on the amount of material objects people own as a sign of success. MA3: I like a lot of luxuries in my life. MA4: I put much emphasis on material things than most people I know. MA5: I would be happier if I could afford to buy more things. MA6: It sometimes bothers me quite a bit that I can't afford to buy all the things I would like.
Ecological consciousness (EC)	EC1: I have convinced my family/friends not to buy products that are harmful to the environment. EC2: I tend not to buy household products that harm the environment. EC3: I tend not to buy products that have excessive packaging. EC4: I make every effort to buy paper products made from recycled paper.

Appendix A. Measurement Items

Constructs	Items
Perceived costs (PC)	PC1: Purchasing electric vehicles will probably result in unexpected hassles.PC2: I worry that electric vehicles will not perform as well as advertised.PC3: I am afraid that the driving range of electric vehicles won't meet my needs.PC4: I worry that electric vehicles will be troublesome in terms of charging.PC5: I am afraid that the battery life of electric vehicles will be short.
Perceived benefits (PB)	PB1: I think that the separate allocation of electric vehicle license plates is attractive to me.PB2: I think that the abolishment of restriction on traffic of electric vehicles is attractive to me.PB3: I think that the government's purchase subsidy for electric vehicles is attractive to me.PB4: I think that the tax exemption policy for electric vehicles is attractive to me.PB5: I think that the low usage cost of electric vehicles can help me save a lot of money.PB6: I think that electric vehicles can contribute to energy conservation and emission reduction.
Resistant attitude (RA)	RA1: I am not optimistic about electric vehicles. RA2: I am opposed to buying electric vehicles. RA3: I think electric vehicles won't replace gasoline vehicles in the future. RA4: I think electric vehicles won't meet my expectations.
Purchase intention (PI)	PI1: I intend to buy an electric vehicle.PI2: I plan to purchase an electric vehicle.PI3: I will give priority to electric vehicles when buying vehicles in the future.PI4: I will purchase an electric vehicle in my next purchase.

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