

Article

Market Cultivation of Electric Vehicles in China: A Survey Based on Consumer Behavior

Shuxia Yang ^{1,2,*}, Di Zhang ^{2,*}, Jing Fu ², Shujing Fan ³ and Yu Ji ² 

¹ Beijing Key Laboratory of New Energy and Low-Carbon Development, North China Electric Power University, Beijing 102206, China

² School of Economics and Management, North China Electric Power University, Beijing 102206, China; fujing_ncepu@163.com (J.F.); jiyu1225jiyu@ncepu.edu.cn (Y.J.)

³ Kunming Power Supply Bureau, Kunming 650000, China; fsj163fsj@163.com

* Correspondence: bjysx216@126.com (S.Y.); zhangdi4796@163.com (D.Z.); Tel.: +86-13681139160 (S.Y.)

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Abstract: Faced with increasingly serious environmental problems, promoting EVs (electric vehicles) has become an important means of sustainable development. In 2017, EV sales accounted for more than half of the world's total. Although the speed of development is fast, the ownership remains low. In 2017, the market share of EVs in China was only 2.7%. At present, there are few studies on the promotion of EVs. This study seeks to contribute to the organic combination of consumer behavioral characteristics and EV market cultivation. Based on the analysis of relevant research at home and abroad, the consumer behavior of EVs is investigated and the factor analysis is used to simplify the feature categories, in order to obtain consumers' behavior characteristics of EVs. According to the characteristics of consumer behavior of EVs, suggestions are put forward to cultivate EV market from the aspects of existent technology and potential future technology of EVs.

Keywords: sustainable development; electric vehicle; consumer behavior theory; market cultivation; separation of vehicle and electricity

1. Introduction

In recent years, various climate problems have become increasingly prominent due to the excessive emission of greenhouse gases. From the perspective of sustainable development, China has implemented policies to purchase EVs without purchase tax [1]. Driven by policies, EV market has developed rapidly since 2011 in China, becoming the world's largest EV market (Table 1). The sales of EVs are fast growing, but the proportion of EVs is still low and the amount of ownership remains small. In 2017, the market share of EVs in China is only 2.7%. Policy promotion is difficult to sustain, and the development of EVs must respect market rules so as to achieve healthy development. Important policies such as subsidy reduction and "double credit score" were successively introduced. "Double credit score" refers to the average fuel consumption points and electric vehicle points of passenger car companies, and the related accounts are calculated. "Double credit score" policy has higher requirements for automobile manufacturers. The more electric vehicles that are produced, the higher and more favorable the score. Otherwise, there is a risk of suspension of business. EV points will be 10% and 12% respectively in 2019 and 2020, and the points will be announced separately after 2021. This will encourage the production of EVs and vehicles with low fuel consumption. Therefore, the development of EVs is facing an important shift from policy-led to market-driven [2,3]. The cultivation of the EV market is the only way.

Table 1. 2011–2017 Sales of EVs (electric vehicles) in China.

Year	Sales of EVs	Year-on-Year Growth (%)	Total Car Sales (104 Cars)	Year-on-Year Growth (%)	The Proportion of EVs (%)
2011	8159		1850.51	2.46	0.044
2012	12791	56.77	1930.64	4.33	0.066
2013	17600	37.60	2198.41	13.87	0.080
2014	74763	324.79	2349.19	6.86	0.318
2015	331092	342.86	2459.8	4.71	1.346
2016	507000	53	2802.8	13.7	1.8
2017	777000	53.25	2887.89	3.04	2.7

Data source: China Auto Industry Association.

There is more and more research on EV market at home and abroad. Germany has studied the consumption of EVs from the perspectives of psychology, environmental management, business management, and information technology. Holland, Norway, Denmark, and Sweden are all well-developed countries in the EV market, and the relevant research is also more systematic [4]. In the fourth quarter of 2011, the German RWE group surveyed 6421 consumers from 12 global auto markets, including 502 from China. Research shows that Chinese consumers will be the second most willing to buy EVs after Indian consumers. The main motive in purchasing EVs of 40% consumers is energy conservation and environmental protection, and the most worrying thing for consumers is charging the vehicle [5]. Consumers in both China and U.S. prefer EVs with lower prices and subsequent use costs, shorter acceleration time, and a quicker charging process [6]. Although government subsidies can stimulate the purchase intention of EVs to a certain extent, the effect is relatively weak; the effect of government subsidies is more obvious for the consumers with lower annual household income, higher preferential policies and environmental awareness [7]. The reduction of monetary cost and purchase tax and the emission of low emission are the main factors to stimulate the consumption demand of EVs [8,9]. Increasing the maximum travel distance, reducing charging time, and improving charging convenience can help to stimulate consumers' purchase intention [10]. The safety of EVs, after-sales service, service convenience, sales price and vehicle performance are the key factors affecting the purchase decision of EVs. The price is the most important factor determining whether the consumers choose the EV or not [7,11,12]. The greater the age, the higher the probability of buying EVs [13]. Limited travel distance and longer charging time are the main reasons why consumers still hold a negative attitude towards EVs [10]. The environmental advantages of EVs do not attract consumers enough, and consumers are concerned about the performance of EVs [14]. Environmental attributes and fuel costs are the most important factors that affect most consumers' purchase of EVs [15].

Drawing on the successful experience of EV market cultivation in developed countries, China must start with the aspects of subdividing the market, grasping the early consumers, respecting the market law, giving priority to the cultivation of the hybrid power, improving the support policy of the industrial chain, and increasing the support of the policy, so as to seek countermeasures for market cultivation of EV industry [16]. At present, the EV users are mainly "innovators". Along with the innovators' first entry, the "followers" (early adopters and early majority, etc.) will gradually enter. The EV manufacturers should dynamically adjust the management decisions according to the consumption characteristics of the two types of users, and the R&D (research and development) input is more effective in promoting the innovators' purchase intention, and the marketing input is more effective in promoting the followers' purchase intention [17]. The enterprise should take "self-construction" as the distinguishing variable of the target population, transmit "related" marketing information into different segmented market, and improve the consumer perception behavior control with detailed product related information. It is suggested that the relevant government departments should actively guide the public perception of the far social distance to the benefits of EVs, stimulate the public's situational self-construction, transmit the related information, and then influence and

promote the consumer's purchase intention of EVs [18,19]. With the formally introduced "double credit score" policy in 2017 and the further cut of national and local subsidies, the EV industry is accelerating from policy-driven to market-driven, and consumer demand needs further stimulation. Consumers are the main subject of the market. Their consumption behavior and consumption attitude affect the development direction and development trend of the EV market [7].

At present, there are few systematic research results on consumer behavior of EVs. This research only focused on the factors that affect consumer decision-making. Although it is partly involved in consumer behavior, it does not carry out a comprehensive study of consumer behavior. In academic research and practice, a consensus has been formed to strengthen the cultivation of EV market. In view of this, there is still a lot of room for systematic research on the cultivation of EV market based on the definition of consumer behavior.

This article is to solve the following problems: (1) Characteristics of consumer behavior of EVs in China. Combining the individual and psychological factors of consumers, starting from the aspects of consumer resources, needs and motivations, consumer perception, learning and memory, consumer attitudes, etc., this paper designs a comprehensive and scientific questionnaire for the required information. The questionnaire is then distributed to actual consumers and those who have a tendency to purchase, while ensuring the reliability and validity of the collected questionnaire. (2) Market cultivation measures based on consumer behavior of EVs. Based on the perspective of consumer behavior, suggestions are put forward to cultivate EV market combined with the current status of China's EV market.

The paper is organized as follows: Section 2 is questionnaire survey and related processing methods. Section 3 provides the data and analysis of consumer behavior of EVs in China. Section 4 summarizes and discusses the results of the investigation. Section 5 provides research conclusions and suggestions for the cultivation of EV market.

2. Methods

2.1. Survey

The survey in this paper is divided into four stages: in-depth interview, questionnaire design, presurvey, formal investigation.

(1) In-Depth Interview

In the initial stage of the survey, the in-depth interview method was used to explore the research information, to understand the consumer behaviors related to EVs at present, to find out the direction that needs to be investigated next, and to lay the foundation for the follow-up questionnaire design.

A total of 10 interviewees were selected during the in-depth interview phase, including actual users of EVs, potential consumers of EVs, and people who have no plans to purchase cars for the time being. Through interviews, the following conclusions are drawn:

- (1) Different consumers have different understandings of EVs, especially the difference between EV owners and those who have no need to purchase cars.
- (2) The motivation for EV owners to buy EVs is mainly the license policy and subsidy policy, while other motivations are not clear.
- (3) There is a widespread lack of understanding of EVs and charging piles.
- (4) It is considered that the EV has insufficient battery life and charging is not convenient.

(2) Questionnaire Design

The questionnaire of this study was designed with reference to the relevant theory of consumer behavior, combined with the interview results obtained by the in-depth interview method, and refined and revised based on the opinions of the automobile sales personnel and the automobile consumers. The content of the questionnaire is divided into 3 parts: the first part is the consumption of the

respondents to EVs, and the related questions were set around the actual consumption of EVs and the purchase process; the second part is the basic situation of the respondents; and the third part is the Likert scale on the attitude of EV consumers, considering consumer needs and motivations, consumer perception, consumer attitudes and concerns. There are 19 questions, of which there are 35 items in the Likert scale. The design of the questionnaire takes full consideration of types and analysis methods of data needed, which takes the information as the starting point. Meanwhile, it ensures the rationality of the questionnaire design, the objectivity of the problem setting, and the privacy of the respondents.

(3) Presurvey

After the design of the questionnaire was completed, the presurvey was conducted so as to optimize the questionnaire according to the results of the analysis. After the questionnaire was distributed through the network and interception, 140 presurvey questionnaires were collected, and the collected questionnaires were processed for data to facilitate reliability analysis.

Reliability analysis is an effective analysis method used to analyze the stability and reliability of a comprehensive evaluation system. In the Likert scale of the questionnaire, the reliability analysis of 35 items was analyzed with the Cronbach's α coefficient method. The results were shown in Table 2, in which $\alpha = 0.945$ and > 0.7 , indicating that the internal reliability of the overall scale was ideal.

Table 2. Reliability Statistics.

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.946	0.945	35

(4) Formal Investigation

In order to study the behavior of EV consumers, this paper limits the respondents of the questionnaire to the actual users of EVs and potential users with recent consumption trends. Therefore, only the target audience can fill out the questionnaire.

In order to facilitate the collection of data and later data processing, this study mainly through the network issued a questionnaire. The survey did not make a distinction in basic conditions like area, age, occupation et al. According to the formula (1) for determining the sample size:

$$n = \frac{Z^2 pq}{E^2} \quad (1)$$

When the confidence level is 95%, $Z = 1.96$, p takes 5%, $q = 1 - p$, error value $E = 2.5\%$, the sample capacity is $n = 292$. At least 292 samples are required to ensure that the error range is less than 2.5% on the confidence level of 95%. In order to obtain the number of required samples, the questionnaire was published online from 3rd April to 20th May 2018, and the interception questionnaire was issued. During the period, 344 questionnaires meeting the target conditions were collected. After eliminating the invalid questionnaires, there were 343 valid questionnaires and they met the sample size requirements.

2.2. Questionnaire Variable Processing

In order to reduce the complexity of the problems and overcome the correlation and overlap between the variables, this paper used factor analysis to simplify the feature categories of the behavior of EV consumers. The analysis can use fewer variables to replace the original variables, and the variables after "dimensionality reduction" can also reflect most of the information in the original variables. The analysis results show that most variables have high correlation and strong linear relationship and it can extract several representative principal components. The KMO (Kaiser-Meyer-Olkin) test and Bartlett's test of sphericity are performed on the data. The results are shown in Table 3. The observational value of the Bartlett's test of sphericity is 10,407.800, and the

corresponding probability p is 0. If the significant level is 0.05, then the original hypothesis is rejected, and the alternative hypothesis is accepted, so the correlation coefficient matrix has a significant correlation with the unit matrix. At the same time, the greater the KMO value, the more suitable for factor analysis. The KMO value of this study is $0.919 > 0.9$, which is a very good representation, thus it is known that the original variable is suitable for extracting the principal component.

Table 3. KMO (Kaiser-Meyer-Olkin) and Bartlett's test.

Kaiser–Meyer–Olkin Measure of Sampling Adequacy		0.919
Bartlett's Test of Sphericity	Approx. Chi-Square	10,407.880
	df	595
	Significance. (p)	0

Using SPSS 22 to analyze the sample data, we can see the factors explaining the total variance of the original variables (Table 4). The principal component analysis method is used to extract the factors, and a total variance interpretation table including the eigenvalue, the variance contribution rate, and the cumulative contribution rate is obtained. It can be seen from Table 4 that the cumulative variance contribution rate of 5 factors is 70.182%, indicating that these five principal components can generalize the meaning of 35 indicators. According to the variable correlation coefficient matrix, using scree plot analysis (Figure 1), through the analysis of scree plot, five factors were selected to be the best.

Table 4. Total variance explained.

Component	Initial Eigenvalues			Extraction Sums of Squared Loading			Rotation Sums of Squared Loading		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	12.553	35.866	35.866	12.553	35.866	35.866	7.500	21.430	21.430
2	4.896	13.989	49.855	4.896	13.989	49.855	4.853	13.867	35.297
3	3.858	11.023	60.879	3.858	11.023	60.879	4.717	13.476	48.773
4	2.088	5.967	66.846	2.08	5.967	66.846	4.085	11.672	60.444
5	1.167	3.336	70.182	1.167	3.336	70.182	3.408	9.737	70.182

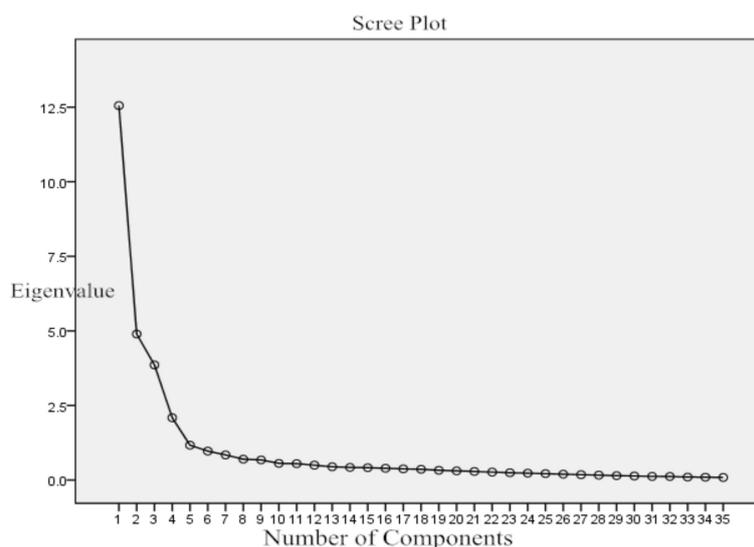


Figure 1. Scree plot factor analysis.

2.3. Factor Analysis

After implementing a Kaiser-normalized orthogonal rotation on the factor load matrix using the maximum variance extraction method, through the collation and induction analysis of each component, the 5 factors that had been extracted are used to describe the 35 items measured in the scale. They can be respectively named as the degree of understanding, purchase concerns, social status, consumer

perception and attitudes, as shown in Table 5. The reliability of five extracted factors was analyzed respectively. The results ranged from 0.856 to 0.950, higher than 0.7, indicating that all five factors had good reliability.

Table 5. Common factor extraction.

Factors	Items	Component 1	Component 2	Component 3	Component 4	Component 5	α
Degree of understanding	Understanding of the price	0.777	0.220	0.127	−0.004	0.009	0.950
	Understanding of endurance mileage	0.814	0.272	0.070	0.081	−0.001	
	Understanding of the charging speed	0.844	0.238	0.034	0.092	0.026	
	Understanding of driving experience	0.841	0.208	0.129	0.062	0.016	
	Understanding of the cost of use	0.883	0.135	0.031	0.067	0.074	
	Understanding of the subsidy policy	0.817	0.206	0.121	0.077	0.047	
	Understanding of charge pile coverage rate	0.849	0.045	0.200	0.070	0.027	
	Understanding of the location of the 4S store	0.823	0.024	0.186	0.160	0.031	
	Convenience to the 4S store	0.769	−0.057	0.226	0.214	0.075	
	More optional vehicle models	0.605	−0.034	0.247	0.412	0.090	
Purchase concerns	Often see advertisements	0.542	0.083	0.133	0.338	0.200	0.912
	Troublesome charging	0.064	0.788	0.051	0.073	−0.002	
	Long charging time	0.152	0.821	0.045	0.044	0.179	
	Unguaranteed battery safety	0.110	0.827	0.061	0.140	−0.057	
	Unguaranteed battery durability	0.134	0.878	0.014	0.038	0.120	
	Used car may not preserve value	0.114	0.819	0.013	0.096	0.144	
	price performance ratio is not higher than traditional fuel vehicle	0.342	0.613	0.187	−0.135	0.113	
	Not enough endurance mileage	0.206	0.708	0.138	−0.081	0.160	
	Bring social recognition and status	0.163	0.102	0.779	0.242	0.265	
	Improve the attitude of others to yourself	0.255	0.058	0.829	0.174	0.222	
Social status	Upgrade the social level	0.201	0.100	0.851	0.237	0.121	0.945
	make people more appreciative of themselves	0.218	0.082	0.826	0.295	0.106	
	Show the taste of fashion and fashion	0.218	0.127	0.809	0.292	0.087	
	Attractive appearance	0.123	0.126	0.555	0.613	0.084	
	Attractive performance	0.149	0.022	0.398	0.724	0.164	
	Attractive storage space	0.167	0.086	0.402	0.721	0.179	
	Attractive subsidy policy	0.100	0.229	0.263	0.648	0.287	
	Meet the need of the vehicle	0.106	−0.039	0.375	0.702	0.271	
	Serious environmental pollution at the moment	0.069	0.210	0.023	0.117	0.666	
	Consider environmental factors when purchasing products	0.017	0.031	0.278	0.144	0.747	
Attitudes	EVs are the future development trend	0.075	0.169	0.023	0.250	0.779	0.856
	Have confidence in domestic EVs	0.178	−0.058	0.232	0.319	0.680	
	Priority consideration of the next car	0.279	−0.037	0.124	0.602	0.425	
	EVs are worth buying	0.232	−0.005	0.050	0.631	0.476	
	Expect to get a purchase proposal	0.029	0.237	0.229	0.159	0.619	

3. Data

3.1. Descriptive Analysis of the Overall Sample

In the statistical results of questionnaires, there are contents without significant difference between the sample statistics of potential consumers and actual consumers. The contents can be represented and explained by the results of the overall sample analysis, including nine areas of the consumption intention of EVs, purchase process, consumer characteristics, degree of understanding, consumer perception, social status, consumer purchase attitudes, purchase concerns and purchase concerns under different understanding levels.

3.1.1. Consumption Intention of EVs

Firstly, the consumption intention in the first part of the questionnaire (the consumption of EVs) is analyzed. In the questionnaire survey, only 28 people have purchased EVs, accounting for 8.16% of

all questionnaires. 315 people have not purchased EVs, accounting for 91.84% of all questionnaires. The main uses of EVs of the overall sample are shown in Figure 2.

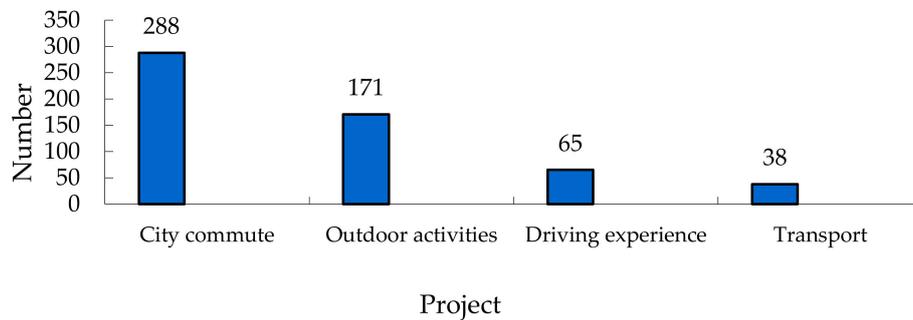


Figure 2. Main uses of EVs.

Through the intuitive display of graphics, consumers mostly want to improve the comfort and convenience of the car, followed by the assisted driving technology, and the interest in the entertainment interconnection is low. The vehicle configuration technologies that consumers want are shown in Figure 3.

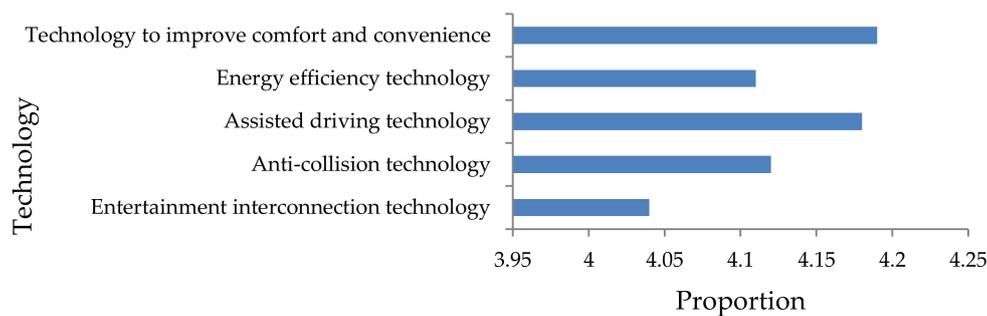


Figure 3. Technology for expecting car configuration.

According to the observation and analysis of Figure 4, the proportion of five passengers is the highest, and the proportion of four people or more is higher than 75%. The passenger room of EVs must be able to meet the multiple passenger need.

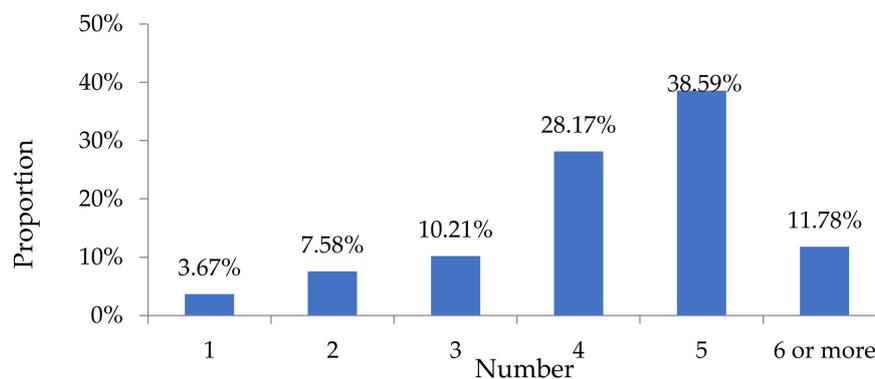


Figure 4. The main number of passengers in the car.

As shown in Figure 5, consumers are more inclined to small and medium-sized cars and sport utility vehicle (SUV). Among them, the proportion of SUV models is more than 36%, and the proportion of small and medium-sized cars is more than half. The largest market for EVs will be concentrated in small and medium-sized cars. Small and medium-sized cars combine practicality and economy, which are favored by most consumers.

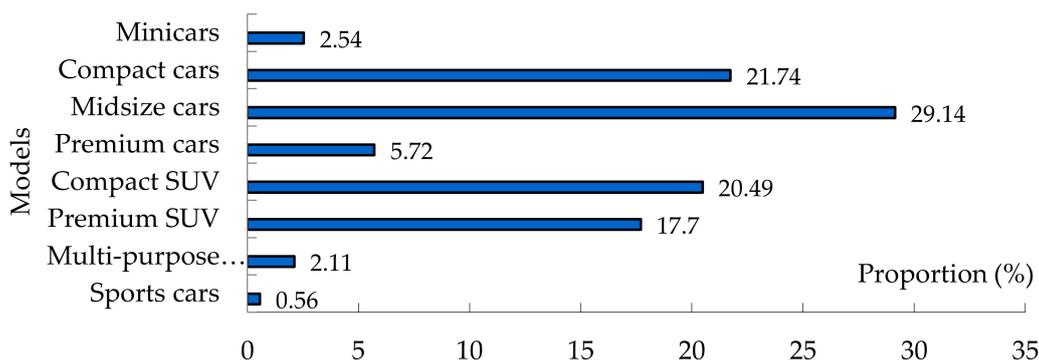


Figure 5. The most likely type of car to buy.

Through statistics, as shown in Figure 6, consumers are most likely to buy plug-in hybrid vehicles, followed by hybrids, and the last is pure electric vehicles. Combined with the above analysis, consumers believe that the endurance mileage of pure electric vehicles is not guaranteed. At the same time, plug-in hybrid vehicles take the characteristics of energy saving and environmental protection into account, which is the main reason why consumers prefer plug-in hybrid vehicles [20,21].

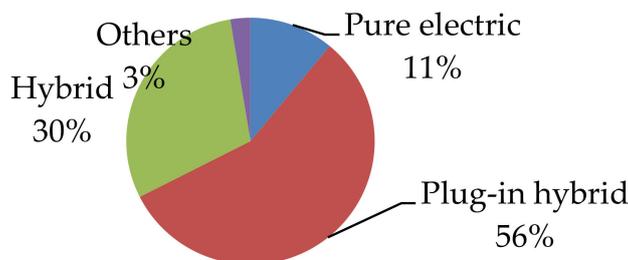


Figure 6. The most likely EV type to be selected.

3.1.2. Purchase Process

The data in Table 6 shows that most consumers prefer the traditional 4S shop dealer pattern to purchase, but there are also quite a few respondents who are willing to choose a new pattern of “online purchase + offline experience + delivery to the door”. There is always a market for demand, and a new consumption pattern for EVs needs to be developed.

Table 6. Preferred purchase patterns.

Purchase Patterns	Quantity	Percentage
4S shop dealer	228	66.47%
Online purchase + offline experience + delivery to the door	107	30.20%
Others	8	2.33%

The data in Table 7 shows that more than two-thirds of respondents are not aware of EV financial loans. About one-third of consumers who understand vehicle finance loans are not satisfied. The reasons for the specific dissatisfaction are yet to be investigated.

Table 7. Satisfaction degree of EV finance loan.

Satisfaction Degree of EV Finance Loan	Quantity	Percentage
Satisfied	74	21.45%
Not satisfied	40	11.59%
Do not understand	231	66.96%

By comparing the data in Table 8, it is found that more than 65% of the respondents will sell EVs in the form of used cars.

Table 8. Post-purchase behavior.

Post-Purchase Disposal	Quantity	Percentage
Sell as a used car	228	66.47%
Scrap treatment	48	13.99%
Transfer to others	29	8.45%
Others	38	11.09%

3.1.3. Consumer Characteristics

In the second part of the questionnaire, the basic situation of consumers was analyzed. Sex ratios and age ratios are shown in Figures 7 and 8, respectively.

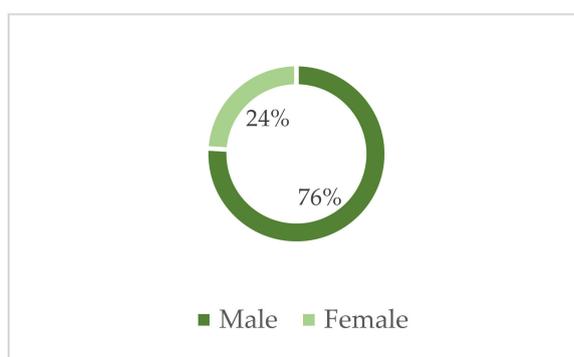


Figure 7. Sex ratio.

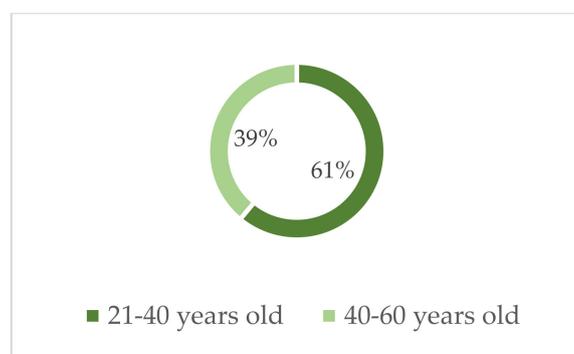


Figure 8. Age ratio.

From the demographic characteristics of the effective questionnaire population, more male car owners pay attention to EVs, accounting for 76%. In terms of age, the proportion of young people aged 21–40 is 61%, which is the absolute main force of market consumption. A combined histogram of the age, education, and income of EV consumers is shown in Figure 9.

From the educational background and income ratios of people of all ages, it can be seen that EV consumers have the following statistical characteristics: age 21–30 years old, undergraduate education and above, middle income level (80,000–200,000/year/person); age 31–40 years old, college degree or above, high income level and above (mean value is 200,000 and above/year/person).

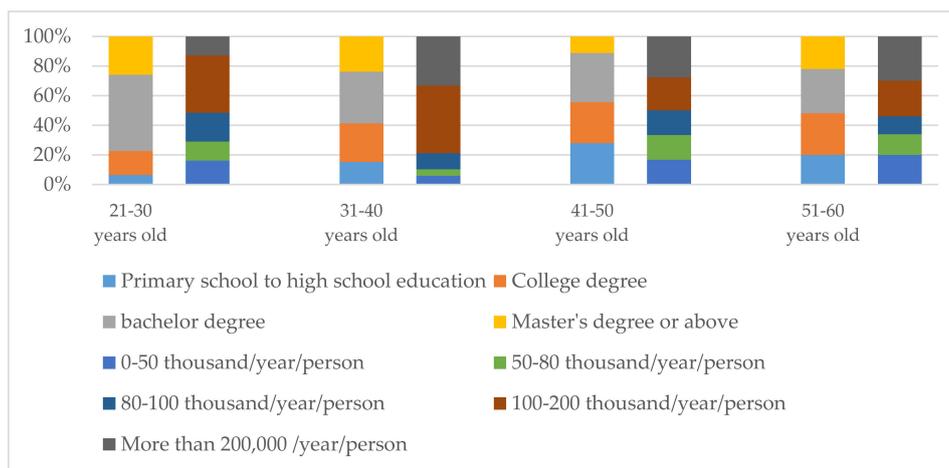


Figure 9. Consumer characteristics.

3.1.4. Degree of Understanding

This paper investigates consumer’s understanding on the price, endurance mileage, charging speed, advertising, usage cost, subsidy policy, charging pile coverage, optional models, and 4S shop location of EVs. According to the intensity of the attitude of understanding, the attitude of consumers is quantified. The minimum score is 1 point (do not understand), the highest score is 7 points (fully understand), and the middle attitude is 4 points (general).

Through the comparison of the mean values of the data, it is found that the average level of consumers’ comprehensive understanding of EVs is 3.86, which is less than the average score of 4 points. Overall, the consumer’s understanding of EVs is low. The consumer’s understanding of the location of the EV 4S store is 3.51, which is the lowest among the averages. Consumers’ understanding of endurance mileage, charging speed, and subsidy policy are 3.97, 3.97, and 3.98, higher than the overall average of 3.86, but still fall below the general level. Consumers’ understanding of EV advertisements reached 4.15, higher than the average of 3.86. This shows that consumers have a certain understanding of EV advertising, but there is only an ambiguous concept understanding, lacking a deeper understanding. The understanding of the optional models of EVs is 3.90, which also reflects the shortage of EV models from the side, and consumers lack understanding of the EV models.

3.1.5. Consumer Perception

The consumer perception data in Likert scale is quantitatively analyzed, and the results are shown in Table 9. It is found that consumers have higher scores for subsidy policies, and subsidy policies have greater appeal to consumers to purchase EVs. This will put a lot of pressure on the current subsidy cuts. On the other hand, it shows that the demand of consumers in the EV market is still driven by policy rather than spontaneous demand. The government should accelerate the EV market transition from policy-led to market-driven.

Table 9. Consumer perception.

	Appearance	Performance	Storage Space	Subsidy Policy	Quality
Mean	4.43	4.77	4.58	5.18	4.86
Standard deviation	1.643	1.619	1.624	1.578	1.534

On the other hand, consumers give the lowest scores for the appearance of EVs. Consumers believe that the EVs in the market are mainly “reconstructed” from traditional fuel vehicles. Although they are EVs, the appearance is similar to that of traditional fuel vehicles. In particular, the face score of domestic EVs has no attractive highlights. In order to reduce the cost of EVs, car companies have chosen a cheaper original model to “renovate” into an EV [22].

According to the opinions of car owners and sales personnel, the storage space of the car is very important for the comfort and convenience of the car, just like the decoration design of the house. The reasonable storage space design can greatly increase the convenience of the driver and passenger. However, in the survey results, consumers' evaluation of storage space is not high. Because of its energy characteristics, EVs have fewer components such as engines, transmission shafts, and gearboxes than conventional fuel vehicles. Therefore, it can make a considerable contribution to the luggage compartment and the cockpit space, thereby increasing the storage space in the vehicle and improving the driving comfort and convenience.

3.1.6. Social Status

Through quantitative analysis, it is found that the comprehensive score of consumers' satisfaction with potential high-level demand is 4.04. Obviously, the EVs do not satisfy the social status of consumers, and the added value of EVs for consumers is lacking. Among social status, the scores are only 3.81 and 3.88 in terms of improving the social level and making others more appreciative of themselves, which is significantly lower than the comprehensive score. In the case of the same overall sample size, the average standard deviation of each item in the social status factors is 1.74, which is significantly higher than the standard deviation of the other four common factors, indicating that people's attitude towards the satisfaction of potential high demand is uneven. Compared with the highly mature traditional fuel vehicle market, different styles, different prices and different product orientation of automobile brands abound. Consumers can meet their potential high-level demands needed through the consumption of different cars. At present, there are fewer models for EVs, and the market is still in its infancy, which can only meet the low-level needs of consumers.

3.1.7. Consumer Purchase Attitudes

The consumer attitude in Likert scale mainly involves six items, and the six attitudes are depicted in the line chart (Figure 10). The corresponding data is shown in Table 10. Consumers believe that EVs are the future development trend, this attitude is the strongest, but consumers' attitude of priority consideration of the next car is lower than other items. By observing the chart, these attitudes are related. Next, the categorical variable Spearman correlation analysis is performed on the six items. The P value between the six items is 0, less than 0.05, which is statistically significant. The correlation coefficient is greater than zero, ranging from 0.227 to 0.779, indicating that there is a strong positive correlation between the six attitudes, that is, environmental pollution will have an impact on the attitude of consumers of EVs.

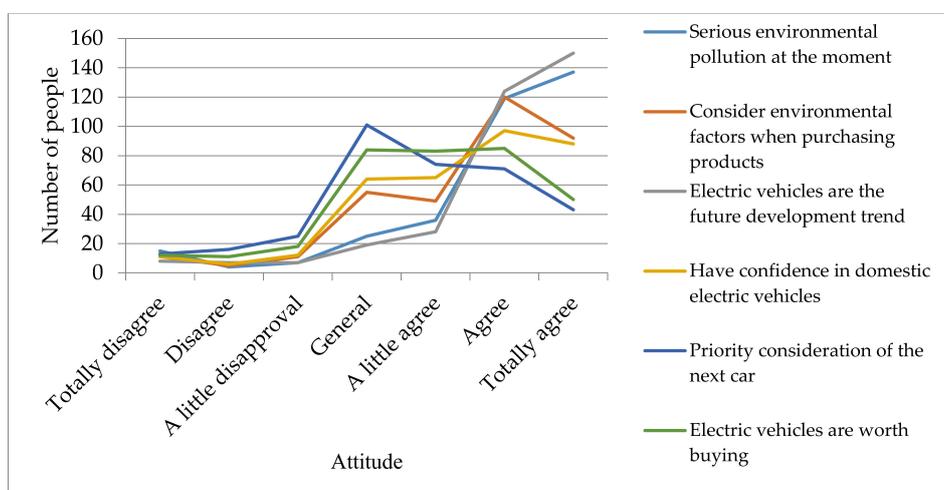


Figure 10. Consumer attitude.

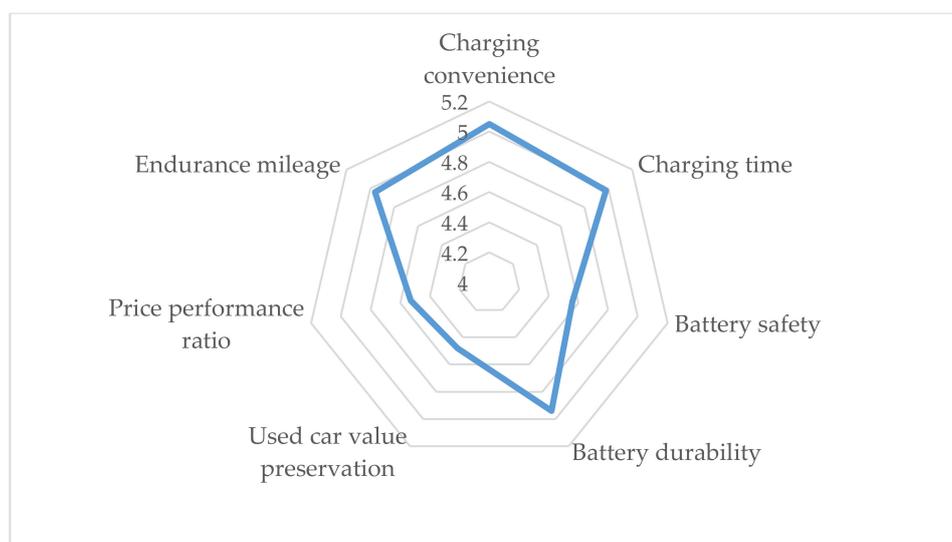
Table 10. Consumer attitude scores.

Item	Mean	Standard Deviation
Serious environmental pollution at the moment	5.82	1.495
Consider environmental factors when purchasing products	5.49	1.457
EVs are the future development trend	5.99	1.356
Have confidence in China's EVs	5.36	1.478
Priority consideration of the next car	4.73	1.501
EVs are worth buying	4.95	1.462

The single sample *t*-test for six items was carried out. Consumers have the strongest attitude toward the 'EVs are the future development trend' item, and the standard deviation is also the smallest, indicating that this is the consensus attitude of most people. However, the attitude of "the next car purchase will consider EVs" has the lowest level of attitude, indicating that consumers are still unwilling to make decisions to purchase EVs. The standard deviation is the largest, indicating that different people have different attitudes towards this.

3.1.8. Purchase Concerns of Consumers

This article investigates consumer buying concerns in terms of charging convenience, charging time, endurance mileage, battery safety, battery durability, used car value preservation rate and price performance ratio. The mean analysis of seven purchase concerns of consumers is shown in Figure 11. The scale is a negative statement, the greater the mean, the higher the concern.

**Figure 11.** Degree of purchase concerns.

Consumers' concerns about using EVs from strong to weak are: charging convenience, charging time, endurance mileage, battery durability, battery safety, price performance ratio, and used car value preservation rate.

The most obvious concern of consumers for EVs is the charging problem, combined with the Likert scale, consumer's understanding of charging pile coverage is only 3.62. Consumers do not understand the charging facilities. Consumers do not think that there is convenient and fast charging service, but it does not mean that the charging facilities cannot meet the consumer demand for charging services. The main reason is that the consumers do not know the coverage of the charging facility and the actual charging process and duration [23].

In terms of endurance mileage, consumers still have higher levels of concern. Some actual purchasers gave their opinions. They mentioned that the endurance mileage was abnormally

attenuated, and the mileage was too short, which was inconsistent with the actual mileage indicated by the manufacturer. Some consumers even need to pay high parking fees and charging fees to fully charge the car. In the long run, this cost is not cheaper than driving a fuel car. If the consumer's endurance requirements for the car cannot be met, it is necessary to frequently replenish the vehicle with energy, which will greatly reduce the convenience of the car. With the rapid advancement of battery technology, the current endurance mileage of pure electric vehicles has reached the level of 400km, which can basically meet the requirements of urban traffic. However, for long-distance self-driving travel, the endurance mileage is still not nearly enough.

Consumers' concerns about the battery safety and nonvalue preservation of EVs are mainly due to the limited battery life. In the years when other parts of the vehicle are still in good condition, the battery will depreciate in advance, failing to reach the required endurance mileage, resulting in direct depreciation of EVs [24].

3.1.9. Purchase Concerns of Consumers under Different Levels of Understanding

In order to observe the different performances of different stages of the consumer group, the number of the top four items with the highest scores in the purchase considerations in the Likert scale of each respondent is counted, and the corresponding percentage is calculated. A combined histogram with the level of understanding and concerns of EV consumers, as shown in Figure 12.

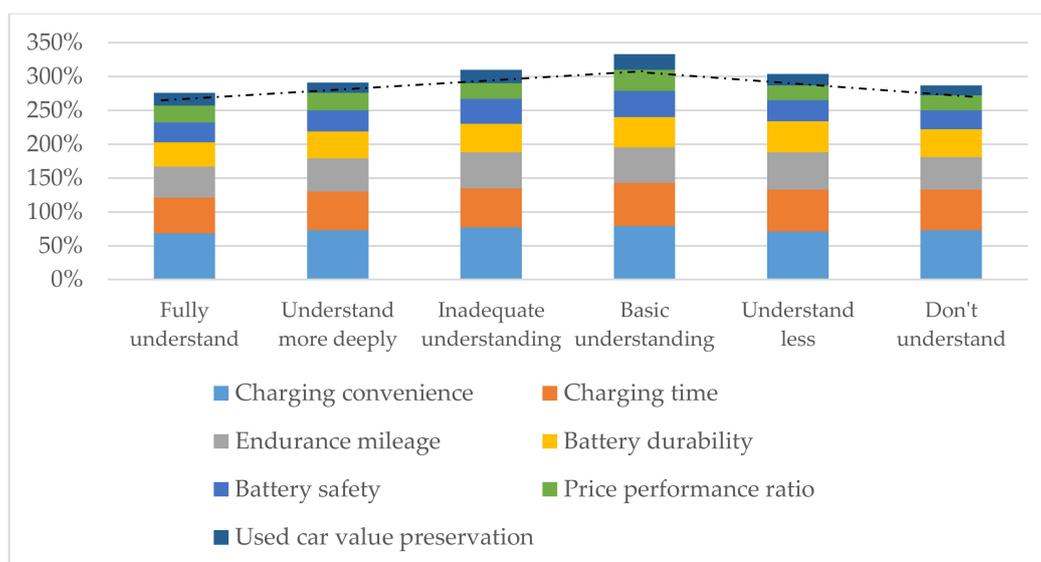


Figure 12. Purchase concerns of users at different stages.

Figure 12 shows that from “don't understand” to “basic understanding”, the proportion of consumers' concerns has gradually increased, and from “basic understanding” to “fully understand”, the proportion of consumers' concerns is gradually decreases.

3.2. Analysis of the Difference between Actual Consumers and Potential Consumers

3.2.1. Comparison of Information Acquisition Sources

Comparing and analyzing the information acquisition sources of actual consumers and potential consumers of EVs, the top five sources of information for actual consumers to buy an EV are: TV, car vertical website, manufacturer's publicity and auto show, relatives and friends and video website. But the top five sources of information for potential consumers to obtain information are: TV, car vertical website, video website, official website, manufacturer's publicity and auto show. As can be seen from the Table 11, whether in the actual consumer samples or the potential consumer samples, the proportion of TV options is more than 35%, and the respondents who choose the car vertical

website are close to 30%. At the same time, it can be seen that among the actual consumers' information acquisition channels, manufacturer's publicity and auto show, as well as relatives and friends, also account for a large proportion of non-news advertising media. This is not consistent with the situation of potential consumers, indicating that consumer participation has increased during the actual purchase process, and testing driving a car has become a necessary prerequisite for purchasing decisions.

Table 11. Sources of information acquisition.

	The First	The Second	The Third	The Fourth	The Fifth
Actual consumer	TV	Car vertical website	Manufacturer's publicity and auto show	Relatives and friends	Video website
Potential consumer	TV	Car vertical website	Video website	Official website	Manufacturer's publicity and auto show

3.2.2. Comparison between Actual Purchase Price and Expected (Acceptable) Price

Analyze the ratios of the most likely price for potential customers to accept and the actual purchaser's purchase price. As shown in Figure 13, among the 28 actual EV purchasers, the proportion of people with a purchase price of 160,000–200,000 is the highest, at 46.43%, followed by 110,000–150,000, accounting for 32.14%, and 210,000–300,000, accounting for 21.43%. Nearly half of the people chose EVs with a price range of 160,000–200,000 in actual purchases. This is quite different from the ratios shown by the potential consumer samples. In the potential consumer samples, the prices of EVs that consumers are most likely to purchase are mainly concentrated between 50,000 and 300,000 Yuan, of which 110,000 to 150,000 Yuan are the most. This means that in the actual consumption process, people's acceptance of the price of EVs is increased, and quality is more likely taken into account, and it may be the result of the influence of sales personnel.



Figure 13. Price comparison.

3.2.3. Comparison of Important Factors

Consumers pay attention to the following factors: appearance, performance, quality, subsidy policy, endurance mileage, charging speed, usage cost and charging pile coverage. Compare the sample data of 28 actual consumers with those of 315 potential consumers, as shown in the Figure 14.

Attention of actual consumers on EVs from high to low: charging pile coverage, quality, endurance mileage, charging speed, usage cost, policy subsidy, performance and appearance; the rank of potential consumers: charging pile coverage, endurance mileage, quality, charging speed, policy subsidies, usage cost, performance and appearance. It can be seen that the actual and potential consumers' attention factors are slightly different. However, charging pile coverage, quality, endurance mileage

and charging speed are the four factors that they value. The ratio of the difference degree of the actual consumer to the potential consumer is then depicted in the line Figure 15.

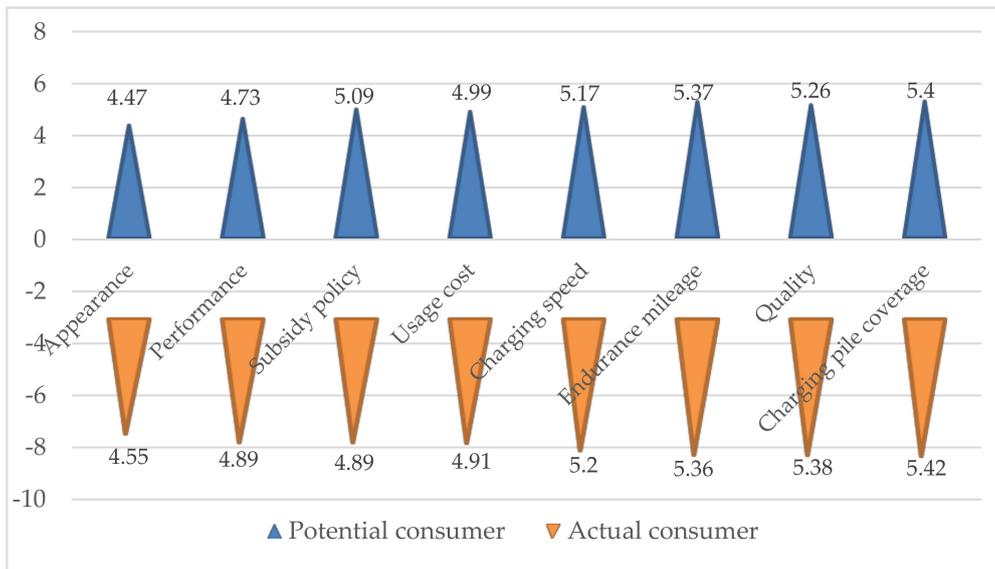


Figure 14. Comparison of important factors.

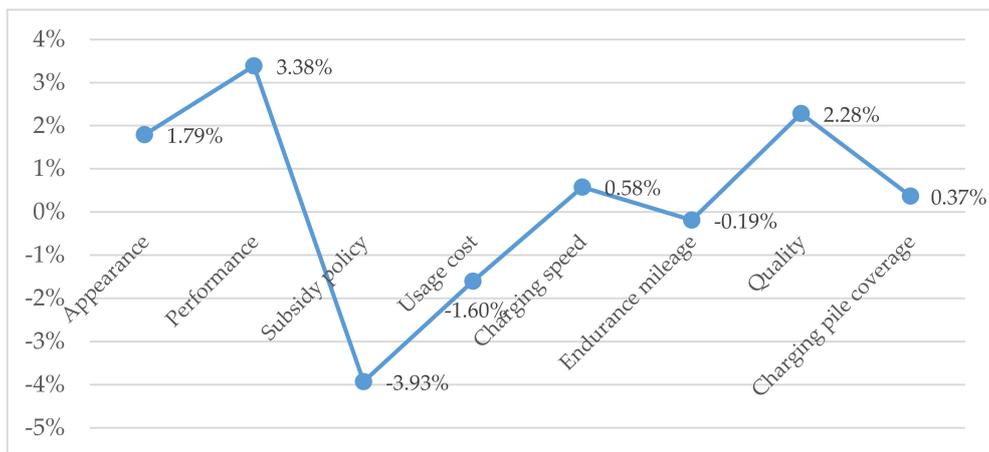


Figure 15. Difference ratio.

A positive percentage value means that the actual consumer attention is stronger than the potential consumer, and the higher the percentage value, the higher the relative emphasis; vice versa. Figure 15 shows that the percentage of performance, quality, appearance, charging speed and charging post coverage is positive. Among them, the percentage of performance, quality and appearance is higher, indicating that these factors are more important to actual consumers; policy subsidies, usage cost and endurance mileage are negative. The difference between the policy subsidy and the cost of use is relatively large, indicating that these factors are more important to potential consumers. The absolute ratios of the difference between the charging pile coverage, the cruising range and the charging speed are close to zero. Combined with the analysis in Figure 14, it can be concluded that there are little difference among these three factors between the actual and potential consumers. And they are the most important factors for consumers.

4. Results and Discussion

4.1. Aspects of EV Consumer Focus

From Figure 2 to Figure 9, it can be concluded that the proportion of five passengers in a family car is the highest, and the proportion of four people or more is higher than 75%. Consumers are more inclined to small and medium-sized cars and SUV models, of which the proportion of small and medium-sized cars is more than half, and the proportion of SUV cars tends to exceed 36%; In terms of automobile configuration, consumers are most expecting the related configuration of improving comfort and convenience, followed by the configuration of assisted driving technology, and they have low interest in the distribution of entertainment interconnection. In terms of the vehicle power type, consumers are most likely to buy EVs with plug-in hybrid power, followed by hybrid power, and the last is pure electric vehicle, which is basically consistent with the results of the literature [25]. There is more detailed research results obtained in this paper, which can provide a reference for the decision of consumers to purchase an EV product.

4.2. Notable Features of EV Consumers

From the basic information of 315 EV consumers in Figure 7, Figure 8 and Figure 9, young and middle-aged men aged 21–40 are the main consumers of EV market consumption. EV consumers have statistical characteristics: age 21–30 years old, undergraduate education and above, middle income level (80,000–200,000/year/person); age 31–40 years old, college degree or above, high income level and above (mean value is 200,000 and above/year/person). This is the conclusion of this paper based on 343 samples.

4.3. Positive Attitude but Insufficient Understanding

The attitude of consumers toward EVs and the future trend of EVs is relatively positive, which is in line with the research results of many consumers' willingness to purchase [7]. However, consumer perception of EVs is still at an early stage and has not kept pace with the fast updating speed of new vehicle models. According to the analysis in Sections 3.1.2 and 3.1.4, the least of what consumers know is the information about the EV 4S store. More than one-third of respondents indicated that they did not understand the finance loan policy of EVs.

4.4. More Demand for EVs

EVs can only meet the basic needs of consumers, with little added value and cannot meet high demands of consumers. The appearance design of EVs is not attractive and cannot show a fashionable image. Consumers do not perceive the advantages of EVs such as flexible spatial design (Table 9). Previous studies on factors affecting the purchase of EVs have mostly focused on price, subsidies and environmental protection [7,8,11], ignored the appeal of the added value, appearance and fashion of EVs to consumers.

4.5. More Misgivings

One of the reasons why consumers do not make a purchase decision is their concern about EVs. As consumer awareness of EVs increases, consumer concerns tend to rise first and then decline (Figure 12), in line with consumer psychology theory. This inspires us to design effective marketing tools to dispel potential consumers' misgiving and promote potential consumers at different levels of understanding to achieve a transition to actual users. From Figure 11, it can be seen that most of them are concerning about charging and endurance mileage like inconvenient charging process, long charging waiting time, and unsatisfied endurance mileage, which is basically the same as the results of the literature [5,6,10]. This shows that consumer concerns are an important factor affecting the EV market. On the other hand, more than 65% of the respondents would sell EVs in the form of

used cars (Table 8), worrying about the battery performance loss and the not preserved value after use. This result is a relatively new finding. Previous studies did not consider the issue of used cars trading.

The research results of consumer perception and purchasing concerns make up for the vacancy of the previous studies, which not only explains the reasons for the positive attitude but negative willing to buy, but also provides the basis for the cultivation of the EV market.

4.6. Difference between Actual Consumer and Potential Consumer Behavior

This paper shows that the consumers and potential consumers have cognitive and behavioral differences in three aspects: information acquisition sources, price, and attention.

In the information acquisition sources of actual consumers or potential consumers, TV and car vertical sites account for a high proportion, the two information channels both accounted for more than 30%, indicating more than 60% consumers get information on EVs from news and advertisement. The difference is that the actual consumer's information acquisition channels are also mainly from several types of non-news advertising media (manufacturer's promotion and auto show, relatives and friends, etc.). However, the main source of information for potential consumers is still the media medium. This shows that in the actual purchase decision process, the participation of consumers is improved, and testing driving EVs becomes a necessary prerequisite for purchasing decisions [26]. Zhou et al thought that in the way of obtaining information from the EV market, 49.2% of the respondents believed that news and advertisements had the greatest impact on their purchase of cars, and the dissemination of media information allowed them to receive more information. 27.6% of the respondents believed that the manufacturer's publicity and auto show had the greatest impact on their access to information [25]. It can be seen that the media effect of the car exhibitions is very good in recent years. 27.6% of the respondents got the car market information from their friends, which shows that friends have a great influence on them. Although this paper differs from Zhou et al in the specific figures, it shows the effectiveness of these sources of information. The way to acquire information can support subsequent selection of sales promotion methods, which is another achievement of this article.

The statistical results of Figure 13 show that the price of the actual purchase of EVs by consumers is higher than the expected acceptable price of potential consumers. The potential consumers who choose between 110,000 Yuan and 150,000 Yuan (accounting for 37.39%) is the most. Nearly half of the people chose EVs with a price range of 160,000–200,000 in actual purchases. It means that in the actual consumption process, people's acceptance of the price of EVs is increased, and quality is taken into account. As the reference [27] shows, in the purchase decision of durable goods, consumers pay more attention to quality than price. In addition, higher than expected purchase prices may also be the result of the influence of salesmen.

The comparison analysis between actual and potential consumers shows that the three factors of charging pile coverage, endurance mileage and charging speed are not much different between actual and potential consumers, and they are the most important factors. The difference is that actual consumers pay more attention to performance, quality and appearance; potential consumers pay more attention to policy subsidies and usage costs. After the consumer's willingness to purchase is transformed into a purchase behavior, the factors of attention also change. The research results of this paper have not been seen in other studies and will provide reference for the promotion of EV products and the improvement of consumer satisfaction after purchase.

5. Conclusion and Market Cultivation Measures

5.1. Conclusion

Only a small number of consumers have bought EVs, most consumers maintain a wait-and-see attitude. The general willingness to purchase EVs has not been translated into actual purchase behavior. Related enterprises need to know the factors affecting the buying behavior of consumers for EVs, so as to take effective measures to promote the purchase of EVs. Government subsidies have weakened the

role of the market itself, resulting in the lack of consumer awareness of the EV itself and its benefits, which have become an obstacle to the selection and purchase of EVs by a large number of consumers. Correctly guiding consumers' perception and effectively stimulating consumer purchase intention of EVs are important issues to enhance the development of EV market.

Concerns and higher requirements for the use of EVs are the main obstacles to consumer consumption behavior of EVs. There are many doubts about the technology reliability of the EVs excepting the high cost. At the same time, concerns are also expressed about the high cost of maintenance, the popularity of maintenance points, the improvement of infrastructure and the power supply support. Consumers also hope that EVs have more ideal design. Enterprise marketers must pay enough attention and reduce consumer concerns in order to have a place in the competitive automobile market to create good conditions for EVs development.

Consumers have certain typical characteristics and have their own requirements for the price, car models, power, and number of passengers. The automobile manufacturer should change in ways that do not divide segment market, design the car according to the characteristics of the target market, and launch more desirable models.

The differentiated cognition and behavior of actual consumers and potential consumers suggests that related enterprises should view marketing and advertising campaigns as a continuous, gradual process. In view of the different stages of the promotion of electric vehicle products, promotion campaigns should be carried out with different strategies. The market should be widely publicized and broadened in the early stage and persuasive information should be conveyed in detail in the medium term. In the later stage, it is necessary to adopt a diversified strategy based on the differentiation of the audience and focus on integrating marketing communication. At the same time, in the processes of design and production of electric vehicle products, we should pay attention to the improvement of performance and quality control and improve the actual consumer satisfaction after purchase in a multitude of ways.

5.2. Market Cultivation Measures

5.2.1. Market Cultivation Measures Based on Existent EV Technology

According to Rogers' diffusion of innovations theory, new product will be diffused from innovators to early adopters, early majority, late majority and laggards. According to market share indicators, there are already innovators in China. The goal of market cultivation is to achieve instant effect and diffuse to early adopters and the early majority as soon as possible. Therefore, suggestions are put forward to cultivate early adopters and early majority market based on existent technology of EVs.

(1) Strengthen Charging Pile Construction and Integration Operation

Long charging time, inconvenient charging, and short cruising range have always been concerns of EV consumers. In order to easing consumer concerns about charging, increase the construction of charging facilities, increase the coverage of charging facilities, and increase the utilization rate of charging facilities have been the top priorities of China's EV market promotion. By the end of 2017, the number of public-type charging facilities in China had reached 213,900, and the number of private charging facilities equipped with EVs was about 231,800. Due to the long charging time of the EV, these charging facilities cannot meet the demand.

Lay out the charging station (pile) rationally. Increase charging facilities and access to higher-level power-related facilities in all types of parking lots (including residential areas) that have been built; construct charging facilities in large public building parking lot and social public parking lot; layout fast charging piles in shopping malls, entertainment venues and large temporary parking lots reasonably; it is necessary to build charging piles because of the rapid growth of private EVs; provide exclusive charging infrastructure for official vehicles, special vehicles, employee vehicles, etc., and related facilities for accessing superior power supplies in conditional parking lots; gradually promote public

charging infrastructure planning from the central city to the suburbs, from the “urban priority to develop” area to the general area.

Encourage private charging pile sharing. Synchronously build a special transformer for charging facilities with the residential quarters and lay the power supply line of the charging facility to each parking space and leave an interface. The residents can purchase the charging pile by themselves. The EV owners can obtain the location of the shared charging pile can be seen on the charging pile sharing APP, in which detailed and accurate charging pile information is introduced, and there is a corresponding scientific and convenient charging and settlement method. The sharing of charging piles can greatly increase the charging pile coverage, increase the charging pile usage rate, and reduce consumer concerns about charging.

Build large automatic quick change charging stations in the center of the transportation hub. Large-scale commercial vehicles for urban public transportation and sanitation are charged at different time. Consider layout battery-changing power stations for taxi charging. The battery quick-change mode is the best choice, so that urban public transportation, sanitation large commercial vehicles, taxis, etc., are not compatible with small-sized vehicles for charging facilities to achieve convenient charging purposes.

In the design of the charging pile, the user experience needs to be fully valued. Provide convenient payment and settlement methods, use corresponding marketing means for charging consumption, encourage market competition, and stimulate the technology advancement through the natural law of survival of the fittest. Provide recreational facilities at the public charging station to avoid the boring waiting of the charging owner, making the charging process more enjoyable.

Integrate the location of the charging facility into the navigation system of the EV. The system collects the dynamic information of the national public charging pile and supervises its operation. It gives the charging suggestions along the way for the driver to choose, which will hope to alleviate the trouble of the difficulty of finding a charging pile of EV owners.

Formulate preferential policies to encourage all parties in the society to actively participate in the construction and operation of charging facilities. Through the implementation of financial subsidy policies and other preferential policies, enterprises and individuals will be attracted to provide funds or land, invest in construction and participate in the operation of charging infrastructure.

(2) Preferential Electricity Price Guidance

High charging costs are another important factor affecting the use of EVs. In 2014, China began to use price leverage to promote the promotion of EVs and implemented a supportive electricity price policy for EVs charging facilities. Implement preferential price for operational and centralized charging facilities and charge at large industrial electricity price. Electricity for facilities of residential area is charged at residential electricity prices. At the same time, the electricity consumption of the vehicle charging facilities is charged according to the peak and valley time-of-use electricity price to encourage users to reduce charging costs.

At present, the main reason for the high charging cost is that the parking fee and the electricity bill are high, and the peak and valley time-of-use electricity price is not well implemented. Firstly, actively connect the power supply department, implement a variety of preferential policies such as low valley electricity price, and encourage users to charge during non-peak hours. Introduce various packages such as “unlimited charging” for monthly subscriptions for EVs users and implement further preferential electricity prices for household EVs charging to encourage home charging. Secondly, reduce the parking fee for the charging facility, thereby reducing the charging cost.

(3) Publicity and Promotion

In view of the fact that consumption perception of EVs is low, consumers’ perception and attitude towards EVs will be affected through various channels, so that consumers’ consumption behavior of EVs will be changed to make consumers be willing to accept EVs, so as to cultivate the vibrant

market demand. To change consumers' perceptions and attitudes, the following aspects need to be considered. Seize TV as the main channel for obtaining automobile information. Directed by the government, nonprofit advertising on EVs can be launched on suitable TV channels. And the advertising creativity should target males aged 20–40 with bachelor's degree or above so that potential consumers can have a more intuitive understanding of EVs. Enhance the exposure level of EVs and enhance the learning and memory of consumers by making use of the appeal of entertainment programs. Choose representative brands and distribute information in entertainment venues in festival and holiday, answer questions, and show the characteristics and advantages of EVs. Set up electric car rental points in tourist attractions, and design EVs with advertising features to make EVs a mobile advertisement. In the main residential areas, densely hanging EV banners to provide visual stimulation and strengthen the imprints of EVs.

(4) Let More Consumers Experience Electric Vehicles

Potential consumers have a lack of understanding of EVs and EVs are fundamentally different from traditional vehicles in terms of power sources. Consumers must be provided with opportunities to fully understand and experience in order to make them proactively accept EVs. Because of the large area, the traditional 4S shops are mostly concentrated in the suburbs and are far away from the crowded areas. It is inconvenient for consumers to participate in experience activities. Therefore, it is recommended that car sales companies put some of the exhibition cars in crowded areas, so that consumers can learn about EVs in their daily leisure shopping. In order to encourage consumers to participate in activities and increase the number of participants in the event, small prizes can be awarded, and interaction activities can be increased.

Excepting static display experiences, consumers are encouraged to conduct test driving activities because the car is a product with dynamic performance. Through the driving experiences, consumers can more fully and deeply understand EVs. Similarly, when setting up the test-taking activities, it is necessary to fully consider the participation convenience and the feeling of the consumers and conduct standardized and professional service marketing training for the relevant staff.

Correspondingly, in the process of purchasing EVs, we can break the sales pattern of traditional 4S stores, and adopt the new pattern of 'offline experience + online car purchase + service station delivery'. This will enable consumers to understand EVs in all aspects, improve the understanding of EVs, and thus narrow the distance between EVs and customers.

(5) Organize Electric Vehicle Social Activities

The potential consumers have a low level of understanding of EVs as a whole, and early adopters and early majority have a wide range of social networks and a large number of information channels. The publicity and promotion alone does not guarantee the consumer stickiness. It also requires large-scale social activities to active consumers. In combination with the current market situation, there are two suggestions: First, hold the national EV competition. On the one hand, it can promote the technological progress of EVs through competitions. On the other hand, it can show endurance, climbing ability, etc., highlighting the selling points of EVs. Meanwhile, it can lead the social trend, change people's traditional perception of cars, develop a new culture of car and increase the attractiveness of EVs. Second, under the background of increasingly prominent environmental issues, EV manufacturers organize large-scale public welfare activities with the theme of protecting the environment, energy conservation and environmental protection. Manufacturers took the first step towards environmental protection, thereby establishing a low-carbon and energy-saving social image and attracting consumers to purchase EVs for more advanced demand motives.

5.2.2. Market Cultivation Measures Based on Future EV Technology

As the market spreads, more and more consumers recognize and begin to accept EVs. The basis of market cultivation measures should turn from existent technology to potential future technology.

(1) Separation of Vehicles and Electricity

EVs face two major problems from the survey results. First, the price is too high, the price performance ratio is low, and the value is not preserved. At the same time, the policy subsidy is facing a problem of declining. The second is the battery problem of trouble charging, life limitation, and long charging time. In order to solve the main contradictions, it is recommended to carry out "separation of vehicle and electricity", that is to purchase EVs, rent batteries, and provide batteries exchange services from the perspective of long-term development of the EV market. In the process of using EVs, consumers use batteries of the battery company and need to pay rent according to the amount of electricity used. Consumers can charge by themselves or they can go directly to the power station to replace the full battery. This can well solve two major problems faced by EV consumers.

(2) Intelligence of EV

Consumers have unmet potential high-level needs, and actual consumers pay more attention to EV qualities. EVs are not well positioned to meet the needs of the social status of consumers, and the added value of EVs for consumers is low. The difference in configuration is an important means to reflect the differences between different car models. EVs in the future should be equipped with high-tech configuration, so they can reflect the image of environmental protection, technology and fashion of EVs in the configuration. They can meet the high-level needs of consumers for love and belonging, self-esteem and self-realization. In terms of technology configuration, automobile companies should focus on technologies and equivalent assisted driving technologies that enhance comfort and convenience. With the rapid development and application of the Internet and big data, EVs must keep up with the trend of automation and intelligence, and more attention should be paid to the driving experience in automobile manufacturing. EVs and traditional fuel vehicles are significantly differentiated by the integration of the latest technology and superior experience.

(3) Unconventional Human Design

There are many unsatisfied aspects of consumer perception. Most of them are expected to have relevant configurations for improving comfort and convenience. The EV design should emphasize humanized design to enhance the comfort of use. EVs should have a completely new independent design, abandoning the design habits of traditional fuel vehicles. Because EVs do not need to leave a lot of space for the engine, it can improve the space utilization of new EVs and driving comfort. Make the product or brand a unique image, inject a unique corporate culture into the brand, and make the appearance and after-sales service of the product have distinctive characteristics. In view of the large number of passengers traveling in the car, the space for the design of the vehicle is emphasized. For issues family planning, it is recommended to introduce models with more seats.

(4) Accelerate the Integration of Transportation and Energy

Fast and convenient charging is the eternal theme of EVs. Make full use of highway pavement resources and innovate the "highway + photovoltaic" pattern to achieve the combination of road access and power generation. It will supply green energy while meeting the driving function and open up a new format for the future "super highway" cross-border integration. Photovoltaic pavement will promote the development of electrification and intelligent transportation, enriching people's travel experience. It will make EVs get rid of battery constraints and achieve transportation sustainability.

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