

Research on Sales Strategy of Target Customers of Electric Vehicle Brand

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Abstract

With the development of the times, from the early rise, decline in the middle, until now electric vehicles has gradually returned to the public vision, and it has experienced a long time. People have long been accustomed to taking fuel vehicles as the first choice of travel vehicles, so how to better popularize and sell electric vehicles to people has become a topic worth studying. This paper can better understand the user's purchase strategies and suggestions on the above issues by building the appropriate model, which can play a certain role in the sales of electric vehicles. Finally, we explore the advantages and disadvantages of the model and promote it.

Keywords

Electric Vehicle; Average Value; Precise Sales.

1. Background and Restatement of the Problem

1.1. Background of the Problem

According to the record of related literatures, electric vehicle is a model based on the power of the on-board power, with the help of the motor drive, it achieves wheel driving, it is consistent with road traffic and related safety regulations, it contains modules such as battery, current, power regulating device, electric device, power transmission operating system, etc., which drive the car move. The ancestor of electric vehicle can be traced back to the middle of the 19th century, but with the advent of the internal combustion engine in the early 20th century, the portability of portable fuel is far superior to that of electric vehicle, which cause electric vehicle gradually to withdraw from people's sight [1].

In the 1960s, the oil crisis prompted people to turn their sight to electric vehicles. Until the beginning of the 21st century, electric vehicles began to be put into large-scale production after the breakthrough of battery technology, but until now, the first choice for most people to purchase travel vehicles is still fuel vehicles [2]. Therefore, strategies that can better popularize electric vehicles among consumers are topic worth studying and exploring.

1.2. Restatement of the Problem

A vehicle brand launched three brand electric vehicles-joint venture brand, self-owned brand and new power brand, and they are represented by 1, 2 and 3, respectively. The sales department of the company invited 1964 customers to experience the three brands of vehicles, the experience results are covered by 8 indexes, they are a1-battery technical performance, a2-comfort, a3-economy, a4-safety, a5-power performance, a6-driving handling, a7-appearance and interior, a8-configuration and quality, the satisfaction scores of 8 indexes are all hundred-mark system.

2. Building and Solution of Model

(1) The influencing factors of the target customer's willingness to purchase electric vehicles only consider the target customer's experience data for electric vehicles and the factors in the

experiencer personal characteristic questionnaire, the symbol explanation is shown in Table 1 below.

Table 1. Symbol explanation

symbol	explanation
X	average value
Z	median
σ^2	variance

There may be outliers and missing values in the data, so the outliers and missing values are identified and processed first. Because the scores of target customers have certain subjectivity, although the values may be extreme, they are all within a reasonable range, in this case, if the outlier detection based on traditional clustering or density is used, the normal value may be eliminated, then different criteria are established for screening and processing based on different indexes. The statistical analysis is conducted on indexes through processed data. In allusion to personal characteristic indexes of b1-b17 target customers, appropriate types of graphs are drawn for description through statistical data, and the overall characteristics of target customer groups are recorded; in allusion of the satisfaction score indexes of a1-a8, the comparative analysis of three brands of electric vehicles is carried out by describing the indexes of the concentration degree, the degree of dispersion, and the types of data distribution.

2.1. Data Processing

2.1.1. Screening Criteria of Different Data

(1) For brand types, 1, 2 and 3 are joint venture brand, self-owned brand, and new power brand, respectively, if there are other data besides this, they are regarded as outliers.

(2) For the satisfaction score indexes of a1-a8, there is a certain degree of subjectivity in the scoring process of target customers, so it is still reasonable if the scores vary dramatically. Therefore, if the data exceeds 0-100, they are regarded as outliers.

(3) For personal characteristic indexes of target customer of b1-b17, due to the different types of questionnaires, they are divided into the following three types:

① the screening criteria are the same as the brand types, and the data beyond the options of this problem is regarded as outliers.

② There is no absolute judgment criterion for this problem, namely, the data does not exceed the boundaries of existing concepts in people's minds, including but not limited to physiology and society.

③ There is also no clear judgment standard for this kind of income problem, and the lower limit is 0 and there is no upper limit.

2.1.2. Recognition and Treatment of Outliers

(1) In allusion the brand types, write program to find out the data that does not belong to 1, 2, 3, and no outliers are found.

(2) In allusion to the satisfaction score indexes of a1-a8, write program to find three outliers, they are 753.054, 605.310, and 702.9961, their value all are 10 times the normal range. The cause of the abnormality is judged as the wrong position of the decimal point, so replace it with 75.3054, 60.5631 and 70.29961, respectively.

(3) Personal characteristic indexes of target customers for b1-b17

It is found that there is an abnormality in the B17 data of the target customer number 0223 via programming, its value is 300, it means that the annual car loan expenditure accounts for 300% of the family's total annual income, which is inconsistent with reality. Considering that the

standard range is 0-100, the original data is 3 times the maximum value, so one 0 is removed and 30 is used to replace it.

2.2. Descriptive Statistical Analysis

2.2.1. Introduction of Indexes

(1) Indexes describing central tendency

① Average X

The average value is commonly used statistic in statistics, it can reflect the relatively more central position of each observation value in the data, and can be used to reflect the general level of the overall phenomenon, or the central tendency of the distribution.

② Median Z

The number of middle positions in a set of data where the median is in sequential order can make up for the deficiency of the average in the skewed distribution to a certain extent. Especially when the difference between the average and the median is too large, it can provide reference for relative samples.

2.2.2. Judgment of Data Distribution

In statistical analysis, it is generally assumed the sample data follows the normal distribution. Therefore, it is necessary to do normality test for the data.

2.2.3. Statistical Results and Analysis of Target Customers' Personal Characteristics

(1) Residence condition

The place of residence is distinguished by hometown, city, and others. Fig.1 is made by counting the number of people of three options. It can be seen that among the target customers, the number of people whose residence is in their hometown accounts for about 30%, the number of people whose residence in the city accounts for about 69%, and the number of people who belongs other situations account for less than 1%. It shows that most of t target customers' residence is in this city.

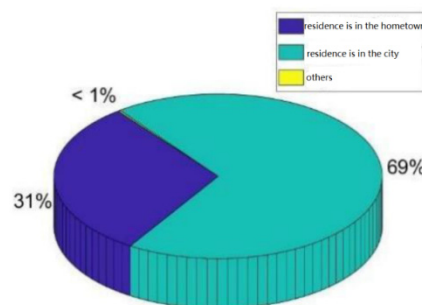


Fig 1. City of residence

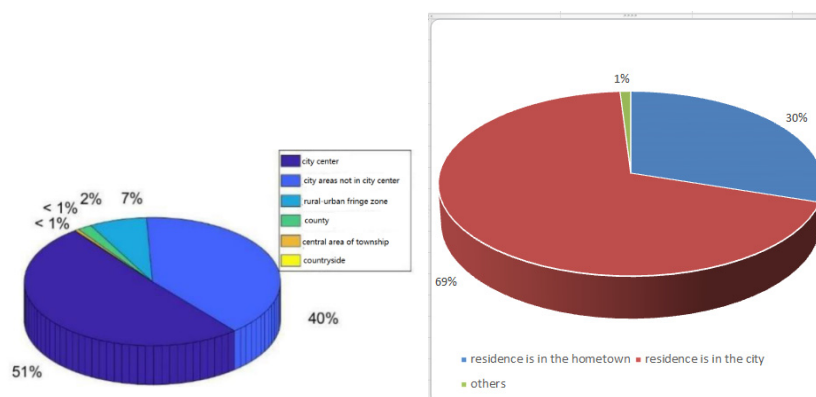


Fig 2. Living area

(2) Living area

The division is carried out with 8 options, after counting the number of people in each option, and Fig.2 is made. It can be seen that the number of people living in the city center is the largest, accounting for about 51%; the second is the number of the number of people living in the city area not in city center, accounting for about 40%; the third is the urban-rural fringe zone, accounting for about 7%; the fourth is the county, accounting for about 2%; the remaining two (township centers and countryside) account for less than 1%. It shows that more than half of the target customers live in the city center; and most of the target customers are from the city center and the city area not in city center.

(3) Living length

The living time in this city (year as unit), this question is a fill-in-the-blank question, we divide it into three ranges-living less than 15 years, living 15-30 years, and living more than 30 years, and Fig.3 is made. It can be seen that the number of people under 15 years is the largest, with 757; the second is 15-30 years, with 606; the third is more than 20 years, with 403.

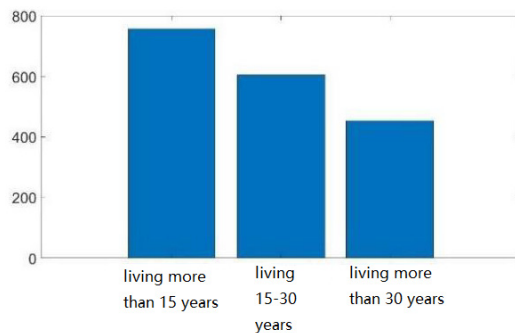


Fig 3. Living length

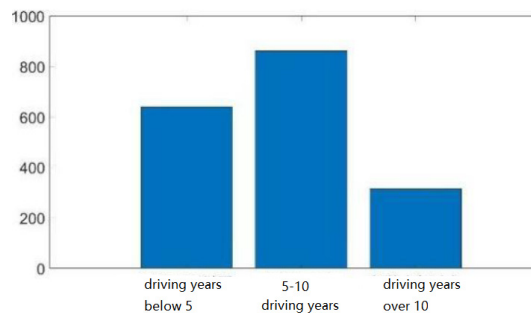


Fig 4. Condition of driving years

(4) Driving years

Driving years, this question is fill-in-the-blank question, we divide it into three parts-driving years below 5, 5-10 driving years, and driving years over 10, and Fig.4 is made. It can be seen that the number of people with 5-10 driving years is the largest, with 862; the number of people with five driving years is second, with 639; the number of people with more than 10 driving years is third, with 315. It shows that among the target customers, the number of people below 10 driving years is the majority, and there are not many old drivers.

(5) The number of family members

Family members who often live together exclude nanny. We divide it into three ranges-three people or less, three to five people, and five people or more, and Fig.5 is made. It can be seen that the number of people with three or less people account for the majority, with 1,158; the second is three to five people, with 598; the third is more than five people, with 60. It shows that most of the target customer groups are families consist of parents and only-child.

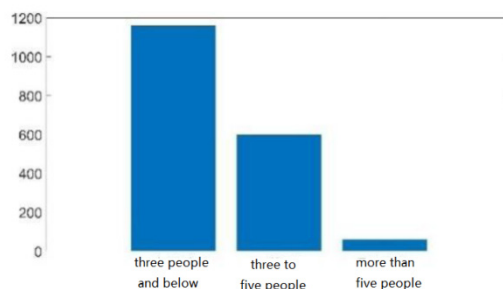


Fig 5. The number of family members

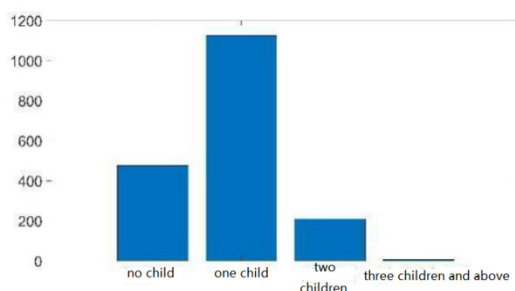


Fig 6. The number of children

(6) The number of children

This question is a fill-in-the-blank question, we divide it into four ranges-no children, one child, two children, and three children and above, and Fig.6 is made. It can be seen that the number of people with only one child is the majority, with 1124; the second is the customers without children, with 476; the third is the customers with two children, with 210; and the fourth is the customers with three or more children, with 6. It shows that most of the target customers have only one child in their families, similarly, it matches family members with three people or less in (5) and people who do not live with their parents and raise the most children in (6).

(7) Marriage and family condition

This question is a single-choice question, the division is carried out with 8 options, and Fig.7 is made. It can be seen that the majority of families who are married, have children and do not live with their parents, accounting for 49%; the second is the married, have children and live with their parents, accounting for about 23%; the following options are in descending order from large to small based on the number of people: the single and living with parents account for about 11%, the married/cohabiting without children (two people without others) account for about 10%, the married/cohabiting without children (living with parents) account for about 4%, and the last two divorced/widowed and others were less than 1%. From the above data, it shows that nearly half of the customers in the target customer group do not live with their parents and raise children, and it also coincides with the number of family members less than or equal to three at most in (5).

(8) Birth year

In fill-in-the-blank question, we divide it into four ranges-before 1970, 1970 to 1982, 1982 to 1995, and after 1995, Fig.8 is made. It can be seen that most of the target customers were born between 1982 and 1995 as high as 1430; the second is the group from 1970 to 1982, with 337; the third was born after 1995, with 37; the last was born before 1970, with 12. It shows that the post-80s and post-90s account for a larger proportion of the whole target customer group, and the average age is relatively young.

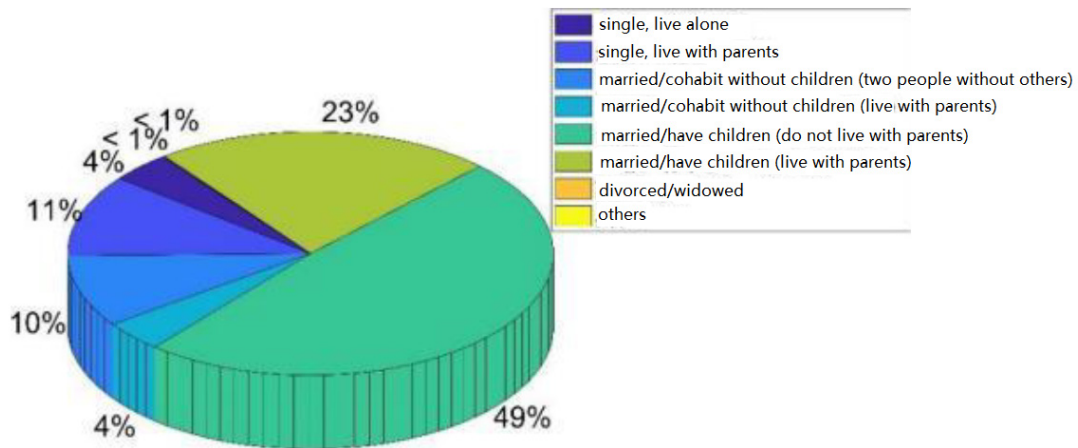


Fig 7. Marriage and family condition

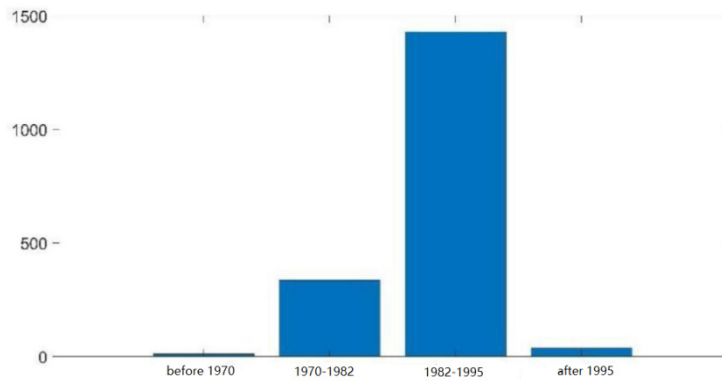


Fig 8. Birth year

(9) Education level

That is the highest qualification. This question is a single-choice question; we summarize it into 5 options for division. Fig.9 is made. It can be seen that most people' qualifications are high school/secondary school/technical school, accounting for about 50% of the total; the second is the junior high school qualification, accounting for about 35%; the third is the primary school qualification, accounting for about 11%; the fourth is the junior college qualification, accounting for about 3%; and the last is uneducated, accounting for about 1%. It shows that the average qualification of the target customer groups is low, and there is no university qualification or above.

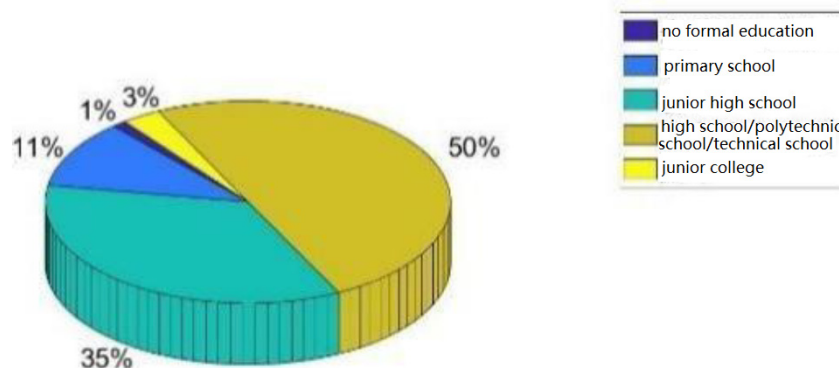


Fig 9. Education level

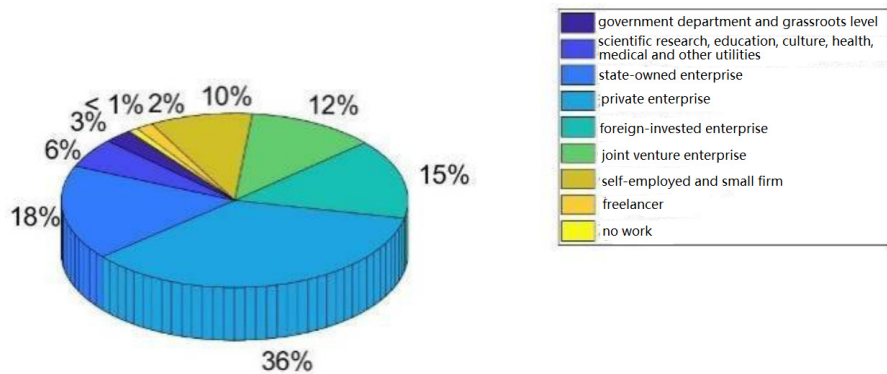


Fig 10. Unit nature

(10) Unit nature

The category of the unit at present, this question is the choice question, division is carried out by 8 options, and Fig.10 is obtained. It can be seen that the number of people in private enterprises is the largest, accounting for about 36%; the second is state-owned enterprises, accounting for about 18%; the third is the foreign-invested enterprise, accounting for about 15%; the fourth is joint venture enterprise, accounting for about 12%; the fifth is self-employed and small companies, accounting for about 10%; the sixth is scientific research, education, culture, health medical and other utilities, accounting for about 6%; the seventh is government department and grassroots level, accounting for about 3%; the eighth is freelancers, accounting for about 2%; the ninth is people without work, accounting for less than 1%.

(11) Position

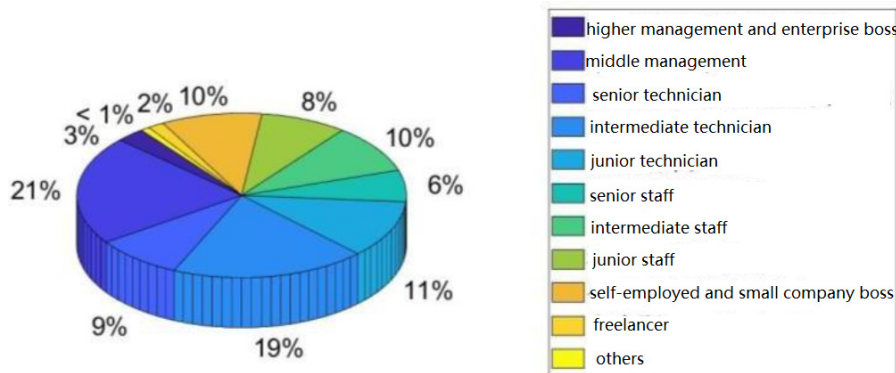


Fig 11. Position

It can be seen that middle management account for about 21%; intermediate technicians account for about 19%; junior technicians account for about 11%; intermediate staff account for about 10%; self-employed and small company boss account for about 10%; junior staff account for about 8%; senior staff accounted for about 6%; senior management and enterprise boss account for about 3%; freelancers account for about 2%; other occupations account for less than 1%. It shows that there are many occupations of target customers, ranging from high-level to low-level occupation.

(12) Working years

Time from formal work after graduation to the present time (year as unit), according to the processed data, the histogram is drawn (Fig.12). It can be seen that the working hours of the target customer groups are mainly concentrated between 5-15 years, 0-5 years and 15 years later are less.

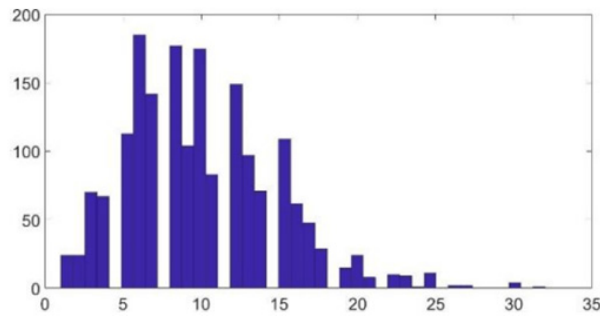


Fig 12. Working years

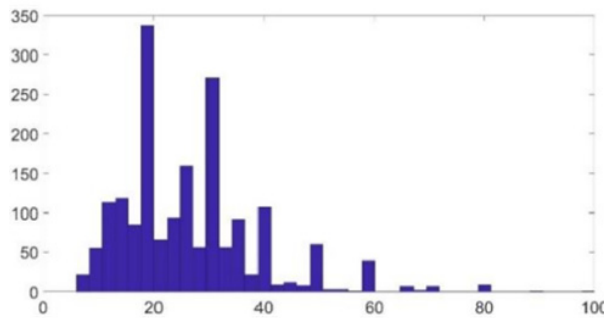


Fig 13. Annual household income

(13) Annual family income (ten thousand yuan)

The histogram (Fig.13) is drawn through the processed data. It can be seen that the annual family income is mainly concentrated in 100000 to 400,000 yuan, especially 200000 yuan and 300000 yuan are more.

(14) Personal annual income (ten thousand yuan)

The histogram (Fig.14) is drawn through the processed data. It can be seen that the annual personal income is mainly concentrated within 200,000 yuan, and there are very few people with more than 200000 yuan. It shows that most of the target customer groups are mainly middle class, and there are few bourgeoisies.

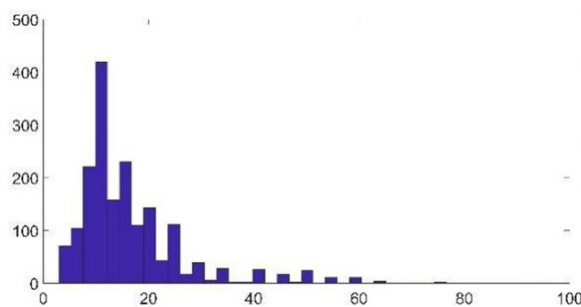


Fig 14. Annual personal income (ten thousand yuan)

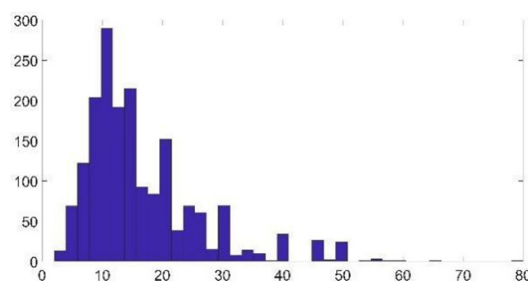


Fig 15. Household disposable income

(15) Family disposable income

Family disposable income includes entertainment, shopping, living expenses, transportation expenses and other expenses, excluding mortgages, car loans, utilities, children's tuition and other monthly fixed expenses. Fig.15 is drawn through the processed data. It can be seen that the disposable income is basically concentrated within 200,000 yuan, more than 200,000 yuan is rare. Moreover, for (5) family members are mainly three or less and (6) the number of children is basically one, it can be roughly inferred that most of the customer groups are middle-class, which coincides with personal annual income (14).

(16) Ratio of annual house loans in total household expenditure

Fig.16 is drawn through the processed data. It can be seen that customers whose mortgage accounts for 0 percent of total household expenditure are most, the next accounts for 20%. It shows that the majority of customers have no mortgage pressure or less pressure.

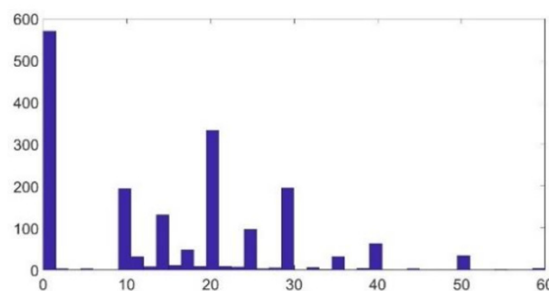


Fig 16. Ratio of annual house loans in total household expenses

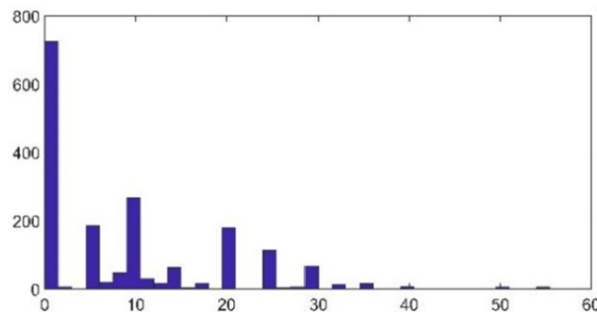


Fig 17. Ratio of annual car loans in total household expenses

(17) Ratio of annual car loans in total household expenses

Fig.17 is drawn through the processed data. It can be seen that the customers whose car loans account for 0 percent of total household expenses are the most; the next is 10%; the third is 20%. It shows that the vast majority of customer groups have no car loans or less pressure.

2.2.4. The Statistical Results and Analysis of Satisfaction Scores of a1-a8

(1) Satisfaction score is obtained by calling MATLAB function and writing program

Table 2. Analysis of performance satisfaction of three brands of vehicle battery technology

brand \ index	average value	median	variance	whether conform to the normal distribution
1	77.9984	77.8167	87.9415	yes
2	77.9677	77.8087	73.8852	yes
3	77.2069	77.8087	92.0376	yes

According to Table.2, the average and median values of the three brands are similar in battery technical performance, and the average level of joint venture brands is greater than that of self-owned brand and new power brand, it shows that the battery technical performance of joint venture brand is better. There is a certain gap in the variance level of the three, the new power brand is larger than the joint venture brand and the self-owned brand, it shows that the data of new power brand car has a greater dispersion degree under this performance, and the target customers have mixed reactions. The three data all obey the normal distribution.

Table 3. Data analysis of three brands of vehicle comfort satisfaction

index brand	average value	median	variance	whether conform to the normal distribution
1	78.6960	78.6130	82.7943	yes
2	77.9537	77.8035	80.6500	yes
3	77.4599	77.8035	90.7720	yes

According to Table.3, in comfort, the average level of joint venture brand is greater than that of self-owned brand and new power brand; it shows that the comfort of joint venture brand is higher. In the variance level, the new power brand is greater than the joint venture brand and the self-owned brand; it shows that the data of new power brand vehicle has a higher dispersion degree than the other two under this performance. All three obey the normal distribution.

Table 4. Analysis of economic satisfaction of three brands of vehicles

index brand	average value	median	variance	whether conform to the normal distribution
1	76.0346	77.8053	110.1587	yes
2	75.9675	77.8053	108.2722	yes
3	74.6490	75.9289	114.9146	no

According to Table 4, in economic satisfaction, the average level of joint venture brand vehicle is greater than that of self-owned brand and new power brand; it shows that joint venture brand vehicle has the strongest economic applicability. However, the variances of the three are relatively large, it shows that the data has a high dispersion degree, and the target customers have mixed reactions. The economic satisfaction data of the three brands of vehicle conform to the normal distribution.

Table 5. Analysis of safety satisfaction of three brands of vehicles

Index brand	average value	median	variance	whether conform to the normal distribution
1	79.4254	78.2148	86.0434	yes
2	78.6802	77.7670	80.4948	yes
3	77.9590	77.7670	101.2695	yes

According to Table 5, in safety satisfaction, the average level of joint venture brand vehicle is greater than that of self-owned brand and new power brand; it shows that the safety of joint venture brand vehicle is higher. There is a certain gap in the variance level of the three, the new power brand is larger than the joint venture brand and the self-owned brand, and the new

power brand is over 100 and has a large gap with the joint venture brand, it shows that new power brand vehicle have a higher dispersion degree than the other two brands in the safety data, and only the new power brands do not conform to the normal distribution.

Table 6. Analysis of satisfaction data of three brands of vehicle power performance

brand \ index	average value	median	variance	whether conform to the normal distribution
1	77.9017	77.7625	90.4703	yes
2	76.9613	77.2625	88.8957	yes
3	75.8296	77.7625	94.1194	no

According to Table.6, in power satisfaction, the average level of joint venture brand vehicle is greater than that of self-owned brand and new power brand, it shows that joint venture brand vehicle has more dynamic. There is a small gap in the variance level among the three, the new power brand is larger than the joint venture brand and the independent brand, it shows that in the new power brand vehicle in the power performance satisfaction score, the overall dispersion degree of the target customers' score for it is greater than that of the other two brands, and only the new power brands do not conform to the normal distribution.

Table 7. Analysis of satisfaction data of three brands of vehicle driving handling

brand \ index	average value	median	variance	whether conform to the normal distribution
1	78.2565	77.7737	90.4774	yes
2	77.7906	77.7737	85.2971	yes
3	77.1633	77.7737	99.7806	no

According to Table.7, in driving handling satisfaction, the average level of joint venture brand vehicle is greater than that of self-owned brands and new power brand; it shows that joint venture brand vehicle has stronger driving handling. The medians of the three are exactly the same, and the central tendency of the data is obvious. In the variance comparison of the three, the new power brand is greater than the joint venture brand and the independent brand, it shows that the data of new power brand vehicle has a higher dispersion degree in overall satisfaction under this performance, target customers have mixed reactions, and only the new power brand vehicle do not conform to the normal distribution.

Table 8. Analysis of satisfaction data of three brands of vehicle in appearance and interior

brand \ index	average value	median	variance	whether conform to the normal distribution
1	78.6558	77.7743	89.4029	yes
2	77.7800	77.7743	82.7333	yes
3	77.6483	77.7743	91.2343	yes

According to Table. 8, in appearance and interior satisfaction, the average level of joint venture brand is slightly higher than that of self-owned brands and new power brand, while the average level of self-owned brand is like new power brand. The medians of the three are exactly the same. In variance level, the new power brand is greater than the joint venture brand and the self-owned brand; it shows that new power brand vehicle has a greater dispersion degree in

the satisfaction score data of appearance and interior. All three conform to the normal distribution.

Table 9. Analysis of satisfaction data of three brands of vehicles in equipment and quality

brand \ index	average value	median	variance	whether conform to the normal distribution
1	78.2984	77.7647	101.2209	yes
2	77.2916	77.7647	86.0587	yes
3	77.2133	77.7647	109.3865	yes

According to Table 9, in equipment and quality, the average level of joint venture brand is slightly higher than that of self-owned brand and new power brand, while the average level of self-owned brand is like new power brands. The medians of the three are exactly the same. In variance level, the new power brand is greater than the joint venture brand and the self-owned brand, and the new power brand and the joint venture brand both exceed one hundred and differs from the self-owned brand, it shows that the dispersion degree of satisfaction score data of these two brands is larger in this performance, customers have mixed reaction. All three conform to the normal distribution.

(2) Summary

According to the analysis of the above eight tables, we can see that among the eight indicators: Average level: the joint venture brand is better than the self-owned brand and the new power brand; it shows that the joint venture brand vehicle has better overall performance in comparison with the other two brands.

Variance level: the new power brand is greater than the joint venture brand and the self-owned brand, it shows that the new power brand has a relatively high dispersion degree in various index data, its safety and economy are particularly obvious, it shows that the target customers have mixed reactions for the various performances of the vehicle brand.

Data distribution: the data of joint venture brand and self-owned brand all conform to normal distribution in satisfaction of various performances, except for battery technical performance, comfort, appearance and interior, equipment and quality, the new power brand do not conform to the normal distribution.

3. Promotion and Evaluation of the Model

3.1. Advantages of the Model

Advantages: in allusion to question 1, because the traditional outlier detection method may eliminate the normal value, the outliers are screened by making criteria suitable for each index, which ensures the completeness and accuracy of the final data.

3.2. Disadvantages of the Model

Disadvantages: in allusion to question 1, a-index which is used for descriptive statistics has few statistics, which can accurately and completely evaluate the performance of the three brands of electric vehicles.

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