

Plan Implementation of Improving Brand Satisfaction Based on Dynamic Programming Model

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Abstract

In order to improve customer satisfaction and purchase intention, the dynamic programming model was built. Firstly, for the joint venture brand, the No. 2 customer was selected, we chose to increase by 3% battery technical performance satisfaction and 5% economy satisfaction, and obtained that the maximum purchase probability of the No.2 customer was 4.18%; secondly, for the self-owned brand, the No.7 customer was selected, we also chose to increase by 5% battery technical performance satisfaction and 3% economy satisfaction, and obtained that the maximum purchase probability of No.7 customer was 56%; finally, for the new power brand, No.11 customer was selected, we chose to increase by 5% comfort satisfaction and 5% a4 safety satisfaction, and obtained that the maximum purchase probability of No.11 customer was 84.39%.

Keywords

New energy vehicles, model checking, dynamic programming.

1. Introduction

As the country strongly supports new energy vehicles, China's new energy vehicle industry has rapidly achieved considerable development and has the foundation for rapid development. Judging from market, with the rapid improvement of domestic new energy vehicles in the fields of intelligent networking and other new technologies, they have been recognized and accepted by increasing young mainstream consumer groups, and new energy vehicles are gradually becoming one of the main forces of domestic vehicle consumption. Under the dominance of globalization, new energy vehicles are no longer a simple emerging industry, they are developing at a terrifying rate and quickly seizing the domestic vehicle market. According to data released by the CPCA, in November 2020, the retail volume of new energy vehicles reached 119000, increased by 97,000 year-on-year, the year-on-year increase was 136.5%.

Furthermore, with the improvement of people's material life and the advancement of science and technology, vehicles have become a necessity in daily life; however, with the aggravation of pollution and the consumption of resources, new energy vehicles will undoubtedly become a new choice for investors and consumers. However, how vehicle companies can more clearly understand consumers' thinking and purchase intentions of new energy vehicles has become the primary task of vehicle companies to promote new energy vehicles.

Therefore, different brands of vehicle companies with have begun to increase their emphasis on the sales of new energy vehicles. Since new energy vehicles is a new type of industry, the public does not know much about its performance in eight aspects, such as comfort, economy, and safety, the market popularity of new energy vehicles is not high. A vehicle company launched three brands, in order to study consumers' willingness to purchase electric vehicles and make corresponding sales strategies, the three brands of electric vehicles were experienced and market research was conducted.

The emphasis of each brand of electric vehicles is different, the target customers will also have different emphasis on them, the good and bad points of the eight performances will have a great

impact on the choice of target customers, moreover, the personal information of the target customer experienter will also have a great impact on whether to buy an electric vehicle or not, how to accurately grasp the preference of target customers is the most important thing in determining their purchase willingness, and it is also a difficult problem faced by each sales department [1-5].

Dynamic programming algorithm is usually used to solve problems with certain optimal properties. There may be many feasible solutions in this type of problem. Each solution corresponds to a value, and we hope to find the solution with the optimal value. The dynamic programming algorithm is similar to the divide-and-conquer method, whose basic idea is to decompose the problem to be solved into several sub-problems, first solve the sub-problems, and then obtain the solution of the original problem from the solutions of these sub-problems. Unlike the divide-and-conquer method, the problems which are suitable for dynamic programming, the sub-problems obtained by decomposition are often not independent. If the divide-and-conquer method is used to solve these problems, the number of sub-problems obtained by decomposition is too large, and some sub-problems are repeatedly calculated many times. If we can save the answers to the sub-questions that have been solved, find out the answers that have been solved when needed, and we can avoid a large number of repeated calculations and save time. We can use a table to record the answers to all the solved sub-problems. Regardless of whether this sub-problem is used in the future, as long as it has been calculated, the result is filled in the table. This is the basic idea of dynamic programming method. The problem that can be solved by dynamic programming generally has three properties: optimality principle: If the solution of the sub-problem contained in the optimal solution of the problem is also optimal, we call the problem with the optimal substructure, namely, it meets the most optimality principle. Without aftereffect: once the state of a certain stage is determined, it will not be affected by subsequent decisions in this state. In other words, the subsequent process of a certain state will not affect the previous state, and it is only related to the current state. There are overlapping sub-problems: namely, the sub-problems are not independent, and a sub-problem may be used multiple times in the next stage of decision-making.

2. Assumptions of Model

- (1) Give the company---sales department a sales strategy suggestion of no more than 500 words. The information of target customers in the sample data is true and effective.
- (2) Whether the target customers choose to purchase car is only related to these factors, and has nothing to do with other factors
- (3) The one -third of the data in column of sample data b7 is null value, so we treat null value as 0

3. Description of Main Symbols

Table.1 Symbol description of model

symbol	symbol description
a1	reliable performance of battery
a2	comfort
a3	economy
a4	safety performance
a5	power performance

a6	driving handling performance
a7	overall appearance and interior
a8	equipment and quality
a9	battery life
b1	household condition
b2	residence life
b3	residential area
b4	driving years
b5	the number of people
b6	marriage
b7	the number of children
b8	birth year
b9	highest qualification
b10	working years
b11	unit nature
b12	position
b13	annual household income
b14	personal annual income
b15	disposable annual income
b16	mortgage expenditure
b17	car loan expenditure
$a_i, i = 1 \dots 8$	the i-th index
y	probability of purchasing vehicle
$w_i, i = 1 \dots 8$	weight of the i-th index
A	sum of all indexes multiplied by weights
k	direct proportion coefficient, is constant

In Table.1, a1-a8 represent the product performance of new energy vehicles, b1-b17 represent some basic conditions and family conditions of the surveyed users, and the remaining parameters represent some parameters of the dynamic programming model.

4. Model Building and Solution

The sample data contains the satisfaction condition of 1900 target customers for eight aspects of the three electric vehicles, as well as their personal information and purchase willingness; the sample data two is the survey table of the personal characteristics of each target customer, including 17 aspects such as household registration, local residence time, etc., we initially believe that there is a great relationship between the disposable annual household income and the annual car loan expenditure, the sample data three is the information of target customers who have not made a purchase decision.

The sales department believes that satisfaction is a feeling of the target customer’s vehicle experience, as long as marketers increase their service efforts, it is possible to increase the satisfaction of a1-a8 by five percentage points in a short period of time, but the service difficulty is proportional to improved satisfaction percentage, namely, the service difficulty of improving experience satisfaction by 5% is 5 times the service difficulty of improving experience satisfaction by 1%. On the basis of this idea and the previous research results, please select one target customer who is not willing to purchase electric vehicle from each brand in the sample data 3, and implement the sales strategy.

It is possible to increase the satisfaction of a1-a8 by 5% in a short period of time by improving service, the service difficulty is proportional to the improved satisfaction percentage, and namely, the service difficulty of improving the experience satisfaction by 5% is 5 times the service difficulty of improving the experience satisfaction.

Under the condition that the service difficulty is as little as possible, the customer's satisfaction is the greatest.

Assume the following conditions:

1. Customer satisfaction is positively related to the probability of purchasing vehicle, the greater the satisfaction, the easier it is to purchase car.
2. Service difficulty is proportional to customer satisfaction, the higher the service difficulty, the more satisfied the customer.
3. Whether to purchase vehicle or not is made in a short time, it does not consider the problem that satisfaction cannot be improved due to too long time.
4. Service difficulty is proportional to customer satisfaction, service difficulty $B = kA$ (k is a constant). Objective function: 1. maximum customer car purchase rate $max(y)$

2. The less difficult the service, the better, namely $min(k \times A)$

Two goals are written as an objective function: $f = max((y - k \times A)^2)$

$$y = \frac{e^{-21.73+0.422(a_1+x_1)-0.194(a_2+x_2)}}{1 + e^{-21.73+0.422(a_1+x_1)-0.194(a_2+x_2)}}$$

Constraint condition: 1. The added value $x_i \in [0,5]$ of each type of satisfaction

2. Satisfaction after improving service intensity increase $0 \leq w_1(a_1 + x_1) + w_2(a_2 + x_2) \leq 100$

The sum of customer satisfaction is $A = w_1a_1 + w_2a_2$ (w_1, w_2 for Weights)

According to the above model, we can see that the maximum cumulative satisfaction of a1-a8 cannot exceed 40%. In order to facilitate the calculation, suppose $k=1$, because the company's service difficulty is limited and cannot be too high, set a value and assumes that the service difficulty B does not exceed 8. At this time, the cumulative maximum satisfaction $A=kB=8$, so the total increase in satisfaction does not exceed 8%.

And because the satisfaction of each factor of a1-a8 cannot exceed 5%, the dynamic programming method can be used to allocate 8% of satisfaction to satisfaction value of factors influencing different brands to maximize the purchase probability. The results are as follows:

The first brand:

Choose No.2 customer (reason for selection: it can be seen by reading the meter that the factors B16 and 17 in the first brand have little effect on the vehicle purchase of No.2 customers, so increasing a1-a8 satisfaction will greatly increase the users' purchase probability)

In the second problem, we conclude that a1 and a3 have a greater impact on the first brand of electric vehicles in a1-a8, so we carry out dynamic planning for the customer satisfaction for a1 and a3. The results are as follows:

Table.2 Dynamic programming results of the first type of model

a1 battery technology	a3 economy	maximum purchase probability
+3%	+5%	0.0418

Sales strategy:

For this target customer, according to the above results, we believe that the company can increase the battery technical performance and the economy (energy consumption and value preservation rate) of the vehicle (especially the economic part) service intensity during sales, so as to in order to improve the customers' overall satisfaction average for this brand of electric vehicle. In addition, although the customer's annual household income and disposable annual income are relatively high, the proportion of loans is relatively low, it shows that the user does not have much financial troubles, and can be considered a good potential buyer.

The second brand:

Select customer No.7 (the reason for selection, the purchase probability of No.7 customer is relatively highest among the second brand of customers without purchasing, and has little effect on b16-17)

In the second problem, we conclude that a1 and a3 have a greater impact on the second brand of electric vehicles in a1-a8; therefore, we conduct dynamic planning for the customer satisfaction for a1 and a3. The results are as follows:

Table.3 Dynamic programming results of the second type of model

a1 battery technology	a3 economy	maximum purchase probability
+5%	+3%	0.5600

Sales strategy:

For this target customer, according to the above results, we believe that the company can increase service of the battery technical performance and the economy (energy consumption and value preservation rate) of the vehicle (especially battery) during sales, and can introduce or answer some battery questions to the customers. In addition, the customer still has some loan problems; his annual income and disposable annual income are not high, it can be considered that the customer is on a tight budget in economy, however, the customer has a 50% probability of buying vehicle in satisfaction, therefore, certain price preferential policies can be appropriately given to the customer during sales, which may continue to increase the customer's probability of purchasing car.

The third brand:

Choose customer No.11 (reason for selection: in the third brand, the affected factor b16 has little impact on customer 11's car purchase, so increasing a1-8 satisfaction will greatly increase its purchase probability).

It is concluded that the a2, a3 and a4 three factors are the most important factors for of the third brand of electric vehicle in the a1 to a8; therefore, dynamic planning is carried out for the customer satisfaction for a2, a3 and a4. The results are as follows in Table 4:

Table.4 Dynamic programming results of the third kind of model

a2	a3	a4	maximum purchase probability
5%	0%	3%	0.8439

Sales strategy:

For this target customer, according to the above results, we believe that the company can increase its service in comfort and safety of electric vehicles (especially comfort in

environmental protection and space seats) during sales. In addition, the customer has the highest annual household income and disposable annual income and does not have any loans; therefore, it can be considered that the customer does not have a financial burden, it also greatly increases purchase rate while improving satisfaction with the performance of electric vehicles, as high as about 84%, and he is a large potential buyer.

5. Promotion and Evaluation of Model

5.1. Advantages of model

We use the entropy method to integrate various relevant factors into an index, find out the relationship between the service difficulty and the index, and finally use the dynamic programming method to find the situation that maximizes the purchase rate. The method is novel and the accuracy is high.

6. Suggestions of Sales Strategies

According to the above research and analysis, the important indexes that affect the purchase rate of the company's three brands of electric vehicles are as follows, and the results are as follows:

Table.5 Important factors affecting purchase rate

	influencing factor	major brands affected
a1	battery technical performance	1,2,3
a2	comfort (environmental protection and space seats)	3
a3	economy (energy consumption and value preservation rate)	1,2,3
a4	safety performance (brake and driving vision)	3
b15	household disposable income	2
b16	the expenditure of annual mortgage in the total annual household income	1,2,3
b17	the expenditure of annual car loan in the total annual household income	1,2

It can be seen from the table that the impact on the purchase rate of electric vehicles can be roughly divided into two aspects, namely, vehicle technology and target customer personal aspects. Therefore, we have the following suggestions for the sales department:

1. For the three brands, it is necessary to focus on explain the battery technical performance and economy. The most critical part of electric vehicles is battery technical performance; this characteristic is beyond other types of vehicles, in the opinion of customers, the better the technical performance of electric vehicles, the better the performance of electric vehicles. Similarly, customers will have the psychology of shopping around, under the same brand, which electric vehicle is more economical, the more it will be favored by customers.

2. It is necessary to learn "teach students in accordance with their aptitude." The disposable annual income of different families is not the same, low-income families buy cars mainly for practicality, in allusion to families with lower disposable incomes, electric vehicles with relatively low prices and complete functionality should be promoted; high-income families buy vehicles mainly for practicality and comfort,

3. The new power brand is the latest product, so all aspects should be paid attention to in the sales process. Because the target customers' ability to accept new products is always relatively

slow, it is necessary to have a detailed introduction to each aspect in the sales process, speed up the customers' recognition for new products, and it is conducive to the sales of new power brands of vehicles.

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