An empirical study on the relationship among perceived value, satisfaction and behavioral intentions of battery electric vehicle user in China

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Abstract. With the rapid development of battery electric vehicle, it has a profound impact on the driving behavior and habits of users. However, studies on the evaluation and users’ behavioral intentions of battery electric vehicle are rare. To promote the further development of battery electric vehicle, a better understanding of battery electric vehicle users is needed. This paper aims to develop a model to investigate the relationship among perceived value, user satisfaction and behavioral intentions of battery electric vehicle. Specifically, we divide perceived value into two dimensions of functional value and symbolic value. Data was collected through questionnaires from battery electric vehicle users in major cities in China. The analysis results of the structural equation model indicate that: 1. the functional value and symbolic value have a direct positive impact on battery electric vehicle user satisfaction and the symbolic value plays a greater role; 2. the functional value and symbolic value have a direct positive effect on the behavioral intentions of battery electric vehicle users; 3 battery electric vehicle user satisfaction and behavioral intentions have a high positive correlation.

1. Introduction

Battery Electric Vehicle (BEV) is considered to be a long-term and effective solution to the problems of environmental pollution and energy shortage. China regards BEV as one of the key products in strategic emerging industries and has issued a series of supporting policies to promote its rapid development. With the strong support of the government, China’s BEV market has expanded rapidly in the past decade and became the world's largest BEV market in 2017. Thus, study of BEV is of great significance to the future of China's automobil industry. However, a lot of studies on BEV are mostly focused on government incentives or technological innovation. Research on the product evaluation or behavioral intentions of BEV users are still missing. There is no doubt that users are critical in the consumer market, especially for emerging products like BEV. User satisfaction and behavioral intentions are the key factors that decide the life cycle of new product and are also the core elements for companies to be profitable. With the increasingly fierce competition in the BEV industry, the survival of BEV companies is determined by improving user satisfaction and guiding positive behavioral intentions to retain users.

Perceived value has been acknowledged that it is a significant factor related with user satisfaction and behavioral intentions. And this kind of relationship is uninvestigated in BEV market context. Hence,
we explored it based on empirical research. To identify relationship of these variables is important for better understanding users and market trends of BEV.

2. Theoretical framework

2.1. Perceived value
Perceived value is the user's assessment of product utility based on gains and losses. It has been long considered a one-dimensional variable in the past. Although one-dimensional is effective and direct, it cannot explain the complex nature of perceived value. Many authors believe that a more sophisticated measure is required. Sweeney & Soutar established a PERVAL scale with 19 items to evaluate the user's perceived value. The scale contains the following four dimensions: functional value (price), functional value (quality), social value and emotional value[1]. The PERVAL scale and the four-dimensional model of perceived value have been widely recognized, but Chen & Hu proposed to divide perceived value into two more universal dimensions, functional and symbolic[2]. Functional value meets the tangible needs of users (such as convenience, quality, and price), symbolic value meets intangible needs of users (like reputation, social status and emotional demand). The two-dimensional measurement makes the understanding of consumers' general needs more effectively, we will adopt it in this study.

2.2. User satisfaction
User satisfaction is defined as “an evaluation between what was received and what was expected”[3]. It is an emotional response. Satisfaction and perceived value are sometimes confused as two important concepts in the field of marketing. Woodruff suggested that satisfaction is a positive or negative emotional state after using product, but the perceived value can be recognized by user whether they have actual experience of product[4]. And perceived value is thought to be the antecedent of user satisfaction[5-6]. Eladly & Eid investigated the relationship between the perceived value and satisfaction of consumers at malls in the united Arab emirates. The research results indicated perceived value had a positive and significant effect on satisfaction[7]. Lam, Lau & Cheung also confirmed user satisfaction was affected by judgments of the product’s perceived value[8]. Therefore, we propose the following hypothesis:

H1a. There is a positive relationship between functional value and BEV user satisfaction.
H1b. There is a positive relationship between symbolic value and BEV user satisfaction.

2.3. Behavioral intentions
Behavioral intentions are the possibility that the user will take a specific behavior in the future triggered by previous experience. It has been extensively studied in the marketing field because behavioral intentions have a high predictive ability for the actual behavior of users. Behavioral intentions generally include two types: economic behavioral intentions (like repurchase behavior, premium payment) and social behavioral intentions (such as recommending to others, complaining behavior). The relationship between perceived value and behavioral intentions has been studied by many scholars in the tourism industry. It is found that perceived value helps promote tourists’ positive behavioral intentions[5][9]. As a result, we deduce the following hypothesis:

H2a. There is a positive relationship between functional value and BEV user behavioral intentions.
H2b. There is a positive relationship between symbolic value and BEV user behavioral intentions.

Satisfaction is also a key indicator of behavioral intentions because users tend to make repurchase/recommendation decisions based on satisfaction. The more satisfied the consumers are, the higher intentions to revisit or recommend[6][10]. Based on this, we deduce the following hypothesis:

H3. There is a positive relationship between user satisfaction and behavioral intentions.

3. Empirical study

3.1. Survey design
The questionnaire is designed in two parts. One is the demographic information of BEV users. The other is the construct indicators of variables, including Functional Value (FV), Symbolic Value (SV), User Satisfaction (US) and Behavioral Intentions (BI). The design of items referred to the literature which have reviewed in the theoretical framework. All items in the questionnaire were measured by 7-level Likert scale, with 1-7 indicating from strong disagreement to strong agreement.

We distributed questionnaire in Beijing, Shanghai, Shenzhen, Hangzhou, Wuhan, Changzhou and Zhuzhou from January to February, 2019. Finally a total of 340 questionnaires were recovered. 332 questionnaires were obtained for subsequent analysis after eliminating incomplete questionnaires. The effective recovery rate of this questionnaire was 97.6%.

3.2. Descriptive statistics
In order to study the demographic characteristics of BEV users in China, respondents were asked to reply the age, gender, education level and household annual income. As illustrated in table 1, 50.6% of the respondents were between 26 and 35 years old and there were more male users (64.3%) than female users (35.7%). In addition, high school graduates consist the majority of respondents, which accounted for 44.6%. Almost 40.9% of the respondents’ annual household income range from 100,000 and 200,000 yuan.

3.3. Data analysis and results
3.3.1. Measurement model. Confirmatory factor analysis (CFA) was conducted through Linear Structural Relationships (LISREL) 8.8 to test the factor loadings of the four constructs (functional value, symbolic value, user satisfaction and behavioral intentions) and the goodness-of-fit of the model. Fit statistics in table 2 indicated that the data and model fit well. Moreover, Cronbach's α coefficients and composite reliability (CR) were calculated to confirm the reliability of the model. The results showed that the Cronbach's α coefficients and CR value (see Table 3) of each construct were greater than the critical value of 0.7, indicating that the consistency of constructs was good and construct indicators were highly intercorrelated. In terms of validity, the average variance extraction (AVE) of each construct was above the recommended value of 0.5 which meant variables can be effectively explained. And the discriminative validity of the constructs was also confirmed since the square root of the AVE was greater than the correlation coefficient of the inter-construct (see Table 4).

| Characteristic | % | Characteristic | % |
|----------------|---|----------------|---|
| **Gender**     |    |                |    |
| Male           | 64.3| Less than 25years | 3.6 |
| Female         | 35.7| From 26 to 35years | 50.6 |
|                |    | From 36 to 45years | 25.3 |
|                |    | From 46 to 55years | 14.5 |
|                |    | Above 55years     |     |
| **Age**        |    |                |    |
| **Education level** |    |                |    |
| High school or | 44.6| ¥0-99,999         | 19.9 |
| College        | 15.7| ¥100,000-199,999  | 40.9 |
| Bachelor degree| 28.9| ¥200,000-299,999  | 14.5 |
| Master degree  | 9.6 | ¥300,000-499,999  | 19.9 |
| Doctor degree  | 1.2 | ¥500,000+         | 4.8 |

| **Household income** | % |
|----------------------|---|
| ¥0-99,999            | 19.9 |
| ¥100,000-199,999     | 40.9 |
| ¥200,000-299,999     | 14.5 |
| ¥300,000-499,999     | 19.9 |
| ¥500,000+            | 4.8 |

| **Table 2. The goodness-of-fit indices.** |
|------------------------------------------|
| Index | Result | Suggested value |
|-------|--------|-----------------|
| $\chi^2$ | 127.77 |                |
| df | 87 |                |
| $\chi^2$/df | 1.47 | < 2            |
| AGFI | 0.91 | > 0.9 |
|-----|------|------|
| CFI | 0.98 | > 0.9 |
| IFI | 0.98 | > 0.9 |
| RMSEA | 0.76 | < 0.08 |

Table 3. Results from the confirmatory factor analysis.

| Variable                 | Factor loading | Cronbach’s α | C.R | AVE |
|--------------------------|----------------|--------------|-----|-----|
| **Functional Value**     |                |              |     |     |
| BEV is worth the money   | 0.77           |              |     |     |
| BEV has great performance| 0.76           |              |     |     |
| BEV is of good quality   | 0.91           |              |     |     |
| **Symbolic Value**       |                |              |     |     |
| BEV demonstrates my environmental attitude | 0.79 |     |     |
| BEV helps me impress others | 0.87 |     |     |
| BEV gives me pleasure    | 0.87           |              |     |     |
| **User Satisfaction**    |                |              |     |     |
| My experience with BEV is satisfying | 0.70 |     |     |
| I made a very wise decision to purchase/use BEV | 0.95 |     |     |
| **Behavioral Intentions**|                |              |     |     |
| I will buy BEV again     | 0.87           |              |     |     |
| I will recommend others to purchase/use BEV | 0.72 |     |     |

Table 4. Discriminant validity of constructs.

|               | Functional Value | Symbolic Value | User Satisfaction | Behavioral Intentions |
|---------------|------------------|----------------|-------------------|-----------------------|
| FV            | 0.82             | 0.71           | 0.59              | 0.54                  |
| SV            | 0.54             | 0.36           | 0.61              | 0.80                  |
| BI            | 0.59             | 0.36           | 0.61              | 0.80                  |

*The diagonals represent the square root of AVE and the following cells represent the correlation between the constructs*

3.3.2. Structural model. Finally, the structural equation model was used to test the hypothesised relationship among the variables of the proposed model shown in figure 1. Table 5 illustrates the results from the structural model. The goodness-of-fit indices of the model (chi-square=127.77, df=87, p < 0.01, chi-square /df=1.469, AGFI=.91; CFI=.98; IFI=.98, RMSEA=.076) demonstrated collected data fits the hypothesis model well.

As shown in table 5, the positive relationship between functional value and user satisfaction was demonstrated by the path coefficient of 0.39(t=5.34, p<0.01). Hence H1a was supported. Then, H1b that there is a positive relationship between symbolic value and BEV user satisfaction was also supported by the path coefficient of 0.50(t=7.63, p<0.01). Therefore, functional value and symbolic value both are proved to be the antecedent factors of BEV user satisfaction. For H2a, the path coefficient of 0.22(t=3.61, p<0.01) supported that functional value exerted a significant positive effect on behavioral intentions. H2a was supported. While symbolic value was also found to have a significant positive relationship with behavioral intentions (path coefficient=0.17, t=2.27, p<0.01), supporting H2b. Lastly, H3 was supported by the path coefficient of 0.52(t=8.89, p<0.01), suggesting that satisfaction has a significant positive impact on behavioral intentions.
4. Conclusion
This paper aims to investigate the relationship among perceived value, user satisfaction and behavioral intentions in BEV market. The empirical results revealed that both functional value and symbolic value have a direct positive effect on BEV user satisfaction, while symbolic value has a greater effect. In addition, the positive influence of perceived value and satisfaction on user behavior intentions in the BEV market has also been verified. Our findings indicated that as a green high-tech product, BEV users not only buy it for the technology and performance, but also attach importance to the social image like environmental pioneer or technology enthusiast which BEV brings to users. This can be a new direction for future promotion of BEV. Mass media was supposed to lead to the popularity of symbolic consumption[11]. Therefore, establishing the positive symbolism of BEV among the public through consistent marketing can stimulate more symbolic consumption of BEV.

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