On Customer Satisfaction of Battery Electric Vehicles Based on Kano Model: A Case Study in Shanghai

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Abstract. Due to the greenhouse effect and limited energy resources, more and more countries and firms have put more attention to clean energy so as to reduce pollution emissions. The development of battery electric vehicle (BEV) becomes crucial to meet the government and society's demands. As one new product with immature technology, there are many factors affecting the wide utilization of BEV. It is necessary to study customer satisfaction of BEV so as to distinguish customer needs, help find the way to improve customer satisfaction, and identify critical factors. Considering the non-linear relationship between product performance and customer satisfaction, the Kano model is used to analyze customer needs for the BEV so as to promote the adoption of BEV in Shanghai. Four approaches to Kano model are used to categorize the BEV attributes as must-be quality, one-dimensional quality, attractive quality and indifferent quality. According to the strategic rule $M > O > A > I$, the priorities of efforts towards promoting the adoption of BEV is identified, i.e., the government and vehicle firms have to fulfill all the must-be requirements. They should make great improvement of one-dimensional qualities to make the BEV competitive to the traditional motor vehicles. Finally, the customers will be very satisfied if the attractive requirements are fulfilled.

Keywords: Battery electric vehicle · Customer satisfaction · Priorities · Kano model

1 Introduction

With the rapid economic development over the past three decades, the total energy consumption in China has increased greatly from 57144 to 375000 (10000 tons of SCE), and the crude oil consumption surges more than 5 times from 12971.6 to 69000 (10000 tons of SCE) [11]. Such a large amount of energy consumption has created heavy energy emissions, which leads to quite serious air pollution in China. As one major source of pollution emissions in China, the road transportation has accounted for about 8% of pollution emissions [1].

V.-N. Huynh et al. (Eds.): IUKM 2015, LNAI 9376, pp. 350–361, 2015.
DOI: 10.1007/978-3-319-25135-6_33

With the rapid economic development, the quantity of motor vehicles in China has reached 137 millions until 2013. Unfortunately, the majority meet relatively low emission standards.

Consequently, Chinese government has been actively exploring and developing effective solutions to reduce exhaust emissions brought by the popularization of motor vehicles so as to reduce the crude oil consumption and improve the air quality. The promotion of new energy vehicles, especially battery electric vehicle (BEV), is one effective way to reduce air pollution [4]. The BEV, one energy-saving and environment-friendly technology, is completely powered by rechargeable batteries (such as lead-acid batteries, nickel cadmium batteries), and excels in lower driving cost, comfort, and quiet driving performance [5]. By replacing conventional motor vehicles, the BEV will save the oil consumption and reduce pollution emissions. It's essential for the government to support the development of BEV technologies. On the other hand, the firms have to continually improve BEV's performance to meet customers' needs by R&D activities.

Quite different from the internal-combustion engine in conventional motor vehicles, the BEV is characterized by limited driving range, new form of fuel refilling, and other attributes, which may create customers' resistance to utilize the BEV in practice. Many studies have focused on the factors affecting the purchasing decision of BEV to enhance customer satisfaction, which is considered to be important for product design and development to succeed in the market place [10]. For example, Sierzchula et al. [13] discussed the relationship between the utilization rate of electric vehicles and the fiscal stimulus, and other social factors by collecting more than thirty countries' data. It was concluded that the fiscal stimulus, number of charging piles, and the presence of local electric vehicle production base are associated with the utilization of pure electric vehicles; however, the fiscal stimulus or sufficient charging infrastructures cannot grantee high utilization rate of electric vehicles. Mau et al. [9] concluded that customers' preferences on price, fuel costs, government subsidies, driving range, charging facilities, service and maintenance have great effects on the utilization rate of electric vehicles. Park et al. [12] predicted the impact on the fuel cell vehicles caused by price change rate and charging stations, based on Bass diffusion model and dynamics.

In summary, there are many factors affecting the adoption of BEV in practice. Most researchers only focus on the analysis of barriers and policies [3,6,14], little research has focused on the development orientation and the priority of factors to improve the BEV. It is important for the improvement of BEV's performance to understand customers' preferences on the adoption of BEV. It is necessary to study customer satisfaction of BEV, so as to distinguish customer' needs, help find the way to improve customer satisfaction, and identify critical factors. Due to the variety of customers' preferences, it is difficult for the firms and government to determine what they should focus on and how to be more targeted. In general, analysis of customer needs involves three aspects [15]: (1) knowing what the customers want and prefer to, (2) the product functional requirements prioritization, and (3) the classification of the functional requirements.

Traditional customer need analysis assumes a linear relationship between customer satisfaction and the performance of product. Taking a different perspective, Kano model [7] combines with hygiene-motivational factors, which is based on nonlinear relationship and takes into account the psychology of customers. The Kano model can identify and classify customer needs by the common surveys.

Toward this end, the main focus of this research is to identify and classify the customer needs of BEV based on the Kano model. By this way, we may use a systematic approach to distinguish consumer needs, identify and prioritize the key factors, and find ways to improve customer satisfaction of the BEV. This research will offer a guidance to the firms to make a trade-off of customer satisfaction and R&D costs. The government can also put forward relevant policies to accelerate the promotion of BEV. The reminder of this paper is as follows. Section 2 reviews four approaches to Kano model. The methodology of customer satisfaction based on Kano model is presented in Section 3. In Section 4, the proposed methodology is applied to BEV in Shanghai by means of the four approaches to Kano model. The results are also compared with each other. Finally, this paper is concluded in Section 5.

2 The Kano Model

Inspired by Herzberg's two-factor theory, Noriaki Kano [7] proposed the Kano model in 1984 to establish the cognitive dimension about fulfillment of product quality characteristics and customer satisfaction. In general, Kano model divides the product attributes into six types:

- Must-be attribute (M). It's the product's basic requirement and essential to the product or service. If well fulfilled, the satisfaction of customers will not be improved; but if not fulfilled, customers will be extremely dissatisfied with the product.
- One-dimensional attribute (O). If well fulfilled, the customer satisfaction will be improved; if not fulfilled, customers will be dissatisfied with the product. Such a type of attributes has a a linear relationship with customer satisfaction.
- Attractive attribute (A). Such a type of attribute will surprise the customer and cause satisfaction. But if it doesn't exist, it will not cause dissatisfaction.
- Indifferent attribute (I). The attribute doesn't have significant influence on the satisfaction. Customers will not pay attention to this type of attributes.
- Reverse attribute (R). The customer doesn't expect this attribute. Its presence will cause dissatisfaction.
- Questionable attribute (Q). The customer gives conflicting answers to this type of attributes.

Fig. 1 shows the relationship between product performance and customer satisfaction. The horizontal axis represents the state of fulfillment of the product

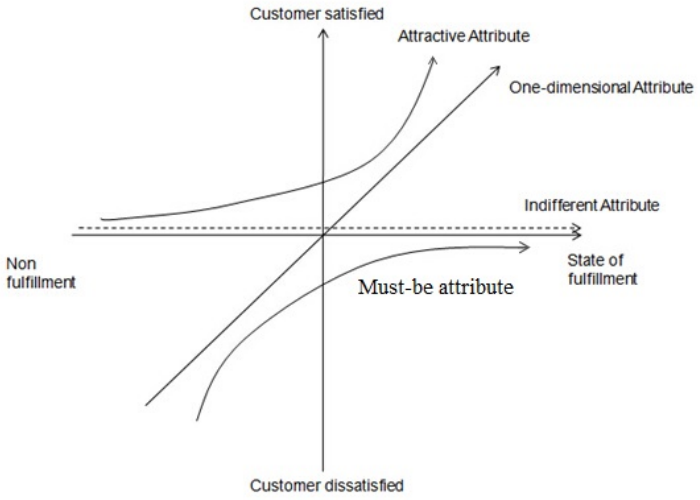


Fig. 1. The Kano model.

performance and the vertical axis represents the customer satisfaction [7]. In this axis, only four attributes are described.

There are several possible analytical methods to rank customer needs. The simple way is to divide the attributes by the frequencies of responses, known as "Frequency-based Attributes Category". The attribute will belong to the category which is the mostly frequently occurring dimension. Such a method is the traditional way to categorize these attributes based on the mode statistic, described as follows:

$$\text{Grade} = \max\{M, O, A, I, R, Q\}. \tag{1}$$

The frequency based method can increase the "noise level" to a point where all "requirements" are considered indifferent. For example, if 18 answerers classify a function as one-dimensional, 19 as attractive, 18 as must-be, 20 as indifferent, 2 as reverse, and 3 as questionable, then the mode statistic classifies this function as indifferent even though 57 out of 82 people answering say that they need this function in one way or the other. One way to decrease the noise level is the comparison-based method, which modifies the mode statistic as follows:

$$\text{Grade} = \begin{cases} \max\{M, O, A\}, \text{ if } (M + O + A) > (I + R + Q); \\ \max\{I, R, Q\}, \quad \text{otherwise.} \end{cases} \tag{2}$$

which indicates that if the sum of One-dimensional, Attractive, and Must-be is larger than sum of Indifferent, Reverse and Questionable, then the attribution will fall into the maximum of the first three. According to the statistic mode above, the attributes can be arranged into groups as the following order:

$$M > O > A > I > R > Q.$$

M:must-be attribution O:one-dimensional A:attractive attribution		I:indifferent attribution R:reverse attribution Q:questionable answer	Dysfunctional				
			Like	Must-be	Neutral	Live with	Dislike
Functional	Like		Q	A	A	A	O
	Must-be		R	I	I	I	M
	Neutral		R	I	I	I	M
	Live with		R	I	I	I	M
	Dislike		R	R	R	R	Q

Fig. 2. The Kano evaluation table.

The evaluation rule above can be used to set proper order to fulfil these requirements.

The above two methods define final classification based on frequency. However, it is difficult to reflect the difference in the properties for the impact of customer satisfaction and dissatisfaction [8]. Berger et al. [2] proposed two indexes to reach this objective. The customer satisfaction index indicates that the degree of satisfaction can be created and the dissatisfaction can be prevented by meeting the function. The customer requirements can be classified by the method proposed in [2]. When the attribute is equipped or not, the assignment of the satisfaction and dissatisfaction level is proposed. The attributes can fall into two-dimensional diagram based on satisfaction index and dissatisfaction index, defined as follows:

$$\begin{aligned} \text{SatIndex} &= \frac{A+O}{A+O+M+I} \\ \text{DisSatIndex} &= \frac{M+O}{A+O+M+I} \end{aligned} \tag{3}$$

The satisfaction index is between 0 and 1, when it is close to 1 means the attribute will make highly influence on customer satisfaction, while it is close to 0 means little influence on customer satisfaction. Similarly, value of dissatisfaction index is greater means the impact is greater on customer dissatisfaction. For each attribute, different coordinate value corresponds to different location. Each attribute means one point, every point scatters in the corresponding location.

- If satisfaction index SatIndex < 0.5, dissatisfaction index DisSatIndex < 0.5, the attribute is indifferent.
- If satisfaction index SatIndex < 0.5, dissatisfaction index DisSatIndex ≥ 0.5, the attribute is must-be.
- If satisfaction index SatIndex ≥ 0.5 and dissatisfaction index DisSatIndex ≥ 0.5, it is one-dimensional.
- If satisfaction index SatIndex ≥ 0.5 and dissatisfaction index DisSatIndex < 0.5, the attribute is attractive.

The $M > O > A > I$ rule is be used to organize the importance of these qualities. The preliminary category of these three methods above is determined by means of the Kano evaluation table in 2.

Table 1. Scales of the functional/dysfunctional attributes

Answers	I like	It must be	I am neutral	I can live with	I dislike
If the attribute is provided.	1	0.5	0	-0.25	-0.5
If the attribute isn't provided.	-0.5	-0.25	0	0.5	1

In order to further classify the attributes quantitatively, the analytical Kano model [15] is put forward to analyze customer needs. If the product is composed of I attributes, the product attributes can be identified as $F = \{f_i | i = 1, 2, \ldots, I\}$, where f_i represents the i-th attribute. Each respondent evaluates the functional and disfunctional attributes as $e_{ij} = (x_{ij}, y_{ij}, w_{ij})$, where x_{ij} is the evaluation of the jth respondent to the product without the i-th attribute or function, y_{ij} is the evaluation of the jth respondent to the product with the i-th attribute or function, w_{ij} is the importance of the j-th respondent to the i-th attribute. Next, for each f_i, the average level of satisfaction for the dysfunctional form question is defined as $\overline{X}_i$, and the average level of satisfaction for the functional form question is defined as $\overline{Y}_i$, i.e.,

$$\overline{X}_i = \frac{1}{J}\sum_{j=1}^{J} w_{ij} \cdot x_{ij}, \quad \overline{Y}_i = \frac{1}{J}\sum_{j=1}^{J} w_{ij} \cdot y_{ij} \tag{4}$$

The value pair $(\overline{X}_i, \overline{Y}_i)$ can be plotted in a two-dimensional diagram, where the horizontal axis indicates the dissatisfaction score and the vertical axis stands for the satisfaction score. The analytical Kano takes into account of the customer self-stated importance and the score of the importance falls into the interval $[0, 1]$. This method designs the scoring scale of satisfactions and dissatisfactions, which are asymmetric and view positive answers are stronger than the negative ones, as shown in Table 1.

3 Research Methodology

In this study, the Kano model is applied to analyze the factors affecting customer's purchasing decision and prioritize these customer requirements to improve the performance targeted. The steps to apply Kano model into analysis of BEV are as follows.

- **1) Collect Customer Needs.** There are many attributes affecting the development of BEV. It is necessary to distinguish key BEV attributes. The common method is to confirm potential customer requirements which constitutes questionnaire by a vast amount of literature collecting and summarizing.
- **2) Develop the Kano Questionnaire.** To construct the questionnaire, we formulate a pair of questions for each potential customer need for which you desire customer feedback. The first question is how a customer feels if the attribute/function is provided, and the other is that how the customer

feels if the attribute/function isn't provided. For each question, customer is required to select one from five answers: "I like it that way", "It must be that way", "I am neutral", "I can live with it that way" and "I dislike it that way". Crossing the answers of each pair of question, customer needs can be evaluated into different dimensions (M: must-be attribute, O: one-dimensional attribute, A: attractive attribute, I: indifferent attribute, R: reverse attribute, Q: questionable attribute).

- **3) Test the Questionnaire and Revise if Necessary.** When a questionnaire is to be sent to many customers, it is important that it be understandable. This is especially true of a Kano questionnaire, since it is unfamiliar to most people asked to fill it out. Therefore a test run will help us identify unclear wording, typographical errors, or confusing instructions. To do so, firstly try to predict the interviewees' response and guess the questions the customer may not understand; secondly, select some students to answer the questionnaire, analyze the results to check the problems which may exist in the it, revise the questions and retest; finally comprehend the interviewees' feedback and revise the questions if necessary.
- **4) Administer the Questionnaires to Customers.** Select customers to fill in the questionnaires. This research is about behavior of buying cars in Shanghai. So the customers working or settling in Shanghai are the ones who can afford the cars or be familiar with cars.
- **5) Process and Analyze the Results.** Based on the data collected, we will analyze the customer needs of BEV by means of the four methods reviewed in Section 2. Consequently, BEV attributes are divided into four categories, which will support the BEV firms and government to make appropriate decisions and policy suggestions to promote faster development of the BEV sector.

4 Case Study: The BEV in Shanghai

In this section, the methodology introduced in Section 3 will be used to analyze the customer needs of BEV in Shanghai. As one new product with immature technology, the attributes affecting the customers' purchasing decision of BEV are quite different from the traditional motor vehicles. Therefore, it is necessary to gain insight into the attributes with respect to the customer satisfaction and firm's capacity. By summarizing a large number of relevant literature and taking into account of the environment and policy issues in Shanghai, finally 20 attributes of BEV are identified, as shown in Table 2.

Our Kano questionnaire is composed of two parts: the first one is the demographic information of respondents, e.g., gender, education; the second one consists of 20 pairs of questions with respect to the 20 attributes in Table 2. Taking attribute f_2 "government subsidy" as an example, the questions are designed as shown in Fig. 3. The respondents who have cars or want to buy new cars in Shanghai were asked to provide their answers with respect to the 20 pairs of questions via two means: face-to-face survey and e-mail. Overall, 103 questionnaires

Table 2. BEV attributes

Attributes	Description of BEV attributes	Benefits provided to customers
f_1	Relatively low price	Beneficial
f_2	Government gives subsidy	Beneficial
f_3	Low fuel costs	Beneficial
f_4	Low maintenance costs	Beneficial
f_5	Free license plate	Beneficial
f_6	Sufficient charging station	Convenient
f_7	High level after-sale service	Convenient, cheerful
f_8	Pre-sale consulting service	Convenient, cheerful
f_9	Complete charging in 15 minutes	Fast, convenient
f_{10}	Battery cycle life is longer than 5 years	Beneficial
f_{11}	Maximum speed is over 120km/h	Fast
f_{12}	Driving range exceeds 120km	Convenient
f_{13}	A wide variety of BEV types	Cheerful
f_{14}	Attractive vehicle's appearance	Cheerful
f_{15}	Good reputation	Cheerful
f_{16}	Various brands	Cheerful
f_{17}	Operational convenience	Convenient, safe
f_{18}	Good acceleration	Fast, safe
f_{19}	Comfortable	Cheerful
f_{20}	Safe	Safe

If you will be given government subsidies when buying the BEV, how do you feel?	I like it that way. It must be that way. I am neutral. I can live with it that way. I dislike it that way.
If you won't be given government subsidies when buying the BEV, how do you feel?	I like it that way. It must be that way. I am neutral. I can live with it that way. I dislike it that way.

Fig. 3. Example of Kano questionnaire: Government subsidy.

were distributed to customers. Since some respondents gave apparently paradoxical answers, the questionnaires answered by them were regarded as invalid. Finally a total of 77 respondents' answers were viewed as reasonable, i.e. the effective response rate is 74.8%.

With the Kano evaluation data collected, we now use the four Kano methods to process and analyze the customer needs of BEV in Shanghai. With the principle of frequency-based and comparison-based category, the classification of the attributes can be obtained, as shown in Columns 2-3 of Table 3. Based on the index-based and analysis-based method, classifications of the BEV attributes are shown in Columns 4-5 of Table 3 and plotted in Fig. 4. These two methods

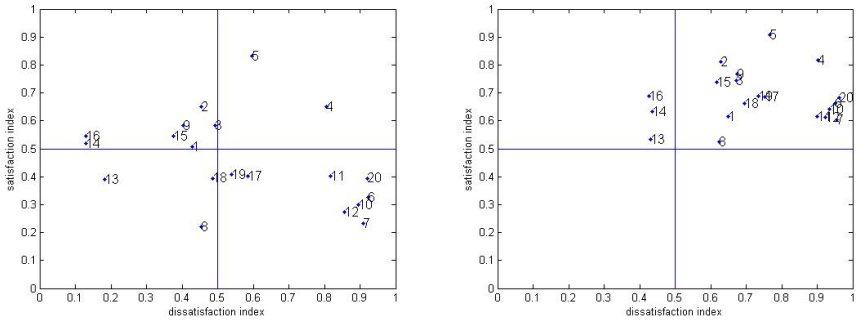
Table 3. Kano categorization of BEV attributes based on four methods.

Attributes	Frequency-based	Comparison-based	Index-based	Analysis-based	Category
f_1	I	A	A	O	A
f_2	A	A	A	O	A
f_3	A	A	A	O	A
f_4	O	O	O	O	O
f_5	O	O	O	O	O
f_6	M	M	M	O	M
f_7	M	M	M	O	M
f_8	I	M	I	O	I
f_9	A	A	A	O	A
f_{10}	M	M	M	O	M
f_{11}	M	M	M	O	M
f_{12}	M	M	M	O	M
f_{13}	I	I	I	A	I
f_{14}	I	A	A	A	A
f_{15}	A	A	A	O	A
f_{16}	A	A	A	A	A
f_{17}	M	M	M	O	M
f_{18}	I	M	I	O	I
f_{19}	M	M	M	O	M
f_{20}	M	M	M	O	M

are based on the satisfaction and dissatisfaction indexes to categorize the BEV attributes. It should be noted that in the analysis-based method, the importance values of BEV attributes are set to be 1 so as to make the four methods be compared reasonably with each other.

It is clearly seen from Table 3 that with the same data set, different results can be obtained by means of the four Kano methods. The classification results of the first three methods are very similar with each other. With the analysis-based method, the attributes are located close to each other in the coordinate axis (Fig. 4), in other words, the classification results by the analysis-based methods is not so good. Therefore, we only compare the first three methods. In addition, the "majority rule" is used to obtain the final categorizations of the BEV attributes, as shown in Column 6 of Table 3.

It is derived that the attributes "f_6: Sufficient charging station", "f_7: High level after-sale service", "f_{10}: Battery cycle life is longer than 5 years", "f_{11}: Maximum speed is over 120km/h", "f_{12}: Driving range exceeds 120km", "f_{17}: Operational convenience", "f_{19}: Comfortable", and "f_{20}: Safe" are categorized as must-be type. It means that without these functions, the customers will be very dissatisfied; however, these functions can not increase customer satisfaction. Taking the attribute "Sufficient charging station" as an example, as a new tech-



(a) The index based method (b) The analysis based method

Fig. 4. Attributes classification of BEV

nology, the customers are worry about the charging stations of BEV. If there are fewer stations, the customers are very dissatisfied. In this sense, "sufficient charging station" is a prerequisite for the customers to use the BEV in practice.

The attributes "f_4: Low maintenance costs" and "f_5: Free license plate" are viewed as one-dimensional quality. It means that with these functions, the customers will be satisfied; and without these functions the customers will be dissatisfied. The Shanghai government has put forward "vehicle license auction policy" to limit the quantity of traditional motor vehicles. In April 2015, more than 150 thousands customers bid the license plate in Shanghai, and the auction price of one license plate is quite expense as high as the license plate in Shanghai can cost as high as 80, 600 RMB (about 13,000 US $). Compared with the traditional motor vehicles, free license plate is a great advantage and will promote the adoption of BEV. In Shanghai, many customers choose to buy one BEV just because the license plate is free and bid is not needed. The license plate can make influence on customer's satisfaction and dissatisfaction. Therefore, the government should keep the policy of free license plate until the BEV technology has been greatly improved. Lower maintenance cost will increase customer satisfaction and higher maintenance cost will increase customer dissatisfaction.

The attributes "f_1: Relatively low price", "f_2: Government gives subsidy", "f_3: Low fuel costs", "f_9: Complete charging in 15 minutes", "f_{14}: Attractive vehicle's appearance", "f_{15}: Good reputation", and "f_{16}: Various brands" are classified as attractive quality. We can conclude that "high price" has little effect on customer dissatisfaction of BEV. Customers who tend to buy BEV already know the prices of BEV are more expensive than the one of traditional motor vehicles; due to the immature technology and lack of large-scale production, high price of the BEV means it doesn't create customer dissatisfaction. However, lower price will significantly increase customer satisfaction. As for the government subsidy, the Shanghai government now provides subsidy to customers who buy BEV. This policy has greatly promoted the adoption of BEV.

The attributes "f_8: Pre-sale consulting service", "f_{13}: A wide variety of BEV types" and "f_{18}: Good acceleration" are categorized as indifferent quality. This means that the firms don't need pay much attention to these functions at present.

In summary, according to the strategic rule $M > O > A > I$, the government and vehicle firms have to fulfill all the must-be requirements, otherwise customers will be very dissatisfied with the BEV. They should make great improvement of one-dimensional qualities to make the BEV competitive to the traditional motor vehicles. Finally, the customers will be very satisfied if the attractive requirements are fulfilled.

5 Conclusions

As one energy-saving and environment-friendly technology, there are many obstacles to the wide adoption of BEV in practice due to the immature technology. It is important to identify and classify the customer needs of BEV so as to help government and firms to pay attention to the attributes which affects customers' purchasing decision of BEV. In this study, customer need analysis for the BEV is investigated based on Kano model to promote the adoption of BEV in Shanghai. To do so, a total of 20 BEV's attributes are firstly determined by summarizing the previous researches and combining current advantages of policy. Secondly, it takes into the customer's psychology account, and combines the frequency-based, comparison-based, index-based and analysis-based methods to categorize the BEV attributes. The BEV attributes are classified as must-be quality, one-dimensional quality, attractive quality and indifferent quality. According to the strategic rule $M > O > A > I$, the priorities of efforts towards promoting the adoption of BEV are identified, i.e., the government and vehicle firms have to fulfill all the must-be requirements, otherwise customers will be very dissatisfied with the BEV. They should make great improvement of one-dimensional qualities to make the BEV competitive to the traditional motor vehicles. Finally, the customers will be very satisfied if the attractive requirements are fulfilled.

Acknowledgement. We would like to appreciate constructive comments and valuable suggestions from the three anonymous referees, which have helped us efficiently improve the quality of this paper. This study was partly supported by the National Natural Sciences Foundation of China (NSFC) under grant nos. 71471063 and 71125002; sponsored by the Innovation Program of Shanghai Municipal Education Commission under grant no. 14ZS060, the Shanghai Pujiang Program, and the Fundamental Research Funds for the Central Universities in China under grant no. WN1424004.

References

1. CO_2 emissions from fuel combustion highlights. Tech. rep., International Energy Agency, Paris (2013)
2. Berger, C., Blauth, R., Boger, D., et al.: Kano's methods for understanding customer-defined quality. Center for Quality Management Journal **2**(4), 3–35 (1993)
3. Caperello, N.D., Kurani, K.S.: Households' stories of their encounters with a plug-in hybrid electric vehicle. Environment and Behavior **44**(4), 493–508 (2012)
4. Duvall, M., Knipping, E., Alexander, M.: Environmental assessment of plug-in hybrid electric vehicles. volume 1: Nationwide greenhouse gas emissions. Tech. rep., Electric Power Research Institute, Palo Alto, CA (2007)
5. Granovskii, M., Dincer, I., Rosen, M.A.: Economic and environmental comparison of conventional, hybrid, electric and hydrogen fuel cell vehicles. Journal of Power Sources **159**(2), 1186–1193 (2006)
6. Hidrue, M.K., Parsons, G.R., Kempton, W., Gardner, M.P.: Willingness to pay for electric vehicles and their attributes. Resource and Energy Economics **33**(3), 686–705 (2011)
7. Kano, N., Seraku, N., Takahashi, F., Tsuji, S.: Attractive quality and must-be quality. Journal of the Japanese Society for Quality Control **14**(2), 147–156 (1984)
8. Lee, M.C., Newcomb, J.: Applying the kano methodology to meet customer rquirements: Nasa's microgravity science program. Quality Management Journal **4**, 95–106 (1997)
9. Mau, P., Eyzaguirre, J., Jaccard, M., Collins-Dodd, C., Tiedemann, K.: The 'neighbor effect': Simulating dynamics in consumer preferences for new vehicle technologies. Ecological Economics **68**(1), 504–516 (2008)
10. McKay, A., de Pennington, A., Baxter, J.: Requirements management: a representation scheme for product specifications. Computer-Aided Design **33**(7), 511–520 (2001)
11. National Bureau of Statistics of China: China Statistical Yearbook 2013. China Statistics Press, Beijing (2013)
12. Park, S.Y., Kim, J.W., Lee, D.H.: Development of a market penetration forecasting model for hydrogen fuel cell vehicles considering infrastructure and cost reduction effects. Energy Policy **39**(6), 3307–3315 (2011)
13. Sierzchula, W., Bakker, S., Maat, K., van Wee, B.: The influence of financial incentives and other socio-economic factors on electric vehicle adoption. Energy Policy **68**, 183–194 (2014)
14. Skippon, S.M.: How consumer drivers construe vehicle performance: Implications for electric vehicles. Transportation Research Part F: Traffic Psychology and Behaviour **23**, 15–31 (2014)
15. Xu, Q., Jiao, R.J., Yang, X., Helander, M.: An analytical kano model for customer need analysis. Design Studies **30**(1), 87–110 (2009)